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A Journal of Indian Zoology

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**RECORDS
OF THE
ZOOLOGICAL SURVEY
OF INDIA**

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RECORDS OF THE ZOOLOGICAL SURVEY OF INDIA

(A Journal of Indian Zoology)

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ON LAND AND FRESHWATER MOLLUSCS OF PUNE DISTRICT, MAHARASTRA.

By

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Zoological Survey of India, Calcutta

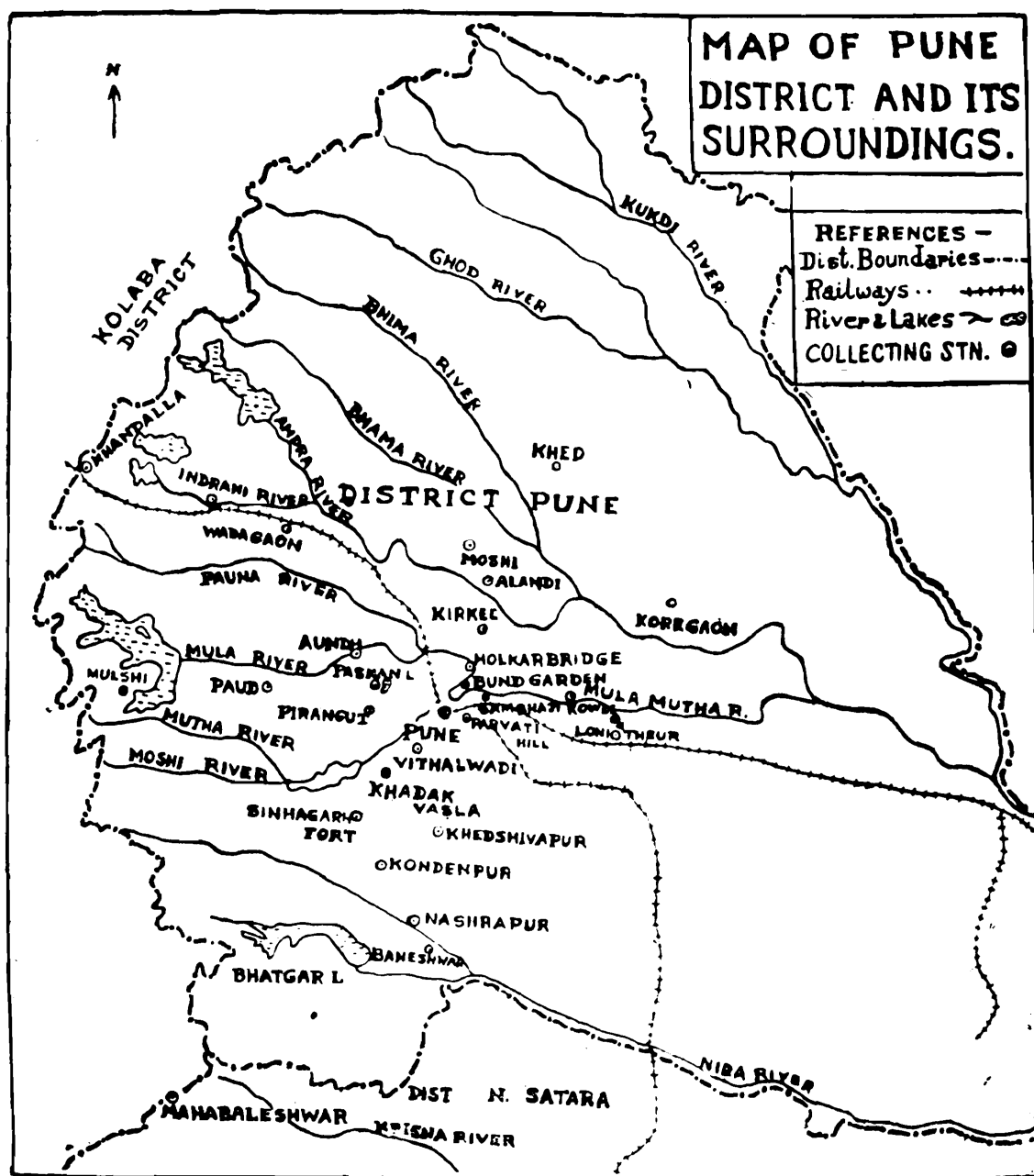
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INTRODUCTION

The Pune district lying between 17°54' and 19°24' N latitude and 73°10' and 75°10' E longitude is bordered on its west by Western Ghats consisting of Sahyadris and other minor ranges. Numerous small streams are running through these hills and forming water falls in the course. Besides these natural streams and rivers, the district has some important artificial lakes and reservoirs. With its preponderance of aquatic bodies the district has ideal habitats for aquatic invertebrates. Yet information about these animals, especially molluscs is poor.

References about the molluscs from the Pune District are few and scattered notwithstanding the fact that type-localities of several species of aquatic and land molluscs are located within the district. Annandale (1919), Annandale & Prashad (1919), and Hora (1925, 1926) made some interesting observations on the hill-stream fauna of the district. A little more than a decade back Tonapi and Mulherkar (1963) and recently Tonapi (1971), published an account of freshwater mollusca of Pune including a few land forms—totalling 53 species. The nomenclature used by them for certain species is backdated and obsolete, and tends to create confusion. Moreover, in those papers no distinction was made between land and freshwater molluscs. In the present paper an attempt has been made to give an adequate picture of the molluscan fauna of Pune District, including an upto-date checklist. As a result of the present study ten species are now being added to the faunal list of molluscs of Pune district and Maharashtra.

The bulk of the material available for the present study was collected by different survey parties of the Western Regional Station, Zoological Survey of India, Pune, during the years 1959-1969. Besides the



Text-fig. 1. Map of Pune District and its surroundings.

Regional Station's material a few other collections from the private parties are also included here. A number of parties from the Head Quarters of the Zoological Survey of India have also periodically surveyed the area and brought some collections, which are deposited in the Mollusca Section. In addition to all these recent collections, the unnamed and named material preserved in the Zoological Survey of India was also examined and references in literature were consulted. The resulting taxonomic view projects a total of about 130 species and varieties falling into 22 families and 51 genera as occurring in the Pune District. The identified material is preserved either in the Western Regional Station, Pune or in the Headquarters of the Survey at Calcutta and in a few instances the material was returned to the party concerned.

The molluscs are well represented in the fauna of the district. A further intensive survey may bring more species into light.

The collecting stations are shown in the map attached herewith. So as to economise space, only the number of examples studied are given for each species, without the details like exact locality, name of the collector and date of collection.

Abbreviations used : H = Height, W = Width, L = Length.

A COMPLETE LIST OF LAND AND FRESHWATER MOLLUSCS SO FAR KNOWN FROM PUNE (ARRANGED IN PHYLOGENITICAL ORDER).

(*The species present in the collection and studied by us.

** New records for Pune District.)

Class GASTROPODA

Order MESOGASTROPODA

Family CYCLOPHORIDAE

1. *Cyclophorus (Glossostylus) indicus* (Deshayes)
2. *C. (G) stenomphalus* Pfeiffer
3. *C. (Annularia) aurantiacus* (Schumacher)
4. *C. (Litostylus) involvulus* (Müller)
5. *Cyathopoma deccanense* Blanford
6. *Nicida liricincta* Blanford
7. *Opisthostoma fairbanki* Blanford

Family POMATIASIDAE

- *8. *Cyclotopsis semistriata* (Sowerby)

Family VIVIPARIDAE

- *9. *Viviparus bengalensis* form *bengalensis* (Lamarck)
- *10. *V. bengalensis* form *doliaris* (Gould)
- *11. *V. bengalensis* form *incrassatus* Annandale
- *12. *Viviparus bengalensis* form *mandiensis* Kobelt
- *13. *V. dissimilis* (Müller)

Family PILIDAE (= AMPULLARIIDAE)

14. *Pila globosa* (Swainson)
- *15. *Turbinicola saxea* (Reeve)

Family HYDROBIIDAE

- *16. *Alocinma orcula* (Benson)
- *17. *A. orcula* var. *producta* (Nevill)

- 18. *Sataria evezardi* (Blanford)
- 19. *Bithynia stenothyroides* Dohrn (= *Bulimus stenothyroides* Dohrn)
- *20. *Digoniostoma pulchella* (Benson)

Family THIARIDAE (= Melanidae)

Subfamily THIARIINAE

- *21. *Thiara scabra* (Müller)
- *22. *T. scabra* var. *elegans* (Benson)
- *23. *Melanoides pyramis* (Hutton)
- **24. *M. pyramis* var. *puteicola* Annandale & Prashad
- *25. *M. pyramis* var. *leopardina* Annandale & Prashad
- 26. *M. riqueti* (Grateloup)
- *27. *M. (Melanoides) tuberculatus* (Müller)

Subfamily PALUDOMINAE

- *28. *Paludomus obesa* Philippi
- 29. *P. tanschaurica* var. *malabarica* Nevill
- 30. *P. (Stomatodon) stomatodon* Benson
- 31. *Sulcospira (Sulcospira) hugeli* var. *compacta* Nevill

Family LITTORINIDAE

- *32. *Cremnoconchus (Cremnoconchus) syhadrensis* (Blanford)
- *33. *C. (Lissoconchus) conicus* Blanford
- *34. *C. conicus* var. *edecollata* Nevill

Order BASOMMATOPHORA

Family LYMNAEIDAE

- 35. *Lymnaea (Pseudosuccinea) acuminata* (Lamarck)
- *36. *L. (P.) acuminata* f. *typica* Lamarck
- *37. *L. (P.) acuminata* f. *gracilior* Martens
- *38. *L. (P.) acuminata* f. *patula* Troschel
- *39. *L. (P.) acuminata* f. *rufescens* Gray
- *40. *L. (P.) acuminata* var. *nana* Annandale
- *41. *L. (P.) acuminata* sub sp. *tonapii* Ray & Roy Chaudhury
- *42. *L. (P.) luteola* (Lamarck)
- *43. *L. (P.) luteola* f. *typica* Lamarck
- *44. *L. (P.) luteola* f. *australis* Annandale & Rao
- *45. *L. (P.) luteola* f. *impura* Troschel
- *46. *L. (P.) luteola* f. *succinea* Deshayes
- 47. *L. auricularia* (Draparnaud)
- 48. *L. pinguis* Dohrn

Family PLANORBIDAE

- *49. *Indoplanorbis exustus* (Deshayes)
- *50. *Gyraulus convexiusculus* (Hutton)
- 51. *G. labiatus* (Benson)

Order SYSTELLOMMATOPHORA

Family VERONICELLIDAE

- *53. *Laevicaulis alte* (Ferussac)
- **53. *Semperula birmanica* (Theobald)
- 54. *Semperula maculata* (Templeton)
- **55. *Sarasinula plebeja* (Fischer)

Order STYLOMMATOPHORA

Family SUCCINEIDAE

- *56. *Succinea raoi* Subba Rao and Mitra
- *57. *S. bensoni* Pfeiffer
- *58. *S. collina* Hanley & Theobald
- *59. *S. tornadri* Rao
- *60. *Indosuccinea khandalla* Rao
- *61. *Lithotis rupicola* Blanford
- *62. *L. tumida* Blanford

Family ENIDAE

Subfamily NAPAEINAE

- 63. *Cerastus abyssinicus* (Pfeiffer)
- 64. *C. densus* (Pfeiffer)
- 65. *C. distans* (Pfeiffer)
- 66. *C. jerdoni* (Reeve)
- 67. *C. jerdoni* var. *redfieldi* (Pfeiffer)
- 68. *C. moussonianus* (Petit)
- *69. *Rachis punctatus* (Anton)
- 70. *Rachisellus bengalensis* Lamarck
- 71. *R. praetermissus* Blanford

Family SUBULINIDAE

- *72. *Opeas gracile* (Hutton)
- 73. *Zootecus chion* (Pfeiffer)
- *74. *Z. insularis* (Ehrenberg)

Family GLESSULIDAE

- *75. *Glessula arthuri* (Benson)
- 76. *G. brevis* (Pfeiffer)
- 77. *G. chessoni* (Benson)
- *78. *G. ceylanica* (Pfeiffer)
- *79. *G. gemma* (Reeve)
- 80. *G. lyrata* Blanford
- **81. *G. illustris* var. *tumida* Godwin-Austen
- *82. *G. notigena* (Benson)
- 83. *G. pulla* Blanford
- 84. *G. rugata* Blanford
- *85. *G. dikrangense* Godwin-Austen
- 86. *G. singhurensis* Blanford
- 87. *G. tornensis* Blanford
- 88. *G. hebes* (Blanford)

Family ARIOPHANTIDAE

Subfamily ARIOPHANTINAE

- *89. *Ariophanta bajadera* (Pfeiffer)
- 90. *A. laevipes* (Müller)
- *91. *Cryptozona* (Nilgiria) *semirugata* (Beck)
- 92. *C. (Xestina) belangeri* var. *bombayana* (Pfeiffer)
- *93. *C. (X) bistrialis* (Beck)
- 94. *Euplecta subdecussata* Pfeiffer

Subfamily HELICARIONINAE

- *95. *Eurychlamys platychamys* Blanford
- 96. *Pseudaustenia atra* Godwin-Austen

Subfamily KALIELLINAE

- 97. *Kaliella barrackporensis* Pfeiffer

Subfamily MACROCHLAMYDINAE

- 98. *Macrochlamys pedina* (Benson)
- 99. *M. petrosa* (Hutton)
- **100. *M. petasus* (Benson)
- 101. *M. infausta* Blanford
- **102. *M. indica* Godwin-Austen
- *103. *M. tenuicula* (H. Adams)

Subfamily GIRASIINAE

104. *Mariaella dussumieri* Gray

Subfamily DURGELLINAE

- **105. *Sitala denselirata* Preston

Family TROCHOMORPHIDAE

- **106. *Trochomorpha (Sivela) billiana* (Mörch)

Family PLEURODONTIDAE

107. *Chloritis leithi* Gude
 108. *C. propinqua* (Pfeiffer)
 109. *Planispira footei* Stoliczka
 110. *P. proxima* (Ferussac)
 *111. *P. (Trachia) crassicostata* (Benson)

Family FRUTICICOLIDAE

- **112. *Eulota scalpturita* (Benson)

Family VALLONIDAE

- *113. *Pupisoma evezardi* (Blanford)

Family STREPTAXIDAE

114. *Streptaxis scalptus* Blanford

Class BIVALVIA

Order EULAMELLIBRANCHIATA

Family UNIONIDAE

- *115. *Indonaia caerulea* (Lea)
 *116. *I. khadakvaslaensis* Ray
 *117. *Lamellidens consobrinus* (Lea)
 *118. *L. corrianus* (Lea)
 *119. *L. marginalis* (Lamarck)
 *120. *L. marginals* var. *cylindrica* (Hanley & Theobald).
 **121. *L. lamellatus* (Lea)
 *122. *Parreysia corrugata* (Müller)
 *123. *P. corrugata* var. *nagpoorensis* (Lea)
 *124. *P. favidens* (Benson)

**125. *P. favidens* var. *marcens* (Benson)

*126. *Parreysia rajahensis* (Lea)

Family CORBICULIDAE

*127. *Corbicula striatella* Deshayes

*128. *C. krishnaea* Ray

*129. *C. peninsularis* Prashad

*130. *C. regularis* Prime

KEY TO THE MOLLUSCS OF PUNE DISTRICT (UP TO FAMILIES)

a. Land

1. Animal slug-like, without a shell, tentacles contractile ... **VERNONICELLIDAE**
Animal with either an internal or external shell, tentacles retractile. .2
2. Aperture of shell in life closed by a circular or horny operculum. .3
Aperture of shell not closed by an operculum . 4
3. Shell larger in size, inner lip and outer lips of the aperture strongly thickened and reflected, foot broad and not grooved **CYCLOPHORIDAE**
Shell smaller in size, lips comparatively thin, simple or expanded, foot with a median longitudinal groove **POMATIASIDAE**.
4. Shell turretted to cylindrical 57
Shell not cylindrical but either globose, trochiform to turbiniform or discoidal 6
5. Shell imperforate with many whorls—more than seven in an adult snail
Shell perforate with less than seven whorls **ENIDAE**
6. Shell drab coloured, slender, body whorl narrow **SUBULINIDAE**
Shell smooth, glossy and thick, body whorl wide, distinct from the spire **GLESSULIDAE**
7. Shell trochiform, minute, lip thin, dilated at the columella obstructing the umbilical opening **VALLONIIDAE**
Shell either globose or flatly depressed, lip thickened 8
8. Shell either flatly compressed or depressed with less pronounced spire . .9
Shell globose with either slightly raised or prominent spire 10
9. Shell flatly compressed, thinly sculptured, body whorl keeled **TROCHOMORPHIDAE**
Shell with a depressed spire, strong sculpture but without keel **PLEURODONTIDAE**
10. Shell widely umbilicate, spire slightly raised **FRUTICICOLIDAE**
Shell with narrow umbilical pore, spire raised and prominent **ARIOPHANTIDAE**

b. *Freshwater*

1. Shell univalve	2
Shell with two valves	9
2. Occurs in fast flowing streams or hill streams, shell depressedly turbinate with a short spire	LITTORINIDAE
Normally found in stagnant water pools, ponds or tanks, shell not depressed, spire prominent	3
3. Shell with operculum	4
Shell without operculum	7
4. Shell moderately to considerably large in size, aperture broad	5
Shell small in size, usually turreted, aperture small	6
5. Shell considerably large in size, globose, body whorl very large, spire comparatively small	PILIDAE (AMPULLARIDAE)
Shell moderately large, top-shaped or turbinated, spire prominent, body whorl not very large when compared with the spire	VIVIPARIDAE
6. Shell corneous, normally conical, spire not large than the body whorl	AMNICOLIDAE
Shell thick, rounded but mostly turreted, spire may be very large or very small than the body whorl	THIARIDAE (MELANIIDAE)
7. Shell thin, aperture large, body whorl generally large, spire short	8
Shell thick, discoidal in shape, animal sinistral	PLANORBIDAE
8. Columellar fold conspicuously twisted longitudinally, truly aquatic.	LYMNAEIDAE
Columellar fold not twisted, found on land or even on trees	SUCCINEIDAE
9. Shell transversely elongated, ligament internal, outer surface without concentric striae	UNIONIDAE
Shell triangular or triangularly ovate, outer surface with concentric striae, ligament external	CORBICULIDAE

SYSTEMATIC ACCOUNT

In the following account nomenclature and the scheme of classification is based largely on Thiele (1931-1937) with a few exceptions here and there. Literature citations under every species have been limited to original description and important subsequent record.

A. LAND MOLLUSCS

Class GASTROPODA

Order MESOGASTROPODA

Family CYCLOPHORIDAE

Genus *Cyclophorus* Montfort, 1810.

Cyclophorus indicus (Deshayes)

1832. *Cyclostoma indicum*, Deshayes, in Belanger *Voy. Ind. Orient. Zool* : 415, pl. 1, figs. 4, 5.

1921. *Cyclophorus indicus* : Gude, *Fauna Brit. India* Mollusca-III : 63.

Total No. of exs. studied : 5. Largest shell $H=30.47$ mm./ $W=35$ mm.

Distribution : India—Elephanta Island; Western Ghats, Bombay, It is restricted to western India.

Family POMATIASIDAE

Genus *Cyclotopsis* Blanford, 1864

Cyclotopsis semistriata (Sowerby)

1843. *Cyclostoma semistriatum* Sowerby, *Thes, Conch.* 1 : 91, pl. 23, fig. 6.

1921. *Cyclotopsis semistriatum* : Gude *Fauna Brit. India*, Mollusca III : 353

Total no. of exs. studied : 100. Largest shell $H=10.31$ mm./ $W=10.5$ mm.

Distribution : India—Pune, Maharashtra. It is restricted to hills near Pune city.

Order SYSTELLOMMATOPHORA

Family VERONICELLIDAE

Genus *Laevicaulis* Simroth, 1913.

Laevicaulis alte (Ferussac)

1821. *Vaginulus alte* Ferussac. *Tabl.Syst. Limaces*, p. 14 (Type locality : Pondicherry, India).

1961. *Laevicaulis alte* : Ray, *Treubia*, 25(3) : 275.

Total no. of exs. studied : 25. Average size, $L=35.5$ mm./ $W=15$ mm.

Distribution : East Africa, Mauritius, Reunion, Madagascar, India, Ceylon, Hongkong, China, Formosa, Indonesia, New Caledonia, and Loyalty Islands.

It is a widely distributed tropical species. It is originally an African species from where it spread to other tropical countries through cultivated plants (Forcart, 1967).

Remarks : Its body is generally black on the dorsal surface and it is characterised by a long cylindrical penis, with a pointed tip.

It is nocturnal and during day it generally hides under foliage or debris avoiding direct sunlight. It frequents damp and wet places. It was recorded as a pest in vegetable gardens (Rao and Ramadoss, 1953).

Genus *Sarasinula* Grimpe & Hoffman, 1924

Sarasinula plebeja (Fischer)

1868. *Vaginula plebeja* Fischer, *J. Conch. Paris*, 6 : 145. (Type-locality : New Caledonia)

1961. *Vaginulus (Sarasinula) plebeja* : Ray, *Treubia*, 25 : 275.

Distribution : East Africa to Pacific islands. From India it was recorded from Chindamabaram, South Arcot District (Ray, 1961). The present one is a second record for India, but is the first report from Maharashtra.

Remarks : It differs from the preceeding species in generally having a pale grey to greyish-yellow dorsal body surface. Its penis is short, stout and asymmetrical.

Genus *Semperula* Grimpe & Hoffman, 1924.

Semperula birmanica (Tehobald)

1864. *Vaginulus birmanicus* Theoblad *J. Asiat. Soc. Beng.*, 33 : 243 (Type-locality : Rangoon, Burma).

1925. *Semperula birmanica* : Hoffmann, *Jenais Zeitschr. Naturw.*, 61 : 182, 254, Tab. 6. fig. 45, KI (Penis)

Total no. of exs. studied : 12. Average size. L = 37 mm. W = 14.7 mm.

Distribution : India-Calcutta, Moiraka; Burma-Rangoon, Pegu-Thayet-Mvo, Aracan, Tennasserim, Penang, Bhamo; Thailand, Zamboanga; Indonesia-Sumatra.

This species is recorded for the first time from Maharashtra. It is not as widely distributed as the other two species-*Laevicaulis alte* (Ferussac) & *Sarasinula plebeja* (Fischer).

Remarks : It is generally yellowish-brown and minutely marked with black dashes and spots. The penis is approximately oval shaped with a pointed tip in the centre. In juvenile forms it is long and almost cylindrical with a blunt tip.

Family ENIDAE

Subfamily NAPAEINAE

Genus *Rhachis* Albers, 1850.

Rhachis punctatus (Anton)

1839. *Bulimus punctatus* Anton, *Verzeich. Conch* : 42.

1961. *Rhachis punctatus* : Ray, *Treubia*, 25(3) : 276.

Total no. of exs. studied : 15. Largest shell, H=13.8 mm. W=6.8 mm. H of aperture=6 mm.

Distribution : India-West Bengal, Orissa, Maharashtra, Tamil Nadu, Uttar Pradesh. Africa-Zanzibar, Mozambique.

Genus *Cerastus* von Martens, 1860

Cerastus densus (Pfeiffer)

1856. *Bulimus* (*Petraeus*) *densus*, Pfeiffer, *Malak. Blatt.*, 2 : 154.

1914. *Cerastus densus* : Gude, *Fauna Brit. India. Mollusca*, 2 : 269.

Total no. of exs. studied : 2. Largest shell, H=19.3 mm.

W=11.2 mm. H. of aperture=8.4 mm.

Distribution : Kerala-Malabar, Maharashtra, Poona. Ahmadnager.

Family SUBULINIDAE

Genus *Opeas* Albers, 1850.

Opeas gracile (Hutton)

1834. No. 5, *Bulimus* ? Hutton, *J. Asiat. Soc. Beng.*, 3 : 84; No 5 *Bulimus* ? (*mihi*) *gracilis* ? p. 93 (Type-locality : Mirzapore, Uttar Pradesh).

1963. *Opeas gracile* : Tonapi and Mulherkar, *J. Bombay nat. Hist. Soc.*, 60(1) : 113.

Total no. of exs. studied : 7. Largest shell H=14.8 mm. W=3.6 mm. H. of aperture = 3.5 mm.

Distribution : India—Tamil Nadu, Andhra Pradesh, Maharashtra Rajasthan, Punjab, Kashmir, Uttar Pradesh, Bihar, West Bengal, Assam, Andaman and Nicobar Islands. Pakistan, Ceylon, Bangladesh, Burma,, Malay Peninsula and Archipelago, Japan, China, Philippines, and Polynesia.

Remarks : It is commonly known as a garden snail and known to cause considerable damage to potted plants (Ray and Mukherjee, 1963).

Genus *Zootecus* Westerlund, 1887.

Zootecus insularis (Ehrenberg)

1831. *Pupa insularis* Ehrenberg, *Symb. Phys. Anim. Evert. Moll.*, 1 : 3.

1963. *Zootecus insularis* : Tonapi and Mulherkar; *J. Bombay nat. Hist. Soc.*, 60(1) : 114.

Total no. of exs. studied : 66. Largest shell H=13.8 mm. W=5.mm.
H. of aperture=3.1 mm.

Distribution : India—Andhra Pradesh, Maharashtra, Gujarat, Rajasthan, Punjab, Kashmir, Uttar Pradesh, Madhya Pradesh, Bihar. Elsewhere—Africa to Arabia, West Pakistan, Ceylon and Burma.

Family GLESSULIDAE

Genus *Glessula* von Martens, 1850.

Glessula illustris var. *tumida* Godwin-Austen

1920. *Glessula illustris* var. *tumida* Godwin-Austen, *Land & Freshwater Moll. India*, 3(1) : 39, pl. CLX, fig. 13 (Type-locality : Lukah Valley, Jaintia Hills)

Total no. of exs. studied : 3. Largest shell, H=12.1 mm. W=7.1 mm.
H. of aperture=5.4mm.

Distribution : Lukah valley, Jaintia.

Remarks : While describing the typical *illustris*, Godwin-Austen (1875) made a reference to the variety, but without any description. At a later date (1920) he gave a complete description and figured the variety. It differs from the typical form in being more tumid. It is recorded for the first time from Maharashtra.

Glessula ceylanica (Pfeiffer)

1845. *Achatina ceylanica* Pfeiffer, *Zeitschr. Mal.*, p. 157.

1909. *Glessula ceylanica* : Pilsbry, *Man. Conch.*, (2) 20 : 57. pl 6, figs. 7, 8

Total no. of exs. studied : 34, Largest shell H=12.9 mm. W=6.9. mm. H. of aperture = 5 mm.

Distribution : India—Maharashtra. Ceylon—Maturata, Bolapiti and Colombo.

Remarks : Shell is oblong-ovate, whorls, 7, spire obtuse, and almost smooth.

Glessula notigena (Benson)

1860. *Achatina notigena* Benson, *Ann. & Mag. nat. Hist.* (3) 5. 462.
(Type-locality : Mahabaleswar ghats.

1914. *Glessula notigena* : Gude, *Fauna Brit. India*, Moll. II : 412.

Total no. of exs. studied : 20, Largest shell H=17.6 mm. W=7.3 mm. H. of aperture = 5.8 mm.

Distribution : Assam—Cherra Poonjee, West Bengal—Darjeeling, Sikkim, Maharashtra—Mahabaleshwar Hills, Pune, Khandala Bangladesh, Sylhet.

Remarks : The shell is elongately conical with a pointed spire, whorls 9-10, with fine longitudinal striae.

Glessula gemma (Reeve)

1850. *Achatina gemma* Reeve, *Conch. Iconica*, 5, *Achatina* pl. 22, Fig. 123
(Type-locality : West Bengal)

1920. *Glessula gemma*; Godwin-Austen. *Land & Freshwater, Moll India*, 3(1): 22.

Total no. of exs. studied : 1, H=12.1 mm. W=6.5mm H. of aperture=4.8 mm.

Distribution : Assam : Garo Hills; West Bengal—Barrackpore, Chandannagore; Bihar—Rajmahal; Maharashtra—Pune; Kerala-Malabar Plains, Beypore; Bangladesh—Jessore district, Chittagong; Burma—Araccan.

Remarks : Shell oblong-conical, whorls six, rounded and smooth.

Family ARIOPAHNTIDAE

Subfamily ARIOPHANTINAE

Genus *Ariophanta* Desmoulins, 1829

Ariophanta bajadera (Pfeiffer)

1850. *Helix bajadera* Pfeiffer, *Zeitschr. Mal.*, p. 69.

1963. *Ariophanta bajadera* : Tonapi & Mulherkar, *J. Bombay nat. Hist. Soc* 60(1) : 116.

Total no. of exs. studied: 15, Largest shell H=26 mm. W=30.6 mm.
H. of aperture=3.1 mm.

Distribution : Bombay, South of the Narbudda, ranging east to Nagpur, Common on the Western Ghats near Bombay.

Genus *Cryptozonia* Mörch, 1872

Subgenus *Xestina* Pfeiffer 1878.

Cryptozonia (Xestina) bistrialis (Beck)

1837. *Nanina bistrialis* Beck, *Index Moll.*, 1 : 2.

1961. *Cryptozonia (Xestina) bistrialis* : Ray, *Treubia*, 25(3) : 278.

Total no. of exs. studied : 12. Largest shell H=20.5 mm. W=30.4 mm. H. of aperture=15.2 mm.

Distribution : It is common in South India. Andhra Pradesh Dumagudem; Tamilnadu : Tiruchirapalli, Balarangam, Shevroys, Madras; Karnataka : Bangalore; Kerala : Kottayam District; Maharashtra : Pune, Panchagani; Ceylon.

Remarks : Subba Rao (1975) mentioned its diagnostic characters ecology and economics.

Subgenus *Nilgiria* Godwin-Austen, 1888

Cryptozona (Nilgiria) semirugata (Beck)

1837. *Galaxis semirugata*, Beck, *Index Moll.*, 1 : 42.

1961. *Cryptozona (Xestina) semirugata* : Ray. *Treubia*, 25(3) : 228.

Total no. exs. studied : 23. Largest shell H=35.5 mm, W=37.2 mm. H. of aperture = 24.7 mm.

Distribution : It is an endemic form to Peninsular India. Its range extends to Gujarat in the West, Bengal in the north and Ceylon in the south.

Remarks : Subba Rao (1975) gave its diagnostic characters and mentioned its economic importance.

Subfamily MACROCHLAMYDINAE

Genus *Macrochlamys* Gray, 1847

Subgenus *Macrochlamys* s. str

Macrochlamys (Macrochlamys) indica Godwin-Austen

1833. *Macrochlamys indica* Godwin-Austen. *Land and Freshwater Moll. India.*, 1 : 97, pl. xviii. figs. 1-8b. (Type-locality : Calcutta).

1975. *Macrochlamys (Macrochlamys) indica* : Subba Rao, *Dr. B.S. Chauhan Comm. Vol.* p. 168.

Total no. exs. studied : 7. Largest shell H=13mm. W=22.3 mm. H. of aperture = 9.6 mm.

Distribution : West Bengal—Siliguri; Assam : Cachai; Orissa; Ganjam, Bihar : Bhagalpur.

It is recorded for the first time from Maharashtra.

Remarks : In literature the author of the species *indica* is often given as Benson. Even Godwin-Austen (1893) attributes this species to Benson. As Benson had not named any such species we

recognise Godwin-Austen as its author. The latter was the first author to give a complete description accompanied by illustrations.

Macrochlamys petasus (Benson)

1859. *Helix petasus* Benson, *Ann. Mag. nat. Hist.*, 3(3) : 388.

(Type-locality-Phil Than, Tenasserim,) Burma)

1908. *Macrochlamys petasus* : Blanford & Godwin-Austen, *Fauna Brit. India. Mollusca*, p. 115.

Total no. of exs. studied : 4. Largest shell=5.5 mm. W=9.5 mm.
H. of aperture=3.6 mm.

Distribution : India—Maharashtra; Burma.

Remarks : The identification is only provisional. It agrees with the figure given by Godwin-Austens.

Macrochlamys (Macrochlamys) tenuicla H. Adams

1868. *Macrochlamys tenuicula* H. Adams, *Proc. zool. Soc., Lond.*, p. 14, pl. 4, fig.9 (Type-locality : Satara, Maharashtra)

1908. *Macrochlamys tenuicula* : Blanford & Godwin-Austen, *Fauna Brit. India*, Moll. p. 130.

Total no. of exs. studied : 6. Largest shell H=5.7 mm. W=8 mm.
H. of aperture=3.8 mm.

Distribution : Bombay and Western Ghats, Khandala, Satara and Surat, Rajpipla Hills at Dholgaum.

Remarks : The shell is easily recognised by its turbinate shape and longitudinal microscopic sculpture.

Subfamily HELICARIONINAE

Genus Eurychlamys Godwin-Austen 1899

Eurychlamys platychlamys Blanford

1880. *Macrochlamys platychlamys* Blanford, *J. asiat. Soc. Beng.*, 2 : 195, pl. 2, fig. 9.

1903. *Eurychlamys platychlamys* : Blanford and Godwin-Austen, *Fauna Brit. India*, Moll., p. 188, fig. 65 A-D

Total no. of exs. studied : 11. Largest shell H=7.5 mm. W=11 mm.
H. of aperture = 4.5 mm.

Distribution : Bombay and its neighbourhood, Girnar hills, Pune

This species is probably restricted to Western India.

Remarks : Shell is openly perforate, thin, smooth and translucent generally resembling that of *Macrochlamys*. But it has remarkable mantle lobes and genitalia which prompted Godwin-Austen to erect a new subgenus with the present species as its type.

Subfamily DURGELLINAE

Genus *Sitala* H. Adams, 1856

Sitala denselirata Preston

1908. *Sitala denselirata* Preston, *Rec. Indian Mus.*, 2 : 187. (Type-locality : Andamans)

Total no. of exs. studied : 3. Largest shell H=5 mm. W=5.2 mm,
H. of operlures=2.6 mm.

Distribution : India-Andamans; Maharashtra-Pune; Burma; Ceylon.

Remarks : The shells agree with the type specimen deposited in Zoological Survey of India. The shells are smaller in size with distinct carination at the periphery. Whorls with fine and distinct spiral striations, which are however, absent on the base of the shell.

Family PLEURODONTIDAE

Genus *Planispira* Beck, 1837

Subgenus *Trachia* Albers, 1860

Planispira (*Trachia*) *crassicostata* (Benson)

1848. *Helix crassicostata* Benson, *Ann. Mag. nat. Hist.*, (2)2 : 159 ("in dumetis Indiae meridionalis")

1914. *Planispira* (*Trachia*) *crassicostata*: Gude, *Fauna Brit India*, Moll., II : 158.

Total no. of exs. studied : 37. Largest shell H=5.2 mm. W=10 mm.
H. of aperture = 4.1 mm.

Distribution : South India, Maharashtra—Pune.

Family TROCHOMORPHIDAE

Genus *Trochomorpha* Albers, 1850

Subgenus *Sivela* Blanford, 1863

Trochomorpha (*Sivela*) *billiana* (Mörch)

1872. *Nanina* (*Videna*) *billiana* Mörch. *J. Conch. Paris*, p. 310.

1914. *Trochomorpha billiana* Gude, *Fauna Brit. India*, Moll. II : 4.

Total no. of exs. studied : 2. Largest shell H=3.6 mm. W=10.3 mm.
H. of aperture = 3.6 mm.

Distribution : Nicobar Islands, Nancowry, Camorta, Katchall; Maharashtra—Pune.

Hitherto it was known from the Nicobar Islands. It is recorded for the first time from (Maharashtra) the Indian mainland.

Family VALLONIIDAE

Genus *Pupisoma* Stoliczka, 1873

Pupisoma evezardi (Blanford)

1875. *Pupa evezardi* Blanford Mss., Hanley and Theobald, *Conch. Indica*, p. 41, pl. 101, figs. 5, 6.

1880. *Pupa (Pupisoma) evezardi* Blanford, *J. asiat. Soc. Bengal.*, 49 : 199, (Type-locality : Karkalla, near Khandala).

Total no. of exs. studied : 12. Largest shell H=3.5 mm. W=2 mm)
H. of aperture = 1.6 mm.

Distribution : Maharashtra-Khandala.

Remarks : The species *evezardi* was described by Blanford (1880. a few year after Hanley and Theobald (1875) and Nevill (1878) who actually figured and listed the species respectively. According to Blanford (1880) Hanley and Theobald's figure was taken from one of the specimens collected by Col. Evezard at Karkalla, near Khandala, at the head of the Bor Ghot, which is the type locality of the species. No specimens were seen by us from Sinhagarh, near Pune, the locality mentioned by Hanley and Theobald.

Hora (1928) has remarked that it climbs trees for purposes of aestivation. At Lonavla several specimens were collected in the crevices of trees along with snails of *Succinea raoi* Subba Rao & Mitra.

Family FRUITICICOLIDAE

Genus *Eulota* Hartmann, 1842

Eulota scalpturita (Benson)

1857. *Helix scalpturita* (Benson), Theobald, *J. asiat. Soc. Beng.*, 26 : 248.

1914. *Eulota scalpturita* Benson; Gude, *Fauna Brit. India*, Moll., II : 203.

Total no. of exs. studied : 11. Largest shell H=9.8 mm. W=14.6 mm. H. of aperture = 7.4 mm.

Distribution : India—Maharashtra : Pune, Burma; Ava, Tsagin, Mandalay, Shan Hills. Thyet Myo.

Remarks : Shell globosely depressed with an obtuse apex, characterised by a brownish band.

b. FRESH WATER AND AMPHIBIOUS MOLLUSCS

Family VIVIPARIDAE

Genus *Viviparus* Montfort, 1810

***Viviparus bengalensis* f. *typica* (Lamarck)**

1822. *Paludina bengalensis* Lamarck, *Hist. nat. Anim. sans. Vert.*, 6(2) : 174.

1921. *Vivipara bengalensis* race *bengalensis* : Annandale & Sewell, *Rec. Indian Mus.*, 22 : 270, pl. 1, figs. 1-3.

Total no. exs. studied : 22. Largest shell H=30.27 mm. W=20.37 mm.

Distribution : Common throughout India, Bangladesh, Burma and Ceylon.

***Viviparus bengalensis* (Lamarck) form *doliaris* (Gould)**

1843. *Paludina doliaris* Gould, *Proc. Boston Soc. nat. Hist.* 1 : 144.
(Type-locality : Burma)

1921. *Viviparus bengalensis* race *doliaris* : Annandale & Sewell, *Rec. Indian Mus.*, 22 : 273, pl. 1, fig. 9.

Total no. exs. studied : 131. Largest shell H=20.45 mm. W=20 mm.

Distribution : India—Maharashtra: Pune, Nasik; West Bengal—Howrah, Jalpaiguri, Sunderbans; Assam; Burma.

***Viviparus bengalensis* (Lamarck) form *mandiensis* Kobelt**

1909. *Vivipara bengalensis* race *mandiensis* Kobelt in, Martini und Chemnitz's *Syst. Conch. Cab.*, 2 : 414, pl. 77, figs. 3, 10. (Type-locality : Mandi, Kangra Valley).

1963. *Viviparus bengalensis* race *mandiensis* : Ray und Mukherjee, *Rec. zool. Surv. India.*, 61 : 415.

Distribution : Bihar, Uttarpradesh, Punjab, Rajasthan & Maharashtra.

Remarks : Annandale (1921) expressed a doubt regarding the type-locality of this form. So far there is no record of *Viviparus bengalensis* from the Mandi district.

Viviparus bengalensis form incrassatus Annandale

1921. *Vivipara bengalensis* phase *incrassata*, Annandale, *Rec. Indian Mus.*, 22 : 277, pl. II, fig. 3.4, (Type-Locality : Tungabhadra, Kurnool Dist., Andhra Pradesh).

Total no. exs. studied : 89. Largest shell H=30.5 mm. W=20.5 mm.

Distribution : India—Andhra Pradesh, Masulipatam, Kurnool, Maharashtra—Pune, Mesopotamia.

Family PILIDAE (= AMPULLARIIDAE)**Genus Turbinicola Annandale & Prashad, 1921****Turbinicola saxea (Reeve)**

1856. *Ampullaria saxea* and *Ampullaria nux.* Reeve, *Conch. Icon.* 10 : *Ampullaria*, pl. 22, fig. 108, pl. figs. 132a, b. (Type-locality : Unknown).
1925. *Turbinicola saxea* : Prashad, *Mem. Indian Mus.*, 8 : 87, pl. 16, figs. 10-12

Total no. of exs. studied : 67. Largest shell H=20.5 mm. W=20.2 mm. H. of aperture=17.2 mm.

Distribution : Small hill-streams round Khandala and Igatpuri in the Western Ghats. Bombay-Pune High Road, at altitudes between 2,500 and 3,000 feet (Prashad, 1925).

Remarks : The columellar callus of the shell is flattened and with the outer lip it forms a continuous margin, enabling the shell to come into much closer contact with the substratum.

It is a hill stream form occurring in the upper parts of the streams near Khandala. Some of the specimens in the collection were collected from the marshy fields to where they might have been carried with the flow of water.

Type-locality : According to Reeve the species *T. saxea* was collected from an unknown locality. Prashad (1925), however, remarked that the type in the British Museum (Natural History), London bears the locality label "Bombay". We now restrict the type-locality to "Streams near Khandala" from where most of the material of this species was collected.

Family HYDROBIIDAE**Genus Alocinma Annandale & Prashad, 1919.****Alocinma orcula (Frauenfeld)**

1862. *Bithynia orcula* Frauenfeld, *Verhandl. zool. Bot. Geschaft.*, p. 1154.

1921. *Amnicola (Alocinma) orcula* : Annandale, *Rec. Indian Mus.*, 22 : 540.

Total no. exs. studied : 68.

Distribution : The typical form is known to occur in Assam, West Bengal, Bihar, Uttar Pradesh, Punjab and Rajasthan.

It is recorded, here for the first time from Maharashtra. The largest shell ($4\frac{1}{2}$ whorls) measures-length 6.45 mm., breadth 4.5 mm. height of the aperture 3.33 mm.

***Alocinma orcula* var. *producta* (Nevill)**

1884. *Bithynia orcula* var. *producta* Nevill, *Hand List Moll. Indian Mus.*, 2 : 37.

1963. *Alocinma orcula* var. *producta* : Ray and Mukherjee, *Rec. zool. Surv. India*, 61 : 420, pl. 19, fig. 1, la.

Total no. exs. studied : 119.

Distribution : Assam, West Bengal, Bihar, Uttar Pradesh, Punjab and Rajasthan.

Remarks : It often occurs in association with the form *typica*. The largest shell ($4\frac{1}{2}$ whorls) measures-length 6.5 mm., breadth 4.4 mm., height of aperture 3.1 mm.

Genus *Digoniostoma* Annandale, 1920.

***Digoniostoma pulchella* (Benson)**

1836. *Paludina puchella* Benson, *J. Asiat. Soc. Beng.*, 5 : 746. (Refers to No. 9 *Valvata*, Hutton, *J. Asiat Soc. Beng.*, 3 : 90. (Type-locality : Mirzapore),

1963. *Digoniostoma pulchella* : Ray and Mukherjee, *Rec. zool. Surv. India*, 61 : 418. pl. 18, figs. 8, 8a.

Total no. exs. studied : 25. Largest shell H=8.5 mm. W=6 mm.

Distribution : India—Common throughout India. Also Burma and Malay Peninsula.

Family THIARIDAE (=Melaniidae)

Subfamily THIARIINAE

Genus *Thiara* Röding

***Thiara scabra* (Müller)**

1774. *Buccinum scabrum* Müller, *Verm. Terr. Fluv. Hist.* 2 : 136. (Type-locality : Tranquebar).

1963. *Melania (Plotia) scabra* : Tonapi and Mulherkar, *J. Bombay nat. Hist. Soc.*, 60 : 109.

Total no. of exs. studied : 731. Largest shell H=20.3 mm.
W=12.5 mm. H. of aperture = 10 mm.

Distribution : India—Kerala, Cochin; Pondicherry; Tamilnadu; Karnataka; Maharashtra, Pune. Madhya Pradesh; Uttar Pradesh; Bihar, West Bengal. Elsewhere Mauritius, Seychelles, Ceylon, Burma, Malay Peninsula, Malay Archipelago, Philippines, Indonesia, Madura, Java.

***Thiara scabra* var. *elegans* (Benson)**

1836. *Melania elegans* Bensons, *J. asiat. Soc. Beng.*, 5 : 782. (refers to sp., c., in, *Gleanings in science*, 2. p. 22, 1830) (Type-locality : River Gumti = Gomati, U. P.).

1963. *Melanoides (Plotia) scabra* var. *elegans*, Hutton : Tonapi and Mulherkar, *J. Bombay nat. Hist. Soc.*, 60 : 110,

Total no. exs. studied : 166. Largest shell H=20.7 mm. W=10.2 mm. H. of aperture=12.5 mm.

Distribution : Tamilnadu—Madras; West Bengal—Calcutta; Uttar Pradesh—Gomati river; Punjab—Ferozapur; Maharashtra-Pune. Persia.

Remarks : Hutton (1849) recorded this species from a stream in the Bolan Pass at Babu Nanee, which forms the western limit of its geographical range. The specimens were found deeply buried in the river bed during February, when it is extremely cold. Annandale and Prashad (1919) could not find any specimens from Baluchistan.

Genus *Melanoides* Olivier, 1807

***Melanoides pyramis* Hutton**

1849. *Melanoides pyramis* Hutton, *J. asiat. Soc. Beng.*, 18(2) : 658. (Refers to Benson, *Gleanings in Science* No. 13 for 1830, p. 22, species B.).

1919. *Melanoides pyramis* : Annandale and Prashad, *Rec. Indian Mus.*, 18 : 22, pl. 5, fig. 3.

Total no. of exs. studied : 51. Largest shell, H=28.5 mm. W=12, H. of aperture = 9.5 mm.

Distribution : Occurs throughout India, quite common in the Gangetic plains. Elsewhere : Pakistan, Iran, Iraq.

***Melanoides pyramis* var. *leopardina* Annandale & Prashad**

1919. *Melanoides pyramis* var. *leopardina* Annandale and Prashad, *Rec. Indian Mus.*, 18 : 33, pl. iv. fig. 4 (Type-locality : Poona),

Total no. of exs. studied : 33. Largest shell, H=28.6 mm. W=10. mm. H. of aperture = 9 mm.

Distribution : It is not uncommon, though apparently sporadic in the Indo-Gangetic plain and Peninsular India.

Remarks : It differs from the typical form in having a slightly narrower body whorl, less produced anterior margin of the lip and indistinct granules on the surface.

Melanoides pyramis* var. *puteicola
Annandale & Prashad

1834. *Melania* (No. 14) Hutton, *J. asiat. Soc. Beng.*, 3 : 91.

1919. *Melanoides pyramis* var. *puteicola* Annandale and Prashad *Rec. Indian Mus.*, 18 : 33, pl. iv., figs. 7, 8. (Type-locality : Ferozpore, Punjab).

Total no. exs. studied : 35. Largest shell H=20.5 mm. W=10.5 mm. H. of aperture = 8 mm.

Distribution : Andhra Pradesh—Kurnool; Maharashtra—Pune Punjab—Ferozpore.

Remarks : It is characterised by smaller and thinner shells with more impressed suture and anteriorly slightly thickened lip.

As remarked by Annandale & Prashad (1919) the variety affords an easy transition to the sub-genus *Plotia*. It differs from the typical *pyramis* in its more conspicuous sculpture. The longitudinal ribs are distinctly seen as in *scabra* but differ from it in not being produced at the upper extremity.

The variety is recorded for the first time from Pune.

***Melanoides tuberculatus* (Müller)**

1774. *Nerita tuberculata* Müller, *Verm. Terr. Fluv. Hist.*, 2 : 191.
(Type-locality : Coromandel coast).

1963. *Melania* (*Striatella*) *tuberculata* : Tonapi and Mulherkar, *J. Bombay nat. Hist. Soc.*, 60 : 110.

Total no. exs. studied : 12. Largest shell, H=29.5 mm. W=12.5 mm. H. of aperture=9 mm.

Distribution : It is very widely distributed. Its range extends from North Africa to Pacific Islands, to Australia and China.

There is no evidence of its occurrence in Baluchistan or Southern Persia (Annandale & Prashad, 1919).

Remarks : The species is variable and often confused with *M.*

pyramis. Annandale & Prashad (1919) had clearly stated its distinguishing characters.

Subfamily PALUDOMINAE

Genus *Paludomus* Swainson, 1840.

Paludomus obesa (Philippi)

1842. *Melania obesa* Philippi, *Abbild. Besch.*, 2 : 170, *Melania*, pl. 4, fig. 3.

1919. *Paludomus obesa* : Annandale, *Rec. Indian Mus.*, 16 : 147.

Total no. of exs. studied : 493. Largest shell H=14.5 mm. W=11 mm. H. of aperture=7 mm.

Distribution : The range consists of the Western part of Indian Peninsula, Khandala and the Indo-Gangetic plain to the north.

Remarks : It is found in abundance in the streams near Khandala. It occurs only in a place where the mountain stream becomes broadened out and its currents become less strong as it crossed a small plain. It feeds on algae covering the rocks (Annandale, 1919).

Family LITTORINIDAE

Genus *Cremnoconchus* Blanford, 1869

Subgenus *Cremnoconchus* Blanford, 1869

Cremnoconchus syhadrensis (Blanford)

1863. *Cremnobates syhadrensis* Blanford, *Ann. Mag. nat. Hist.*, (3) 12 : 184, pl. iv. figs. 1-7., (Type-locality : Syhadri hills in Western Ghats).

1919. *Cremnoconchus syhadrensis* : Annandale, *Rec. Indian Mus.*, 16 : 149, pl. iv., figs. 2-4.

Total no. exs. studied : 130. Largest shell H=10 mm. W=9.6 mm. H. of aperture = 6 mm.

Distribution : Western Ghats—Khandala. Localised distribution (Hora, 1926).

Remarks : Hora (1928) recorded some interesting observations. It had been observed to hibernate on rocks projecting out of water at the edge of the pool below the falls at Khandala. The specimens were found firmly gripped in fairly deep pits well protected from the mid-day sun.

C. syhadrensis possesses both a gill and a branchial chamber with a small orifice that can be completely closed. The branchial chamber is however not transformed into a lung. A thin film of water is found

in the chamber and the absorption of oxygen takes place through that film (Annandale, 1919).

Type-locality : Blanford (1863) did not specify the exact type-locality. We now designate "Khandala" as the type-locality.

Subgenus *Lissoconchus* Thiele, 1981

Cremnoconchus conicus Blanford

1871. *Cremnoconchus conicus* Blanford, *J. asiat. Soc. Beng.*, 39 (2) : 10, pl. 3, figs. 3, 3a. (Type-locality : Torna hills, near Pune).

1915. *Cremnoconchus conicus* : Preston, *Fauna of British India, Mollusca* (Freshwater Gastropoda and Pelecypoda), p. 65.

Total no. exs. studied : 28. Largest shell H=8.5 mm. W=7.5 mm.
H. of aperture=5.3 mm.

Distribution : Not recorded outside Torna hills.

Remarks : It is characterised by a shell which is longer than broad making it ovately conical, sutures are very much impressed, the shell is olivaceous, smooth or with very fine longitudinal striae, body whorl with the distinct dark rufous-brown bands, the upper band is broader than the lower one.

All the specimens in the collection are decollated.

Cremnoconchus conicus var. *canaliculatus* Blanford

1870. *Cremnoconchus conicus* var. *canaliculatus* Blanford, *J. asiat. Soc. Beng.*, 39 (2) : 11, pl. 3, fig. 4. (Type-locality : Torna).

1915. *Cremnoconchus conicus* var. *canaliculatus* : Preston, *Fauna Brit. India, Mollusca* (Freshwater Gastropoda & Pelecypoda). p. 66.

Total no. of exs. studied : 8. Largest shell H=8 mm. W=6 mm.
H. of aperture=4 mm.

Distribution : Not recorded beyond Torna.

Cremnoconchus conicus var. *edecollata* Nevill

1877. *Cremnoconchus conicus* var. *edecollata* Nevill, *Hand List Moll. Indian Mus.*, pt. II, p. 173. (Type-locality : Near Pune).

Total no. exs. studied : 12. Largest shell H=7 mm. W=5 mm.
H. of aperture=3.5 mm.

Remarks : The material which was studied by Nevill is present in Zoological Survey of India. Evidently it constitutes the Syntype series.

It agrees completely with the preceding species in its characters but differs from it in having complete spire without any decollation.

There is no recent material to ascertain whether it is a distinct variety. The exact type—locality was also not designated by Nevill.

Order BASOMMATOPHORA

Family LYMNAEIDAE

***Lymnaea* (Pseudosuccinea) *acuminata* form *typica* Lamarck**

1822. *Limnaea acuminata* Lamarck, *Hist. Nat. Anlm Sans, Vert.* 6(2):160.

1963. *Lymnaea acuminata* : Tonapi and Mulherkar, *J. Bombay nat. Hist. Soc.* 60(1) p. 111.

Total no. exs. studied : 70. Largest shell H=20.5 mm. W=15 mm.
H. of aperture = 16.6 mm.

Distribution : India. Also Bangladesh, Pakistan and Burma.

***Lymnaea* (Pseudosuccinea) *acuminata* f. *rufescens* Gray**

1820. *Limnaea rufescens* Gray, in Sowerby's *Genera of shells* London, 1, *Limnaea* fig. 2.

1925 *Limnaea* (Pseudosuccinea) *acuminata* f. *rufescens* : Annandale and Rao, *Rec. Indian Mus.*, 27 ; 181, fig. III.

Total no. exs. studied : 21. Largest shell H=32 mm. W=18.5 mm.
H. of aperture=24.5 mm.

Distribution : India, also Bangladesh and Burma.

***Lymnaea* (Pseudosuccinea) *acuminata* (Lamarck) f. *patula* Troschel**

1837. *Limnaeus patula* Troschel, Weigman's *Arch. f. Naturges*, 3 : 167.

1925. *Limnaea* (Pseudosuccinea) *acumicata* f. *patula* : Annandale and Rao *Rec. Indian Mus.*, 27 : 181, fig. III, no. 9.

Total no. exs. studied : 44. Largest shell H=24 mm. W=14.5 mm.
H. of aperture = 17.5 mm.

Distribution : India, also Burma, Nepal and Pakistan

Lymnaea* (Pseudosuccinea) *acuminata

Sub. sp. *tonapii* Ray & Roychoudhury

1969. *Lymnaea* (Pseudosuccinea) *acuminata* sub. sp. *tonapii* Ray & Roychoudhuri, *Proc. zool. Soc., Calcutta* 22; 44-51, pl. 4, figs. 1-11.
(Type-locality : Mula Mutha River, Pune).

Total no. exs. studied : 86. Largest shell H=12 mm. W=5 mm.
H. of aperture = 7.5 mm.

Distribution : Maharashtra—Pune.

***Lymnaea* (Pseudosuccinea) *acuminata* f. *gracilior* Martens**

1881. *Limnaea acuminata* var. *gracilior* Martens, *Conch. Mitheil*, 1 : 77.

1925. *Limnaea acuminata* f. *gracilior* : Annandale & Rao, *Rec. Indian Mus.*, 27 : 181.

Total no. exs. studied : 4. Largest shell H=13.8 mm. W=7.5 mm.
H. of aperture = 9.5 mm.

Distribution : India-Assam: West Bengal; Bihar; Raneeunge, Singhbhum, Orissa : Ganjam; Uttar Pradesh : Ghazipur, Mordabad, Kerala : Malabar, Burma : Moulmein : Mandalay.

***Lymnaea* (Pseudosuccinea) *luteola* f. *succinea* Deshayes**

1834. *Limnaea succinea* Deshayes, *Voy. dans. Ind. Belangar, Zool.* p. 418, pl. ii, figs. 13, 14.

1925. *Lymnaea luteola* f. *succinea* Annandale & Rao, *Rec. Indian Mus.*, 27 : 185.

Total no. exs. studied : 27. Largest shell H=14.9 mm. W=10 mm.
H. of aperture = 10 mm.

Distribution : India—Assam: Barpeta; West Bengal; Uttar Pradesh: Benaras; Kashmir; Andhra Pradesh : Hyderabad, Kurnool, Godavari, Tamilnadu; Nilgiris and Pulney Hills.

***Lymnaea* (Pseudosuccinea) *luteola* f. *australis* Annandale & Rao**

1925. *Limnaea* (Pseudosuccinea) *luteola* f. *australis* Annandale and Rao, *Rec., Indian Mus.*, 27 : 184., fig. IV no. 3.

1943. *Lymnaea* (Pseudosuccinea) *luteola* f. *australis* : Ray, *J. asiat. Soc. Beng.* 9 : 64.

Total no. exs. studied : 1. H=11.1 mm. W=7.2 mm. H. of aperture = 7.5 mm.

Distribution : India—Assam: Gauhati, Barpeta; Orissa : Puri; Chandbally; Bihar : Chakradharpur, Ranchi; Uttar Pradesh : Mizapore, Moradabad; Punjab : Ferozepur : Madhya Pradesh; Maharashtra : Nagpur, Pune, Satara : Karnataka : Bangalore; Kerala : Tranvancore; Tamilnadu : Coimbatore, Trichinopoly, Nilgiris : Elsewhere: Ceylon, Burma, Bangladesh and Pakistan.

***Lymnaea* (Pseudosuccinea) *luteola* f. *impura* Troschel**

1837. *Limnaeus impurus*, Troschel, in Weigman's *Arch. f. Naturges*, Berlin, 3 : 172.

1925. *Limnaea (Pseudosuccinea) luteola* f. *impura*. Annandale & Rao, *Rec. Indian Mus.*, 27 : 185, fig. IV, no. 7.

Total no. exs. studied : 47. Largest shell H=19 mm. W=12 mm.
H. of aperture = 13.2 mm.

Distribution : India, Burma and Ceylon.

Family PLANORBIDAE

Genus *Indoplanorbis* Annandale & Prashad 1921

Indoplanorbis exustus (Deshayes)

1834. *Planorbis exustus*, Deshayes, *Voy. Belang. Ind. Orient. Zool.* p. 417, pl. i, figs. 11-13.
1963. *Planorbis (Indoplanorbis) exustus* : Tonapi and Mulherkar *J. Bombay nat. Hist. Soc.*, 60(1), pp. 112-113.

Total no. exs. studied : 1, 741. Largest shell H=7.8 mm. W=16.5 mm.

Distribution : A common species in India. It is widely distributed in Pakistan, Tibet, Bangladesh, Burma, Ceylon, Thailand, China, Iran, Malay Peninsula & Archipelago.

Genus *Gyraulus* Charpentier, 1837

Gyraulus convexiusculus (Hutton)

1849. *Planorbis convexiusculus* Hutton, *J. asiat. Soc. Beng.*, 18 (2) : 657., (Type-locality : Candahar, in tanks; Quetta and the Kojuck pass).
1963. *Planorbis (Gyraulus) convexiusculus* Germain, Tonapi Mulherkar, *J. Bombay nat. Hist. Soc.*, 60(1) : p. 113.

Total no. exs. studied : 95. Average size, H=1.8 mm. W=5.7 mm.
H. of aperture = 3 mm.

Distribution : A common species in India. It has got a wide range extending from Iran to the Philippines and Japan. It is recorded from Pakistan, Ceylon, Bangladesh, Burma, Malay Archipelago, Thailand, China.

Order STYLOMMATOPHORA

Family SUCCINEIDAE

Subfamily SUCCINEINAE

Genus *Succinea* Draparnaud, 1810

Succinea bensoni Pfeiffer

1849. *Succinea bensoni* Pfeiffer, *Proc. zool. Soc. Lond.*, p. 133.

1924. *Succinea bensoni* : Rao, *Rec. Indian Mus.*, 26 : 394.

Total no. of exs. studied : 6. Average size, H=7.5 mm. W=5 mm.
H. of aperture = 5.4 mm.

Distribution : Maharashtra : Bombay, Pune, Gujarat, Kutch; Uttar Pradesh : Mordabad; West Bengal : Calcutta, Shibpore (Howrah).

Succinea collina Hanley & Theobald

1876. *Succinea collina*, Hanley & Theobald, *Conch. Indica*, p. 30. pl. 68, figs. 8, 9. (Type-locality : Mahableswar).

1924. *Succinea collina* : Rao, *Rec. Indian Mus.*, 26 : 384.

Total no. exs. studied : 1. =14 mm. W=10 mm.
H. of aperture = 11.1 mm.

Distribution : It is probably restricted to Western Ghats.

Remarks : The single shell from Torna Hills is slightly more tumid and differs slightly from the typical shell.

Succinea raoi Subba Rao & Mitra

1927. *Succinea arboricola* Rao, *Rec. Indian Mus.*, 27 : 394, figs. 7-11. (Preoccupied by *Succinea arboricola* Connolly).

1976. *Succinea raoi* Subba Rao & Mitra, *Nautilus*, 90 (3) : 125.

Total no. of exs. studied : 116. Average size, H=6.3 mm. W=4.7 mm.

Distribution : Restricted to streams around Khandala.

Remarks : As the specific name *arboricola* Rao was preoccupied by *Succinea arboricola* Connolly we have proposed a new name (Subba Rao & Mitra, 1976).

Normally all the molluscs, especially land and amphibious forms are active during monsoon, but contrary to that *Succinea raoi* aestivates during that period. Hora (1928) attributes this habit as due to its incapacity to exercise properly its respiratory functions in the presence of water. It is remarkable to note that this is the only succineid which was found hibernating on bark of trees.

Rao (1925) described in detail the morphology and anatomy of this species.

Succinea tornadri Rao

1924. *Succinea tornadri* Rao, *Rec. Indian Mus.*, 26 : 384. (Type-locality : Torna hills, Pune).

Total no. exs. studied : 3. Largest shell, H=15.6 mm. W=11.5 mm.
H. of aperture = 11.6 mm.

Distribution : Maharashtra : Pune.

Remarks : It is allied to *S. collina* but can be distinguished by its more tumid body whorl, straight and oblique outer lip of the aperture and less coarse sculpture.

Genus *Indosuccinea* Rao, 1924

Indosuccinea khandalla Rao

1924. *Indosuccinea semiserica* f. *khandalla* Rao, *Rec. Indian Mus.* 26 : 407
(Type-locality : Moist ground near Khandalla).

Total no. exs. studied : 5. Largest shell. H=9.5 mm. W=6.5 mm
H. of aperture = 7.8 mm.

Distribution : Restricted to Khandala.

Remarks : *Indosuccinea semiserica* and *I. Khandalla* are found living on shrubs and trees in the rainy season. During unfavourable season they conceal themselves and hibernate. With the onset of monsoon they become active.

Genus *Lithotis* Blanford, 1863

Lithotis tumida Blanford

1870. *Succinea (Lithotis) tumida*, Blanford, *J. asiat. Soc. Beng.*, 39 : 23, pl. 3
fig. 24 (Type-locality : Singhur).

1924. *Lithotis tumida* : Rao, *Rec. Indian Mus.*, 24 : 372.

Total no. exs. studied : 14. Largest shell, H=8 mm., W=5.6 mm.,
H. of aperture = 5.7 mm.

Distribution : India—Maharashtra : Pune.

Remarks : In general form the shell approaches that of *Succinea* but can be easily distinguished by its short depressed spire, characteristic coarse sculpture, the broadly oval aperture, the well defined, relatively thick columellar fold.

It has not been found again since its discovery in 1870, and we know very little either about the structure of the animal or its habits (Hora 1926).

Lithotis rupicola Blanford

1863. *Succinea (Lithotis) rupicola*, Blanford, *Ann. Mag. nat. Hist.* (3) 12 :
186, pl. 4, figs. 8-10. (Type-locality : Syhadri).

1924. *Lithotis rupicola* : Rao, *Rec. Indian Mus.*, 26 : 372.

Total no. exs. studied : 74. Largest shell, H=10, W=7.1,
H. of aperture = 8.8.

Distribution : Restricted to water falls at Khandala.

Remarks : It occurs in abundance on the wet rocks with algal encrustations at the sides of the waterfall at Khandala. *Cremnoconchus syhadrensis* is found in association with this species

Rao (1925) made a detailed study of the morphology and anatomy of the species.

Class BIVALVIA

Order EULAMELLIBRANCHIATA

Family UNIONIDAE

Genus *Indonaia* Prashad, 1918.

Indonaia caerulea (Lea)

1834. *Unio caeruleus* Lea, *Trans. Amer. Phil. Soc.*, 4 : 95, pl. xii fig. 28.
(Type-locality : River Hooghly, Calcutta.)

1943. *Indonaia caerulea* : Ray, 1943, *J. asiat. Soc. Beng., Sci.*, 9 : 78.

Total no. exs. studied : 88. Largest shell, H=48.5 mm. W=26 mm.,
Thickness = 18.7 mm.

Distribution : It is a very common species in India. Also occurs in Bangladesh, Burma, Nepal, Pakistan.

Indonaia khadakvaslaensis Ray

1966. *Indonaia khadakvaslaensis* Ray, *J. Conch. Paris*, 105 (4) : 226-229.
(Type-locality : Khadakvasla Dam, Pune.)

Total no. exs. studied : 2. Largest shell, L=47.8 mm., W=22.8 mm.,
Thickness = 21.1 mm.

Distribution : Maharashtra, Pune.

Remarks : No fresh collections could be made. The species is known by its types only.

Genus *Lamellidens*, Simpson, 1900

Lamellidens marginalis (Lamarck)

1819. *Unio marginalis* Lamarck, *Hist. Anim. sans, vert.* 6 : 79.

1960. *Lamellidens corrianus*, Satyamurti, *Bull. Madras Govt. Mus., N. S. nat. Hist. Soc.*, 6(4) : 148.

Total no. of exs. studied : 91. Largest shell L = 74.4 mm., W = 41.5 mm., Thickness : 22.2 mm.

Distribution : Assam : Sibsagar, Sylhet; Manipur Valley; West Bengal, Calcutta, Berhampur, Murshidabad; Bihar : Arrah, Santal Parganas; Uttar Pradesh : Lucknow; Maharashtra : Pune; Tamilnadu : Madras; Burma : Pegu.

Lamellidens lamellatus (Lea)

1838. *Unio lamellatus* Lea, *Trans. Amer. Phil. Soc.*, 6 : 19, pl. 6, fig. 16.

1928. *Lamellidens lamellatus* : Rao, *Rec. Indian Mus.*, 30 : 463.

Distribution : India—West Bengal, Calcutta. Burma—Mandalay, Bhamo, Pegu, Shan States; Ceylon.

It is recorded for the first time from Maharashtra.

Lamellidens consobrinus (Lea)

1859. *Unio consobrinus* Lea, *Proc. Acad. Natu. Sci. Philad.*, 3 : 331.

1915. *Lamellidens marginalis* sub sp. *consobrina* : Preston *Fauna Brit. India, Mollusca*, (Freshwater Gastropoda & Pelecypoda) p. 180.

Total no. exs. studied : 1. L = 90.0 mm., W = 54.1 mm., Thickness = 33 mm.

Distribution : Widely distributed in India & Ceylon. Also occurs in Burma and China.

Genus **Parreysia** Conrad, 1853.

Subgenus **Parreysia** s. str.

Parreysia (Parreysia) corrugata (Müllec)

1915. *Parreysia (Parreysia) corrugata* : Preston, *Fauna Brit. India, Moll.* (Freshwater Gastropoda and Pelecypoda) p. 154.

Total no. exs. studied : 15. Largest L = 45 mm., W = 30.5 mm.,

Distribution : Throughout India, Burma and Ceylon.

Parreysia (Parreysia) corrugata (Müller) var. nagpoorensis (Lea)

1859. *Unio nagpoorensis* Lea, *Proc. Acad. Natu. Sci. Philad.*, 3 : 331.

1960. *Parreysia (Parreysia) corrugata* var. *nagpoorensis* : Satyamurti, *Bull. Madras Govt. Mus., N. S. Nat. Hist. Sec.* 6(4) : 144-145.

Total no. exs. studied : 5. Largest shell, L = 50.2 mm., W = 30.4 mm., Thickness = 26.8 mm.

Distribution : Maharashtra : Nagpur, Pune; Andhra Pradesh : Gudur, Godavari River; Tamilnadu : West Bengal.

Parreysia (Parreysia) favidens (Benson)

1862. *Unio favidens* Benson. *Ann. Mag. nat. Hist.*, 10 : 188.

(Type-locality : "Ganges at Bhitoura between Cawnpore and Allahabad",).

1915. *Parreysia (Parreysia) favidens* : Preston, *Fauna Brit. India*, (Freshwater Gastropoda and Pelecypoda), p. 158.

Total no. exs. studied : 38. Largest shell, L=41.5 mm., W=32.7mm., Thickness = 21.1 mm.

Distribution : Assam : East Cachar, Silchar, Tejpore, West Bengal : Calcutta, Sunderbans; Orissa : Berhampur; Bihar : Arrah, Rajmahal, Hazrapur, Ranigunj; Uttar Pradesh : Mordabad; Rajasthan.

Parreysia (Parreysia) favidens (Benson) var. marcens (Benson)

1862. *Unio favidens* var. *marcens* Benson, *Ann. Mag. nat. Hist.*, 10 : 188.

(Type-locality : Brahmaputra River, Assam.)

1915. *Parreysia (Parreysia) favidens* var. *marcens* : Preston *Fauna Brit. India*, Moll. (Freshwater Gastropoda and Pelecypoda, p. 159.)

Total no. exs. studied : 4. Largest shell, L=58.5 mm., W=37.1 mm., Thickness = 24.2 mm.

Distribution : Assam : Brahmaputra River; Maharashtra—Pune.

Parreysia (Parreysia) rajahensis (Lea)

1841. *Unio rajahensis* Lea, *Proc. Amer. Phil. Soc.*, II : 30.

1915. *Parreysia (Parreysia) rajahensis*. Preston, *Fauna Brit. India*, (Freshwater Gastropoda & Pelecypoda) p. 169.

Total no. exs. studied : 1. L=37.7 mm., W=31.5 mm., Thickness 20.5 mm.

Distribution : Bihar : West Bengal; Madhya Pradesh; Maharashtra.

Family CORBICULIDAE

Genus *Corbicula*, Mergerle von Muhlfeldt

Corbicula striatella Deshayes.

1854. *Corbicula striatella* Deshayes, *Proc. zool. Soc. London*, 22 : 344.

(Type-locality : Pondicherry.)

1960. *Corbicula striatella* : Satyamurti, *Bull. Madras Govt. Mus. N.S. Nat. Hist. Sec.*, 6(4) : 153.

Total no. exs. studied : 243.

Distribution : It is fairly common all over India. It has a wide range of distribution in India as well as in Burma.

Remarks : Prashad (1928) had given a complete synonymy for the species and redescribed it. According to him Dëshayes type-series consists of young shells only.

***Corbicula peninsularis* Prashad**

1928. *Corbicula peninsularis* Prashad, *Mem. Indian Mus.*, Calcutta., 9 : 21, pl. iv, figs. 13-16. (Type-locality : Bombay.)

Total no. of exs. studied : 10. Largest shell, L=28 mm., W=16.8 mm., Thickness = 13.6 mm.

Distribution : Maharashtra : Pune, Bombay.

Remarks : Prashad (1928) described this species basing on a few specimens from Bombay. He had also examined a good series from the same place in the Museum d'Histoire Naturelle, Paris. After its first description no one has collected or described this species. The present collection is from Pune and it forms a new record extending its range beyond Bombay.

***Corbicula krishnaea* Ray**

1967. *Corbicula krishnaea*, Ray, *Arch. Moll.* 96: (3-6) 191-193.
(Type-locality: Krishna River, near Sangli, Pune.)

Total no. exs. studied : 1. L=6.5 mm., W=5.5 mm., Thickness = 3.4 mm.

Distribution : Pune.

SUMMARY

The present account gives a comprehensive picture of the molluscan fauna of the Pune district. A total of 130 species and varieties of land and freshwater molluscs are reported from the district, based on records in literature and on examination of collections received in Zoological Survey of India. Of these, land molluscs are represented by 71 species and varieties, while freshwater molluscs are known by 60 species and varieties. The material studied by us includes only 81 species and varieties -48 freshwater and 33 land. This calls for more intensive surveys for a more comprehensive information about land molluscs. Freshwater molluscs were collected in fairly good number and among bivalves, except for *Corbicula regularis* Prime, all were present in the collections studied.

Ten species are recorded for the first time from Pune district and also Maharashtra (Subba Rao and Mitra, 1975). *Glessula ceylanica* (Pfeiffer) and *Eulota scalpturita* (Benson) reported from Sri Lanka and Burma respectively are recorded for the first time from India. *Sitala denselirata* Benson and *Trochomorpha billeana* (Mörch) known hitherto from Andaman & Nicobar Islands are recorded here from the Indian mainland.

It is interesting to note that type localities for 16 species reported here fall within the Pune district and majority of them are recorded from hill streams near Khandala. All these species are having restricted range of distribution in the Western Ghats, and are not known beyond it.

The type-localities of *Turbinicola saxea* (Reeve) and *Cremnoconchus syhadrensis* Blanford are designated as "Streams or falls near Khandala"

The molluscan fauna of Pune district is remarkable for two reasons; the presence of marine element and in showing wonderful adaptations to the changing weather conditions in the Western Ghats. *Cremnoconchus*, reported from Khandala belongs to the family *Littorinidae*, which is truly marine. Succinids and *Turbinicola* are known for their interesting adaptations. Hora (1926) has pointed out the necessity of studies on mollusca of Western Ghats. Our knowledge on the ecology of land molluscs, like slugs and amphibious molluscs like *Lithotis tumida* Blanford is still inadequate. It is hoped that the present study will lay the foundation for further research work on habits and life-histories of the interesting molluscs like *Cremnoconchus*, *Turbinicola* and succinids.

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A SYNOPTIC LIST OF MALLOPHAGA *SENS. LAT.* (PHTHIRAPTERA : INSECTA) FROM INDIA AND ADJACENT COUNTRIES TOGETHER WITH HOST AND REGIONAL INDICES

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I. INTRODUCTION

Mallophaga sens.lat. (Phthiraptera : Insecta) includes the small, dorsoventrally flattened, apterous insects infesting the birds and mammals. Though apterous, they are often carried to far off places by their hosts, and this phenomenon is more noticeable in case of those parasitic on birds, and also at times by phoresy. Due to these reasons, it is not unusual that one may find the same species occurring in different geographical regions in the host range. Ignoring this fact on one hand, and the non-accessibility to literature on the other, resulted in the description of many species in the past, which were later proved to be conspecific with species described earlier. A lot of confusion exists in the taxonomy of the group, and of late, attempts have been made to standardize the nomenclature and fixing up of the correct type-hosts. The Check-lists, or synoptic-lists, serve as ready reckoners for a taxonomist, and also others to have an idea of the fauna of a particular region. The more frequent enquiries on the parasites or their distribution to the present author indicate the urgent need of such a list on the mallophagan parasites of our region, which incidentally provide the frame work for the *Fauna of India* (Phthiraptera : *Mallophaga sens. lat.*) volumes which are now under contemplation by the Zoological Survey of India. In the present work, all the species so far known from India, and its adjacent countries have been listed together with the host and regional indices. It is hoped, that this list would prove useful not only to the phthiropterologists of the region, but others as well.

Kellogg (1908)^{1,2} published the list of the then known species

¹ KELLOGG, V. L. 1908. *Mallophaga*. In Wytsmann, *Genera Insectorum*, 66 : 86 pp., 3 pl.

² KELLOGG, V. L. 1908. The Mallophaga of the World.-*Psyche*, 15 : 11-13.

together with their host and locality records. Harrison (1916)³ in his work, tried to clear the several discrepancies in the earlier publications on the genera and species. Bedford (1932)⁴ listed the ectoparasites of the South African mammals, aves, and reptiles, which includes the Mallophaga also. Thompson (1938-1950)⁵ published a series papers on the type-hosts and the lice described from them. Hopkins (1949)⁶ gave an exhaustive account of the host-associations of lice of mammals, which includes the chewing and sucking-lice as well. Hopkins and Clay (1952, 1953, 1955)⁷⁻⁹ are the most up-to-date lists of Mallophaga and their type hosts. Emerson (1964)¹⁰ published a checklist of Mallophaga of North America (north of Mexico) and later revised it (Emerson, 1972)¹¹. Price and Emerson (1966-67)¹²⁻¹³, and Price (1970)¹⁴ published

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- ³ HARRISON, L. 1916. The Genera and species of Mallophaga.-*Parasitology*, 9(1) : 1-156.
- ⁴ BEDFORD, G.A.H. 1932. A Synoptic check-list and host-list of the ectoparasites found on south African Mammalia, Aves, and Reptilia.-18th *Rep. vet. Res. S. Afr.*, : 223-523.
- ⁵ THOMPSON, G. B. 1938-1950. A list of the type-hosts of the Mallophaga and the Lice described from them.-*Ann. Mag. nat. Hist.*, pt. I. (1938) (11) 2 : 580-593; pt. II. (1939) : (11) 2: 241-252; pt. III-V (1940) (11) 5 : 48-55, 297-308, & 409-418; pt. VI.—VIII (1948) (11) 14:373-388, 737-767, & (12) 1 : 335-368; IX-XI.—(1950) (12) 3 : 269-287, 365-382, & 716-720.
- ⁶ HOPKINS, G.H.E. 1949. The Host-associations of the Lice of Mammals.-*Proc. Zool. Soc. Lond.*, 119(2) : 387-604.
- ⁷ HOPKINS, G.H.E. & CLAY, T. 1952. *A Check List of Genera and Species of Mallophaga*.-/London/Bull. Br. Mus. Nat. Hist., : 362 pp.
- ⁸ HOPKINS, G.H.E., & CLAY, T. 1953. Additions and corrections to the Check List of Mallophaga (Pt. I).-*Ann. Mag. nat. Hist.*, (12) 6 : 434-448.
- ⁹ HOPKINS, G.H.E., & CLAY, T. 1955. Additions and corrections to the Check List of Mallophaga (Pt. II).-*Ann. Mag. nat. Hist.*, (12) 8 : 177-190.
- ¹⁰ EMERSON, K. C. 1964. *A Checklist of the Mallophaga of North America (north of Mexico)*.-/Utah/, Desert Test Center : 217 pp ; 20 pp.
- ¹¹ EMERSON, K. C. 1972. *A Checklist of the Mallophaga of North America (north of Mexico)*.-/Utah/, Desert Test Center: Pt. I : 200 pp.: pt. II. : 218 pp.; pt. III : 28 pp.; & pt. IV : 216 pp.
- ¹² PRICE, R. D. & EMERSON, K. C. 1966. New synonymies within the bird lice (Mallophaga).-*J. Kans. ent. Soc.*, 39(3) : 430-433.
- ¹³ PRICE, R. D. & EMERSON, K. C. 1967. Additional synonymies within the Amblyceran bird lice. (Mallophaga).-*Proc. ent. Soc. Wash.*, 69(3) : 248-251.
- ¹⁴ PRICE, R. D. 1970. Three new synonymies within the ctenidia-bearing bird lice (Mallophaga : Menoponidae).-*Proc. ent. Soc. Wash.*, 72 (1) : 134.

the new and additional synonymies of Mallophaga which supplement the lists of Hopkins & Clay (op. cit.). Ansari (1956)¹⁵ published the host list of the Phthirapteran parasites on the Indo-Pakistan mammals and aves, which is not easily accessible to the workers. Emersan (1973)¹⁶ though listed the Mallophagan parasites of the birds of Asia, it is far from complete. Therefore, this list originally prepared in 1968, is thoroughly revised in the light of recent researches during this decade and include the records upto the end of 1974, and also supplemented by the host-and regional-indices.

II. *Scope and format of the Synoptic list*

The list is divided into three parts, viz., Part I. Parasite Index, Part II. Host Index, and Part III. Regional Index.

1. *Classification :*

The genera and species have been arranged alphabetically in the present list as in Hopkins and Clay (op. cit.). The respective genera in the different families of the three suborders (or superfamilies auct.) viz., Amblycerophthirina, Ischnocerophthirina, and Rhynchophthirina¹⁷⁻¹⁸,

¹⁵ ANSARI, M.A.R. 1956. A host-list of Phthirapteran parasites (Lice) found on Indo-Pakistan mammals and birds.-*Pakistan J. Hlth.*, 6(1) : 1-39; 73-112.

¹⁶ EMERSON, K. C. *Mallophaga*: In McClure, H. E. & Ratnaworabhan, N. et al. *Some ectoparasites of the birds of Asia*.-/California; Thailand/Migratory Animal Pathological Survey SEATO Medical laboratory & Applied Scientific Research Corporation of Thailand: 79-119; 132-219.

¹⁷ LAKSHMINARAYANA, K. V. 1970. *Systematic studies on Mallophaga on Indian birds and mammals*.-Ph. D. Thesis, Agra University)/Agra/, Vol. I : (Text) xvii+572pp., Vol. II : (Text-figs) pls. A-U; (Photomicrographs) pls. 1-33; & Reprints/transcripts.

¹⁸ LAKSHMINARAYANA, K. V. 1976. Nomenclatural changes in Phthiraptera (Insecta)—some suggestions.-*Angew. Parasitol.*:17 (3):160-167.

however are as follows (valid generic names are printed in bold with number of valid species given in parenthesis) :

a) **AMBLYCEROPHTHIRINA** Lakshminarayana (= *Amblycera* Kellogg)

Family 1 : **BOOPIIDAE**

1. **Boopia** (1)
2. **Heterodoxus** (1)

Family 2 : **LAEMOBOTHRIIDAE**

1. **Eulaemobothrion** (2)
2. **Laemobothrion** (3)

Family 3 : **MENOPONIDAE**

1. **Actornithophilus** (15)
Aegypipphilus
Allocolpocephalum
2. **Amyrsidea** (5)
3. **Ardeiphilus** (2)
4. **Austromenopon** (7)
5. **Bonomiella** (1)
6. **Chapinia** (2)
7. **Ciconiphilus** (4)
8. **Colpocephalum** (34)
Columbimenopon
9. **Comatomenopon** (1)
10. **Ctenigogus** (1)
11. **Cuculiphilus** (5)
12. **Dennyus** (4)
13. **Eidmanniella** (2)
Eomenacanthus
14. **Eucolpocephalum** (1)
Ferrisia
Galliferrisia
15. **Heleonomus** (4)
16. **Hohorstiella** (1)
17. **Holomenopon** (4)
18. **Kelerimenopon** (1)
19. **Kurodaia** (5)
Liotheum
20. **Menacanthus** (19)
21. **Menopon** (5)
22. **Meromenopon** (1)

- 23. **Myrsidea** (39)
Neocolpocephalum
- 24. **Neomenopon**
Neumannia
Nitzschia
- 25. **Nosopon** (2)
Piagetia
- 26. **Piagetiella** (1)
Pseudocolpocephalum
- 27. **Pseudomenopon** (7)
Tetraophthalmus
Uchida
- Family 4 : RICINIDAE**
Nirmus
Physostomum
- 1. **Ricinus** (7)
- Family 5 : TRINOTONIDAE**
1. **Trinoton** (4)

b) ISCHNOCEROPHTHIRINA LAKSHMINARAYANA (= Ischnocera Kellogg)

Family 1 : PHILOPTERIDAE

- 1. **Acidoproctus** (3)
- 2. **Aegypoecus** (2)
Akidoproctus
- 3. **Alcedoecus** (2)
- 4. **Alcedoffula** (3)
- 5. **Allobrueelia** (2)
- 6. **Anaticola** (7)
- 7. **Anatoecus** (4)
Anousceps
- 8. **Aquanirmus** (1)
- 9. **Ardeicola** (10)
- 10. **Bedfordiella** (1)
Bitrabeculus
- 11. **Brueelia** (45)
- 12. **Buceronirmus** (2)
- 13. **Campanulotes** (3)
- 14. **Capraiella** (3)
- 15. **Carduiceps** (3)
Carrikericeps
Chadriceps
- 16. **Chelopistes** (1)
Cirrhophthirius
Cistellatrix

- 17. **Coloceras** (5)
- 18a. **Coloceroides** (2)
- 18. **Columbicola** (11)
 - Corvonirmus
- 19. **Craspedorrhynchus** (6)
- 20. **Cuclogaster** (7)
- 21. **Cuculicola** (3)
- 22. **Cuculoecus** (1)
- 23. **Degeeriella** (14)
 - Docophorulus
 - Docophorus
- 24. **Echinophilopterus** (1)
- 25. **Esthiopterum** (2)
 - Eustrigiphilus
 - Falcoecus
- 26. **Falcolipeurus** (8)
- 27. **Falcolius** (1)
- 28. **Fulicoffula** (1)
 - Gallipeurus
 - Glareolites
- 29. **Goniocotes** (9)
- 30. **Goniodes** (29)
 - Gonocephalus
 - Gonotyles
 - Haematophagus
 - Helluo
 - Himantophagus
- 31. **Ibidoecus** (4)
- 32. **Incidifrons** (1)
 - Kelerinirmus
 - Koeniginirmus
- 33. **Lagopoecus** (2)
- 34. **Lipeurus** (10)
- 35. **Luniceps** (5)
- 36. **Maculinirmus** (1)
 - Margaritenes
 - Megalipeurus
- 37. **Meropoecus** (3)
 - Mjoberginirmus
- 38. **Mulcticola** (3)
- 39. **Neophiloptenus** (1)
- 40. **Neopsittaconirmus** (2)

- 41. **Nigronirmus** (4)
 - Nirmoides
 - Nirmus
 - Nirmus
- 42. **Nitzschiella** (2)
 - Oedicnemiceps
 - Olivinirmus
 - Oncophorus
- 43. **Otidoecus** (2)
 - Oulocrepis
- 44. **Oxylipeurus** (5)
- 45. **Pachyskelotes** (1)
 - Painjunirmus
- 46. **Paragoniocotes** (1)
- 47. **Pectinipygus** (3)
- 48. **Penenirmus** (2)
- 49. **Perineus** (1)
 - Peripetasma
 - Phichthyophaga
- 50. **Philopterus** (21)
- 51. **Picicola** (1)
 - Picophilopterus
 - Proneptis
- 52. **Psittaconirmus**
- 53. **Quadriceps** (26)
- 54. **Rallicola** (8)
- 55. **Reticulipeurus** (11)
 - Rhombiceps
- 56. **Rhynonirmus** (1)
- 57. **Saemundssonina** (2)
- 58. **Spiroirmus** (2)
 - Stenocrotaphus
- 59. **Strigiphilus** (9)
- 60. **Struthiolipeurus** (1)
- 61. **Sturnidoecus** (18)
- 62. **Syrrhaptoecus** (7)
 - Szidatiella
 - Tetrophthalmus
 - Timmermanniceps
 - Traihoriella
- 63. **Turnicola** (1)
- 64. **Turturicola** (2)
- 65. **Upupicola** (1)
 - Virgula

Family 2 : TRICHODECTIDAE (16)
Bovicola

1. **Damalinia** (10)

2. **Felicola** (3)

Paradoxuroecus

3. **Trichodectes** (3)

Tricholipeurus

c) RHYNCHOPHTHIRINA Ferris

Family 1 : HAEMATOMYZIDAE (1)

1. **Haematomyzus** (1)

Idolocoris

Incertae sedis

Pediculus of old authors now restricted to Siphunculophthirina Lakshminarayana (Siphunculata of Anoplura *auct*). The author has his own reservations on certain genera and species, but the status of them has not been changed in this work except where the opinions have already been published by him.

* * * *

NUMBER OF GENERA AND SPECIES INCLUDED
IN THIS LIST UPTO THE END OF 1974

	Genera	Species
AMBLYCEROPHTHIRINA		
Family 1 : Boopiidae	2	2
„ 2 : Laemobothriidae	2	5
„ 3 : Menoponidae	26	173
„ 4 : Ricinidae	1	7
„ 5 : Trinotonidae	1	4
ISCHNOCEROPHTHIRINA		
Family 6 : Philopteridae	65	356
„ 7 : Trichodectidae	3	16
RHYNCHOPHTHIRINA		
Family 8 Haematomyzidae	1	1
	101	564

2. Listing of the Genera :

The genera are arranged alphabetically as already stated; the valid genera are given in bold, while those considered as junior homo-

nyme or synonyms are given in italics. In the synonymy, only those referred in the publications are listed, and therefore, attention is invited to Hopkins and Clay (1952; 1953; 1955), and Price and Emerson (1966; 1967) in addition to the recent revisionary works for others.

3. *Listing of the species :*

The valid species are also arranged alphabetically, serially numbered, and printed in bold. Where the species is considered as a junior synonym, it is numbered in parentheses and printed in italics. Where a species is transferred to another genus, it is given in normal print and a reference to the genus to which it is transferred is given. The specific name is followed by the author's name, year of publication, and the bibliographic reference; if it is a species transferred from another genus as a new combination, then the original generic appellation is given between the year of publication and the bibliographic reference, but in italics.

4. *Host nomenclature :*

Under each species, the name of the host(s) as published in the original citation is given along with the revised name, if any subsequent changes are made. In the Part II, viz., the host-index, the list of avian and mammalian hosts referred to in this work are given. The orders, families, and species are also numbered. As in the case of parasite species in part I, the host species are also given in bold, if they are valid, and otherwise in italics with an index to its senior synonym, and also its number is placed in parentheses. Alongside the valid host name, a cross index to the parasitic genera and species reported on it are indicated in decimal system. The number on to the left of the decimal indicates the genus number in Part I (Parasite index) and the number to the right of the same refers to the species in that genus. For example, 1.2, indicates the genus numbered 1, i.e. *Acidoproctus*, and the species numbered 2, i.e. *moschatae*. The orders, families, and subfamilies are given either in alphabetical sequence or in natural hierarchy, where well known.

The following works have been consulted for the avian classification and nomenclature, besides Peter's Check-lists :

- (i) BISWAS, B. & RIPLEY, S. D. 1963. Comments on Ripley's A synopsis of the birds of India and Pakistan (B. Biswas), with a supplement (by Ripley).-*J. Bombay nat. Hist. Soc.*, 60(3) : 679-689.
- (ii) DELACOUR, J. 1951. *The Pheasants of the World*.-/London/ Country Life Ltd. : 347 pp.; 32 pls; 21 maps & diagrams.

- (iii) DELACOUR, J. (1954-59). *The Waterfowl of the World* (III): [London], Country Life Ltd., I (1954) : 284 pp.; 15 col. pl.; 33 maps; II (1956): 232 pp.; 23 col. pl.; 29 maps; III (1959) : 270 pp.: 19 col. pl.; 46 maps.
- (iv) MAYR, E. & AMADON, D. 1951, A Classification of Recent birds.-*Am. Mus. Novitates*. No. 1496 : 1-42.
- (v) RIPLEY, S. D. 1961. *A Synopsis of the birds of India and Pakistan together with those of Nepal, Sikkim, Bhutan, and Ceylon*. [Bombay] Bombay nat. Hist. Soc.,: 702 pp.;-1 histogram, 4 maps.
- (vi) SALIM ALI, & RIPLEY, S. D. 1968-1974. *Handbook of the birds of India & Pakistan together with those of Nepal, Bangladesh, Sikkim, Bhutan, & Sri Lanka*. (I-IX).-[Bombay], Oxford Univ. Press : I (1968) : 380 pp; 18col. pl; II. (1969): 345pp; 19-31 col. pl.; III (1969) : 325 pp.; 32-43 col. pl.; IV (1970) : 265pp.; 44-54 col. pl.; V (1972): 276 pp.; 55-64 col. pl.; VI (1971) : 245 pp.; 65-72 col. pl.; VII (1972) ; 236 pp.; 73-83 col. pl.; VIII (1973) : 277 pp.; 84-91 col. pl.; IX (1973) : 306 pp.; 92-101; and X (1974) : 334 pp.; 102-113 col. pl.
- (vii) STORER, R. W. 1971. A Classification of birds.-*Avian Biol.*, Vol. I: 605 pp.
- (viii) VAURIE, C. 1959-65. *The birds of the Palaearctic fauna*.-[London], H. F. & G. Witherby. I (1959) : 762 pp.; II. (1965) : 763 pp.
- (ix) WETMORE, A. 1951. A revised classification for the birds of the World.-*Smiths. misc. Coll.*, 117(4) : 1-22.

The mammalian host nomenclature and classification is as in HOPKINS, G.H.E. 1949. The Host-associations of the lice of mammals.-*Proc. zool. Soc. Lond.*, 119 (2) : 387-604.

5. *Locality Records :*

Although it is recognized well that the real locality for a parasite is its host body, yet the geographical region from where the host has been actually collected or reported in the original citations is given after the host name. Besides the species reported from the mainland India and its associated Islands, those reported from Afghanistan, Bangladesh, Bhutan, Burma, Nepal, Pakistan, Sri Lanka, Tibet, Szechwan & Yunnan (China), and Turkestan (Russia) are included in this list. In the Indian limits, both Oriental and Palaearctic fauna intergrade with each other together with an Ethiopian element. The present list does not include however Thailand, Formosa etc., of the Indo-Chinese subregion; and Malaysia and Indonesian group of Islands of the Malaysian subregion, which the author hopes to deal with later.

Where the locality name is changed for various reasons, the one cited in the original publication is given in parentheses along with the latest name (as far as practicable). The geographical name follows that of the host in a square bracket. In case, a species has been reported from more than one country, then each country is separated by a semicolon. The geographical names especially for India, are after the Surveyor-General of India's "*School, Atlas*" (1961 ed.) and the 'Reader's Digest's "*Great World, Atlas*" (1962 ed.).

In Part III, a regional index to the countries dealt with is given. Under each region, numbers of the genera and species of the parasites reported from that country are given in the decimal system (*vide supra*).

6. Author citation & Bibliography :

If a species has been described from the region under discussion, the author's name follows that of the generic or specific appellations, followed by the year, and its bibliographic reference. The same procedure is followed for the subsequent records also, but given after the locality record from where the host has been taken. Full titles of the papers are not given and attention is invited to the following papers for further details:

- (i) LAKSHMINARAYANA, K. V. 1972. Mallophaga Indica VII. Historical Resume and bibliography of Mallophaga Indica.—*Angew. Parasitol.*, 13(3) : 169-178, 3 figs.
- (ii) LAKSHMINARAYANA, K. V. 1975. Bibliography of Mallophaga Indica : Supplement I and Errata.—*Angew. Parasitol.*, 16 (1) : 28-30.
- (iii) LAKSHMINARAYANA, K. V. & SATYARANI, R. (in press). Bibliography of Mallophaga Indica : Supplement II.—*Angew. Parasitol.*, : 5pp. (Ms.).

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(Part I : PARASITE INDEX)**1. Acidoproctus Piaget, 1878**

Acidoproctus Piaget, 1878, *Tijaschr. Ent.*, 21 : 178. Type species (by subsequent designation, Johnston & Harrison, 1911. *Proc. Linn. Soc., N. S. W.*, 36 : 326) : *A. marginatus* Piaget.

Akidoproctus Piaget, 1880, *Pediculines* : 208. Emendation of *Acidoproctus*.

1. **emersoni** Timmermann, 1963, *Z. Parasitenk.*, 22 (2) : 145.
Host : *Dendrocygna javanica* (Horsfield), [Burma; Sri Lanka (Ceylon)], (Slide in B. M. Nat. Hist.).
2. **moschatae** (Linne), 1758, (*Pediculus*). *Syst. Nat.* ed. 10 : 612.
Nomen novum for Redi's "Pollino del german turco"
Host : *Netta rufina* (Pallas), [India : (Rajputana) Rajasthan].
Clay & Hopkins, 1950. *Bull. Br. Mus. nat. Hist. (Ent.)*, 1 (3) : 239, figs. 22-25, pl. 1 figs. 3 & 4; also *Ibid.*; 241 as *A. stenopyx* (Burmeister) and *A. stenopygos* (Nitzsch).
3. **rostratus** (Rudow), 1866, (*Ornithobius*). *Z. ges. NatWiss.*, 27:465,
Host : *Dendrocygna viduata* (Linne), [Sri Lanka (Ceylon)].
(Slide in B. M. (Nat. Hist.).
- (4) **stenopygos** (Giebel), 1861, (*Lipeurus*). *Z. ges. Nat Wiss.*, 18 : 318.
Nomen novum for *Nirmus stenopyx* Burmeister = no. 2.
- (5) **stenopyx** (Burmeister), 1838, (*Nirmus*). *Handb. Ent.*, 2: 428.= no. 2.

2. Actornithophilus Ferris, 1916

Actornithophilus Ferris, 1916, *Canad. Ent.*, 48: 303. Type species: *Colpocephalum uniseriatum* Piaget.

- (1) **affinis** (Nitzsch), 1874, (*Colpocephalum*). In Giebel, *Insecta epizoa* : 276.=no. 11.
2. **grandiceps** (Piaget), 1880, (*Colpocephalum*). *Pediculines* : 558, pl. 46 fig. 7.
Host : *Ibidorhyncha struthersii* Vigors, [China : Szechwan; Tibet; India: Kashmir] Clay, 1962. *Bull. Br. Mus. nat. Hist. (Ent.)*, 11 (5) : 226. (Slide in B. M. (Nat. Hist.).
3. **himantopy** Blagoveshtchensky, 1951, *Mag. parasit.*, it. al. & Moscow : 13 : 281.

- Host : **Himantopus** [h.] **himantopus** (Linne), [India], Emerson, 1973. In: *Some ectoparasites of the birds of Asia* : 105.
4. **hoplopteri** (Mjöberg), 1910, (*Colpocephalum*). *Ark. zool.*, 6 (13) : 40, fig. 24, pl. 5 fig. 3.
Host : (*Lobipluvia malabarica*) = **Vanellus malabaricus** (Boddaert) and (*L. indicus*) = **V. indicus** (Boddaert), [India], (Slide in B. M. Nat. Hist.).
5. **limosae** (Kellogg), 1908, (*Colpocephalum*), *Wytsaman's Gen. Ins.* (Mallophaga) 56. *Nomen novum* for *Colpocephalum ochraceum* "Nitzsch" Grube 1851 nec Nitzsch, 1818.
Host : **Limosa lapponica** (Linne), [India], Emerson, 1973. In: *Some ectoparasites of the birds of Asia* : 105.
6. **lyallpurensis** Ansari, 1955, *Proc. 7th Pak. Sci. Conf. Sec. Agric.* : 55.
Host : **Tringa o. ochropus** Linne, [Pakistan]; also Ansari, 1956. *Indian J. Ent.* (1955), 17 (3) : 400 and Ansari, 1957. *Indian J. Ent.* (1956), 18 (4) : 434, figs. 42-49. (Also cf. Clay, 1962. *Bull Br. Mus. nat. Hist. (Ent.)*, 11 (5) : 217, fig. 15.); same host, [India] Emerson, 1973. In *Some ectoparasites of the birds of Asia* : 99, inadvertently as *Quadriceps lyallpurensis* Ansari 1951.
7. **ochraceus** (Nitzsch), 1818, (*Liotheums. g. Colpocephalum*). *Germar's Mug. Ent.*, 3 : 299. *Nomen novum* for Redi's pl. 11 upperfig.
Host : **Charaddius dublus** Scopoli, [Afghanistan]; (*Chettusia gregaria*) = **Vanellus gregarius** (Pallas) and (*Chettusia leucura*) = **Vanellus leucurus** (Lichtenstein), [India], (Slide in B. M. (Nat. Hist.).
8. **paludosus** Clay, 1962, *Bull. Br. Mus. nat. Hist. (Ent.)*. 11 (5) : 29, fig. 47, pl. 5 figs. 3 & 6.
Host : **Tringa nebularia** (Gunnerus), (Burma), (Slides from India and Sri Lanka (Ceylon) are present in B. M. Nat. Hist.).
9. **patellatus** (Piaget), 1890, (*Colpocephalum*), *Tijdschr. Ent.*, 33 : 254, pl. 10 fig. 8.
Host : **Numenius (a.) arquata** (Linne), [India], Emerson, 1973. In *Some ectoparasites of the birds of Asia* : 105.
10. **pediculoides** (Mjöberg), 1910, (*Colpocephalum*), *Ark. Zool.*, 6. (13) : 44, pl. 2 fig. 6.

Host : *Arenaria interpres* (Linne) [Sri Lanka (Ceylon)],
(Slides present in B. M. Nat. Hist.).

11. **pustulosus** (Piaget) 1880, (*Colpocephalum*). *Pediculines* : 522, pl. 43 fig. 6.

Host : *Philomachus pugnax* (Linne), [India], Emerson, 1973.
In : *Some ectoparasites of the birds of Asia* : 106.

12. **raviensis** Ansari, 1955, *Proc. 7th Pak. Sci. Conf. Soc. Agric.* : 55.

Host : *Himantopus h. himantopus* (Linne), [Pakistan]; also
Ansari, 1956. *Indian J. Ent.*, 17 (3) : 400 and Ansari,
1957. *Indian J. Ent.* (1956), 18 (4) : 434, figs. 4 50-54.
(May be a synonym of *A. himantopi* Blagovesht-
chensky, 1951. *Mag. Parasit. Leningr.*, Moscow, 13 :
281. cf. Clay, 1962. *Bull. Br. Mus. nat. Hist. (Ent.)*,
11 (5) : 236.).

13. **spinulosus** (Piaget), 1880, (*Colpocephalum*), *Pediculines* : 563, pl. 47 fig. 3.

Host : *Limosa limosa* (Linne), [India]; Sri Lanka (Ceylon)
(Slides in B. M. Nat. Hist.).

14. **tetracis** Clay, 1962, *Bull. Br. Mus. nat. Hist. (Ent.)*, 11 (5) : 206,
figs. 22, 40, 48, 53, 54, 58, pl. 4 fig. 2, pl. 9 fig. 5, & pl. 10
fig. 6.

Host : *Esacus magnirostris recurvirostris* (Cuvier), [Upper
Burma].

15. **totani** (Schrank), 1803, (*Pediculus*). *Fauna Boica* : 191.

Host : *Himantopus h. himantopus* (Linne) & *Tringa o. ochro-*
pus Linne, [Pakistan : Lyallpur], Ansari, 1951, *Proc.*
nat. Inst. Sci. India, 17 (2) : 172, as *A. affinis* (Nitzsch),
cf. Clay, 1962. *Bull. Br. Mus. nat. Hist. (Ent.)*, 11
(5) : 215; *Tringa totanus totanus* (Linne), [Sri Lanka
(Ceylon)], *T. erythropus* (Pallus), [India], and *T.*
stagnatilis (Bechstein), [India], Clay, 1962. *Bull. Br.*
Mus. nat. Hist. (Ent.), 11 (5) : 215, figs. 3, 23, 41,
59 & 60, pl. 2 fig. 1.; *Tringa erythropus* (Pallas) &
T. totanus (Linne), [India], Emerson, 1973. In : *Some*
ectoparasites of the Asia : 106.

- (16) **trilobatus** (Giebel), 1874, (*Colpocephalum*), *Insecta epizoa* : 275
= no. 17.

17. **umbrinus** (Burmeister), 1838, (*Clopocephalum*), *Handb. Ent.*, 2: 438.

Host : (*Erolia m. minuta*) = **Calidris m. minuta** (Leisler), [Pakistan : Lyallpur], Ansari, 1951. *Proc. nat. Inst. Sci. India*, 17 (2) : 172, as *A. trilobatus* (Giebel), cf. Clay, 1962. *Bull. Br. Mus. nat. Hist. (Ent.)*, 11 (5) : 212, figs. 6, 9, 57, 69, pl. 6 figs. 4, & 6, pl. 7 fig. 3 & pl. 10 fig. 1; 3 species of *Calidris*, [India]. Emerson, 1973, In: *Some ectoparasites of the birds of Asia* : 106.

Aegypiphilus Eichler, 1944

Aegypiphilus Eichler, 1944. *Dtsch. ent. z.*, 1943 : 56. Type species : *A. gypsis* Eichletr.

Inseparable from *Cuculiphilus*. Considered as a subgenus.

3. *Aegypoecus* Clay & Meinertzhagen, 1939

Helluo Clay & Meinertzhagen, 1938, (nec. Bonelli, 1809), *Entomologist*, 71 : 276. Type species: *H. neophron* Clay & Meinertzhagen.

Aegypoecus Clay & Meinertzhagen, 1939, *Entomologist*, 72 : 36. *Nomen novum* for *Helluo* Clay & Meinertzhagen.

1. **brevicollis** (Burmeister), 1838, (*Docophorus*). *Handb. Ent.*, 2 : 424.

Host : (*Vultur cinereus*) = **Aegyptius monachus** (Linne), [Pakistan : Lyallpur], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 261.

- (2) **griffoneae** Ansari, 1947. *Proc. natn. Inst. Sci. India*, 13(6) : 261, fig. 2 = no. 3.

3. **perspicuus** (Kellogg), 1914, (*Docophorus*), *Sci. Bull. Brooklyn Inst.*, 2 : 83 pl. 16 fig. 3.

Host : **Gyps himalayensis** Hume. [Pakistan : Lyallpur]. Ansari, 1947. *Proc. natn. Inst. Sci. India*, 13 : 261, fig. 2, as *A. griffoneae* Ansari; **Neophron percnopterus** (Linne), [India : Lucknow], Dhanda, 1960. *Ann. Mag. nat. Hist.*, (13) 3 : 660 figs. 1, 9, 22, 28, 34, 36 & 41.

Akidoproctus Piaget, 1880

Akidoproctus Piaget, 1880; *Pediculines* : 208.

An unwarranted emendation of *Acidoproctus* Piaget.

4. Alcedoecus Clay & Meinertzhagen, 1939

Alcedoecus Clay & Meinertzhagen, 1939. *Entomologist*, 72 : 62. Type species : *Philopterus capistratus* Neumann.

1. **annularis** Ansari, 1955, *Proc. 7th Pak.Sci.Conf.*, : 45.

Host : **Halcyon s. smyrnensis** (Linne), [Pakistan : Lyallpur : Jati (Tatta Dist.)]; also Ansari, 1956. *Pakistan J. Sci. Res.*, 8(1) : 11; Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 397; and Ansari, 1959. *Indian J. Ent.*, (1958), 20 (2) : 92 figs. 182-186.

2. **capistratus** (Neumann), 1912, (*Philopterus*). *Arch. Parasit.*, Paris, 15 : 375. fig. 20.

Host : **Halcyon s. smyrnensis** (Linne), [India : Kulu], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 26.8

5. Alcedoffula Clay & Meinertzhagen, 1939

Alcedoffula Clay & Meinertzhagen, 1939, *Entomologist*, 72 : 161. Type species : *Philopterus alcedinis* (Denny).

1. **alcedinis** (Denny), 1842, (*Docophorus*), *Mon.Anopl. Brit.*, 48, 11. pl. 6 fig. 1.

Host : **Alcedo/atthis/ispida** (Linne) & **Halcyon s. smyrnensis** Linne, [Pakistan : Lyallpur]. Ansari, 1947. *Proc. natn. Inst. Sci. India*, 13 (6) : 264.

2. **machera** Ansari, 1955, *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 46.

Host : **Ceryle rudis leucomelanura** Reichenbach, [Pakistan : Shujawal (Tatta Dist.)]; also in Ansari, 1956. *Pakistan J. Sci. Res.* 8 (1) : 12, figs. 1-5.; and Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 397.

3. **mahagir** Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 46.

Host : **Halcyon s. smyrnensis** Linne, (Pakistan); also Ansari, 1956. *Indian J. Ent.* (1955), 17 (3) : 397; and in Ansari, 1959. *Indian J. Ent.*, (1958), 20 (2) : 93, fig. 187.

6. Allobrueelia Eichler, 1952

Allobrueelia Eichler, 1951, *Bedeutung der Vogelwelt in Forschung und Praxis*. Berlin : 56. Type species : *A. amsel* Eichler.

1. **daumae** (Clay,) 1936, (*Degeeriella*). *Proc. Zool. Soc. Lond.*, (1935): 910, figs. 5, 7c, pl. 2 fig. 2.
Host : (*Turdus d. dauma*) = **Zoothera d. dauma** (Latham) [Himalaya] & (*T. d. aureus*) = **Zoothera d. aurea** [Holandre], [Burma], as *D. zootherae daumae* (Ztotorzycka, 1964. *Acta Parasitol. Polonica*, 12 (24) : 266, considers this subspecies as fulledged species).
- (2) **marginalis** (Burmeister), 1838, (*Nirmus*). *Handb. Ent.*, 2 : 431 = no. 4.
- (3) **marginallis** (Nitzsch), 1838, (*Nirmus*), *Handb. Ent.*, 2 : 431 (*Sensu* Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 289) = no. 4.
4. **marginata** (Burmeister), 1838, (*Nirmus*). *Handb. Ent.*, 2 : 431.
Host : (*Dendrocitta rufa*) = **Dendrocitta vagabunda parvula** Whistler & Kinnear, [Burma] India : Calcutta, (Gowhatty) Gauhati & Cachar (Asam) : (*Dendrocitta himalayensis*) = **D. formosae himalayensis** Blyth [Nepal] & (*Urocissa occipitalis*) = **Kitta erythrorhyncha occipitalis** (Blyth) [Upper Burma]; India : (Manndi) Mandi (Himachal Pradesh); Kellogg & Paine, 1914, *Rec. Indian Mus.*, 10 : 236 as *N. marginalis* Burm. : (*Urocissa erythrorhynchus occipitalis*) = **Kitta erythrorhyncha occipitalis** Blyth, [Pakistan : Lyallpur], (*U. f. flavirostris*) = **Kitta f. flavirostris** (Blyth), [India : Kulu] & (*Trochalopteron lineatum grisescentor*) = **Garrulax lineatus lineatus** (Vigors), [India : Kulu], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (5) : 289, as *Brueelia marginallis* (Nitzsch).

Allocolpocephalum Qadri, 1939

Allocolpocephalum Qadri, 1939, *Indian J. Ent.* 1 : 66. Types species : *Colpocephalum semicinctum* Rudow.

Inseparable from *Colpocephalum*.

7. *Amyrsidea* Ewing, 1927.

Amyrsidea Ewing, 1927, *J. Wash. Acad. Sci.*, 17 : 90. Type species : *Menopon ventrale* Nitzsch.

1. **Occuleae** Price and Elbel, 1969, *J. kans. ent. Soc.*, 42 (3) : 336, figs. 1-3.

Host : **Caloperdix o. oculate** (Temminck), [Burma].

2. **minuta** Emerson, 1961. *Florida Entomol.*, 44 (3) : 117, figs. 1,3.

Host : **Pavo cristatus** Linne, [Bangla Desh : Dacca; India]
Slides in British Museum Nat. Hist. & Z. S. I.

3. **phaeostoma** (Nitzsch), 1866, (*Menopon*). *Z. ges. Nat. Wiss.*, 28 : 391.

Host : **Pavo cristatus** Linne [India : Attari], Ansari, 1951.
Proc. natn. Inst. Sci. India, 17 (2) : 166.

- (4) **subaequalis** (Piaget), 1880, (*Menopon*; *nec. Liotheum subaequale* Haan, 1829). *Pediculines* : 463 pl. 37 fig. 5 = no. 5.

5. **substituta** (Harrison), 1916, (*Menopon*). *Parasitology*, 9 : 45.
Nomen novum for *Menopon subaequale* Piaget, 1880 (*nec. Liotheum subaequale* Haan, 1829).

Host : (**Acomus erythrophthalmus**) = **Houppifer erythrophthalmus** (Raffles), [no history] & (**Gennaeus melanotus**) = **Lophura leucomelana melanota** Hutton, [Bhutan], Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 : 232, as *Menopon subaequale* Piaget.

6. **ventralis** (Nitzsch), 1866, (*Menopon*). *Z. ges. Nat. Wiss.*, 26 : 291.

Host : **Argusianus argus** (Linne), [India : no history], Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 : 232.

8. **Anaticola** Clay, 1936

Anaticola Clay, 1936, *Proc. zool. Soc. Lond.*, 1936 : 617. Type species : *Esthiop-
terum crassicornis* (Scopoli).

1. **anseris** (Linne), 1758, (*Pediculus*), *Syst. nat.* 10 : 612, *Nomen novum* for "Redi's pollini del. oca reale"

Host : **Anser anser** (Linne) & **A. indicus** (Latham) (India), Emerson, 1973. In : *Some ectoparasites of the birds of Asia* : 83.

2. **coloratus** (Piaget), 1880, (*Lipeurus*). *Pediculines* : 346.

Hosts : **Sarkidornis melanotos** (Pennant), [India], Emerson. 1973, In : *Some ectoparasites of the birds of Asia* : 83.

3. **crassicornis** (Scopoli), 1763, (*Pediculus*). *Ent. Carniolica* : 383.

Hosts : (*Anas Boschas*) = *Anas p. platyrhynchos* (Linne), (*Casarca f. ferruginea*) = *Tadorna ferruginea* (Pallas), & (*Nettion c. crecca*) = *Anas c. crecca* Linne, [India: Kulu: Pakistan: Lyallpur]; (*Nyroca f. ferina*) = *Aythya f. ferina* (Linne), [Pakistan : Lyallpur]; and (*Myophonus coeruleus temminckii*) *Myiophonus caeruleus temminckii* (Vigors), [India: Kulu-a straggler], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 259; *Anas acuta* (Linne), *A. clypeata* Linne, *A. crecca* Linne, *A. penelope* Linne, *A. strepera* Linne, & *Netta rufina* (Pallas), [India], Emerson, 1973. In : *Some ectoparasites of the birds of Asia* : 83.

4. **ewingi** (Qadri), 1935, (*Columbicola*). *Z. Parasitenk.*, 8 : 233 fig. 6.

Host : (Unidentified duck-probably a teal), [India : Aligarh Dist.].

5. **fuligulae** (T. Mueller), 1927, (*Lipeurus*). *Ber. Westpreuss. bot.—Zool. ver.*, 49 : 23.

Host : (*Nyroca ferina*) = *Aythya f. ferina* (Linne), [India : Punjab], Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 399; also Ansari, 1959. *Indian J. Ent.*, (1958), 20 (2) : 99.

6. **magnificus** Ansari, 1955, *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 51.

Host : (*Casarca ferruginea*) = *Tadorna ferruginea* (Pallas), [Pakistan]; also Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 399 and Ansari, 1959. *Indian J. Ent.*, (1958), 20 (2) : 99, figs. 227-234.

7. **sordidus** (Giebel), 1866, (*Lipeurus*). *Z. ges. NatWiss.*, 28 : 385.

Host : *Anas crecca* Linne, [Pakistan], Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 517, Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 399; also Ansari, 1959. *Indian J. Ent.*, (1958), 20(2) : 99.

- (8.) **squalidus** (Nitzsch), 1818, (*Philopterus*). *Germar's Mag. Ent.*, 3 : 292. *Nomen novum* for *Pediculus anatis* Fabricius 1794) *nec*, (Schrank, 1781) = no. 3.

9. *Anatoecus* Cummings, 1916

Anatoecus Cummings, 1916, *Proc. zool. Soc. Lond.*, 1916 : 653. Type species "*Anatoecus icterodes* Nitzsch".

1. **dentatus** (Scopoli), 1763, (*Pediculus*). *Entomologia carniolica* : 383.
Host : (*Casarca ferruginea*) = **Tadorna ferruginea** (Pallas), (*Nyroca ferina*) = **Aythya ferina** (Linne) [Pakistan : Lyallpur], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 268.
2. **difficilis** Cummings, 1916, *Proc. zool. Soc. Lond.*, 653, 654 & 659.
Host : (Dun bird) Probably **Aythya ferina** (Linne), [India : Punjab], Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 51; also on the same host in Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 399 and Ansari, 1959. *Indian J. Ent.*, (1958), 20 (2) : 100.
3. **pygaspis** (Nitzsch), 1866 (*Docophorus*). In Giebel's *Z. ges. NatWiss.*, 28 : 361.
Host : (*Phoenicopterus antiquorum*) = **Phoenicopterus roseus** Pallas, [India]. (Slide in B. M. (Nat. Hist.).
4. **regina** Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 51.
Host : (*Casarca ferruginea*) = **Tadorna ferruginea** (Pallas) [Pakistan]; also Ansari, 1956. *Indian J. Ent.* (1955), 17 (3) : 399 and Ansari, 1959. *Indian J. Ent.* (1958), 20 (2) : 100, figs. 235-237.

Anousceps Zlotorzyska, 1967

Anousceps Zlotorzyska, 1967, *Pol. Pismo Ent.*, 37 (4) : 730.

Type species : *Nirmus separatus* Kellogg & Kuwana. For the present retained under *Quadriceps*.

10. *Aquanirmus* Clay & Meinertzhagen, 1939

Aquanirmus Clay & Meinertzhagen, 1939, *Entomologist*. 72 : 163.,

Type species : "*Degeeriella runcinata* (Nitzsch)".

1. **bahli** Tandan, 1951, *Ann. Mag. nat. Hist.* (12) 4 : 803, figs. 1-4.
Host : **Podiceps ruficollis capensis** Salvadori, [India : Lucknow : Kukrail]; same host, [India], Emerson, 1973. In : *Some ectoparasites of the birds of Asia* : 84.

11. *Ardeicola* Clay, 1936.

Ardeicola Clay, 1936, *Proc. zool. Soc. Lond.*, 1936 : 615. Type species : *Esthiop-
terum ardeae* (Linne).

1. **asiaticus** Kumar and Tandan, 1971. *Bull. Br. Mus. nat. Hist. (Ent.)*, 26 (2) : 146, pl. figs. 3. pl. 2. fig. 7, figs. 37, 55.
Host : **Xenorhynchus a. asiaticus** (Latham), [India : (Rajputana) Rajasthan].
2. **burmanus** Hajela and Tandan, 1970, *Zool. J. Linn. Soc.*, 49 (4) : 324, figs. 6, 20, 28, 36, and 37.
Host : **Pseudibis davisoni** (Hume), [Burma].
3. **castaneus** (Piaget), 1885, (*Lipeurus*), *Pediculines Supplement* : 62
Host : (*Dissoura* [e.] *episcopus*), **Ciconia** [e.] **episcopus** (Boddaert), [India], Qadri, 1936. *Z. Parasitenk.* 8 : 643, fig. 4 as *Degeeriella episcopi* Qadri; same host, [Burma], Kumar and Tandan, 1971. *Bull. Br. Mus. nat. Hist. (Ent.)*, 26 (2) : 141, figs. 10, 19, 53.
4. **dennelli** Hajela & Tandan, 1967. *Proc. R. ent. Soc. Lond. (B)*, 36 (5-6) : 73, figs. 10-17.
Host : **Pseudibis papillosa** (Temminck), [India : Lucknow]; also Hajela & Tandan, 1970. *Zool J. Linn. Sci.* 49 (4) : 323, figs. 5, 13, 17, 27.
- (5) **episcopi** (Qadri), 1936, (*Degeeriella*). *Z. Parasitenk.*, 8 : 643, fig. 4. = no. 3.
6. **gaibagla** Ansari, 1947. *Proc. natn. Inst. Sci. India*, 13 (6) : 256, fig. 1.
Host : **Bubulcus ibis coromandus** (Boddaert) [Pakistan : Lyallpur].
7. **hardayali** Tandan and Kumar, 1969. *Ann. Soc. Ent. Fr. (N.S.)* 5 : (1) : 146, figs. 1, 2, 4, 6, 7, 9, 11-16, 20, 22.
Host : **Leptoptilos javanicus** (Horsfield), [India], Kumar and Tandan, 1971. *Bull. Br. Mus. nat. Hist. (Ent.)*, 26 (2) : 154.
8. **indicus** Brelih, 1965. *Ann. Mag. nat. Hist.*, (13)., (85/86) : 56, figs. 6, 9 & 13.
Host : **Threskiornis melanocephala** (Latham), [India : Deccan].
9. **lepidus** (Nitzsch), 1866, (*Lipeurus*). In Giebel, *Z. ges. NatWiss.* 28 : 383.

Host : *Anastomus oscitans* (Boddaert), [India : Moirang (Manipur), Unao, U. P.], Kumar and Tandan, 1971, *Bull. Br. Mus. nat. Hist. (Ent.)*, 26 (2) : 133, figs. 4,6,7,13,16,30,39,49.

10. **plataleae** (Linne), 1758, (*Pediculus*). *Syst. Nat. ed.*, 10 : 613.
Nomen novum for Redi's Pollino del palletone.

Host : *Platalea* 1. *leucordia* Linne [India : (Rajputana) Rajasthan], Clay & Hopkins, 1950 *Bull. Br. Mus. nat. Hist. (Ent.)*, 1 (3) : 245, figs. 29-33, pl. 1, fig. 8.

11. **tantali** (J. C. Fabricius), 1798, (*Pediculus*). *Ent. Syst. Suppl.* : 571.

Host : (*Tantalus leucocephalus*)=*Ibis leucocephalus* (Pennant), [India : Tranquebar]; same host, [India : (Rajputana) Rajasthan, (Lucknow) U.P.], Kumar and Tandan 1971. *Bull. Br. Mus. nat. Hist. (Ent.)*, 26 (2) : 145, pl. 1. fig. 2, pl. 2. fig. 6; figs. 34,54, 58.

12. *Ardeiphilus* Bedford, 1939

Ardeiphilus Bedford, 1939. *Onderstepoort J. vet. Sci.*, 12 : 139.

Type species: *Colpocephalum trochioxum* "Nitzsch".

1. **mirzai** (Qadri), 1935, (*Cuculiphilus*). *Z. Parasitenk.*, 8 : 232, fig. 5.

Host : *Ardeola grayii* (Sykes), [India].

2. **trochioxus** (Burmeister), 1838, (*Colpocephalum*). *Handb. Ent.*, 2 : 438.

Host : *Ardeola grayii* (Sykes), [India], Ansari, 1951. *Proc. nat. Inst. Sci. India*, 17 (2 : 162).

13. *Austromenopon* Bedford, 1939

Austromenopon Bedford, 1939. *Onderstepoort J. vet. Sci.*, 12 : 122.

Type species: *Menopon crocatum* Nitzsch.

1. **crocatum** (Nitzsch) 1866, (*Menopon*). *Z. ges. NatWiss.*, 28 : 392.

Host : *Numenius arquata* (Linne), & *N. minutus* (Gould) ? [India], Emerson, 1973. In : *Some ectoparasites of the birds of Asia* : 107.

2. **cursorius** (Giebel), 1874, (*Menopon*). *Insecta epizoa* : 296.

Host : *Cursorius cursor cursor* (Latham), [Pakistan : Lyallpur], Ansari, 1951. *Proc. nat. Inst. Sci. India*, 17 (2) : 173.

3. **icterum** (Burmeister), 1838, (*Menopon*). *Handb. Ent.*, 2 : 440.

Host : **Himantopus h. himantopus** (Linne), & **Tringa o. ochropus** Linne, [Pakistan : Lyallpur], Ansari, 1951. *Proc. nat. Inst. Sci. India*, 17 (2) : 173.

4. **leucurae** Timmermann, 1955. *Bonn. Zool. Beitr.*, 5 : 200.

Host : (**Chettusia leucura**) = **Vanellus leucurus** (Lichtenstein), [India; also Pakistan : Bahawalpur] (Slide in B. M. (*Nat. Hist.*)).

5. **limosae** Timmermann, 1955. *Bonn. zool. Beitr.*, 5 : 202.

Host : **Limosa limosa** (Linne) [India? : (Radschputana Probably Rajaputana) Rajasthan].

6. **mohni** Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Agric.* : 56.

Host : **Himantopus h. himantopus** (Linne), [Pakistan]; also Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 400 and Ansari, 1957. *Indian J. Ent.*, (1956), 18 (4) : 435, figs. 55-59; Clay, 1959. *Proc. R. Ent. Soc. Lond. (B)*, (11-12) : 167.

7. **sohni** Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Agric.* : 56.

Host : **Tringa ochropus** Linne, [Pakistan]; also Ansari, 1956. *Indian J. Ent.*, (1955), 17, (3) : 400, and Ansari, 1957. *Indian J. Ent.*, (1956), 18 (4) : 435, figs. 60-62. [not identifiable from the description], Clay, 1959. *Proc. R. Ent. Soc. Lond. (B)*, : 28 (11-12) : 167.

14. **Bedfordiella** Thompson, 1937

Bedfordiella Thompson, 1937. *Ann. Mag. nat. Hist.* (10) 20 : 434.

Type species : *B. unica* Thompson.

1. **unica** Thompson, 1937, *Ann. Mag. nat. Hist.* (10), 20 : 434, figs. 1,2.

Host : **Pterodroma brevirostris** (Lesson), (Off S. Indian, Ocean).

Bitrabeculus Uchida, 1948

Bitrabeculus Uchida, 1948. *Japan med. J.*, 1 : 318. Type species: *Docophorus singularis* Kellogg.

Not separable from *Philopterus*.

15. Bonomiella Conci, 1942

Bonomiella Conci, 1942. *Riv. Soc. Stud. Venezia Tridentina*, 23 : 1.

Type species: *B. insolitungincolata* Conci.

1. **bieri** Eichler, 1959. *Dte. gesundhwes*, Berlin, 14 : 1173.

Host : *Streptopelia chinensis ceylonensis* (Reichenbach), [Sri Lanka (Ceylon)].

16. Boopia Piaget, 1880

Boopia Piaget, 1880, *Pediculines*: 599. Type species (by monotypy) : *B. tarsata* Piaget.

1. **grandis** Piaget, 1885. *Pediculines supplement* : 154, pl. 16 fig. 8.

Host : (*Lutra pruneri*-Error) **Macropus rufus** (Desmarest), (India ?) Mjöberg, 1910. *Ark. Zool.* 6 : 21, 240, figs. 10-18; 132, pl. 4 fig. 9 as *Boopia peregrina* Mjöberg.

2. *peregrina* Mjöberg, 1910. *Ark. Zool.*, 6 : 21, 240, figs. 10-18; 132, pl. 4 fig. 9 = no. 1.

Bovicola Ewing, 1929

Bovicola Ewing, June 1929, *Man. ext. paras.*, 121, 123, 193.

Type species : *Trichodectes caprae* Gurlt.

Is regarded as a subgenus of *Damalinia*.

17. Brueelia Kéler, 1936

Brueelia Kéler, 1936, *Arb. morph.-tax. Berlin-Dahlem*, 3 : 257.

Type species : *B. rossittensis* Kéler.

Corvonirmus Eichler, 1944, *Stettin. ent. Ztg.*, 105 : 81.

Type species : *Nirmus uncinus* "Nitzsch in Burmeister".

Painjunirmus Ansari, 1947, *Proc. nat. Inst. Sci. India*, 13 (6) : 285.

Type species : *P. pengya* Ansari.

Traihoriella Ansari, 1947, l.c. : 290. Type species: *T. punjabensis* Ansari.

Olivinirmus Złotorzycka, 1964, *Acta Parasitol. Polonica* 12 (24) : 246. Type species : *Nirmus glandarii* Denny.

1. **antennatus** Ansari, 1956. *Pak. Jour. Hlth.*, Lahore; 6 : 139.

Host : *Garrulax striatu(m)s sikkimensis* (Tiechurst), [India : Chungtang, Sikkim] (Slide in B. M. nat. Hist. (Ent.) London.

2. **argula** (Burmeister), 1838, (*Nirmus*). *Handb. Ent.*, 2 : 430.

- Host : (*Corvus corax laurencei*) = *Corvus corax subcorax* Severtzov, [Afghanistan : Chorband & Kabul; Pakistan : Lyallpur], Ansari, 1957. *Bull. Br. Mus. nat. Hist. (Ent.)*, 5 (4) : 145, figs. 1-8 & 60-64.
3. *atherae* Ansari, 1957, *Bull. Br. Mus. nat. Hist. (Ent.)*, 5 (4) : 161, figs. 18, 44-45 & 101-104.
- Host : (*Corvus corax laurencei*) = *Corvus corax subcorax* Severtzov. [Afghanistan : Shiber pass].
4. *avinus* Ansari, 1956. *Pak. Jour. Hlth.*, 6 : 141.
- Host : *Garrulax s. subunicolor* (Blyth), [India : Sikkim Chung-tang].
5. *biguttata* (Kellogg & Paine), 1914, (*Nirmus*). *Rec. Indian Mus.*, 10, (4) : 214, pl. 14 fig. 2.
- Host : (*Graculus graculus*) = *Pyrrhocorax g. graculus* (Linne), [India]; also on the same host, [Tibet (Khambajon)] Ansari, 1956. *Bull. Br. Mus. nat. Hist. (Ent.)*, & 4 (8) : 300, figs. 69-75.
6. *biocellata* (Piaget), 1880, (*Nirmus*). *Pediculines* : 66, pl. 5 fig. 2.
- Host : *Pica pica bactriana* Bonaparte, [Afghanistan : Kabul, India : Ladakh], Ansari, 1956. *Bull. Br. Mus. nat. Hist. (Ent.)*. 4 (8) : 396, figs. 90-93.
7. *cambayensis* Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 54.
- Host : *Saxicoloides fulicata cambaiensis* (Latham), [Pakistan], also on the same host, Ansari, 1956. *Indian J. Ent.*; (1955), 17 (3) : 395 and Ansari 1958. *Indian J. Ent.*, 20 (1) : 50, fig. 24, (Inconsistent spellings have been used for *cambayensis* as *cambayensis* (in text) *cambayansis* for figure).
8. *chayanh* Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 55.
- Host : *Acridotheres t. tristis* (Linne), [Pakistan]; also Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 395 and Ansari, 1958. *Indian J. Ent.*, 20 (1) : 54, figs. 38-42.
9. *chilchil* Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 53.
- Host : *Turdoides c. caudatus* (Dumont) [Pakistan]; also Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 394 and Ansari, 1958. *Indian J. Ent.*, 20 (1) : 48, figs. 9-15.

chitlatilyar Ansari, 1955. See *Spironirmus*.

10. **cyclothorax** (Burmeister), 1838, (*Nirmus*). *Handb. Ent.*, 2 : 429.

Hosts : (*Gymnorhina* x. *xanthocollis*) = *Petronia* x. *xanthocollis* (Burton); *Passer domesticus indicus* Jardine & Selby & (*Anthus richardi rufulus* = probably *Anthus novaeseelandiae richardi* Vieillot, [Pakistan : Lyallpur], Ansari, 1947. *Proc. nat. Inst. Sci. India*. 13 (6) : 288 as *Painjunirmus cyclothorax* (Nitzsch).

daumae (Clay), 1936, (*Degeeriella*). See *Allobrueelia*.

11. **dicruri** Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 53.

Host : (*Dicrurus macrocercus*) = *Dicrurus adsimilis macrocercus* Vieillot, [Pakistan : Jati (Tatta Dist.)], also Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 395 and Ansari, 1956. *Pakistan J. Sci. Res.*, 8 (1) : 12, figs. 6-10.

12. **effronte** Ansari, 1956. *Pak. Jour. Hlth.* 6 : 155.

Host : *Garrulax squamatus* (Gould), [India].

13. **ginginianus** Ansari, 1955. *Proc. 7th Pak. Sci. Cong. Sec. Biol.* : 55.

Host : *Acridotheres ginginianus* (Latham), [Pakistan]; also Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 395 and Ansari, 1958. *Indian J. Ent.*, 20 (1) : 55, figs. 43-48.

14. **grandalae** (Clay), 1936, (*Degeeriella*). *Proc. Zool. Soc. Lond.*, 1935 : 912, fig. 7 e, pl. 2 fig. 5.

Host : *Grandala c. coelicolor* Hodgson, [India : Sikkim].
gulabitylar Ansari, 1955. See *Spironirmus*.

15. **guldum** Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 54.

Host : *Pycnonotus cafer intermedius* Blyth, [Pakistan], also Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 394 and Ansari, 1958. *Indian J. Ent.*, 20 (1) : 49, figs. 16-23.

16. **husaini** Ansari, 1956. *Bull. Br. Mus. nat. Hist. (Ent.)*, 4 : 383. figs. 35 & 43.

Host : (*Urocissa flavirostris cucullata*) = *Kitta flavirostris cucullata* (Gould), [India : Kashmir & Kulu]; (*Urocissa melanocephala occipitalis*) = *Kitta erythrorhyncha occipitalis* (Blyth), [India : Kulu; Nepal].

17. **iliaci** (Denny), 1842, (*Nirmus*). *Mon. Anopl. Brit.* : 51, 130, pl. 9 fig. 4.
 Hosts : (*Pastor roseus*) = **Sturnus roseus** (Linne); **Acridotheres t.tristis** (Linne) & **A. ginginianus** (Latham), [Pakistan: Lyallpur], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 28 as *Painjunirmus iliaci* (Denny).
18. **impressifrons** Ansari, 1956. *Pak. Jour. Hlth.*, 6 : 152.
 Host : (*Garrulax a. affine*) = **Garrulax a. affinis** Blyth, [India], also (Nepal) Slides in B. M. (Nat. Hist).
19. **indiensis** Ansari, 1956. *Biologia*, 2 : 111.
 Host : **Turdus ruficollis atrogularis** Jarocki, (India : U. P.).
20. **longisternus** Ansari, 1956. *Pak. Jour. Hlth.*, 6 : 146.
 Host : **Cutia n. nipalensis** Hodgson, [India: Sikkim]
21. **maharastran** Ansari, 1956. *Pak. Jour. Hlth.* 6 : 164.
 Host : (*Turdoides somervillei*) = **Turdoides striatus somervillei** (Sykes), [India: Bombay].
marginalis (Burmeister), 1838, (*Nirmus*). See *Allobrueelia*.
marginallus (Nitzsch), *Handb. Ent.*, 2 : 431 (*Sensu* Ansari, 1947). See *Allobrueelia*.
22. **meinertzhageni** Ansari, 1956. *Bull. Br. Mus. nat. Hist. (Ent.)* 4 : 381.
 Hosts : (*Dendrocitta rufa vagabunda*) = **Dendrocitta vagabunda** (Latham), [Burma; India & Nepal] (*D. vagabunda pollida*) = **D. v. pallida** Blyth (Pakistan : Jati (Tatta Dist. Sind); also Ansari. 1956. *Indian J. Ent.* (1955), 17 (3) : 395. & Ansari, 1956. *Pakistan J. Sci. Res.*, 8 (1) : 13.
23. **multipunctata** (Clay), 1936, (*Degeeriella*). *Proc. Zool. Soc. Lond.* (1935), 2 : 906, fig. 2, pl. 1. fig. 2.
 Host : **Nucifraga caryocatactes multipunctata** Gould (India : Kashmir); also Ansari, 1956. *Bull. Br. Mus. nat. Hist. (Ent.)*, 4 (8) : 398, figs. 94-100.
munda (Nitzsch), 1866, (*Nirmus*). See *Maculinirmus*.
munia Ansari, 1955. See *Nigronirmus*.
24. **myiophoneae** (Clay), 1936, (*Degeeriella*). *Proc. Zool. Soc. Lond.* (1935) 2 : 911, fig. 7 g, pl. 2 fig. 4.

- Host : (*Myiophoneus t. temminckii*) = *Myiophoneus coeruleus temminckii* Vigors (India : Kashmir & Kulu); also Ansari, 1947. *Proc. natn. Inst. Sci. India*. 13 (6): 29.
25. **nigrosignata** (Piaget), 1880, (*Nirmus*). *Pediculines* : 157. pl. 13. fig. 6.
Host : *Garrulus leucotes* Hume, (Upper Burma), Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 (4) : 236 as *N nigrosignatus* Piaget.
26. **nipalensis** Ansari 1956. *Pak. Jour. Hlth.*, 6 : 143.
Host : *Garrulax striatu* [m]s. *sikkimensis* (Ticehurst). [India : Sikkim].
27. **novafacies** Ansari, 1956. *Pak. Jour. Hlth.* 6 : 154.
Host : *Garrulax s. subunicolor* (Blyth). [India : Sikkim].
28. **olivacea** (Burmeister), 1838, (*Nirmus*). *Handb. Ent.*, 2 : 431.
Hosts : *Corvus splendens* Vieillot [India : Calcutta & Trivandrum; Nepal]; *C. macrorhynchus* Wagler, [Nepal] & (*Pica rustica*) = *Pica pica bactriana* Bonaparte, [Upper Burma], Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 (4) : 236 as *Nirmus olivaceus* Nitzsch.
29. **oudhensis** Ansari, 1956. *Biologia*, 2 : 130.
Host : (*Turdus merula nigropelios*) = *Turdus merula nigropileus* (Lafresnaye), [India : (Bombay State), Gujarat & Maharashtra].
30. **pagodarum** Ansari, 1955. *Proc. 7th. Pak. Sci. Conf. Sec. Biol.* : 55
Host : (*Temenuchus pagodarum*) = *sturnus pagodarum* (Gmelin) [Pakistan]; also Ansari, 1956, *Indian J. Ent.*, (1955), 17 (3) : 395, and Ansari 1958. *Indian J. Ent* 20 (1) : 53. fig. 37.
31. **pakistanaise** Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 52,
Host : *Lanius vittatus* Valenciennes, [Pakistan : Karachi], also Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 395 and Ansari, 1956. *Pakistan J. Sci. Res.*, 8 (1) : 13. figs. 11-16.
parae Ansari, 1955. See *Nigronirmus*.

32. **pengya** (Ansari), 1947, (*Painjunirmus*). *Proc. natn. Inst. Sci. India*, 13 (6) : 285, fig. 10.
Hosts : (*Turdoides t. terricolor*) = **Turdoides striatus sindianus** (Ticehurst), & (*Argya c. caudata*) = **Turdoides c. caudatus** (Dumont), [Pakistan : Lyallpur.]
33. **punjabensis** (Ansari), 1947, (*Traihoriella*). *Proc. natn. Inst. Sci. India*, 13 (6) : 290, fig. 11.
Host: **Megalaima virens marshallorum** Swinhoe, [India:Kulu].
34. **saliemi** Ansari, 1957. *Bull. Br. Mus. nat. Hist. (Ent.)*, 5 (4) : 158, figs. 16, 40, 41, 92-96.
Hosts : **Corvus splendens** Vieillot, [India : Bihar & Deccan Nepal; Pakistan : Lyallpur]; **C. splendens zugmayeri** Laubmann, [Pakistan : Sind]; (*Corvus Coronoides intermedius*) **Corvus macrorhynchos intermedius** Adams, [India : Bihar], Ansari, 1957. *Bull. Br. Mus. nat. Hist. (Ent.)*, 5 (4) : 160, figs. 17, 42, 43, 97-100 as **B. s. mollii** Ansari; also Emerson, 1973. In : *Some ectoparasites of the birds of Asia* : 86.
35. **sehri** Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 53.
Host : (*Trochalopteron lineatum grisescenter*) = **Garrulax lineatus lineatus** (Vigors), [Pakistan]; also Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 39 & Ansari, 1958. *Indian J. Ent.*, 20 (1) : 47, figs. 1-8.
36. **sternotransversa** Ansari, 1956. *Pak. Jour. Hlth.*, 6 : 147.
Host : **Garrulax a. albogularis** (Gould), [India]; also [Nepal] (Slide in B. M. Nat. Hist.)
37. **sternotypicus** Ansari, 1956. *Pakistan J. Hlth.*, 6 : 148.
Host : **Garrulax p. pectoralis** (Gould), [India : Manipur.]
38. **stresemanni** (Clay), 1936, (*Degeeriella*). *Proc. zool. Soc. Lond.*, 1935, 2 : 910, figs. 6, 75, pl. 2 fig. 3.
Host : **Zoothera (m.) monticola** (Vigors), [India : Sikkim].
39. **subtilis** (Nitzsch), 1874, (*Nirmus*). In Giebel's *Insecta Epizoa*: 137.
Host : **Passer domesticus indicus** Jardine & Selby, [India : Punjab], Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 395.

40. **tasniemae** Ansari, 1957, *Bull. Br. Mus. nat. Hist. (Ent.)*, 5 (4) : 152, figs. 12, 32-33, 74-78.

Host : **Corvus f. frugilegus** Linne, [Afghanistan : Kabul].

41. **uncinosa** (Burmeister), 1838, (*Nirmus*). *Handb. Ent.*, 2 : 430.

Host : **Corvus (c.) cornix** Linne, [India : Gilgit], Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 (4) : 236 as *Nirmus uncinosus* Nitzsch.

42. **varia** (Burmeister), 1838, (*Nirmus*). *Handb. Ent.*, 2 : 430.

Hosts : **Corvus monedula** Linne. & **C. frugilegus** Linne, [India : Gilgit], **C. corax** Linne. (India : Ladakh), and (Picarustica)=**Pica pica bactriana** Bonaparte [India Gilgit & Ladakh], Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 (4) : 236 as *Nirmus varia* Nitzsch (*Corvus corax laurencei*)=**Corvus corax subcorax** Severtzov, (*Corvus frugilegus tachusii*)=**C. f. frugilegus** Linne and **C. s. splendens** Vieillot [Pakistan : Lyallpur], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 289; (material from the last named species may be same as no. 34); (*Corvus frugilegus tschusii*)=**C. f. frugilegus** Linne, /Pakistan : Lyallpur **C. monedula soemoeringii** Fisher, **C. corone corone** Linne, & **C. corone orientalis** Eversmann, [Afghanistan]. Ansari, 1957. *Bull. Br. Mus. nat. Hist. (Ent.)*, 5 (4) : 166, figs. 20, 48, 49, 109-113.

43. **ventratum** Ansari, 1956. *Pak. Jour. Hlth.* 6 : 150.

Host : **Garrulax r. ruficollis** Jardine & Selby, [India : Manipur]

44. **vulgata** (Kellogg), 1896, (*Nirmus*). *Occ. Pap. Calif. Acad. Sci.*, (2) 6 : 495, pl. 67, fig. 5.

Hosts : (*Urocissa malabarica*) = **Lonchura malabarica** (Linne) [Pakistan : Lyallpur] & (*Saxicoloides fulicata cambaiensis* (Latham), [Pakistan : Lyallpur], may be No. 6. Ansari, 1947. *Proc. nat. Inst. Sci. India*. 13 (6) : 287 as *Painjunirmus vulgata*.

xanthocollis Ansari, 1955. See *Nigronirmus*.

45. **zootherae** (Clay), 1936, (*Degeeriella*). *Proc. Zool. Soc. Lond.*, (1935), 2 : 909, figs. 4, 7a, pl. 2 fig. 1.

Host : **Zoothera marginata** Blyth, [parvula Delacour], [India : Himalaya].

46. sp. indeterminate Ansari, 1947. *Proc. natn. Inst. Sci. India*. 13 (6) : 2.

Host : **Oenanthe picata** (Blyth), [Pakistan : Lyallpur].

18. **Buceronirmus** Hopkins, 1941

Buceronirmus Hopkins, 1941, *J. ent. Soc. Sthrn Afr.*, 4 : 43.

Type species: *B. longicuneatus* Hopkins.

1. **albescens** (Piaget), 1890, (*Nirmus*) *Tijdschr. Ent.*, 33 : 226, pl. 8, fig. 4.

Host : **Anthracosceros albirostris** Gyldenstolpe (?), [Nepal], Emerson, 1973. In : *Some ectoparasites of the birds of Asia* : 86.

2. **zonatus** (Piaget), 1881, (*Lipeurus*). *Tijdschr. Ent.*, 24 : 3, pl. 1 fig. 3.

Host : (*Buceros nepalensis*) = **Aceros nipalensis** (Hodgson). [Nepal]; also Kellogg, 1908. *Genera Insectorum*; 46,

19. **Campanulotes** Kéler, 1939

Campanulotes Kéler, 1939, *Nova Acta Leop.-Carol.* (n. F.) 8 : 157.

Type species : *Goniocotes compar* 'Nitzsch'.

1. **bidentatus** (Scopoli), 1763, (*Pediculus*). *Entomologia Carniolica*: 385.

Host : **Columba livia intermedia** Strickland & **Streptopelia decaocta** (Frivaldzsky), [Pakistan : Lyallpur], Ansari, 1947. *Proc. natn. Inst. Sci. India*, 13 (6) : 296.

2. **compar** (Eurmeister), 1838, (*Goniocotes*). *Handb. Ent.* 2 : 431.

Host : **Columba livia intermedia** Strickland, [India : Punjab] Ansari, 1956, *Indian J. Ent.* (1955), 17 (3) : 398. & Ansari, 1959. *Indian J. Ent.* (1958), 20 (2) : 96.

3. **heteroceros** Tendeiro, 1969. *Rev. Cienc. vet. Sec. (A)* 2 : 399, figs.

Host : **Columba l. leuconota** Vigors, [India : Sikkim].

20. **Capraiella** Conci, 1941

Capraiella Conci, 1941, *Boll. Soc. ent. Ital.*, 73 : 126.

Type species : "*Degeeriella subcuspidata* Nitzsch".

1. **masumae** Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 47,

Host : *Coracias b. benghalensis* (Linne), [Pakistan], also Ansari, 1956. *Indian J. Ent.* (1955), 17 (3) : 398 and Ansari, 1959. *Indian J. Ent.* (1958), 20 (2) : 94 fig. 195.

2. **sabzak** Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.*, 46.

Host : *Coracias b. benghalensis* (Linne), [Pakistan]; also Ansari 1956. *Indian J. Ent.*, (1955), 17 (3) : 398 and Ansari 1959. *Indian J. Ent.*, (1958), 20 (2) : 93, figs. 188-194=probably no. 3.

3. **subcuspidata** (Burmeister), 1838 (*nec* Piaget, 1880), (*Nirmus*). *Handb. Ent.*, 2 : 430.

Host : *Coracias b. benghalensis* (Linne), [India : Lucknow], Tandan, 1955. *Ann. Mag. natn. Hist.*, (12) 8 : 425. figs. 13-16.

21. *Carduiceps* Clay & Meinertzhagen, 1939

Carduiceps Clay & Meinertzhagen, 1939, *Ann. Mag. nat. Hist.* (11) 4 : 451.

Type species : *Degeeriella complexiva* (Kellogg & Chapman).

1. **cingulatus** (Denny), 1842, (*Nirmus*). *Mon. Anopl. Brit.*, 54, 146, pl. 11, fig. 3.

Host : *Limosa l. limosa* (Linne), [India], (Slide in B. M. (Nat. Hist.), (cf. Timmermann, 1954. *Ann. Mag. nat. Hist.*, (12) 8 : 527).

2. **scalaris** (Piaget), 1880, (*Nirmus*). *Pediculines* : 190, pl. 17, fig. 2.

Host : *Philomachus pugnax* (Linne), [Pakistan]. Ansari, *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 49; also in Ansari, 1956. *Indian J. Ent.*, (1958), 20 (2) : 97.

3. **zonarius** (Nitzsch), 1866, (*Nirmus*). *Z. ges. NatWiss.*, 28 : 374.

Host : (*Erolia m. minuta*) = *Calidris m. minutus* (Leisler), [Pakistan : Lyallpur], Ansari, 1947. *Proc. natn. Inst. Sci. India*, 13 (6) : 280 as *Carduiceps cingulatus zonarius* (Nitzsch).

Carrikericeps Eichler & Ztotorzycka, 1964

Carrikericeps. Eichler & Ztotorzycka, 1964. *Dtsch. ent. Zeitschr.*, (n. F.), 11 (4-5) :

320. Type species : *quadriceps punensis* Carriker.

For the time retained under *Quadriceps*.

Chadriceps Ztotorzycka, 1967

Chadriceps Ztotorzycka, 1967, *Pol. Pismo Ent.*, 37 (4) : 728.

Type species : *Pediculus hiaticulae* O. Fabricius.

For the retained under *Quadriceps*.

22. Chapinia Ewing, 1927

Chapinia Ewing, 1927, *J. Wash. Acad. Sci.*, 17 : 88.

Type species : *Chapinia robusta* Ewing.

1. **acutovulvata** (Piaget), 1881, (*Menopon*), *Tijdschr. Ent.*, 24 : 5, pl. 1, fig. 4.

Hosts : (*Buceros malabaricus*) = *Anthracoceros malabaricus* (Gmelin), [Nepal], *A. albirostris leucogaster* (Blyth) ? [Burma : Myitkina], *A. coronatus* (Boddaert), [India : Kanha (M. P.) & Nawadeh, Bihas (=probably Nawada, Bihar) & elsewhere; Sri Lanka (Ceylon)], Elbel, 1967. *Proc. U. S. Nat. Mus.*, 120 (3558) : 23, figs. 9, 10, 35, & 36.

2. **clayae** Elbel, 1967. *Proc. U. S. Nat. Mus.*, 120 (3558) : 21, figs. 8, 33, & 34.

Hosts : *Tockus birostris* (Scopoli), [India : Rajasthan (Rajputana), Kotla (Kangra), Bherahat, Belwani (Kisli), Kanha, Baihar (Balaghat), all in Madhya Pradesh (old C.P.), Kalnali, & Nichland (U.P.); Nepal : Simra and other areas]; & *T. g. griseus* (Latham), [India : Nilambu(s)r (Kerala)].

23. Chelopistes Kéler, 1939

Chelopistes Kéler, 1939, *Nova Acta Leop. Carol.* (n. F.), 8 : 180.

Type species : *Rhopaloceras stylifer* (Nitzsch).

Virgula Clay, 1941, (*nec.* Simpson, 1900), *Parasitology*, 33 : 119.

Type species : *Goniodes meleagridis* Linne.

1. **lervicola** (Clay), 1941, (*Virgula*). *Parasitology*, 33 : 124, figs. 5-7.
Host : *Lerwa lerwa* (Hodgson), [India : Sikkim].

24. Ciconiphilus Bedford, 1939

Ciconiphilus Bedford, 1939, *Onderstepoort J. vet. Sci.*, 12 : 141.

Type species : *Colpocephalum quadripustulatum* "Nitzsch".

1. **decimfasciatus** (Boisduval & Lacordaire), 1835, (*Liotheum*). *Faune ent. Environs Paris* : 123.

Host : *Bubulcus ibis coromandus* (Boddaert), [Pakistan : Lyallpur], Ansari, 1951. *Proc. nat. Inst. Sci. India*, 17 (2) : 154, fig. 11 as *Pseudocolpocephalum doraibagla* Ansari, *Nycti corax n. nycticorax* (Linne), [Pakistan : Karachi], Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Agric.* : 54; Ansari, 1956. *Indian J. Ent.*, (1955). 17 (3) : 399 and also Ansari, 1956. *Pakistan J. Sci., Res.* 8 (2) : 57 as *Colpcephalum nyctardis* Denny; also Carriker, 1964. *Rev. Bras. Biol. Rio de Janeiro*, 24 (1) : 98, fig. 5 as *Ciconiphilus doraibagla* (Ansari); *Ardea purpurea* Linne, [India], Price & Beer, 1965. *Canad. Ent.*, 97 (6) : 661. figs. 10-12.

(2). *doraibagla* (Ansari), 1951, (*Pseudocolpocephalum*). *Proc. natn. Inst. Sci. India.*, 17 (2) : 154, fig. 11. = no. 1.

3. *matosi* (Tendeiro), 1958, (*Colpocephalum*). *Publ. Cult. Cia Diamant* Angola, No. 40 : 92.

Host : *Ibis leucocephalus* (Pennant), [India], Price & Beer, 1955. *Canad. Ent.*, 97 (6) : 660, figs. 13-15.

(4). *nyctardis* (Denny), 1842, (*Colpocephalum*). *Mon. Anopl. Brit.*, : 199, 215, pl. 20, fig. 9. = no. 1.

5. *quadripustulatus* (Burmeister), 1838, (*Colpocephalum*). *Handb. Ent.*, 2 : 438.

Hosts : *Xenorhynchus a. asiaticus* (Latham), *Anastomus oscitans* (*Dissoura e. episcopus*) *Ciconia e. episcopus* (Boddaert), [India], Price & Beer, 1965. *Canad. Ent.*, 97 (6) : 658, figs. 1-3.

6. *temporalis* (Piaget), 1880, (*Menopon*). *Pediculines* : 487.

Host : *Leptoptilos dubius* (Gmelin), [Burma : (Zoo) : India] & *L. javanicus* (Horsfield), [India], Price & Beer, 1965. *Canad. Ent.*, 97 (6) : 659, figs. 4-7.

Cirro-phthirius Timmermann, 1953

Cirro-phthirius Timmermann, 1953, *Bombus*, 78/79 : 330. Type species : *Cirro-phthirius recurvirostris* (Linne)

Absolute synonym of *Rhombiceps* Eichler.

Cistellatrix Timmermann, 1953

Cistellatrix Timmermann, 1953, *Bombus*, 78/79 : 331. Type species : *Cistellatrix decipiens* (Denny).

For the present treated under *Quadriceps*.

25. *Coloceras* Taschenberg, 1882

Coloceras Taschenberg, 1882, *Nova Acta Leop.-Carol.*, 44 : 42.

Type species : (by subsequent designation) Harrison, 1916, *Parasitology*, 9 : 21) : *Goniodes damicornis* Nitzsch.

1. **aegyptiacum** (Kellogg & Paine), 1911, (*Goniocotes*). *Bull. ent. Res.*, 2 : 148, pl. 5, figs. 2, 2a.
Host : **Columba livia intermedia** Strickland, [India : Punjab]. Ansari 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 48; also in Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 398 & Ansari, 1959. *Indian J. Ent.*, (1958), 20 (2) : 96.
2. **chinense** (Kellogg & Nakayama), 1902, (*Goniocotes*). *J. N. Y. ent. Soc.*, 10 : 160, pl. 13, fig. 5.
Host : **Streptopelia chinensis** (Scopoli), [Burma; India; Nepal]. (Slides in B. M. (Nat. Hist.).
3. **lativentre** (Uchida), 1916, (*Goniodes*). *Annot. Zool. Jap.*, 9 : 81, figs. 1 & 2.
Host : **Streptopelia chinensis suratensis** (Gmelin), [India : Punjab], Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 48; also in Ansari, 1956. *Indian J. Ent.* (1955), 17 (3) : 398.
- (4) **minus** (Piaget), 1880, p. 256 (*Goniodes*), *nec G. minor* Piaget, 1880, 241, 248, *Pediculines* : 256, pl. 21, fig. 3. = no. 5.
5. **piageti** (Johnston & Harrison), 1912, (*Goniodes*). *Proc. roy. Soc. Qd.*, 24 : 19. *Nomen novum* for *Goniodes minor* Piaget, 1880, *Pediculines* : 256.
Host : **Streptopelia chinensis suratensis** (Gmelin) & **S. decaocta decaocta** (Frivaldszky), [Pakistan : Lyallpur] Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 294.
6. **sofloticus** Eichler, 1950. *Doriana*, 1 : 3, figs. 1 & 2.
Host : **Streptopelia d. decaocta** (Frivaldszky), [India : Punjab], Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.*, 48, also in Ansari, 1956. *Indian J. Ent.*, 17 (3) : 398, also Ansari, 1959. *Indian J. Ent.*, (1958) : 20 (2) : 96.

25a. Coloceroides Tendeiro, 1972*Coloceroides* Tendeiro, 1972, *Rev. de ciencias Vet.* LaurengoMarques 5. Ser. A.: 25. Type species: *Coloceroides nitens* Tendeiro, 1972.

1. **indicus** Tendeiro, 1973. *Rev. de Cienc. vet.*, 6 Ser. A; 188, Photo 1-3.

Host : *Columba hodgsonii* Vigors [India : Sikkim] (Slides in Br. Mus. nat. Hist. (Ent.) London).

2. **unchalli** Tendeiro, 1972. *Rev. de ciencias Vet.*, Laurengo Marques 5. Ser. A : 38, fig. 2, photos 9, 14 & 15.

Host : *Macropygia unchall tubalia* (Blyth) [India : Kan. gpokpi, Manipur].

26. Colpocephalum Nitzsch, 1818

Colpocephalum Nitzsch, 1818, *Germar's Mag. Ent.*, 3 : 298. Type species : "*Colpocephalum Zebra* Burmiester" (vide *Bull. Zool. Nomencl.* 1951, 6 (2) : 56-57).

Ferrisia Uchida, 1926 (nec Fullaway, 1923), *J. Coll. Agric. Tokyo*, 9 : 43. Type species : *Colpocephalum turhinetum* Denny.

Neocolpocephalum Ewing, 1933, *J. Parasitol.*, 20 : 65. *Nomen novum* for *Ferrisia* Uchida.

Pseudocolpocephalum Qadri, 1936, *Z. parasitenk.*, 8 : 640.

Type species : *P. uchidi* Qadri.

Allocolpocephalum Qadri, 1939, *Indian J. Ent.*, 1 : 66.

Type species : *Colpocephalum semicinctum* Rudow.

Galliferrisia Ansari, 1951, *Proc. nat. Inst. Sci. India*, 17 (2) : 150.

Type species : *Galliferrisia tausi* Ansari.

1. **aethiopicae** Price & Beer, 1965. *Ann. Ent. Soc. Amer.*, 58 (1) : 121, figs. 38-40.

Host : *Threskiornis m. molucca* (Cuvier), [India].
affine Nitzsch, 1874. See *Actornithophilus*.

2. **angulaticeps** Piaget, 1880. *Pediculines* : 569.

Host : *Fregata ariel* (G. R. Gray), [Sri Lanka (Ceylon)]
same host, [Sri Lanka (Ceylon)], Price, 1967, *Canal. Ent.* 99 (3): 277, figs. 12-16.

3. **apivorus** Tendeiro, 1953. *Publ. Cult. de Camp. Diam. Angola*, no. 40 : 89.

Host : (*Pernis apirovus ruficouis*) *Pernis ptilorhynchus ruficollis* Lesson; [India], Price & Beer, 1963. *Canad. Ent.*, 95 (7): 751, figs. 41 & 45.

4. **asiatici** Price & Beer, 1965. *Ann. Ent. Soc. Amer.*, 58 (1) : 114. fig. 19.
Host : **Xenorhynchus a. asiaticus** (Latham), [India].
5. **barbati** Price & Beer, 1963. *Canad. Ent.*, 95 (7) : 748, figs. 34-37.
Host : **Gypaetus barbatus aureus** (Hablizl), [Afghanistan: Kabul].
- (6) **bengalensis** Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Agric.* : 58. = no. 10.
7. **cooki** Price & Beer, 1965, *Ann. Ent. Soc. Amer.*, 58 (1) : 116, figs. 23 & 24.
Hosts : **Leptoptilos dubius** (Gmelin), [Burma : Mandalay], & **L. javanicus** (Horsfield), [India].
8. **davisoni** Price & Beer, 1965. *Ann. Ent. Soc. Amer.*, 58 (1) : 125, fig. 74.
Host : **Pseudibis davisoni** (Hume), [Burma].
dolium Rudow, 1869. See *Pseudomenopon*.
doraibagla (Ansari), 1951. See *Ciconiphilus*.
9. **flavescens** (Haan), 1829, (*Liotheum* s.g. *Colpocephalum*). *Mem. Mus. Hist. nat. Paris*, 18 : 309. *Nomen novum* for Lyonet's pou d'aigle l.c. 262, pl. 12, figs. 1-3.
Host : **Haliastur indus** (Boddaert), [India]. Piaget, 1880 *Pediculines* : 516 as *C. flavescens* var. *alpha*.; also Kellogg, 1908. *Genera Insectorum* : 55, (*Haliaster indus*) = **Haliastur indus** (Boddaert), [India: Calcutta], Kellogg & Nakayama, 1915. *Rec. Indian Mus.*, 11 (1) : 139 as *C. flavescens* Nitzsch.
10. **fregili** Denny, 1842. *Mon. Anopl. Brit.*, 198, 208.
Hosts : **Corvus splendens** Vieillot, [India : Calcutta & Trivandrum] & **C. [splendens]**, **insolens** Hume [Burma : Mergui], Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 (4) : 228 as *C. semicinctum* Rudow; (*Corvus corax laurencei*) = **CORVUS, CORAX SUBCORAX** Severtzov & **C. s. splendens** Vieillot, [India: Punjab], Ansari, 1951. *Proc. nat. Inst. Sci. India*, 17 (2) : 163 as *Col. subaequale* Burmeister; also as *Col. laurencei* Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Agric.* : 51 *Nomen novum* for *Col. subaequale* Burmeister, 1838

(*nec* Haan, 1829) *Handb. Ent.* 2:438; also as *Col. laurencei* Ansari, 1956. *Nomen novum* for *Col. subaequale* Burmeister (*nec* Haan, 1829), Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3): 399 & Ansari, 1957. *Indian J. Ent.* (1956), 17 (2) : 163; ***Corvus macrorhynchus*** Wagler, [Pakistan], Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Agric.* : 58, [Bangla Desh : Harbanga (Chittagong Dist.)], Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 399 & Ansari, 1956. *Pakistan J. Sci. Res.*, 8 (2) : 57, figs. 1-7 as *Col. bengalensis* Ansari, 1955; ***Corvus s. splendens*** Vieillot, [Pakistan], Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Agric.* 51 & Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 399 and Ansari, 1957. *Indian J. Ent.*, (1956), 18 (4) : 428. figs. 1-9 as *Col. splendens* Ansari, 1955; and ***Corvus splendens*** Vieillot, [India : Burma], & ***C. macrorhynchus*** Wagler, [Burma], Price & Beer, 1965. *Proc. Ent. Soc. Wash.*, 67 (1) : 7, figs. 1-4; ***C. splendens*** Vieillot, [India], Emerson, 1973. In : *Some ectoparasites of the birds of Asia* : 108.

grandiceps Piaget, 1880. See *Actornithophilus*, *corvus*.

11. ***griffoneae*** Ansari, 1955*. *Proc. 7th Pak. Sci. Conf. Sec. Agric.* : 51.

Host : ***Gyps himalayensis*** Hume, [Pakistan]; also Ansari, 1956. *Indian J. Ent.* (1955), 17 (3) : 399 and Ansari, 1957. *Indian J. Ent.*, (1956), 18 (4) : 428, figs. 10-14; Price & Beer, 1963. *Canad. Ent.* 95 (77) : 761.

- (12) ***gypae*** (Qadri), 1935, (*Neocolpocephalum*). *Z. Parasitenk.*, 8 : 229. fig. 3. = no. 39.

13. ***heterosoma*** Piaget, 1880. *Pediculines* : 572, pl. 48, figs. 3 & 4.

Host : (*Phoenicopterus antiquorum*) ***Phoenicopterus rosens pallas*** [India], Clay, 1951. *Ann. Mag. nat. Hist.*, (12) & 4 : 1159, figs. 1-7, 9-12, pl. 20, figs. 1, 2 & 4.

hoplopteri Mjöberg, 1910. See *Actornithophilus*.

14. ***impressum*** Rudow, 1866. *Z. ges. NatWiss.* 27 : 475.

Host : ***Aquila n. nipalensis*** (Hodgson), [India], Price & Beer, 1963. *Canad. Ent.*, 95 (7) : 747. figs. 35 & 38., on the same host, [India], Emerson, 1973. In : *Some ectoparasites of the birds of Asia* : 108.

* spelled as 'griffoni' emended by Price & Beer.

15. **indi** Price & Beer, 1963. *Canad. Ent.* 95, (7) : 751, figs. 42 & 46.
 Host : **Haliastur indus** (Boddaert), [Burma; India], on the same host, [India], Emerson, 1973. In : *Some ectoparasites of the birds of Asia* : 108.
- (16) **laurencei** Ansari, 1955. *Proc. 7th Sci. Conf. Sec. Agric.* : 51. *Nomen novum* for *Col. subaequale* Burmeister, 1838 (nec. Haan, 1829). = no. 10.
17. **leucocephali** Price & Beer, 1965. *Ann. Ent. Soc. Amer.*, 58 (1) : 116, figs. 16.
 Host : **Ibis leucocephalus** (Pennant), [India : (Rajaputana) Rajasthan; Sri Lanka (Ceylon) : nr. Hambantota], on the same host. [India], Emerson, 1973. In : *Some ectoparasites of the birds of Asia* : 103.
18. **longicaudum** Nitzsch, 1866. In Giebel's *Z. ges. Nat Wiss.*, 28 : 39.
 Host : **Columba livia [domestica]** (Gmelin), [India : Calcutta] Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 (4) : 231.
macilentus Nitzsch, 1866. See *Heleonomus*.
- (19) **maculatum** Piaget, 1880. *Pediculines* : 516, pl. 43, fig. 1 = no. 27. *mianarium* Kellogg, 1910. See *Heleonomus*.
20. **melanocephalae** Price & Beer, 1965. *Ann. Ent. Soc. Amer.*, 58 (1) : 121, figs. 49-51.
 Host : **Threskiornis melanocephala** (Latham), [India : (Rajaputana) Rajasthan & Deccan; Sri Lanka (Ceylon)].
21. **napiforme** Rudow, 1869, *Z. ges. NatWiss*, 34 : 395.
 Host : **Ichthyophaga icthyaetus plumbeiceps** Stuart Baker, [Sri Lanka (Ceylon)]. Price & Beer, 1963. *Canad Ent.*, 95 (7) : 746, fig. 32.
nyctardae Denny, 1842. See *Ciconiphilus*.
22. **occipitale** Nitzsch, 1864. In Giebel's *Z. ges. NatWiss.*, 28 : 394.
 Host : **Anastomus oscitans** (Boddaert), [India], Price & Beer, 1965. *Ann. Ent., Soc. Amer.*, 58 (1) : 115, figs. 17 & 18.
ochraceum Nitzsch, 1818. See *Actornithophilus*.
23. **oscitansi** Price & Beer, 1965. *Ann. Ent. Soc. Amer.*, 58 (1) : 126. figs. 93 & 94.

- Host : **Anastomus oscitans** (Boddaert), [India : Moirang (Manipur)].
patellatum Piaget, 1890. Sec. *Actornithophilus*.
24. **pectinatum** Osborn, 1902. *Ohio. Nat.*, 2 : 201.
 Hosts : **Athene brama indica** (Franklin), [India : (Rajaputana) Rajasthan] & **Otus b. bakkamoena** Pennant, [Sri Lanka (Ceylon)], Price & Beer, 1963. *J. Kansas Ent. Soc.*, 36 (1) : 61, figs. 1-4 & 7.
pediculoides, Mjöberg, 1910, See *Actornithophilus*.
25. **percnopteri** Price & Beer, 1963, *Canad. Ent.*, 95 (7) : 758.
 Host : **Neophron percnopteri** (Linne), [India : Deccan].
26. **plataleae** Price & Beer 1965. *Ann. Ent. Soc. Amer.*, 58 (1) : 123, figs. 61-63.
 Host : **Platalea leucordia** (Linne), [India : (Rajaputana) Rajasthan].
27. **polybori** Rudow, 1869, *Z. ges. NatWiss.*, 34 : 397.
 Host : (*Vultur monachus*) = **Aegypocetus monachus** (Linne) [India : Dhappa (Calcutta)], Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 (4) : 242 as *Col. maculatum* ?
pustulosum Piaget, 1890. See *Actornithophilus*.
quadripustalatum Burmeiester, 1838. See. *Ciconiphilus*.
28. **rosei** Price & Emerson, 1974. *J. Kans. Ent. Soc.*, 47 (1) : 63-66, 3 figs.
 Host : **Phoenicopterus roseus**. (Pallas), [India : Pt. Calimere, Thanjavur, Tamil nadu].
29. **salimalii** Clay, 1951. *Ann. Mag. nat. Hist.*, (12) 4 : 1162, figs. 8, 14, 15, pl. 20, figs. 3 & 5.
 Host : (*Phoenicopterus antiquorum*) = **Phoenicopterus roseus** Pallas, [India : Kutch]; also on the same host, [India], Price & Beer, 1965. *Ann. Ent. Soc. Amer.*, 58 (1) : 128, fig. 92.
- (30) **semicinatum** Rudow, 1866. *Z. ges. NatWiss.*, 27 : 475. = no. 10.
spinulosum Piaget, 1880. See. *Actornithophilus*.
31. **sinensis** Price, 1968. *Ann. Ent. Soc. Amer.*, 61 (4) : 819, fig. 4.
 Host : **Centropus sinensis sinensis** (Stephens), [India : Bahawalpur]. May be Bahawalpur in Pakistan].

- (32) *splendens* Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Agric.* : 51. no. 10.
- (33) *subaequale* Burmeister, 1838 (*nec.* Haan, 1829). *Handb. Ent.*, 2 : 438. no. 10.
subpachygaster Piaget, 1880. See. *Kurodaia*.
34. *tausi* (Ansari), 1951, (*Galliferrisia*). *Proc. natn. Inst. Sci. India*, 17 (2) : 151, fig. 10.
 Host : *Pavo cristatus* (Linne), [India : Hoshiarpur; Atari], also on the same host, [India : Lucknow; Nepal], Price & Beer, 1964. *Ann. Ent. Soc. Amer.*, 57 : 394, figs. 12-14.
35. *tetraophasis* Price & Beer, 1964. *Ann. Ent. Soc. Amer.*, 57 : 395, figs. 26 & 27.
 Host : *Tetraophasis obscurus* (J. Verreaux), [China : Yunnan] & *Lerwa lerwa* Hodgson, [China : Szechwan].
36. *thoracicum* Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 (4) : 230, fig. 3.
 Host : *Pavo muticus* Linne, [Burma].
37. *tirkhan* (Ansari), 1951, *Cuculiphilus* (*Picusphilus*). *Proc. nat. Inst. Sci. India* : 7 (2) : 164, fig. 15.
 Host : *Picus squamatus squamatus* Vigors, [India : Simla Kangra & Kulu Valleys, Punjab]; also in Price & Beer, 1964. *New York Ent. Soc.*, 72 : 167, fig. 9.
- (38) *Tricinctum* Nitzsch, 1961. In Giebel's *Z. ges. NatWiss.*, 17 : 524. =no. 39.
trilobatum Giebel, 1874. See *Actornithophilus*.
trochioxum Burmeister, 1838. See *Ardeiphilus*.
39. *turbinatum* Denny, 1842. *Mon. Anopl. Brit.*, 198, 209, pl. 21, fig. 1.
 Hosts : (*Vultus indicus*) = *Gyps indicus* (Scopoli), [India], Qadri, 1935. *Z. Parasitenk.*, 8 : 229, fig. 3 as *Neocolpocephalum gypae* Qadri; *Milvus migrans govinda* Sykes [Pakistan : Lyallpur], Ansari, 1951. *Proc. nat. Inst. Sci. India*, 17 (2) : 154 as *Col. tricinctum* Nitzsch.; *Columba livia* Gmelin [Sri Lanka (Ceylon)], *Haliaeetus leucoryphus* (Pallas), [India : Lucknow], *Milvus migrans* (Boddaert), [India], (*Milvus l. lineatus*) *Milvus migrans lineatus* (J. E. Gray), [Burma], *Gyps*.

i. **indicus** (Scopoli), [India: (Rajaputana) Rajasthan]. (*Pseudogyps bengalensis*) = **Gyps bengalensis** (Gmelin), [India], **Haliastur indus** (Boddaert), [Burma; India]: Deccan, Sri Lanka (Ceylon)], **Spizaetus n. nipalensis** (Hodgson), [Nepal], & (*Buteo burmanicus burmanicus*) = **Buteo buteo burmanicus** Hume, [Burma], Price & Beer, 1963. *Canad. Ent.*, 95 (7) : 754, figs. 17, 23, 24, 49, 53 & 57. (One slide containing a male and female specimens on **Columba livia** Gmelin, (Reg. No. 1089/H8), Z.L.M.U. Aligarh, Coll. Dr. Qadri and one slide containing a specimen from the same host from Sylhet, Assam (India), Coll. J. M. Roy is available in Z.S.I.).

40. **uchidi** (Qadri), 1936, (*Pseudocolpocephalum*). *Z. Parasitenk.*, 8. 64, figs. 2 & 3.

Host : (*Dissoura e. episcopus*) **Ciconia e. episcopus** (Boddaert), [India].

umbrinus Burmeister, 1838. See *Actornithophilus*.

41. **zerafae** Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Agric.* : 52,

Host : (*Falco jugger*) = **Falco biarmicus jugger** J. E. Gray, [Pakistan]; also Ansari, 1956. *Indian J. Ent.* (1955), 17 (3) : 399 & Ansari, 1957. *Indian J. Ent.* (1956), 18 (4) : 428, figs. 15-18; **Accipiter badius** (Gmelin), [India], Price & Beer, 1963. *Canad. Ent.* 95 (7) : 758, figs. 27, 55 & 59, **F. tinnunculus** Linne, [India], Emerson, 1978. In : *Some ectoparasites of the birds of Asia* : 109.

42. **species indeterminate**, Ansari, 1956. *Pakistan J. Sci. Res.* 8 (2): 53.

Host : **Hieraaetus pennatus** (Gmelin), [Pakistan : Shujawal (Tatta Dist.), Sind.].

27. **Columbicola** Ewing, 1929.

Columbicola Ewing, 1929, *Man. ext. Parasites* : 190. Type species: *Esthiopteum columbae* (Linne).

- (1). **baculus** (Nitzsch), 1818, (*Philopterus*) s.g. *Lipeurus*, *German's Mag. Ent.*, 3 : 293. *Nomen novum* for Redi's Plate, 2, Upper fig. and *Pediculus columbae* "Panzer" = no. 2.

2. **columbae** (Linne), 1758, (*Pediculus*). *Syst. Nat. ed.* 10: 614. *Nomen novum* for Redi's "Pollino del piccion grosso".

Hosts : (Domestic pigeon) **Columba livia** [domestica Linne], [India : Calcutta], Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 : 242 as *Lipeurus baculus* Nitzsch; **Columba l.** [domestica Linne] & (*Crocopus p. phoenicopterus*) = **Treron phoenicoptera** (Latham), [India : Ambala], **Columba l. intermedia** Strickland, **Streptopelia chinensis suratensis** (Gmelin), **S. senegalensis cambayensis** (Gmelin) (material of this host may be same as no. 12). **s.d. decaocta** (Frigalszky), & (*Oenopopelia t. tranquebarica*) = **Streptopelia t. tranquebarica** (Hermann), (material from this host may be same as no. 8). [Pakistan : Lyallpur], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 259.

3. **confusissimus** Eichler, 1947. *Tierartz. Umschau*, 2 : 264. *Nomen novum* for "*Columbicola baculus* Sensus Wd. Eichler, C1942g (*S. B. Ges. natur. Fr. Berl.*) pp. 273-274.

Host : **Streptopelia d. decaocta** (Frigalszky), [India ? : Punjab], Ansari, 1956. *Indian J. Ent.* (1955), 17 (3) : 398 & Ansari, 1959. *Indian J. Ent.*, (1958), 20 (2) : 94.

4. **elbeli** Tendeiro, 1965. *Jta. Invest. Ultramar.* (2), 32 : 321, figs. 108, 109, 155-160. photos, 220, & 221.

Hosts : (*Sphenurus sphenurus*) = **Treron sphenura** (Vigors) [India : Sikkim; Nepal] & **Treron pompadora** (Gmelin), [Burma; India : Nepal, Sri Lanka (Ceylon)]; (Slides in B. M. Nat. Hist.).

ewingi Qadri, 1935. See *Anaticola*.

5. **exilicornis** (Piaget), 1880, (*Lipeurus*). *Pediculines* : 679, pl. 56, fig. 9.

Host : **Macropygia unchall** (Wagler), [India; Nepal], Tendeiro, *Jta. Invest. Ultramar*, (2) 32 : 175, figs. 46-51, photos 63-67, 202. (Slides in B. M. Nat. Hist.).

6. **fulmeki** Eichler, 1942. *S. B. Ges. Naturf. Fr. Berl.* (1941) : 274, fig. 2.

Host : **Streptopelia chinensis suratensis** (Gmelin), [India : Punjab], Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.*, : 47; also in Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 398 & Ansari, 1959. *Indian J. Ent.* (1958), 20 (2) : 94.

7. **guimaraesi** Tendeiro, 1965. *Jta. Invest. Ultramar* (2) 32 : 166, fig. 42. photos 51-54, 199.

Host : **Chalcophaps indica** (Linne), [India : Dehradun], (Slides in B. M. Nat. Hist.), **Columba vitiensis** Quoy & Gaimard? [Bhutan], Emerson, 1973. In : *Some ectoparasites of the birds of Asia* : 87.

8. **hopkinsi** Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 47.

Host : (*Oenopopelia t. tranquebarica*) = **Streptopelia t. tranquebarica** (Hermann). [Pakistan]; also in Ansari, 1956. *Indian J. Ent.* (1955). 17 (3): 398 and Ansari, 1959. *Indian J. Ent.*, (1958), 20 (2): 96, figs. 204-210.

9. **keleri** Tendeiro, 1965. *Jta. Invest. Ultramar*, (2) 32 : 127.

Host : **Columba hodgsonii** vigors, [India : Punjab].

10. **orientalis** Tendeiro, 1965. *Jta Invest. Ultramar*, (2) 32 : 232.

Host : **Streptopelia orientalis** (Latham), [Nepal].

11. **phoenicopterae** Tendeiro, 1965. *Jta. Invest. Ultramar*, (2) 32 : 321, figs. 110, 111. photos 61-164, 222.

Host : **Treron phoenicopterae** (Latham), [India], as *C. elbeli phoenicopterae* Tendeiro. (Slides in B. M. Nat. Hist.)

12. **theresae** Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 47.

Host : **Streptopelia senegalensis cambayensis** (Gmelin), [Pakistan], also in Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 398 and Ansari, 1959. *Indian J. Ent.*, (1958), 20, (2) : 94, figs. 196-203.

Columbimenopon Ansari, 1951.

Columbimenopon Ansari, 1951, *Proc. nat. Inst. Sci. India*, 17 (2) : 130.

Type species : *Columbimenopon modestus* Ansari.

Chanabensis Ansari, 1951, See *Nosopon*.

modestus Ansari, 1951, See *Hohorstiella*.

28. Comatomenopon Uchida, 1920.

Comatomenopon Uchida, 1920, *Annot. Zool. Japan*. 9 : 648. Type species : *Comatomenopon elongaumi* Uchida.

1. **grayi** Price, 1965. *Pan-Pacific Entomologist*, 41 (2): 83, figs. 11, 12.

Host : **Ardeola grayii** (Sykes), [Sri Lanka (Ceylon)].

Corvonirmus Eichler, 1944

Corvonirmus Eichler, 1944. *Stettin. ent. Ztg.*, 105 : 80. Type species : *Nirmus uncinosus* "Nitzsch in Burmeister".

Not separable from *Brueelia*.

29. *Craspedorrhynchus* Kéler, 1938

Craspedorrhynchus Kéler, Aug. 1938, *Arb. morph. tax. Ent. Berlin-Dahlem*, 5 : 239. Type species : *Docophorus platystomus* Nitzsch.

Falcoecus Clay & Meinertzhagen, Dec. 1938, *Entomologist*, 71 : 275.
Type species : *Philopterus aquilinus* (Denny).

1. **chicquerae** Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 48.
Host : (*Falco c. chiquera*) = **Falco c. chicquera** Daudin, [Pakistan]; also in Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 398 and Ansari, 1959 *Indian J. Ent.*, (1958), 20 (2) : 97. figs. 211-212. Two different spellings were used, one rightly with a C and other without it by the author.
- (2) **gonorrhynchus** (Nitzsch), 1861, (*Docophorus*). In Giebel's *Z. ges. NatWiss.*, 17 : 526. = no. 3.
3. **nisi** (Denny), 1842, (*Docophorus*). *Mon. Anopl. Brit.*, 48; 109 pl. 3, fig. 11.
Host : (*Milvus melanotis*. Error) = Probably **Spilornis cheela melanotis** (Jerdon). [India : Kurseong], Kellogg & Nakayama, 1915. *Rec. Indian. Mus.*, 11 (1) : 139 as *Doc. gonorrhynchus* Nitzsch.
4. **platystomus** (Burmeister), 1838, (*Docophorus*). *Handb. Ent.*, 2 : 426,
Host : **Corvus** [corone], cornix Linne, [India : Gilgit]. Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 : 234 as *Doc. platystomus* Nitzsch. Probably error.
5. **ranjhae** Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 49.
Host : (*Hieraaetus? pennatus*) = **Hieraaetus pennatus** (Gmelin), [Pakistan : Shujawal (Dt. Tatta)]; also Ansari, 1956. *Pak. J. Sci. Res.*, 8 (1) : 14, figs. 17-22 and Ansari 1956. *Indian J. Ent.*, (1955), 17 (3) : 398. Different spellings for the host name has been used by the author.
6. **spathulatus** (Giebel), 1874, (*Docophorus*). *Insecta epizoa* : 73.

Host : *Milvus migrans govinda* Sykes, [India], Sen, 1942. *Indian J. vet. Sci.*, 12 : 171, fig. 2 as *philopterus tropicus* Sen; also on the same host, [Pakistan : Lyallpur], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 237, as *Falcoecus ? milvi* (Mjöberg); also Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 398 and Ansari, 1959. *Indian J. Ent.*, (1958), 20 (2) : 96.

7. **triangularis** (Rudow), 1869, (*Docophorus*). *Beitr. Kenntn. Malloph.*, 10.

Host : *Circaetus gallicus* (Gmelin), [Pakistan : Sakrand (Nawabshah Dt.)], Ansari, 1956. *Pak. J. Sci. Res.* 8 (1) : 15 and Ansari, 1956, *Indian J. Ent.*, (1955) 17 (3) : 398.

(8). **tropicus** Sen, 1942, (*Philopterus*). *Indian J. vet. Sci.*, 12 : 171, fig. 2. = no. 6.

30. **Ctenigogus** Eichler & Zlotorzyska, 1963

Ctenigogus Eichler & Zlotorzyska, 1963, *Angew. Parasitol.*, 4 : 40, 6 figs. Type species : *C. erinaceimorphus* Eichler & Zlotorzyska.

1. **erinaceimorphus** Eichler & Zlotorzyska, 1963. *Angew. Parasitol.*, 4 : 40, 6 figs.

Host : (*Pseudogyps bengalensis*) = *Gyps bengalensis* (Gmelin), [India].

31. **Cuclotogaster** Carriker, 1936

Cuclotogaster Carriker, 1936, *Proc. Acad. natn. Philad.*, 88 : 67.

Type species : *C. laticorpus* Carriker.

Gallipeurus Clay, 1938, *Proc. zool. Soc. Lond.*, (3) 108 : 135.

Type species : *Lipeurus heterographus* "Giebel".

1. **cinereus** (Nitzsch), 1866, (*Lipeurus*). *Z. ges. Nat. Wiss.*, 27 : 118.

Host : *Coturnix c. coturnix* (Linne), [Pakistan : Lyallpur], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 293.

2. **heterographus** (Nitzsch), 1866, (*Lipeurus*). *Z. ges. Nat. Wiss.*, 28 : 381.

Host : *Gallus gallus [domesticus]* Linne, [India : Punjab], Ansari, 1943. *Indian J. Ent.*, 5 (1 & 2) : 133 as *Gallipeurus heterographus* Nitzsch; *G. g. [domesticus]* Linne, [India : Hoshiarpur], *Alectoris graeca pallescens*

- (Hume), [India : Kulu] & ***Milvus migrans govinda*** Sykes (Probably stragglers), [Pakistan : Lyallpur] Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 292.
3. ***insolitus*** (Clay), 1938, (*Gallipeurus*). *Proc. Zool. Soc. Lond.*, 108 : 155, fig. 25c, pl. 7 fig. 6.
Host : ***Arborophila rufogularis tickelli*** (Hume), [Lower Burma].
4. ***nigromarginatus*** (Piaget), 1880, (*Nirmus*). *Pediculines* : 166, pl. 14, fig. 1.
Host : ***Gallus sonneratii*** Temminck, [India : no history], Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 : 218 as *Nirmus nigromarginatus* Piaget.
5. ***spinicaudatus*** (Clay), 1938, (*Gallipeurus*). *Proc. Zool. Soc. Lond.* 108 : 151, figs. 23e, pl. 7, fig. 4.
Host : ***Perdica a. asiatica*** (Latham), [India : (Rajputana) Rajasthan].
6. ***tetraogallus*** (Clay), 1938, (*Gallipeurus*). *Proc. Zool. Soc. Lond.*, 108 : 154, figs. 24c, 25a, pl. 8 fig. 2.
Host : ***Tetraogallus h. himalayensis*** G. R. Gray, [India : Ladakh] & ***T. tibetanus tibetanus*** Gould, [India : Sikkim].
7. ***theresae*** Tendeiro, 1958. *Estud. Ens. Docum. Jta. Invest. Ultramar, Lisboa*, 44 : 70.
Host : ***Francolinus francolinus henrici*** (Bonaparte), [India : Pakistan].

32. *Cuculicola* Clay & Meinertzhagen, 1939

Cuculicola Clay & Meinertzhagen, 1939, *Entomologist*, 72 : 165. Type species : *Degeeriella latirostris* (Burmeister).

1. ***concolor*** Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 44.
Host : ***Clamator j. jacobinus*** (Boddaert), [Pakistan]; also Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 397 & Ansari, 1959. *Indian J. Ent.*, (1958), 20 (2) : 89, figs. 161-168.
2. ***jamilae*** Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 44.
Host : ***Eudynamus s. scolopace[us]a*** (Linne), [Pakistan];

also Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 397 & Ansari, 1959. *Indian J. Ent.*, (1958), 20 (2) : 90, figs. 169-177.

3. **latirostris** (Burmeister), 1838, (*Nirmus*). *Handb. Ent.*, 2 : 429.

Host : (*Hierococcus varius*) = **Cuculus varius** Vahl, & **Clamator j. jacobinus** (Boddaert), [Pakistan: Lyallpur], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 281.

33. **Cuculiphilus** Uchida, 1926

Cuculiphilus Uchida, 1926, *J. Coll. Agric. Tokyo*, 9 (1) : 47. Type species : *Pediculus fasciatus* Scopoli.

Aegypiphilus Eichler, 1944, *Dtsch. Ent. Ztg.*, 1943 : 56. Type species : *A. gypsis* Eichler.

- (1). **breviceps** (Giebel), 1874, (*Menopon*). *Insecta epizoa* : 279. = no. 2.

2. **cathartaepapae** (Nitzsch), 1861, (*Menopon*). *Z. ges. Nat. Wiss.*, 17 : 518.

Host : (Domestic duck Error). [India : (Berhampur, *nec.* Berhampur (Ganjam) Orissa) Berhampore (Murshidabad Dist. : West Bengal)], Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 (4) : 242, as *Menopon breviceps* (Obviously this is a case of misidentification).

- (3). **centropi** Qadri, 1935. *Z. Parasitenk.*, 8 : 231, fig. 4. = no. 8.

- (4). **contrastus** Eichler & Zlotorzycka, 1963, *Acta Parasitol. Polonica* 11 : 216. = no. 6.

5. **fasciiventris** Carriker, 1955. *Bol. Entomol. Venezol.*, 11 : 44.

Host : **Eudynamys scolopacea** (Linne), [Nepal], Scharf & Price, 1965, *Ann. Ent. Soc. Amer.*, 58 (4) : 551, figs. 19, & 36, as *C. (Cuculiphilus) fasciiventris* Carriker.

6. **gypsis** (Eichler), 1944, (*Aegypiphilus*). *Dtsch. ent. Ztg.* 1943 : 57, fig. 1.

Host :: (*Pseudogyps bengalensis*) = **Gyps bengalensis** (Gmelin), [India], Scharf & Price, 1965. *Ann. Ent. Soc. Amer.*, 58 (4) : 553, figs. 3, 9, 21, 25, 29 & 35, as *C. (Aegypiphilus) contrastus* Eichler & Zlotorzycka; also see Price & Emerson, 1967. *Proc. Ent. Soc. Wash.*, 69 : 248-251.

marzai Qadri, 1935. See *Ardeiphilus*.

punjabensis Ansari, 1951. See *Kurodaia*.

- (7). *pupiya* Ansari, 1951. *Proc. natn. Inst. Sci. India*, 17 (2) : 158, fig. 13. = no. 8.

8. *snodgrassi* (Kellogg & Kuwana), 1902, (*Menopon*). *Proc. nat. Acad. Sci. Wash.*, 4 : 486, pl. 31 fig. 3.

Hosts : *Centropus* [s.] *sinensis* (Stephens), [India], Qadri, 1935. *Z. Parasitenk.*, 8 : 231, fig. 4, as *Cuculiphilus coromandus* var. *centropi* Qadri; *Clamator j. jacobinus* (Boddaert), [Pakistan : Lyallpur], Ansari, 1951. *Proc. nat. Inst. Sci. India*, 17 (2) : 158, fig. 13, as *C. pupiya* Ansari; *Centropus sinensis* (Stephens), [India : (Rajputana) Rajasthan], *Clamator jacobinus* (Boddaert), [India : Punjab], *Rhopodytes diardi* (Lesson) & *Surniculus lugubris* (Horsfield), [Sri Lanka (Ceylon)], Scharf & Price, 1965. *Ann. ent. Soc. Amer.*, 58 (4) : 549, figs, 15, 17, & 34, as *C. (Cuculiphilus) snodgrassi* (Kellogg & Kuwana); *Cacomantis merulinus* (Scopoli), *C. sonneratii* (Latham), *Clamator jacobinus* (Boddaert), *Surniculus lugubris* (Horsfield), [India], Emerson 1973. In : *Some ectoparasites of the birds of Asia* : 110.

tirkhan Ansari, 1951. See *Colpocephalum*.

9. *upak* Ansari, 1951. *Proc. nat. Inst. Sci. India*, 17 (2) : 156, fig. 2.

Host : (*Hierococcyx varius*) = *Cuculus varius* Vahl., [Pakistan Lyallpur]; also on the same host, [India : Punjab; Nepal]. Scharf & Price, 1965. *Ann. Ent. Soc. Amer.*, 58 (4) : 551, fig. 18.

34. *Cuculoecus* Ewing, 1926

Cuculoecus Ewing, 1926, *Proc. ent. Soc. Wash.*, 28 : 148. Type species : *Phlopterus coccygii* (Osborn).

1. *distinctus* Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 45.

Host : *Clamator j. jacobinus* (Boddaert),; [Pakistan] also Ansari, 1955. *Indian J. Ent.*, 17 (3) : 397 and Ansari, 1959. *Indian J. Ent.*, (1958), 22 (2) : 91, figs. 178-181.

35. *Damalinia* Mjöberg, 1910

Damalinia Mjöberg, 1910, *Ark. Zool.*, 6 (13) : 69. Type species : *Trichodectes crenelatus* Piaget.

Bovicola Ewing, June, 1929. *Man. ext. Paras.*, : 121, 123, 193. Type species : *Trichodectes caprae* Gurlt.

Tricholipeurus Bedford, 1929. *Rep. vet. Res. S. Afr.*, 15 : 514. Type species : *T. aepycerus* Bedford.

1. **bovis** (Linne), 1758, (*Pediculus*). *Syst. Nat. ed.*, 10 : 611.
 Host : *Bos taurus* Linne & *Bos indicus* Linne, [India : Punjab], Ansari, 1951. *Indian J. Ent.*, 13 (2) : 131, fig. 35; (cow), [Nepal : Zeit, Mustang] & (Zhumo)=cow & yak [Nepal : Thodung, Ramechap] Emerson, 1971. *J. med. Ent.*, 8 (6) : 622.
2. **caprae** (Gurlt), 1843, (*Trichodectes*). *Mag. ges. Thierheilk*, 9 : 3, pl. 1 fig. 2.
 Host : *Capra hircus* Linne, [India : Amritsar, Bijnor, Delhi, Dhariwal, Jullundar & Pathankot; Pakistan : Lahore & Lyallpur], Ansari, 1951. *Indian J. Ent.*, 13 (2) : 131.
3. **dimorpha** Bedford, 1939, (*Bovicola*). *Onderstepoort. J. vet. Sci.*, 12 : 114, figs. 11-13.
 Host : *Nemorhaedus goral* (Hardwicke), [Nepal : Namsangsang and Melumche, Sindu], Emerson, 1971. *J. Med. Ent.*, 8 (6) : 622.
4. **equi** (Denny), 1842, (*Trichodectes*). *Mon. Anopl. Brit.*, 61, 191, pl. 17 fig. 7.
 Host : *Equus caballus* Linne, *E. asinus* Linne, & *E. caballus* *E. asinus* (mule), [Pakistan : Lahore & Lyallpur], Ansari, 1951. *Indian J. Ent.*, 13 (2) : 131, fig.
5. **forficula** (Piaget), 1880 (*Trichodectes*). *Pediculines* : 400, pl. 32 fig. 7.
 Host : (Wild dog), (*Cyon duchunensis*? = *Cyon dukhunensis*) *Cuon javanicus* (Desmarest), [India : Garhwal], Paine, 1912. *Ent.*, 28 : 438; also Sen & Fletcher, 1962. *Vet. Ent. & Acarology*, India, I.C.A.R. Publ., New Delhi : 409; *Axis axis* Erxleben [Nepal : Johama, Khatmandu]. Emerson, 1971, *J. med. ent.*, 8 (1) : 622.
6. **hemitragi** (Cummings), 1916, (*Trichodectes*). *Proc. zool. Soc. Lond.*, 273, figs. 11-12.
 Host : *Hemitragus jemla [h] icus* (Hamilton & Smith), [Nepal : Gosainkund, Nuwakot; Namsangsang and Melumche, Sindu], Emerson, 1971. *J. med. ent.* 8 (6) : 622.

7. **indica** (Werneck), 1950, (*Tricholipeurus*). *Malafagos de Mamiferos*, pt. 2 : 177, figs. 267-272.
Host : **Muntiacus muntzak** (Zimmermann), [India : Imphal, Manipur].
8. **limbata** (Gervais), 1844, (*Trichodectes*). *Hist. Ins. Apteres*, 3 : 313, pl. 48, fig. 4.
Host : (Goat), [Nepal : Rana, Mugu; Mahendranagar, Kanchanpur; Balaju, Katmandu; Bhadgaon and Katunje, Bhaktapur; Thodung, Ramechap], Emerson, 1971, *J. med. ent.* 8 (6) : 622.
9. **muntiacus** (Séguy), 1948, (*Trichodectes*). *Notes Ent. Chin.*, 18 : 149.
Host : **Muntiacus muntzak curvostylis** (Gray), [Burma], Werneck, 1950. *Malafagos de Mamiferos*, pt. 2 : 133, figs. 177, 178, as *D. forficula siamensis* Werneck.
10. **ovis** (Linne), 1758, (*Pediculus*). *Syst. Nat.* ed. 10 : 611.
Host : 4-horned sheep, [Nepal], (Sheep) **Capra hircus** (Linne), [India : Pusa], Sen & Fletcher, 1962. *Vet. Ent. & Acarology for India*, I.C.A.R. Publ., New Delhi : 407, pl. 39; Sheep, [Langtang Valley, Rasuwa; Katunje, Bhaktapur], Emerson, 1971. *J. med. ent.*, 8 (6) : 322.
- (11). **siamensis** Werneck, 1950. *Malafagos de Mamiferos*, pt. 2 : 133, figs. 177 & 178.=no. 9.

36. *Degeeriella* Neumann, 1906

Nirmus Nitzsch, 1818, *Germar's Mag. Ent.*, 3 : 291 (*nec.* Hermann 1804) (Rejected name: *vide Bull. Zool. Nomencl.* 1962, 19 (2) : 91-96).

Degeeriella Neumann. 1906, *Bull. Soc. Zool. Fr.*, 20 : 60. *Nomen novum* for *Nirmus* Nitzsch *nec.* Hermann. Type species (by subsequent designation), Johnston & Harrison. 1911. *Proc. Linn. Soc. N.S.W.*, 36 : 326 "*D. discocephalus* N."

Kelerinirmus Eichler, 1940. *Zool. Ang.*, 130 : 101. Type species : "*Nirmus fuscus* Nitzsch in Denny".

1. **beaufacies** Ansari, 1955. *Proc. 7th Pak. Sci. Conf., Sec. Biol.* : 42.
Host : **Butastur teesa** (Franklin), [Pakistan]; **B. teesa** (Franklin), [India], & **B. liventer** (Temminck), [Burma], Clay, 1958. *Bull. Br. Mus. nat. Hist. (Ent.)*, : 7 (4) : 162, pl. 8, fig. 4, figs. 2, 23, 43, 77; also on **B. teesa**

(Franklin), [Pakistan], Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 397 & Ansari, 1959. *Indian J. Ent.*, 20 (2) : 87, figs. 152-158; **B. teesa** (Franklin), [Nepal], Emerson, 1973. In : *Some ectoparasites of the birds of Asia* : 89.

conformis Blagoverhschensky, 1948. See *Quadriceps*.

daumae Clay, 1936. See *Brueelia*.

2. **discocephalus**, [aquilarum], Eichler, 1943. *Zool. Anz.*, 142 : 93, fig. 1.

Host : **Aquila pomarina hastata** (Lesson), [India : Manipur, (Rajputana) Rajasthan], **A. h. heliaca** Savigny, [India : (Rajputana) Rajasthan], Clay, 1958. *Bull. Br. Mus. nat. Hist., Ent.*, 7 (4) : 170, pl. 9, fig. 2.

3. **elani** Tendeiro, 1955. *Bol. cult. da Guine Port.*, 9 (35) : 598, figs. 36-37, pl. 17-18.

Host : **Elanus caeruleus vociferus** (Latham), [India : Deccan], Clay, 1958. *Bull. Br. Mus. nat. Hist. (Ent.)*, 7 (4) : 174, pl. 6, fig. 1, figs. 4, 36, 54, 91.

episcopi Qadri, 1936. See *Ardeicola*.

4. **fulva** (Giebel), 1874, (*Nirmus*). *Insecta epizoa* : 124.

Hosts : **Aquila rapax** (Temminck), [India : (Rajputana) Rajasthan], **Ichthyophaga ichhyaetus** (Horsfield), [India : Deccan], (*spilornis cheela albidus*) **Spilornis cheela melanotis** (Jerdon), [India : (Rajputana) Rajasthan], & **S. c. cheela** (Latham) [Nepal], Clay, 1958, *Bull. Br. Mus. nat. Hist. (Ent.)*, 7 (4) : 144, figs. 1, 9, 11-17, 26, 42, 70, 84, 102, 105, 109, 112-118, pl. 1, figs. 1-7 & pl. 8, fig. 3.

5. (**fusca** Denny), 1842, (*Nirmus*). *Mon. Anopl. Brit.* : 49, 118, pl. 9, fig. 8.

Hosts : **Falco c. chicquera** Daudin, **Butastur teesa** (Franklin) and **Milvus migrans govinda** Sykes, [Pakistan : Lyallpur], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 284, as *Kelerinirmus fusca* (Nitzsch); **Circus aeruginosus** (Linne), [India : Sri Lanka (Ceylon)] & **C. melanoleucos** (Pennant), [India : Assam], Clay, 1958. *Bull. Br. Mus. nat. Hist. (Ent.)*, 7 (4) : 162, figs. 3, 30, 48, pl. 4, fig. 3 & pl. 8. fig. 6.

grandalae Clay, 1936, See *Brueelia*.

- (6). *masumae* Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 72.
= no. 13.
7. *mookerjeei* Clay, 1957. *Proc. zool. Soc. Calcutta, Mookerjee Memor.* vol : 342, figs. 1b, c, 2d, 3d, f & 4b.
Hosts **Pernis ptilorhynchus** (Temminck), [Burma : Myitkyina] & **P. ptilorhynchus ruficollis** Lesson, [Nepal].
multipunctata Clay, 1936. See *Brueelia*.
myiophoneae Clay, 1936. See *Brueelia*.
8. *nisus* [*frater*], (Piaget), 1880, (*Nirmus*). *Pediculines* : 145, pl. 12, fig. 2.
Hosts : **Accipiter badius** (Gmelin), [Burma; Nepal], Clay, 1958. *Bull. Br. Mus. nat. Hist. (Ent.)*, 7 (4) : 158, figs. 25, 31-32, 47, pl. 3, fig. 3.
9. *nisus* [*nisus*] (Giebel), 1866, (*Nirmus*). *Z. ges. NatWiss*, 2 : 364.
Host : **Accipiter nisus** (Linne), [Afghanistan; Pakistan].
Clay, 1958. *Bull. Br. Mus. nat. Hist. (Ent.)*, 7 (4) : 155, figs. 24, 29, 46, 88, & 110, pl. 3. fig. 1. & pl. 8, fig. 5.
10. *punctifer* (Gervais), 1844, (*Philopterus*). In *Walckenaer's Hist. nat. Ins.*, 3 : 353, pl. 49, fig. 1.
Host : **Gypaetus barbatus aureus** (Hablizl), [India : Sikkim], Clay, 1958. *Bull. Br. Mus. nat. Hist. (Ent.)*, 7 (4) : 196, figs. 8, 41, 57, 83, 103, 108, 122, pl. 9, fig. 3.
11. *regalis* [*deignani*] Clay, 1958. *Bull. Br. Mus. nat. Hist. (Ent.)*, 7, (4) : 190, fig. 40, pl. 5, fig. 2.
Host : **Haliastur i. indus** (Boddaert), [Burma; Sri Lanka (Ceylon)].
12. *regalis* [*regalis*] (Giebel), 1886, (*Nirmus*). *Z. ges. NatWiss.*, 28 : 364.
Hosts **Milvus migrans govinda** Sykes, [India : Deccan; & Nepal], **Haliastur i. indus** (Boddaert), [India; Deccan, (Rajputana) Rajasthan & Lucknow] & **Haliaeetus leucoryphus** (Pallas), [India : several localities], Clay, 1958. *Bull. Br. Mus. nat. Hist. (Ent.)*, 7 (4) : 186, figs. 6, 39, 56, 80, 81, 121, 130-137, pl. 5, fig. 1.
13. *rufa* (Burmeister), 1838, (*Nirmus*). *Handb. Ent.*, 2 : 43.

Hosts : (*Falco jugger*) = *Falco biarmicus jugger* J. E. Gray & (*Cerchneis tinnunculus interstinctus*) = *Falco tinnunculus interstinctus* McClelland, [Pakistan : Lyallpur], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 285; (*Falco jugger*) = *Falco biarmicus jugger* J. E. Gray, [Pakistan], Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 72; Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 397 & Ansari, 1959. *Indian J. Ent.*, 20 (2) : 85 figs. 137-143, [as *Deg. masumae* Ansari, 1955; (*Cerchneis tinnunculus interstinctus*) = *Falco tinnunculus interstinctus* McClelland, [Pakistan], Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.*, 72, Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 397 and Ansari, 1959, *Indian J. Ent.*, (1958), 20 (2) : 86, figs. 144-151, as *Deg. splendidus* Ansari, 1955. (also spelled as *D. splendens* in 1956); (*Falco cherrug*) = *Falco biarmicus cherrug* J. E. Gray, [India], (*F. jugger*) = *F. biarmicus jugger* J. E. Gray, [Afghanistan; India], *F. peregrinus* Tunstall, [Burma : Mandalay; Sri Lanka (Ceylon)], *F. subbuteo* Linne & *F. naumanni* Fleischer, [Afghanistan] & *F. tinnunculus* Linne, [Burma; India : Ladakh, Manipur, Northern India, Sikkim], Clay, 1958. *Bull. Br. Mus. nat. Hist. (Ent.)*, 7 (4) : 180, figs. 5, 10, 18-22, 38, 55, 75, 95, 104, 107, 111, 120, 129, 139-164, pl. 6, fig. 3 & pl. 8. fig. 7; *Falco tinnunculus* Linne, [Nepal], Emerson, 1973. In : *Some ectoparasites of the birds of Asia* : 90.

(14). *splendidus* Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 72 = no. 13.

stresemanni Clay, 1936. See *Brueelia*.

subsellata Harrison, 1916. See *Lipeurus*.

15. *storeri* Elbel & Price, 1973. *Pacific. Ins.*, 15 (1) : 97, figs. 3, 5, 8, 9.

Host : *Accipiter trivirgatus indicus* (Hodgson), [India : Assam, Khasia Hills & Garo Hills], *A. t. peninsulæ* Koelz. [India Castle rock, Kanara, Maharashtra.]

16. *vittata* (Giebel), 1874, (*Nirmus*). *Insecta epizoa* : 127.

Host : *Milvus migrans govinda* Sykes [India : Punjab], Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 43, Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 397 & Ansari, 1959. *Indian J. Ent.*, (1958), 20 (2) : 87.

zootherae Clay, 1936. See *Brueelia*.

zootherae stresemanni Clay, 1936. See *Brueelia*.

37. Dennyus Neumann, 1906

Nitzschia Denny, 1842, (nec Baer, 1827). *Mon. Anopl. Brit.* : 230.

Type species (by monotypy) : *N. burmeisteri* Denny.

Dennyus Neumann, 1906, *Bull. Soc. Zool. Fr.*, 20 : 60. *Nomen novum* for *Nitzschia* Denny.

1. **cypsiurus** Thompson, 1948. *Bol.-Ent. Venezuel.*, 7 : 4, fig. 9.

Host : **Cypsiurus parvus batasiensis** (J. E. Gray), [Sri Lanka (Ceylon)]; also [India; Hyderabad, (A. P.) Bombay; Sri Lanka (Ceylon) : Gammaduwa Mousakande], Ledger, 1971. *J. ent. Soc. sth. Afr.*; 34 (1) : 48, figs. 10-13.

2. **giganteus** Emerson & Price, 1968. *Proc. Biol. Soc. Wash.*, 81 : 87 figs. 1-4.

Host : **Chaetura gigantea indica** (Hume), [India : Punjab].

3. **hirundinis** (Linne), 1761, (*Pediculus*). *Fauna Suecica*. 2 : 479.

Host : (*Cypselus affinis*) **Apus affinis affinis** (J. E. Gray) [India : Calcutta]; also Kellogg & Nakayama, 1915. *Rec. Indian Mus.*, 11 (1) : 140; also on the same host (and also as on *Micropus affinis*) [India : Indore, (M. P.) Lucknow, (U. P.)] and *A. affinis nipalensis* (Hodgson) [Nepal], *A. affinis singalensis* Madarász, [Sri Lanka (Ceylon) : Kathiraveli], Ledger, 1971. *J. ent. Soc. sth. Afr.*, 34 (1) : 39, 43, figs. 1-9.

4. **minor** (Kellogg & Paine), 1914, (*Nitzschia*). *Rec. Indian Mus.*, 10 (4) : 242, pl. 15, fig. 10. = no. 3.

5. **von arxi** Buttiker, 1954, *Acta trop.*, 11 (2) : 161.

Hosts : (*Micropus melba tuneti*)=**Apus melba tuneti** [Afghanistan : Kabul], (*Micropus melba bakeri*)=**Apus melba bakeri** Hartert [India : Indore; Sri Lanka (Ceylon) : Gammaduwa, Mousakande], Ledger, 1971. *J. Ent. Soc. sth. Afr.*, 34 (1) : 50, figs. 14, 15, 17, 19, 20.

Docophorulus Eichler, 1944

Docophorulus Eichler, 1944. *Stettin. ent. Ztg.*, 105 : 80. Type species: *Docophorus communis* Nitzsch var. *passeris* Piaget.

Inseparable from *Philopterus*.

***Docophorus* Nitzsch, 1818**

***Docophorus* Nitzsch, 1818. *Germar's Mag. Ent.*, 3 : 289. Type species: (by subsequent designation, Clay, 1938. *Entomologist*, 71 : 207) : *Philopterus* (*Docophorus*) *ocellatus* (Scopoli).**

An absolute synonym of *Philopterus*.

***affinis* Piaget, 1880. See *Sturnidoecus*.**

***alcedinus* Denny, 1842. See *Alcedoffula*.**

***atratus* (Nitzsch), 1818. See *Philopterus*.**

***bituberculatus* Giebel, 1874. See *Sturnidoecus*.**

***brevicollis* Burmeister, 1838. See *Aegypoeus*.**

***clausus* Giebel, 1874. See *Ibidoecus*.**

***crassipes* Burmeister, 1838. See *Philopterus*.**

***cursor* Burmeister, 1838. See *Strigiphilus*.**

***excisus* (Nitzsch), 1818. (*Philopterus* s.g. *Docophorus*). See *Philopterus*.**

***extraneus* Piaget, 1885. See *Philopterus*.**

***fulvus* Burmeister, 1838. See *Philopterus*.**

***fuscicollis* Burmeister, 1838. See *Philopterus*.**

***gonorhynchus* Nitzsch, 1861. See *Craspedorrhynchus*.**

***graculae* Piaget, 1880. See *Sturnidoecus*.**

***guttatus* [Nitzsch] See. *Philopterus guttatus* Denny, 1842.**

***heteroceros* Nitzsch, 1861 (*nec.* Grube, 1851). See *Strigiphilus*.**

***leontodon* (Nitzsch), 1880. See *Sturnidoecus*.**

***meropis* Denny, 1842. See *Meropoecus*.**

***nisi* Denny, 1842. See. *Craspedorrhynchus*.**

***nudipes* Piaget, 1880. See *Strigiphilus*.**

***ornatus* Nitzsch, 1866. See *Philopterus*.**

***passerinus* Denny, 1842. See *Philopterus*.**

***pastoris* Denny, 1842. See *Sturnidoecus*.**

***perspicuus* Kellogg, 1914. See *Aegypoeus*.**

***pertusus* Burmeister, 1838. See *Incidifrons*.**

***plataleae* Denny, 1842. See *Ibidoecus*.**

***platystomus* Burmeister, 1838. See *Craspedorrhynchus*.**

***pygaspis* Nitzsch, 1866. See *Anatoecus*.**

***rostratus* Burmeister, 1838. See *Strigiphilus*.**

***rotundatus* Piaget, 1880, p. 47 (*nec.* pp. 21. 60), See *Philopterus*.**

***spathulatus* Giebel, 1874. See *Craspedorrhynchus*.**

***superciliosus* Burmeister, 1838. See *Penenirmus*.**

***thryptocephalus* Kellogg & Paine, 1914. See *Philopterus*.**

***triangularis* Rudow, 1869. See *Craspedorrhynchus*.**

38. *Echinophiloaterus* Ewing, 1927

***Echinophiloaterus* Ewing, 1927, *J. Wash. Acad. Sci.*, 17 : 92.**

Type species : *E. chapini* Ewing.

1. **tota** Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 263.

Host : (*Psittacula krameri manillensis*?)=**Psittacula krameri borealis** (Neumann), [Pakistan : Lyallpur].

39. *Eidmanniella* Kéler, 1938

Eidmanniella Kéler, 1938, *Ann. Mus. Zool. Polon.*, 13 : 81

Type species : *Menopon brevipalpe* Piaget.

1. **albescens** (Piaget), 1880, (*Menopon*), *Pediculines* : 491, pl. 41, fig. 4.
Host : **Sula sula** (Linne), [Indian Ocean], Ryan & Price, 1969. *Ann. Ent. Soc. Amer.*, 62 (4) : 822, figs. 5, 13, 26, 29.
2. **subrotundata** (Piaget), 1880, (*Menopon*), *Pediculines.*, : 453, pl. 35, fig. 2.
Host : **Phalacrocorax sulcirostris** (Brandt), [Sri Lanka (Ceylon)] **Haliaeetus niger** (vieillot), [India], Ryan & Price, 1969. *Ann. Ent. Soc. Amer.*, 62 (4) : 820, figs. 18, 19, 22, 27, 28.

Eomenacanthus Uchida, 1926

Eomenacanthus Uchida, 1926. *J. Coll. Agric. Tokyo*, 9: 30. Type species : *Eomenacanthus biseriatus* (Piaget).

Inseparable from *Menacanthus*.

40. *Esthiopterum* Harrison, 1916

Esthiopterum Harrison, 1916. *Parasitology*, 9: 26. Type species: "*E (Lipeurus) ebraeum* Burmeister"

1. **elbeli** Tandan, 1973. *J. Ent. (B)* 42 (1) : 91, figs. 10, 22, & 35.
Host : **Anthropoides virgo** (Linne), [India : Hyderabad, (A. P.); Nepal].
2. **indicum** Tandan, 1973. *J. Ent. (B)* 42 (1) : 98. figs. 2, 7, 11, & 15.
Host: **Grus antigone antigone** (Linne), [India : (Rajputana) Rajasthan].
'secretarium' (Giebel), 1874, (*Lipeurus*). *Insecta epizoa* : 213.
Sensu Quadri, 1936. *Proc. Indian Acad. Sci.*, 6 : 464, fig. 9A.
See *Falcolipeurus longiphallus* Zlotorzyska.

41. *Eucolpocephalum* Bedford, 1930

Eucolpocephalum Bedford, 1930, *Rep. vet. Res. S. Afr.*, 16 : 161. Type species : *E. robustum* Bedford.

1. **femorale** (Piaget), 1880, (*Menopon*), *Pediculines* : 484, pl. 39, fig. 8.
Host : *Platalea leucordia* Linne, [India], (Slide in B. M. Nat. Hist.).

42. *Eulaemobothrion* Ewing, 1929

Eulaemobothrion Ewing, 1929, *Man. ext. Parasit.*, : 105, 189. Type species : *Laemobothrion nigrum* Burmeister.

'*Eulaemobothrion* Ewing, Sensus Lakshminarayana, 1968. *Orient Ins.*, (1967), 1 (3 & 4) : 259. (Genus redéf.)

1. **atrum** (Nitzsch), 1818, (*Liotheum*). *Germar's Mag. Ent.*, 3 : 302.
Nomen novum for Redi's p. 4 fig. 7.

Host : *Fulica a. atra* Linne, [India : (Rajpurana) Rajasthan] Clay & Hopkins, 1960. *Bull. Br. Mus. nat. Hist. (Ent.)*, 9 (1) : 53, figs. 78, 83, 84-94; [India : Manipur]. Slide in B. M. Nat. Hist.

2. **biswasi** Lakshminarayana, 1968. *Oriental Ins.*, (1967), 1 (3 & 4) : 259, figs. 1, 4, 7, 8, 11 & 15.

Host : (*Porphyrio poliocephalus poliocephalus*) *Porphyrio porphyrio poliocephalus* (Latham), [India : Nalbani, West Bengal]; [India : (Deccan) Andhra Pradesh, (Rajputana) Rajasthan; Sri Lanka]. Slides in B. M. (nat. Hist.)

Eustrigiphilus Ewing, 1926

Eustrigiphilus Ewing, 1926, *Proc. ent. Soc. Wash.*, 28 : 148. Type species : *Philopterus ceblebrachys* "Nitzsch".

Inseparable from *Strigiphilus*.

Falcoecus Clay & Meinertzhagen, 1938

Falcoecus Clay & Meinertzhagen, Dec. 1938., *Entomologist*. 71 : 275.

Type species : *Philopterus aquillinus* (Denny).

A synonym of *Craspedorrhynchus* Kéler Aug. 1938.

43. *Falcolipeurus* Bedford, 1931.

Falcolipeurus Bedford, 1931, *Rep. vet. Res. S. Afr.*, 17 : 290. Type Species : *Esthiopterum secretarium* (Giebel).

1. **frater** (Giebel), 1874, (*Lipeurus*). *Insecta epizoa* : 210.

Host : *Neophron percnopterus* (Linne), [India : Lucknow],

Tandan, 1964. *Proc. R. ent. Soc. Lond.* (B) 33 (11-12) : 177, 178, 179, pl. 1, fig. 1, & pl. 2. fig. 2.

2. **gallivalerioi** Eichler, 1941. *Schweiz. Arch. Tierheilk*, 83 : 180, fig. 1.

Host : **Gyps himalayensis** Hume [India : Himalaya]; also on the same host, [India : Punjab], Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 398 & Ansari, 1959. *Indian J. Ent.*, (1958), 20 (2) : 96.

3. **hopkinsi** Tandan, 1952. *Ann. Mag. nat. Hist.*, (12) 5 : 461, figs. 1-5.

Host : (*Sarcogyps calvus*) **Torgos calvus** (Scopoli), [India : Lucknow]; also in Tandan, 1964. *Proc. R. ent. Soc. Lond.* (B) 33 (11-12) : 177-179, pl. 1, fig. 3 & pl. 2, fig. 4.

4. **longiphallus** Zlotorzyska, 1963. *Angew. Parasitol.*, 4 : 159, figs. 18-21.

Host : (*Pseudogyps bengalensis*) : **Gyps bengalensis** (Gmelin), [India : Several localities including Lucknow, Bharatpur (Rajasthan)], Tandan, 1964. *Proc. R. ent. Soc. Lond.*, (B) 33 (11-12) : 174, pl. 1, fig. 7, pl. 2. figs., 5, 6, and text figs. 1-4. (According to Tandan *Esthiopeterum secretarium* (Giebel) sensu Qadri, 1936, *Proc. Indian Acad. Sci.*, 6 : 464, fig. 9A, from Northern India is an error and it belongs to *F. longiphallus*.)

5. **quadripustulatus** (Burmeister), 1938 (*nec.* Denny, 1842), (*Lipeurus*). *Handb. Ent.*, 2 : 434.

Host : **Gyps himalayensis** Hume, [Pakistan : Lyallpur], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 258, **G. fulvus** (Hablizl), **Aegypius monachus** (Linne), [India : Locality not cited], **Gyps i. indicus** (Scopoli), [India : (Rajputana) Rajasthan] & **G. himalayensis** Hume [India : Simla], Tandan, 1964. *Proc. R. ent. Soc. Lond.* (B) 33 (11-12) : 178-179, pl. 1, fig. 2 & pl. 2 fig. 3.

6. **secretarius** (Giebel), 1874, (*Lipeurus*). *Insecta epizoa* : 213.

Host : (*Vultur monachus*) = **Aegypius monachus** (Linne), [India : Calcutta (Dhappa)], Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 : 292 as *L. secretarius* (Esthio-

pterus secretarium (Giebel) *sensu* Qadri, 1936. *Proc. Indian Acad. Sci.*, 6 : 464, fig. 9a is an error. Probably refers to no. 4).

7. **suturalis** (Rudow), 1869, (*Lipeurus*). *Beitr. Kenntn. Malloph.* : 44.

Hosts : *Aquila chrysaetos* (Linne); *A. h. heliaca* Savigny; *A. clanga* Pallas, *A. pomarina hastata* (Lesson), [Loc, not cited], *A. rapax vindhiana* Franklin, [India : U. P.], *A. n. nipalensis* Hodgson, [India : Lucknow], Tandan, 1964. *Proc. R. ent. Soc. Lond.* (B) 33 (11-12) : 177, 178, pl. 1, fig. 5, 6, & pl. 2, fig. 2.

8. **yasmini** Ansari, 1956. *Pak. J. Sci. Res.*, 8 (1) : 15, figs. 23-24.

Host : *Hieraaetus pennatus* (Gmelin), [Pakistan : Shujawal (Tatta Dt.)]; also in Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 398.

44. **Falcolius** Clay, 1955

Falcolius Clay, 1955, *Trans. R. ent. Soc. Lond.*, 107 : 180. Type species : *Falcolius jordani* Clay.

1. **jordani** Clay, 1955. *Trans. R. ent. Soc. Lond.*, 107 : 181, figs. 21, 31-34, 36-38, 41-42, 47-49, pl. 1, figs. 3 & 4.

Host : *Microhierax caerulescens burmanicus* Swann [Burma : Myitkyina].

45. **Felicola** Ewing, 1929

Felicola Ewing, l. vi. 1929, *Man. ext. parasites* : 121, 122, 192. Type species : *Trichodectes subrostratus* "Nitzsch"

Paradoxuroecus Conci, 1942, *Boll. Soc. ent. Ital.*, 74 : 141. Type species : *P. jucci* Conci.

1. **jucci** (Conci), 1942, (*Paradoxuroecus*). *Boll. Soc. ent. Ital.*, 74 : 141.

Host : (*Paradoxurus grayi*) = *Paguma larvata grayi* (Bennett), [Burma]; also in Emerson, 1964. *Proc. Biol. Soc. Wash.*, 77 : 195.

2. **rohani** Werneck, 1956. *Rev. Brasil. biol.*, 16 (1) : 25, figs. 1-5.

Host : *Herpestes edwardsi* (Geoffroy), [Nepal : Madhuban, Bara; Hitaare, Makwanpur], *H. auropunctatus*, Hodgson [Nepal : Swiyamba Temple, Khatmandu; Trisuli, Nuwakot] Emerson, 1971. *J. Med. Ent.*, 8 (6) : 622.

3. **subrostratus** (Burmeister), 1838, (*Trichodectes*). *Handb. Ent.*, 2 : 438.

Host : (Semimongrel cat) *Felis catus* Linne, [Pakistan : Lahore], Ansari, 1951. *Indian J. Ent.*, 13 (2) : 133, fig. 4.

Ferrisia Uchida, 1926 (*nec* Fullaway, 1923), *J. Coll. Agric. Tokyo*, 9(1) : 43. Type species: *Colpocephalum Turbinatum*. Denny. A synonym of *Neocolpocephalum* Ewing, which is inseparable from *Colpocephalum*.

46. *Fulicoffula* Clay & Meinertzhagen, 1938

Fulicoffula Clay & Meinertzhagen, 1938, *Entomologist*, 71 : 5. Type species : *Esthiopterum luridum* (Denny).

1. **lurida** (Nitzsch), 1818, (*Philopterus*). *German's Mag. Ent.*, 3 : 292. *Nomen novum* for Redi's plate 4, fig. 11.

Host : *Fulica. a. atra* (Linne), [Pakistan : Lyallpur], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 258; on the same host, [India : Manipur], Clay & Hopkins, 1960. *Bull. Br. Mus. nat. Hist. (Ent.)*, 9 (1) : 40, figs. 62-71, pl. 6, figs. 1, & 2.; also [India], Emerson, 1973. In: *Some ectoparasites of the birds of Asia* : 90.

Galliferrisia Ansari, 1951.

Galliferrisia Ansari, 1951, *Proc. nat. Inst. Sci. India*. 17 (2) : 150.

Type species : *Galliferrisia tausi* Ansari.

Inseparable from *Colpocephalum*.

Gallilipeurus Clay, 1938

Gallilipeurus Clay, 1938, *Proc. Zool. Soc. Lond. (B)* 108 : 135.

Type species : *Lipeurus heterographus* "Giebel".

A synonym of *Cuclotogaster*.

Glareolites Eichler, 1944

Glareolites Eichler, 1944, *Stettin. ent. ztg.*, 105 : 80. Type species : *Nirmus ellipticus* Nitzsch.

The genus is provisionally considered inseparable from *Quadriceps*.

47. Goniocotes Burmeister, 1838

Goniocotes Burmeister, 1838, *Handb. Ent.*, 2 : 431 Type species : (by subsequent designation, Johnston & Harrison, 1911, *Proc. Linn. Soc. N.S.W.*, 36 : 326) : *G. gallinae* (De Geer) (= *G. hologaster* N.)"

abdominalis Piaget, 1880. See *Goniodes*.

aegypticus Kellogg & Paine, 1911. See *Coloceras*.

1. alatus Piaget, 1885. *Pediculines supplement* : 45, pl. 5, fig. 4.

Host : **Alectoris graeca pallescens** (Hume), [India : Hoshiarpur], Ansari, 1947. *Proc. natn. Inst. Sci. India*, 13 (6) : 298.

astrocephalus Burmeister, 1838. See *Goniodes*.

bidentatus (Scopoli), 1763, (*sensu* Ansari, 1947). See *Campanulotes*.

chinensis Kellogg & Chapman, 1902. See *Coloceras*.

2. chrysocephalus Giebel, 1874, *Insecta epizoa* : 189.

Hosts : (*Lophura diardi*) = **Diardigallus diardi** Bonaparte (?) [India : No history], (*Gennaeus andersoni*) = **Lophura andersoni** (Elliot), [no history], (*Gennaeus albicristatus*) = **Lophura leucomelana hamiltoni** (J. E. Gray), [India : Mundali (Garhwal Himalaya), & (*Phasianus soemmeringii scintillans*) = **Syrmaticus (Graphophasianus) soemmeringi scintillans** Gould, [India : no history], Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 (4) : 220.

compar Burmeister, 1838. See *Campanulotes*.

coronatus Giebel, 1874. See *Goniodes*.

3. gallinae (De Geer), 1778, (*Ricinus*). *Mem. Hist. Ins.*, 7 : 79, pl. 4, fig. 15.

Hosts : **Gallus gallus** (Linne), [India : (Gaya Dt.) Bihar]. Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 (4) : 221, as **Goniocotes hologaster** Nitzsch; **Gallus gallus [domesticus]** (Linne), [India : Punjab], Ansari, 1943. *Indian J. Ent.*, 5 (1 & 2) : 135, figs. 7 & 9, as **Goniocotes hologaster** Nitzsch; **G. gallus [domesticus]** (Linne), [India : Punjab], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 297; also [Southeast Asia]. Emerson, 1956. *J. Kansas Ent. Soc.*, 29 (2) : 67, pl. 2, figs. 1-3.

gigas Taschenberg, 1879. See *Goniodes*.

- (4). *hologaster* (Nitzsch), 1818. (nec Denny, 1842), (*Philopterus* s.g. *Goniodes*) *Germar's Mag. Ent.*, 3 : 294. *Nomen novum* for *Ricinus gallinae* De Geer. = no. 3.
indicus Kellogg & Paine, 1914. See *Goniodes*.
5. *jirufti* Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 298, fig. 12.
 Host : *Franocolinus f. asiae* Bonaparte, [Pakistan : Lyallpur].
6. *maculatus* Taschenberg, 1882. *Nova Acta Leop.-Carol.*, 44 : 76, pl. 3, fig. 3.
 Host : *Gallus gallus [domesticus]* (Linne), [India : Punjab].
 Ansari, 1943. *Indian J. Ent.*, 5 (1 & 2) : 135 as *G. hologaster* var. *maculata* Taschenberg.
7. *mayuri* Lakshminarayana and Emerson, 1971. *Oriental Ins.*, 5 (1) : 98, figs. 5-9.
 Host : *Pavo cristatus* Linne, [India : Assam : Jamduar (Goalpara Dist.), Delhi; Nepal : Tamispur, Navalpur, (Parasi Dist.)].
nirmoides Kellogg & Paine, 1914. See *Lagopoecus*.
8. *parviceps* (Piaget), 1880, (*Goniodes*). *Pediculines*: 277, pl. 23, fig. 2.
 Host : *Pavo cristatus* Linne, [India : Delhi; Nepal : Tamispur, Nawalpur (Parasi Dist.)], Lakshminarayana and Emerson, 1971. *Oriental Ins.*, 5 (1) : 95, figs. 1-4, [Burma], Slide in B. M. nat. Hist.
9. *rectangulatus* Nitzsch, 1866. In Giebel's *Z. ges. NatWiss.*, 28 : 389
 Hosts : (*Pavo nigrigipennis*) = *Pavo cristatus [nigripennis* *Sclater*] [India : no history], Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 (4) : 221; *Pavo cristatus* Linne, [India : Hoshiarpur], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 297. See also Lakshminarayana and Emerson, 1971, *Oriental Ins.*, 5 (1) : 97.
10. *yngarejsuf* Eichler, 1950. *Doriana*, 1 (9) : 4.
 Host : *Pavo cristatus* Linne [India]

48. *Goniodes* Nitzsch, 1818

Goniodes Nitzsch, 1818, *Germar's Mag. Ent.*, 3 : 293. Type species : (by subsequent designation, Johnston & Harrison, 1911. *Proc. Linn. Soc. N.S.W.*, 36 : 326) : '*G. pavonis* Linne, (=syn. *G. falcicornis* N.)'.

Gonocephalus 'Nitzsch'. Kéler, 1937, *Arb. morph. tax. Ent. Berlin-Dahlem*, 4 : 130. Type species : '*chellcornis* Nitz.'

Gonotyles Kéler, 1939, *Nova Acta Leop. Carol.* (n. F.), 8 : 48.

Type species : *Goniodes cervinicornis* 'Nitzsch'.

Oulocrepis Kéler, 1939, *loc. cit.*, : 97. Type species : *Goniodes dissimilis* 'Nitzsch'.

Stenocrotaphus Kéler, 1939, *loc. cit.* : 124. Type species : *Goniocotes gigas* Tasch.

Margaritenes Kéler, 1939, *loc. cit.* : 132. Type species : *Goniodes eurygaster* Piaget.

(1) *abdominalis* (Piaget), 1880, (*Goniocotes*). *Pediculines* : 238, pl. 20, fig. 9=no. 20.

2. *ammoperdix* Clay, 1940. *Proc. Zool. Soc. Lond.* (B), 110 : 93 & 64.

Host : *Ammoperdix griseogularis* (J. F. Brandt), [Afghanistan; India; Pakistan : Peshawar].

3. *astrocephalus* (Burmeister), 1838, (*Goniocotes*). *Handb. Ent.*, 2 : 431.

Hosts : *Coturnix c. coturnix* (Linne), [Afghanistan] & *C. coromandalica* (Gmelin), [India : Deccan], Clay, 1940. *Proc. Zool. Soc. Lond.* (B), 110 : 100, figs. 66b & 68a; *C. c. coturnix* Linne, [Pakistan : Lyallpur], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 296.

(4) *bicuspidatus* Piaget, 1880. *Pediculines* : 278, pl. 22, fig. 3.=no. 34.

(5) *breviantennatus* Piaget, 1885. *Pediculines supplement* : 50, pl. 5, fig. 8=no. 34.

6. *cervinicornis* Giebel, 1874, *Insecta epizoa* : 199.

Hosts : (*Lophura diardi*) *Diardigallus diardi* Bonaparte, [India : no history], Kellogg & Paine, 1914. *Rec. Indian mus.*, 10 (4) : 29; also Kéler, 1939. *Nova Acta Leop.-Carol.* (n. F.) 8 : 48, figs. 20-22 as *Gonotyles cervinicornis* Giebel; (*Gennaesus nycthemerus horsfieldi*;) *Lophura nycthemerus horsfieldi* (*Lophura leucomelana lathami* (J. E. Gray), [India : Assam], Clay, 1940. *Proc. Zool. Soc. Lond.* (B), 110 : 71, figs. 26, 47, 48b & 49; on the same host, [India : Himalaya]. Overgaard, 1943. *Ent. Medd.*, 23 : 2 as *Goniotyles cervinicornis* (Giebel).

7. *chrysolophi* Clay, *Proc. Zool. Soc. Lond.* (B), 110 : 51, figs. 33, & 34a.

Host : *Chrysolophus amherstiae* (Leadbeater), [Tibet].

8. **colchici** Denny, 1842 (nec Giebel, 1874). *Mon. Anopl. Brit.*, 56, 158, pl. 12, fig. 4.
 Hosts : (*Gennaeus albicristatus*) **Lophura leucomelanos hamiltoni** (J. E. Gray), [India : Simla, Mundali (Garhwal : Western Himalaya)], (*G. leucomelanus*)=**Lophura leucomelana** (Latham), [Nepal], (*G. melanotus*) **Lophura leucomelana melanota** (Hutton), [Bhutan] **Chrysolophus pictus** (Shaw), [Burma], Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 (4) : 229; **Phasianus colchicus bianchii** Buturlin, [Afghanistan]. Clay, 1940. *Proc. Zool. Soc. Lond. (B)*, 110 : 50, figs. 32 & 34b.
9. **confusio** Clay, 1940. *Proc. Zool. Soc. Lond. (B)*, 110 : 105.
 Host : (*Megapodius n. nicobariensis*) **Megapodius freycinet nicobariensis** Blyth, [India : Nicobar], as *G. minor confusio*.
10. **coronatus** (Giebel), 1874, (*Goniocotes*). *Insecta Epizoa* : 302. *Nomen novum* for *Goniocotes obscurus* Giebel, 1874, p. 191 nec p. 188.
 Host : **Rollulus roulroul** (Scopoli), [Burma], Clay, 1940. *Proc. Zool. Soc. Lond. (B)*, 110 : 19 fig. 13.
11. **costatus** (Kéler), 1939, (*Gonocephalus*). *Nova Acta Leop.-Carol.* (n.f.) 8 : 83, fig. 42.
 Host : **Tetraogallus h. himalayensis** G. R. Gray, [Afghanistan; India : (Ladak) Ladakh;] **T. t. tibetanus** Gould, [India : (Ladak) Ladakh, & Sikkim], **T. tibetanus aquilonifer** R. & A. Meinertzhagen [India : Sikkim], Clay, 1940. *Proc. Zool. Soc. Lond. (B)*, 110 : 75, figs. 50 & 51, as *G. tetraogallus* Clay.
12. **curvicornis** Nitzsch, 1866. *Z. ges. NatWiss.*, 28 : 388.
 Host : **Argusianus argus** (Linne), [India : no history], Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 (4) : 229.
- (13) **dentatus** (Rudow), 1870, (*Goniocotes*). *Z. ges. NatWiss.*, 35 : 476. = no. 29.
14. **dispar** Burmeister, 1838. *Handb. Ent.*, 3 : 432.
 Host : **Alectoris graeca chukar** (J. E. Gray) & **A. g. pallescens** (Hume), [India : (Ladak) Ladakh], **A. g. falki** Hartert,

[Afghanistan], Clay, 1940. *Proc. Zool. Soc. Lond.* (B), 110 : 87, fig. 60a; *Alectoris graeca chukar* (J. E. Gray), [India : Kulu & Hoshiarpur], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 295.

15. **dissimilis** Denny, 1842. *Mon. Anopl. Brit.*, 57, 162, pl. 12, fig. 6.

Hosts : (*Phasianus torquatus*)=*Phasianus colchicus torquatus* Gmelin, [India : Calcutta], (*P. soemmeringi scintillans*)=*Syrmaticus soemmeringi scintillans* (Gould), [India : no history], *Ithaginis cruentus* (Hardwicke), [India Sikkim], (probably *G. ithaginis* Clay), *Gallus sonnoerati* Temminck, [India : Bangalore] & *G. gallus* [domesticus] (Linne), [India], Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 (4) : 229; also Kéler, 1939. *Nova Acta Leop.-Carol.* : 98, figs. 51-52, as *Oulocrepis dissimilis* (Nitzsch); *Gallus g. murghi* Robinson & Kloss, [India : Sikkim], & *G. lafayettii* Lesson, [Sri Lanka (Ceylon)], Clay, 1940. *Proc. Zool. Soc. Lond.* (B), 110 : 62, figs. 41-43; *G. gallus* [domesticus] (Linne), [India ? : Punjab], Ansari, 1943. *Indian J. Ent.*, 5 (1 & 2) : 133; (Black minorca), [India : Gurdaspur], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 295, (Wild chicken), [Southeast Asia], Emerson, 1956. *J. Kansas Ent. Soc.*, 29 (2) : 69, pl. 3, figs. 1-3; (one slide containing specimen from *G. g.* [domesticus] (Linne), [India : Mysore city], coll. Mr Mariappa is available in Z.S.I).

16. **dolani** Eichler, 1937. *S. B. ges. naturf. fr. Berl.*, 1937 : 96.

Host : *Crossoptilon c. crossoptilon* (Hodgson), [China : Szechwan], as *G. crossoptilon dolani*.

17. **eurygaster** Piaget, 1885. *Pediculines Supplement* : 53, pl. 6, fig. 1.

Hosts : *Lophophorus impejanus* (Latham), [India : Mussorie, (Kumaon) Kumaun, Darjeeling, Sikkim], Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 (4) : 229; also Kéler, 1939. *Nova Acta Leop.-Carol.* (n.f.) 8 : 133, fig. 71 as *Margaritenes eurygaster* (Piaget); *Lophorus impejanus* (Latham), [Nepal], Clay, 1940. *Proc. Zool. Soc. Lond.* (B), 110 : 16, figs. 8b, 10, 11b & 12; also Overgaard, 1943. *Ent. Medd.*, 23 : 4 figs. 1 & 2, as *Margarirtenes eurygaster* (Piaget); (3 slides containing 9 specimens from Kellogg's coll. are available in Z.S.I).

- (18). *extraneus* Clay, 1940. *Proc. Zool. Soc. Lond. (B)*, 110; 79, figs. 54 & 55. = no. 35.
- (19). *falcicornis* (Nitzsch), 1818 (*Philopterus* s.g. *Goniodes*). *Germar's Mag. Ent.*, 3 : 293. *Nomen novum* for *Pediculus pavonis* Linne. = no. 30.
20. *gigas* (Taschenberg), 1879, (*Goniocotes*). *Z. ges. NatWiss.*, 52 : 104, pl. 1, fig. 10.
- Host : *Gallus [gallus] domesticus* (Linne) [India ? : Punjab], 1943. *Indian J. Ent.*, 5 (1 & 2) : 135; also in Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 298 (Slide containing a female specimen from *Gallus gallus*. [*domesticus*] (Linne), Z. L., M. U., Coll. Qadri and labelled as *Goniocotes gigas* Tasch., and another slide containing a female specimen from fowl. Hyderabad, Dn, (A. P.), Z.S.I. Lot. No. 59/58. Coll. Dr. K. V. Gurumurthy, det. Mr. G. Mathai, are available in Z.S.I.
- hologaster* Nitzsch, 1818 (*nec hologaster* Denny, 1842) (*Philopterus* s.g. *Goniodes*) = See *Goniocotes*.
21. *humiae* Clay, 1940. *Proc. Zool. Soc. Lond. (B)* 110 : 67, figs. 44a & 45a.
- Host : *Syrnaticus h. humiae* (Hume), [Burma], *S. h. burmanicus* (Oates), (Yunnan).
22. *indicus* (Kellogg & Paine), 1914, (*Goniocotes*). *Rec. Indian Mus.*, 10 (4) : 218, pl. 14, fig. 4.
- Hosts : (*Arboricola rufogularis*) *Arborophila rufogularis* (Blyth), [India : (Jorpokri) Jorpakuri (E. Himalaya)]; *A. r. tickelli* (Humme), [Burma : Tennasserim], *A. t. torqueola* (Valenciennes), [India : Sikkim], *A. t. batemani* (Oglivie-Grant); [Burma] & *A. t. millardi* (Stuart Baker), [India : Central Himalaya], Clay, 1940. *Proc. Zool. Soc. Lond. (B)* 110; 21, fig. 14.
23. *intermedius* Neumann, 1913. *Arch. Parasit. Paris*, 15 : 627, figs. 15-18.
- Host *Pucrasia macrolopha biddulphi* Marshall, [India: Kashmir], Clay, 1940. *Proc. Zool. Soc. Lond.*, (b), 110 : 65, figs. 1d, 44b & 45b.
24. *ithaginis* Clay, 1949. *Proc. Zool. Soc. Lond. (B)*, 110 : 48, figs. 31 & 36.

Host : *Ithaginis c. cruentus* (Hardwicke), [India : Sikkim],
I. c. clarkei Rothschild, [China : Yunnan], *I. c. geoffroyi* Verreaux [E. Tibet].

- (25). *latifaciatus* Piaget, 1880 (*nec.* Piaget, 1885 & Carriker, 1945)
Pediculines : 269, pl. 22, fig. 4. = no. 26.

lativentris Uchida, 1916. See *Coloceras*.

26. *longus* Rudow, 1869 (*nec* Le Souef, 1902). *Beitr. Kennt. Malloph.* : 26.

Hosts : *Lophura ignita* (Shaw), *Polyplectron bicalcaratum* (Linne) & (*Acomus erythrophthalmus*) *Houppifer erythrophthalmus* (Raffles), [India : no history], Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 (4) : 229; also Kéler, 1939. *Nova Acta Leop.-Carol.*, 8 : 23-25.

27. *megaceros* Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 (4) 227, pl. 15, fig. 8.

Host : *Lophophorus impejanus* (Latham), [India Calcutta]; also in [India : Sikkim], Clay, 1940. *Proc. Zool. Soc. Lond. (B)*, 110 : 13, figs. 8a & 11a.

28. *meinertzhageni* Clay, 1940. *Proc. Zool. Soc. Lond. (B)*, 110 : 9 figs. 1b, 4b, 6, 7 & 9b.

Host *Pavo cristatus* Linne, [India : Delhi].

minor Piaget, 1880. *Pediculines* : 256 (*nec* pp. 241 & 248). see *Coloceras*.

neumannia Kellogg & Paine, 1914. See *Pachyskelotes*.

29. *ocellatus* (Rudow), 1869, (*Goniocotes*). *Beitr. Kenntn. Malloph.* : 23.

Hosts : (*Gennaeus leucomelanos hamiltonii*) *Lophura leucomelana hamiltonii* (J. E. Gray), [India ? : E. Himalaya], (*G. leucomelanos*) *Lophura leucomelana* (Latham), [Nepal], (*G. nycthemerus horsfieldi*) *Lophura leucomelana lathami* (J. E. Gray). [India : Assam]. (*G. b. oates*.) *Lophura leucomelana oatesi* (Oglivie-Grant) [Burma], *Pucrasia m. macrolopha* (Lesson), [India ? : Himalaya] & *P. macrolopha biddulphi* Marshall, [India : Kashmir], Clay, 1940. *Proc. Zool. Soc. Lond. (B)*, 110 : 53 figs. 35, 36b & 37 as *G. dentatus* (Rudow), *Bambustricola f. fitchii* Anderson [Upper Burma].

parviceps Piaget, 1880. See *Goniocotes*.

30. **pavonis** (Linne), 1758, (*Pediculus*). *Syst. Nat. ed.*, 10 : 613.

Hosts : (*Pavo nigripennis*) = **Pavo cristatus** [nigripennis Sclater], [India : Calcutta], Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 (4) : 230, as *G. falcicornis* (Nitzsch); also in Kéler, 1969. *Nova Acta Leop.-Carol.* (n.f.) 8 : 39, figs. 13-15; **P. cristatus** Linne, [India], Clay, 1940. *Proc. Zool. Soc. Lond.*, (B), 110 : 5, figs. 1a, 3, 4a, 5 & 9a; on **Pavo cristatus** Linne, [India], Overgaard, 1943. *Ent. Medd.*, 23 : 1; also on the same host, [India : Amritsar, (Attari) Atari & Hoshiarpur], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 295. [Bangla Desh : Dacca; India : General Delhi, Lucknow] Slides in B.M. Nat. Hist. piageti Johnston & Harrison, 1912. See *Coloceras*.

31. **processus** Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 (4) : 226, pl. 15, fig. 9.

Host : (*Arboricola rufogularis*) = **Arborophila r. rufogularis** (Blyth), [India : (Jorpokri) Jorpakuri (E. Himalaya)]; **A. r. rufogularis** (Blyth), **A. r. tickelli** (Hume), [Burma : Tennasserim], **A. r. intermedia** (Blyth), [Burma], **A. t. torqueola** (Valenciennes), [India : Assam, Sikkim], **A. t. millardi** (S. Baker), [India ? : Central Himalaya] & **A. atrogularis** (Blyth), [India : Assam], Clay, 1940. *Proc. Zool. Soc. Lond.* (B), 110 : 23, fig. 15.

32. **sectus** Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 (4) : 224, figs. 1 & 2.

Host : **Catreus wallichii** (Hardwicke), [India : Garhwal & (Kumaon) Kumaun]; on the same host, [India ? : Central Himalaya], Clay, 1940. *Proc. Zool. Soc. Lond.* (B); 110, : 56, fig. 38.

33. **souefi** Clay, 1940. *Proc. Zool. Soc. Lond.* (B), 110 : 100, figs. 66b & 68a.

Host : (*Excalfacioris c. chinensis*) = **Coturnix c. chinensis** (Linne), [India : Bengal].

34. **spinicornis** Nitzsch, 1866 In *Giebel's Z. ges. NatWiss.*, 28 : 389.

Hosts : **Tragopan blythi** (Jerdon), [India : Assam, Naga, Haka & Mishimi Hills], **T. satyra** (Linne), [India : (Kumaon) Kumaun (Western Himalaya)], Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 (4) : 229, as *G.*

bicuspidatus Piaget; *T. satyra* (Linne), [India : Calcutta], Kellogg & Nakayama, 1915. *Rec. Indian Mus.*, 11 (1): 139, as *G. bicuspidatus* Piaget; also Kéler, 1939. *Nova Acta Leop.-Carol.* (n.f.) 8 : 43, figs. 16-18; *T. satyra* (Linne), [India : Sikkim], *T. b. blythi* (Jerdon), *T. temminckii temminckii* (J. E. Gray), [China : Szechwan; India : Assam], *T. caboti* (Gould) [S. China], Clay, 1940. *Proc. Zool. Soc. Lond.* (B), 110 : 11, fig. 9c; also on the same hosts [India], Overgaard, 1943. *Ent. Medd.*, 23 : 2; *T. blythi* (Jerdon) [Burma], Eichler, 1950. *Doriana*, 1 (9) : 4, as *G. spinicornis blythi* Eichler.

35. *temporalis* (Kéler), 1939, (*Stenocrotaphus*). *Nova Acta Leop.-Carol.* (n.f.) 8 : 131, fig. 70.

Host : *Francolinus gularis* (Temminck), [India : N. Bengal; Nepal], Clay, 1940. *Proc. Zool. Soc. Lond.*, (B), 110 : 79, figs. 54 & 55, as *G. extraneus* Clay.

- (36) *tetraogallae* Clay, 1940. *Proc. Zool. Soc. Lond.* (B), 110 : 74, figs. 50 & 51. = no. 11.

37. *tragopan* Clay, 1940. *Proc. Zool. Soc. Lond.*, (B), 110 : 13, figs. 9d & 11c.

Host : *Tragopan melanocephalus* (J. E. Gray), [India : Kashmir].

Gonocephalus Kéler, 1937

Gonocephalus "Nitzsch" Kéler, 1937, *Arb. morph. tax. Ent.*, Berlin-Dahlem, 4 : 130. Type species : "*chelicornis* Nitzsch."

Not separable from *Goniodes*.

Gonotyles Kelér, 1939

Gonotyles Kéler, 1939, *Nova Acta Leop.-Carol.* (n. F.) : 8:48. Type species : *Goniodes cervinicornis* "Nitzsch"

Inseparable from *Goniodes*.

49. *Haematomyzus* Piaget, 1869

Haematomyzus Piaget, 1869, *Tijdschr. Ent.*, 12 : 254, pl. 2. figs. 1-14. Type species : *Haemto, myzus elephantis* Piaget.

Idolocoris Walker, 1872 (nec Douglas & Scott, 1865), in Reuter, *Hardwicke's, Sci. Gossip*, 1871 : 131. Type species : *I. elephantis* walker.

1. *elephantis*; Piaget, 1869, *Tijascher. Ent.*, 12 : 254, pl. figs. 1-14.
 Hosts : *Elephas maximus ceylonicus* (Blainville), [Sri Lanka (Ceylon)], Walker, 1872, in Richter, *Hardwicke's Sci. Gossip*, 1871 : 132, fig. 67, as *Idolocoris elephantis*; *E. maximus* Linne, [Burma], Bhattacharjee, 1939. *Indian J. vet. Sci.*, 9 : 437; also on *E. maximus* Linne, [Pakistan : Lahore], Ansari, 1951. *Indian J Ent.*, 13 (2) : 131, figs. 45 & 46; *Elephas maximus* Linne, [India : Calcutta (ports)], Mukherji & Sen-Sarma, 1955. *Parasitology*, 45 (1 & 2) : 5, 40 figs.; same host, [Burma], Werneck, 1950. *os Malofagos de Mamiferos*, pt. 2 : 199, figs. 306-314.
- (2) *elephantis* (Walker), 1872, (*Idolocoris*). In Reuter, *Hardwicke's Sci. Gossip*, 1871 : 132, fig. 67. = no. 1.

Haematophagus Timmerman, 1950

Haematophagus Timmerman, 1950, *Fauna Islandica*, 2: 1. Type species: *Quadriceps haematopi* (Denny).

For the present treated under *Quadriceps*.

50. *Heleonomus* Ferris, 1916

Heleonomus Ferris, 1916, *Canad. Ent.*, 48 : 305. Type species : *Colpocephalum truncatum* Piaget.

1. *elbeli* Price, 1970. *Ann. Ent. Soc. Amer.*, 63 (4) : 1170, fig. 24.
 Host : *Anthropoides virgo* (Linne), [India : Deccan, Hyderabad, (A.P.)].
2. *laveryi* Price, 1970. *Ann. Ent. Soc. Amer.*, 63 (4) : 1171, figs. 35, 38.
 Host : *Grus antigone*, (Linne) [India : (Rajputana) Rajasthan and general].
3. *macilentus* (Nitzsch), 1866, (*Colpocephalum*). In Giebel's *Z. ges. NatWiss.*, 28 : 394.
 Host : *Grus g. grus* (Linne), [India], (Slide in B. M. Nat. Hist. (*G. nigricollis* Przevalski, [Asia and Tibet], Price, 1970. *Ann. ent. Soc. Amer.*, 63 (4) : 1166, figs. 13-19, 25-27.
- (4). *miandrius* (Kellogg), (*Colpocephalum*). *Wiss Ergebn. Schwed. Zool. Exped. Kilimandjaro*, 3 abt. 15 : 53, pl. 7, fig. 10. = no 5.

5. **semiluctus** (Gervais), 1844, (*Liotheum*). In Walckener, *Hist. nat. Ins.*, 3 : 322, pl. 49, fig. 7.

Host : **Balearica pavoni[c]na** (Linne), [India : Calcutta] Kellogg & Nakayama, 1915. *Rec. Indian Mus.*, 11. (1) : 139, as *Colpocephalum meandrium* Kellogg.

Helluo Clay and Meinertzhagen, 1938 (nec Bonelli, 1809).

Helluo Clay and Meinertzhagen, 1938, *Entomologist*, 71, 2. Type species : *Helluo neophron* Clay and Meinertzhagen.

A junior homonym of *Helluo* Bonelli, 1809 and synonymous with *Aegypocerus* Clay & Meinertzhagen, 1939.

51. **Heterodoxus** Le Souëf & Bullen, 1902.

Heterodoxus Le Souëf & Bullen, 1902, *Vict. Nat.*, 18 : 159. Type species (by monotypy) : *H. macropus* Le Souëf & Bullen.

1. **spiniger** (Enderlein), 1909, (*Menopon*). *Jenais. Denkschr.*, 14 : 80. pl. 8, figs. 4, 5.

Host : **Canis familiaris** Linne, [India], Plomley, 1940. *Pap. & Proc. Roy. Soc. Tasmania*, (1939) : 19, pl. 3, figs. A-J, pl. 4, figs. A, B, D-K, pl. 5, figs. A, C-G, pl. 6, figs. B & C; on the same host. [Burma], Thompson, 1940. *Pap. & Proc. Roy. Soc. Tasmania*, (1939) : 27; also [India ? : Punjab], Ansari, 1951. *Indian J. Ent.*, 13 (2) : 133, fig. 43; [India : Calcutta], Sen & Fletcher 1962. *Vet. Ent. & Acarology for India* : 409, pl. 39, as *H. longitarsus* Piaget; [Nepal : Balaju, Khatmandu], Emerson, 1971. *J. med. Ent.* 8(6) : 622; [Sri Lanka (Ceylon)], Kéler, 1971, *Austr. J. Zool.* (S.S.) Suppl. No. 6. : 64. figs. 17-20, 82, 84, 115E. 116 I, 116K-N, 117-119.

Himantophagus Zlotorzyska, 1967

Himantophagus Zlotorzyska, 1967, *Pol. Pismo Ent.*, 37 (4) : 732.

Type species : *Nirmus hemichrous* Nitzsch.

Retained for the present under *Quadriceps*.

52. **Hohorstiella** Eichler, 1940

Hohorstiella Eichler, 1940, *Zbl. Bakt. (I. Orig.)*, 145 : 362. Type species : *Menopon latum* Piaget.

1. **modestum** (Ansari), 1951, (*Columbimenopon*). *Proc. nat. Inst. Sci. India*, 17 (2) : 131, fig. 1.

Host : **Streptopelia d. decaocta** (Frivaldszky), [Pakistan : Lyallpur].

53. **Holomenopon** Eichler, 1941.

Holomenopon Eichler, 1941. *Stettiner Entomol. ztg.*

102 : 125. Type species : *Menopon albofasciatum* Piaget.

1. **clypeilargum** Eichler, 1943. *Mitt. Münch Entomol. ges.*, 33 : 236
Host : **Anas querquedula** (Linne), [Nepal], Price, 1971. *Ann. Ent. Soc. Amer.*, 64 (3) : 643, figs. 26-29.
2. **leucoxanthum** (Burmeister), 1838, (*Menopon*), *Handb. Ent.*, 2:440.
Host : **Netta rufina** (Pallas), [India : (Rajputana) Rajasthan], Price, 1971. *Ann. Ent. Soc. Amer.*, 64 (3) : 635, figs. 2-13; **Sarkidiornis melanotos** (Pennant), [India], Emerson, 1973. In : *Some ectoparasites of the birds of Asia* : 112.
3. **setigerum** (Blagoveshtchensky), 1948, (*Menopon*). *Mag. Parasit. Inst. Zool. Acad. Sci.*, U.S.S.R., 10 : 260.
Host : **Anas querquedula** Linne, [Nepal], Price, 1971. *Ann. Ent. Soc. Amer.*, 64 (3) : 637, figs. 1, 14, 15.
4. **tadornae** (Gervais), 1844, (*Philoptyerus*). In Walckenaer, *Hist. Nat. Inst.*, 3 : 323.
Host : **Tadorna ferruginea** (Pallas), [India : (Rajputana) Rajasthan], Price, 1971. *Ann. Ent. Soc. Amer.*, 64 (3) : 640, figs. 17, 18.

54. **Ibidoecus** Cummings, 1916

Ibidoecus Cummings, 1916, *Proc. Zool. Soc. Lond.* (B) : 663. Type species : *Philoptyerus plataleae* Denny.

1. **clausus** (Giebel), 1874, (*Docophorus*). *Insecta epizoa* : 107.
Host : **Threskiornis melanocephala** (Latham), [India : several localities], Tandan, 1958. *Trans R. ent. Soc. Lond.*, 110 (14) : 403, figs. 7, 11, 14-16 & 18.
2. **dennelli** Tandan, 1958. *Trans R. ent. Soc. Lond.*, 110 (14) : 395, figs. 1-4, 8, 12, 13 & 17.
Host : **Pseudibis papillosa** (Temminck), [India : Lucknow, U.P. & North].

3. **plataleae** (Denny), 1842, (*Docophorus*). *Mon. Anopl. Brit.* : 46, 100, pl. 4, fig. 9.

Host : **Platalia l. leucordia** Linne, [India : U.P., (Rajputana) Rajasthan], Tandan, 1958. *Trans. R. ent. Soc. Lond.*, 110 (14):496, figs. 5, 9, 22, & 26.

4. **robustus** Qadri, 1935. *Z. Parasitenk.*, 8 : 235, fig. 7.

Host : (Water-bird)=Probably **Threskiornis melanocephala** (Latham), or **Plegadis falcinellus** (Linne), or **Platalea leucordia major** Temminck & Schlegel, (India), Hopkins & Clay, 1952. *Check list of the Genera & Species of Mallophaga*, 176; probably no. 1, Tandan, 1958. *Trans. R. ent. Soc. Lond.*, 110 (4) : 403.

Idolocoris Walker, 1872

Idolocoris Walker, 1872, (nec Douglas & Scott, 1865), *Hardwicke's Sci. Gossip*, (1871) : 131. Type species (by monotypy) : *I. elephantis* Walker.

An absolute synonym of *Haematomyzus*.

55. *Incidifrons* Ewing, 1929

Incidifrons Ewing, 1929. *Man. ext. Parasites* : 111, 189. Type species : *Philopterus pertusus* 'Nitzsch'

1. **fulcae** (Linne), 1758, (*Pediculus*). *Syst. Nat.* ed. 10 : 613. *Nomen novum* for Redi's "Pollino dellafolaga"

Host : **Fulica a. atra** Linne, [Pakistan : Lyallpur], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 267, as *Incidifrons pertusus* (Burmeister); On the same host, [India : (Rajputana) Rajasthan; Pakistan : Sind], Clay & Hopkins, 1950. *Bull. Br. Mus. nat. Hist. (Ent.)*, 1 (3) : 255, figs. 48, 49, 50, & 51; on the same host, [India : Loc. not cited], Ansari, 1956. *Indian J. Ent.* (1955), 17 (3) : 399 & Ansari, 1959. *Indian J. Ent.* (1958), 20 (2) : 100.

pertusus (Burmeister, 1838, (*Docophorus*). *Handb. Ent.*, 2 : 436. =no. 1.

56. *Kelerimenopon* Conci, 1942

Kelerimenopon Conci, 1942, *Ann. Mus. civ. Stor. nat. Genova*, 61 : 262. Type species : *Kelerimenopon sanfilippoi* Conci.

1. **psittaculae** Price & Emerson, 1966. *Pacific Insects*, 8 (2) : 360.

Hosts : **Psittacula krameri manillensis** (Bechstein), [India : Lucknow Zoo] & **P. K. borealis** (Neumann), [India : (Rajputana), Rajasthan].

Kelerinirmus Eichler, 1940

Kelerinirmus Eichler, 1940, *Zool. Anz.*, 130 : 101. Type species : "**Nirmus fuscus** Nitzsch in Denny"

Inseparabile from *Degeeriella*.

Koeniginirmus Eichler, 1940

Koeniginirmus Eichler, 1940, *Zool. Anz.*, 130 : 101. Type species : "**Koeniginirmus punctatus** (Nitzsch in Burmeister, 1838, Jedoch sensu A. Koenig)"

For the time being the genus is considered inseparable from *Quadriceps*.

57. Kurodala Uchida, 1926

Kurodaia Uchida, 1926, *J. Coll. Agric. Tokyo*, 9 (1) : 50. Type species : *Colcephalum haliaeti* Denny.

1. **deignani** Elbel & Emerson, 1960. *Proc. Biol. Soc. Wash.*, 73 : 119, figs. 1, 2, 3, 5 & 7.

Host : **Glaucidium cuculoides** (Vigors), [India : Sikkim].

2. **fulvofasciata** (Piaget), 1880, (*Menopon*). *Pediculines* : 417.

Host : **Buteo buteo** (Linne), [India], Price & Beer, 1963. *Ann. ent. Soc. Amer.*, 56 : 382, figs. 4-6.

3. **longipes** (Giebel), 1874, (*Menopon*). *Insecta epizoa* : 280.

Host : **Bubo bubo bengalensis** (Franklin), [Pakistan], Ansari, 1955. *Proc. 7th. Pak. Sci. Conf. Sec. Agric.* : 54; Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 400 & Ansari, 1957. *Indian J. Ent.*, (1956), 18 (4) : 434.

4. **panjabensis** (Ansari), 1951, (*Cuculiphilus*). *Proc. nat. Inst. Sci. India*. 17 (2) : 160, fig. 14.

Host : **Athene brama indica** (Franklin), [Pakistan : Lyallpur]; also on the same host, [India], Price & Beer, 1963. *Ann. ent. Soc. Amer.*, 56 : 855, figs. 15 & 24.; same host, [India], Emerson, 1973. In : *Some ectoparasites of the birds of Asia* : 112.

5. **subpachygaster** (Piaget), 1880, (*Colpocephalum*). *Pediculines* : 517. pl. 43, fig. 2.

Host : *Tyto alba stertens* Hartert, [Pakistan], Ansari, 1955. *Proc. 7th Pak. Sci. Cong. Sec. Agric.* : 54; Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 400; & Ansari, 1957. *Indian J. Ent.*, (1956), 18 (4) : 434.

58. *Laemobothrion* Nitzsch, 1818

Laemobothrion Nitzsch, 1818, *Germar's Mag. Ent.*, 3 : 301. Type species (by subsequent designation, Johnston & Harrison, 1911 : 327) : *L. maximum* Scopoli (= *L. giganteum* N.).

- (1) *aquab* Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 57 = no. 8.
 - (2) *circi* (Fourcroy), 1785, (*Pediculus*). *Entomologia Parisiensis*, 2 : 518 = no. 6.
 - (3) *giganteum* (Nitzsch), 1818, (*Liotheum*) s. g. *Laemobothrion*). *Germar's Mag. Ent.*, 3 : 301. = no. 6.
 - (4) *hieraaeti* Eichler, 1943. *Mitt. naturW. Ins. Sofia*, 16 : 209, fig. 3. = no. 6.
 - (5) *indicum* Sen, 1942. *Indian J. vet. Res.*, 12 : 169, fig. 1. = no. 6.
6. **maximum** (Scopoli), 1763, (*Pediculus*). *Ent. Carniolica* : 382.

Hosts : (*Baza jerdoni*) = *Aviceda jerdoni* (Blyth), [India : Kurseong], Kellogg & Nakayama, 1915. *Rec. Indian Mus.*, 11 (1) : 140, as *L. titan* Piaget; [India : Shembaganur and Madurai], Kéler, 1937. *Arb. morph. tax. Ent.*, 4(4) : 314, as *L. giganteum* Nitzsch; *Milvus migrans govinda* Sykes, [India], Sen, 1942. *Indian J. vet., Res.*, 12 : 169, fig. 1, as *L. indicum* Sen; *M. migrans govinda* Sykes, [Pakistan : Lyallpur], Ansari, 1951. *Proc. nat. Inst. Sci. India*, 17 (2) : 192, fig. 26, as *L. titan* Piaget; *Circus ae. aerugiosus* (Linne), [India], Clay & Hopkins, 1954. *Bull. Br. Mus. nat. Hist. (Ent.)*, 3 (6) : 258, figs. 57, 60, 62-66, pl. 12 figs. 3-5, as *L. circi* (Fourcroy); (*Circaetus ferox*) = *Circaetus gallicus gallicus* (Gmelin), [Pakistan], Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 57, as *L. siddiqui* Ansari; also on the same host, [Pakistan : Sakrand (Nawabshah)], Ansari, 1956. *Pakistan J. Sci. Res.*, 8 (2) : 61, figs. 15-18 & Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 400 as *L. siddiqui*

Ansari., (*Hieraaeti pennatus*)=**Hieraetus pennatus** (Gmelin), [Pakistan : Shujawal (Tatta Dist.)], Ansari, 1956. *Pakistan J. Sci. Res.*, 8 (2) : 7 & Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 400, as *L. hieraaeti* Eichler; (*Milvus lineatus*)=**Milvus migrans lineatus** (J. E. Gray), [Burma], **Haliastur indus** (Boddaesrt), [India; Sri Lanka (Ceylon)], **Accipiter badius** (Gmelin), **Buteo rufinus** (Cretzschmar), & **B. indicus** (Franklin), [India], Nelson & Price, 1965. *J. Med. Ent.*, 2 (3) : 253, figs. 1, 2, 8, 12, 16, 17 & 13, as *L. maximum* (Scopoli).

(7) *siddiqui* Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 57. =no. 6.

8. **tinnunculi** (Linnaeus), 1759, (*Pediculus*). *Syst. Nat. ed.* 10 : 612.

Hosts: **Falco t. tinnuculus** Linne, [India], Clay & Hopkins, 1950. *Bull. Br. Mus. nat. Hist. (Ent.)*, 1 (3) : 228, figs. 1-5, pl. 1, fig 1; (*Falco jugger*) **Falco biarmicus jugger** J. E. Gray, [Pakistan : Lyallpur], Ansari, 1951. *Proc. nat. Inst. Sci. India*, 17 (2) : 192; (*Falco jugger*) **Falco birmicus jugger** J. E. Gray, [Pakistan], Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 57, as *L. aquab* Ansari; also on the same host, [Pakistan : Mancher Lake (Sind)], Ansari, 1956. *Pakistan J. Sci. Res.* 8 (2) 60, figs. 11-14; also Ansari, 1956. *Indian J. Ent.* (1955), 17 (3) : 400 & Ansari, 1957. *Indian J. Ent.*, (1956), 18 (4) : 437, figs. 63-67, as *L. aquab* Ansari; & (*Falco jugger*)=**Falco biarmicus jugger** J. E. Gray & **F. tinnunculus** Linne, [India], Nelson & Price 1965. *J. med. Ent.*, 2 (3) : 253, figs. 4, 5, 9, 11 & 15, as *L. tinnunculi* (Linne); **F. tinnunculus** Linne, [Nepal], Emerson, 1973. In ; *Some ectoparasites of the birds of Asia* : 104.

(9) *titan* Piaget, 1880. *Pediculines* : 578, pl. 49, fig. 1.=no. 6.

10. **vulturis** (J. C. Fabricius), 1775, (*Pediculus*). *Syst. Entomologiae Flenshurgi et Lipsiae* : 806.

Host : (*Pseudogyps bengalensis*)=**Gyps bengalensis** (Gmelin), [India : Deccan], Clay & Hopkins, 1951. *Bull. Br. Mus. nat. Hist. (Ent.)*, 2 (1) : 33, fig. 45, pl. 3 figs. 4-6; **Aquila heliaca** Savigny, [India], **A. clanga** Pallas [Afghanistan], **A. pomarina** C. L Brehm, **Haliaeetus**

leucoryphus (Pallas), (*Sarcogyps calvus*)=**Torgas calvus** (Scopoli), **Gyps fulvus** (Hablizl), **G. himalayensis** Hume, [India], **G. indicus** (Scopoli), (*Pseudogyps bengalensis*)=**Gyps bengalensis** (Gmelin), & **Gypaetus barbatus** (Linne), [India], Nelson & Price, 1955. *J. Med. Ent.* 2 (3) : 235, figs. 6, 7, 13, 19 & 22.

59. **Lagopoecus** Waterston, 1922

Lagopoecus Waterston, 1922, *Ent. mon. Mag.*, 58 : 159. Type species : *Nirmus cameratus* "Lyonet"

1. **heterotypus** (Mégnin), 1880, (*Nirmus*). *Parasites et Maladies parasit.* : 87.

Host : **Lophophorus impejanus** (Latham), [India : Calcutta], Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 (4) : 219, pl. 15, fig. 5, as *Goniocotes nirmoides* Kellogg & Paine; **L. impejanus** (Latham), [India : Sikkim; Nepal], **L. sclateri** Jerdon [China : Yunnan; Tibet], Clay, 1938. *Proc. Zool. Soc. Lond.* (B) 108 : 192, fig. 43c, pl. 14, fig. 4.

2. **meinertzhageni** Clay, 1938. *Proc. Zool. Soc. Lond.* (B) 108 : 192, figs. 44b, c, 45, pl. 14, fig. 3.

Host : **Lerwa lerwa** (Hodgson), [India : Sikkim].

- (3) **nirmoides** (Kellogg & Paine), 1914, (*Goniocotes*). *Rec. Indian Mus.* 10 (4) : 219, pl. 15, fig. 5. = no. 1.

Liotheum Nitzsch, 1818

Liotheum, Nitzsch, 1818, *Germar's Mag. Ent.*, 3 : 420. Type species : sub *judice*.

Undecided generic name

atrum Nitzsch, 1818. See *Eulaemobothrion*.

cucullare Nitzsch, 1818. See *Myrsidea*.

decimfasciatus Boisduval & Lacordaire, 1835. See *Ciconiphilus*.

flavescens Haan, 1829. See *Colpocephalum*.

gigantieum Nitzsch, 1818. See *Laemobothrion*.

mesoleucum Nitzsch, 1818. See *Myrsidea*.

ochraceum Nitzsch, 1818. See *Actornithophilus*.

pallidum Nitzsch, 1818. See *Menopon*.

semiluctus Gervais, 1844. See *Heleonomus*.

stramineum Nitzsch, 1818. See *Menacanthus*.

60. *Lipeurus* Nitzsch, 1818

Lipeurus Nitzsch, 1818, *Germer's Mag. Ent.*, 3 : 292. Type species : (by subsequent designation, Johnston & Harrison, 1911. *Proc. Linn. Soc. N.S.W.*, 36 : 326) : *Pediculus caponis* Linne. (vide, 1955. *Bull. Zool. Nomencl.*, 10 (9) : 273)

alchatae Rudow, 1869, See *Syrrhaptaecus*.

angustissimus Giebel, 1866. See *Turnicola*.

antilogus Nitzsch, 1866. See *Otidoecus*.

appendiculatus Piaget, 1880. See *Oxylipeurus*.

baculus (Nitzsch) 1818, (*Philopterus* s.g. *Lipeurus*). See *Columbicola*.

1. *boonsongi* Emerson & Elbel, 1957. *Proc. Ent. Soc. Wash.*, 59 : 237.

Host : *Francolinus pintadeanus* (Scopoli), [Burma].

burmeisteri Taschenberg, 1882. See *Oxylipeurus* & *Reticulipurus*.

2. *caponis* (Linne), 1758, (*Pediculus*). *Syst. Nat.* ed. 10 : 614.

Hosts : (*Geunaeus melanotus*)=*Lophura leucomelana melanota* (Hutton), [India : Darjeeling], (*G. swinhoii*)=*Hierophasis swinhoii* (Gould) ? [India : ? no history], *Argusianus argus* (Linne), [India ? : no history], (*Pavo nigripennis*)=*Pavo cristatus* [*nigripennis* Sclater], [India : no history] & *Gallus gallus* [*domesticus*] Linne, [India : Calcutta], Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 (4) : 221 (Kellogg & Paine's (*Loc. cit.*) record on (*Phasianus torquatus*) please refer to *L. maculosus* Clay; *Gallus g. gallus* (Linne), [Burma], *G. g. murghi* Robinson & Kloss, [India : Sikkim], *G. lafayettii* Lesson, [Sri Lanka (Ceylon)], & *G. soneratti* Temminck, [India : Nilgiris], Clay, 1938. *Proc. Zool. Soc. Lond.* (B), 108 : 111, figs. 1, 2a, b, 3a; *Gallus gallus* [*domesticus*] & others cited above [Burma; India; & Sri Lanka (Ceylon)], Overgaard, 1943. *Ent. Medd.*, 23 : 8, *G. gallus* [*domesticus*] Linne, [India : Punjab] Ansari, 1943. *Indian J. Ent.*, 5 (1 & 2) : 132, as *L. variabilis* Burmeister : *G. gallus* [*domesticus*] (Linne), [India : Loc. not cited], & *Francolinus f. asiae* Bonaparte, [Pakistan : Lyallpur], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 293; (domestic chicken), [Southeast Asia], Emerson, 1956. *J. Kansas ent. Soc.*, 29 (2) : 69, pls. 1-3. (One slide containing specimens from *G. gallus domesticus* (Linne), from India (Basti : U.P.) Coll. A. W. Hamid & one slide

containing specimens from the same host, Z. L., Aligarh Muslim University, Coll. M.A.H. Qadri are available in Z.S.I. colls.).

oastaneus Piaget, 1885 p. 62 (nec. p. 73). See *Ardeicola*.

cinereus Nitzsch, 1866. See *Cuclostogaster*.

coloratus Piaget, 1880. See *Anaticola*.

3. *crinitus* (Rudow), 1869, (*Nirmus*). *Beitr. Kenntn. Mallophaga* : 19.

Host : *Clerysolophus amhersliae* (Leadbeater), [Tibet], Clay, 1940. *Proc. Zool. Soc. Lond. (B)* 108 : 119, pl. 1 fig. 5a; fig. 7a.

dentatus Sugimoto, 1934. See *Oxylipeurus*.

denticlypeatus Sugimoto, 1935. See *Oxylipeurus*.

4. *eurycnemus* Taschenberg, 1882. *Nova Acta Leop.-Carol.*, 44 : 171, pl. 6 fig. 5.

Host : *Lophophorus impejanus* (Latham), [India], (Slide available in B. M. Nat. Hist.).

exilicorins Piaget, 1880. See *Columbicola*.

frater Giebel, 1874 p. 210 (nec. p. 242). See *Falcolipeurus*.

fuligulae T. Müller, 1927. See *Anaticola*.

heterographus Nitzsch, 1866. See *Cuclostogaster*.

himalayensis Rudow, 1869. See *Oxylipeurus* & *Reticulipeurus*.

hyalinus Neumann, 1911. See *Perineus*.

intermedius Piaget, 1880. See *Reticulipeurus*.

5. *introducatus* Kellogg, 1896. *Proc. Calif. Acad. Sci. (2)* 6 : 500, pl. 68 figs. 1 & 5.

Hosts : (*Gennaeus n. oatesi* = *Lophura nycthemerus oatesi*) *Lophura leucomelana oatesi* (Ogilvie-Grant), [Burma], (*G. n. leucomelanos*) = *Lophura leucomelana* Latham [Nepal], (*G. n. hamiltonii*) = *Lophura leucomelana hamiltonii* (J. E. Gray), [India : Central Himalaya], (*G. n. horsfieldii*) = *Lophura leucomelana lathamii* (J. E. Gray), [India : Assam], Clay, 1938. *Proc. Zool. Soc. Lond. (B)*, 108 : 118, figs. 3b, 5d, 6c, pl. 1 fig. 6 as *L. subsellatus* Harrison.

(6) *keleri* Clay, 1938. *Proc. Zool. Soc. Lond.*, (B), 108 : 122, figs. 3d, 4c, 5f, pl. 2 fig. 2.

Host : *Crossoptilon c. crossoptilon* (Hodgson), [China : Szechwan].

7. **lawrensis*** Bedford, 1929. *Rep. vet. Res. S. Afr.*, 15: 521, figs. 22-24

Host : **Gallus gallus [domesticus]** (Linne), [India ? : Punjab], Ansari, 1943. *Indian J. Ent.*, 5 (1 & 2) : 132, figs. 2, 3, as *L. tropicalis* Peters; (Black minorca), [India], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 293, as *L. tropicalis* Peters; (Domestic chicken), [India], Emerson, 1956. *J. Kansas ent. Soc.*, 29 (2) : 73, pl. 6 figs. 1-3, as *L. lawrensis tropicalis* Peters. (Two slides labelled as *L. tropicalis* Peters from Fowl, India (Hyderabad : Andhra Pradesh), Coll. Dr. K. V. Gurumurthy) are available in Z. S. I.).

lepidus Nitzsch, 1866. See *Ardeicola*.

8. **lewisi** Elbel and Price, 1970. *J. Kans. ent. Soc.*, 43 (2) : 238, figs. 1-4.

Host : **Caloperdix o. oculate** (Temminck), [Burma].

longus Piaget, 1880. See *Oxylipaeus* & *Reticulipaeus*.

luridus (Nitzsch), 1818 (*Philoptyrus* s. g. *Lipeurus*). See *Fulicoffua*.

9. **maculosus** Clay, 1938. *Proc. Zool. Soc. Lond.*, (B), 108:116, figs. 5a, 6a, pl. 1 fig. 2.

Host : (*Phasianus torquatus*)=**Phasianus colchicus torquatus** Gmelin, [India : Captive birds, Calcutta], Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 (4) : 221 labelled as *Lipeurus caponis* is available in Z. S. I., but the specimens are identical with **L. maculosus** Clay.... Lakshminarayana, 1970, *Ph. D. Thesis, systematic studies on Mallophaga on birds & mammals*, Agra, university, Agra : 261 pl. ? figs. 1-2; pl. 16 figs. 2-3.

megalops Piaget, 1880. See *Reticulipaeus*.

mesopelios Nitzsch, 1806. See *Reticulipaeus*.

mississippiensis McGregor, 1917. See *Picicola*.

orthopleurus Nitzsch, 1874. See *Pachyskelotes*.

10. **pavo** Clay, 1938. *Proc. Zool. Soc. Lond.*, (B), 108 : 125, figs. 2c, 4d, 7d, 10a, pl. 4 fig. 1.

Host : **Pavo cristatus** Linne, [India : Delhi, Nepal]; on the same host, [India : Hoshiarpur, (Attari) Atari], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 292. (One slide containing specimen from the same host from India (Goalpara : Assam), Coll. B. K. Tikader

*. Recently transferred to *Numidilipeurus Tendeir*

is available in Z. S. I. (*Vide*. Lakshminarayana, 1970. Ph. D. Thesis; *Systematic studies on Mallophaga on birds & mammals*, Agra university, Agra : 264.

quadripustulatus Burmeister, 1838 (*nec*. Piaget, 1838). See *Falcolipeurus*.

secretarius Giebel, 1874. See *Falcolipeurus*.

(11) *sellatus* (Rudow), 1870, (*Nirmus nec N. sellatus* Burmeister, 1838). Z. ges. NatWiss., 35 : 470=no. 13 & 5.

12. *songprakobi* Elbel and Price, 1970. J. Kans. ent. Soc., 43 (2) : 241. figs. 7-10.

Host : *Caloperdix o. oculate* (Temminck), [Burma].

sordidus Giebel, 1866. See *Anaticola*.

squalidus (Nitzsch), 1818. (*Philopterus s. g. Lipeurus*). See *Anaticola*.

stenopygos Giebel, 1861. See *Acidoproctus*.

13. *subsellatus* (Harrison), 1916, (*Degeeriella*) *Parasitology*, 9 : 124. *Nomen novum* for *Nirmus sellatus* Rudow (*nec*. Burmeister, 1838)=no. 5.

sulae Rudow, 1869. See *Pectinopygus*.

suturalis Rudow, 1869. See *Falcolipeurus*.

14. *tropicalis* Peters, 1931. *Ent. News*, 42 : 195, figs. 1 & 2=no. 7. *unicolor* Piaget, 1880. See *Oxylipeurus*.

(15) *variabilis* Burmeister, 1838. *Handb. Ent.*, 2 : 434.=no. 2. *zonatus* Piaget, 1881. See *Buceronirmus*.

61. *Lunaceps* Clay & Meinertzhagen, 1939

Lunaceps Clay & Meinertzhagen, 1939, *Ann. Mag. nat. Hist.* (11) 4 : 450.

Type species : *Degeeriella actophila* (Kellogg & Chapman).

1. *actophila* (Kellogg & Chapman), 1899, (*Nirmus*). *Occ. Pap. Calif. Acad. Sci.*, 6 : 78, pl. 6 fig. 4.

Host : (*Erolia m. minuta*)=*Calidris minutus* (Leisler), [Pakistan : Lyallpur], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13(6) : 280. (May be identical with no. 3).

2. *falcinellus* Timmermann, 1954. *Ann. Mag. nat. Hist.* (12) 7 : 627.

Host : *Limicola falcinellus* (Pontoppidan), [India; Pakistan : Karachi].

3. **holophaeus** (Burmeister), 1838, (*Nirmus*). *Handb. Ent.*, 2 : 427.

Host : **Philomachus pugnax** (Linne), [Pakistan : Lyallpur], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 279, as *Quadriceps holophaea* (Nitzsch); also in Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 398 & Ansari, 1959. *Indian J. Ent.*, (1958), 20 (2) : 98; also on the same host. [India], Emerson, 1973. In : *Some ectoparasites of the birds of Asia* : 91.

4. **husainii** Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 49.

Host : (*Erolia m. minuta*)=**Calidris minutus** (Leisler), [Pakistan], also Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 398 & Ansari, 1959. *Indian J. Ent.* (1958), 20 (2) : 98, figs. 213-220.

5. **limosella** Timmermann, 1954. *Ann. Mag. nat. Hist.*, (12) 7 : 629.

Host **Limosa lapponica** (Linne), [India], Emerson, 1973. In : *Some ectoparasites of the birds of Asia* : 92.

62. *Maculinirmus* Ztotorzycka, 1964.

Maculinirmus Ztotorzycka, 1964, *Acta Parasitol. Polonica*, 12 (24) : 247.

Type species : *Nirmus mundus* Nitzsch.

1. **mundus** (Nitzsch), 1866, (*Nirmus*). *z. ges. NatWiss.*, 28 : 266.

Host : **Oriolus o. kundoo** Sykes & **Saxicola torquata indica** (Blyth) [Pakistan : Lyallpur], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 289, as *Brueelia* (= *Degeeriella*) *munda* (Nitzsch).

Margaritenes Kéler, 1939

Margaritenes Kéler, 1939, *Nova Acta Leop.-Carol.* (n.f.) 8 : 132.

Type species : *Goniodes eurygaster* Piaget.

Inseparable from *Goniodes*.

Megalipeurus Kéler, 1958

Megalipeurus Kéler, 1958, *Deutsche Ent. Zeitschr.*, (n. F.) 5 : 327.

Type species : *Lipeurus unicolor* Piaget.

A subgenus of *Reticuliperus* Kéler.

63. *Menacanthus* Neumann, 1912

Menacanthus Neumann, 1912, *Arch. Parasit., Paris*, 15 : 353. Type species : *Menopon robustum* Kellogg.

Neumannia Uchida, 1926, (nec. Trouessart, 1888). *J. Coll. Agric. Tokyo*, 9 : 27.
Type species : *Neumannia okadai* Uchida.

Eomenacanthus Uchida, 1926, *J. Coll. Agric. Tokyo*, 9 : 30. Type species : *Eomenacanthus biseriatus* (Piaget).

Uchida Ewing, 1930, *Proc. biol. Soc. Wash.*, 43 : 125, *nomen novum* for *Neumannia* Uchida.

1. **abdominalis** (Piaget), 1880 (*Menopon*). *Pediculines* : 473, pl. 36 fig. 9.
Host : *Coturnix c. coturnix* (Linne), [Pakistan : Lyallpur], Ansari, 1951. *Proc. nat. Inst. Sci. India*, 17 (2) : 135, fig. 3; as *Uchida abdominalis indicus* Ansari.
2. **annulatus** (Giebel), 1874, (*Menopon*). *Insecta epizoa* : 285.
Host : *Passer [d]. indicus* Jardine et Selby, [India : Punjab], Ansari, 1956. *Indian J. Ent.* (1955), 17(3) : 400., & Ansari, 1957. *Indian J. Ent.* (1956), 18 (4) : 434.
3. **camellinus** (Nitzsch), 1874, (*Menopon*). *Insecta epizoa* : 288, pl. 15 fig. 3.
Host : *Lanius excubitor lahtora* (Sykes), [Pakistan : Lyallpur], Ansari, 1951. *Proc. nat. Inst. Sci. India*, 17 (2) : 143, fig. 7, as *M. dudiyalatora* Ansari. (of. Zlotorzycka, 1965. *Acta Parasitologica Polonica*, 13 (6) : 46.
- (4). **dudiyalatora** Ansari, 1951. *Proc. nat. Inst. Sci. India*, 17 (2) : 143, figs. 7. = no. 3.
5. **gonophaeus** (Burmeister), 1838, (*Menopon*). *Handb. Ent.*, 2 : 440.
Host : *Corvus corax*, (corax) Linne, [India : Calcutta; Nepal], Kellogg & Nakayama, 1915. *Rec. Indian Mus.* 11 (1) : 139, as *Menopon gonophaeum* Nitzsch; (*C. corax laurancei*) *Corvus corax subcorax* Severtzov & (*C. frugilegus tschusii*) *Corvus f. frugilegus* Linne, [India : Punjab], Ansari, 1951. *Proc. Inst. Sci. India*, 17 (2) : 139.
6. **gulabimaina** Ansari, 1951. *Proc. nat. Inst. Sci. India*, 17 (2) : 139.
Host : (*Pastor roseus*) = *Sturnus roseus* (Linne), [Pakistan : Lyallpur]. (probably *M. mutabilis* Blagoveshtchensky, 1940. of Zlotorzycka, 1965. *Acta Parasitologica Polonica*, 13 (6) : 48.
7. **guldum** Ansari, 1951. *Proc. nat. Inst. Sci. India*, 17 (2) : 140, fig. 5.

- Host: (*Molpastes cafer intermedius*)=**Pycnonotus cafer intermedius** Blyth, [Pakistan : Lyallpur]. Probably *Camelinus*.
8. **himalayicus** Ansari, 1951. *Proc. nat. Inst. Sci. India*, 17 (2) : 148, fig. 9.
Host: (*Sturnus vulgaris humii*) = **Sturnus vulgaris indicus** Blyth, [Pakistan : Lyallpur] = Probably *M. mutabilis* Blagoveshtchensky, 1940. (of. Hopkins & Clay, 1953. *Ann. Mag. nat. Hist.*, (12) 6 : 439 and Zlotorzyska, 1965. *Acta Parasitol. Polon.* 13 (6) : 50, fig. lg. 3a).
9. **kalatitar** (Ansari), 1951, (*Uchida*). *Proc. nat. Inst. Sci. India*, 17 (2) : 137, fig. 4.
Host: **Francolinus f. asiae** Bonaparte, [Pakistan: Lyallpur].
10. **laticeps** Blagoveshtchensky, 1948. *Mag. Parasit. Leningr.*, 10 : 264, fig. 5 & 5a.
Host: **Corvus [f.] frugilegus** Linne, [Pakistan], Ansari, 1955. *Proc. 7th. Pak. Sci. Conf. Agric.*, : 54; also Ansari, 1956. *Indian J. Ent.* (1955), 17 (3) : 400, & Ansari, 1957. *Indian J. Ent.* (1956), 18 (4) : 433.
11. **mamola** Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Agric.*: 53.
Host: **Enicurus maculatus maculatus** Vigors, [Pakistan]; also Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 400 & Ansari 1957. *Indian J. Ent.*, (1956), 18 (4): 433, figs. 35-41.
12. **masudi** Qadri, 1935. *Z. Parasitenk.*, 8 : 226, fig. 2.
Host: **Corvus [s.] splendens** Vieillot, [India]; on the same host, [Pakistan: Lyallpur], Ansari, 1951. *Proc. nat. Inst. Sci. India*, 17 (2) : 139.
13. **monochromateus** (Kellogg & Paine), 1914, (*Menopon*). *Rec. Indian Mus.*, 10 (4) : 240, fig. 5.
Host: (*Garrulus glandarius lanceolatus*) **Garrulus lanceolatus** Vigors, [India : Simla].
14. **mutabilis** Blagoveshtchensky, 1940. *Mag. Parasit. Leningr.*, 8 : 31, 78, fig. 5. Probably no. 5 & no. 8 may be conspecific with this species. (of. Zlotorzyska, 1965. *Acta Parasitol. Polon.* 13 (6) : 50, fig. lg. & 3a.

15. **pallidulus** (Neumann), 1912, (*Menopon*). *Arch. Parasit.*, 15 : 361, figs. 7-9.
Host: Wild chicken [Southeast Asia], Emerson, 1956. *J. Kansas ent. Soc.*, 29 (2) : 77, pl. 8 figs. 1-3.
quadrifasciatum Piaget, 1880. See *Myrsidea*.
16. **safedgal** Ansari, 1951. *Proc. nat. Inst. Sci. India*. 17 (2) : 141, fig. 6.
Host: (*Molpastes l. leucogenys*) = *Pycnonotus l. leucogenys* (Gray), [India : Kulu].
17. **spiniferus** (Piaget), 1885, (*Menopon*). *Pediculines supplement* : 99, pl. 10 fig. 9.
Host: *Acridotheres t. tristis* [Linne], [Pakistan : Lyallpur], Ansari, 1951. *Proc. nat. Inst. Sci. India*, 17 (2) : 150.
spinigerus (Neumann), 1912, (*Menopon s. g. Menacanthus*). See *Heterodoxus*.
18. **stramineus** (Nitzsch), 1818, (*Liotheum s. g. Menopon*). *Germar's Mag. Ent.*, 3 : 300. *Nomen novum* for *Pediculus meleagridis* Panzer, 1793 (*nec. Linne*, 1758).
Host: *Gallus [gallus] domesticus* (Linne), [India : Punjab], Ansari, 1943. *Indian J. Ent.*, 5 (1 & 2) : 131, fig. 1; on the same host, [India : Amritsar, Dhariwal, Pathankot & Bijnor; Atari; Pakistan : Lahore & Lyallpur], Ansari, 1951. *Proc. nat. Inst. Sci. India*, 17 (2) : 139. One slide on domestic fowl, [India : Calcutta], Coll. Mrs. J. Chakraborty is available in Z. S. I.
19. **tristis** Qadri, 1935. *Z. Parasitenk.*, 8 : 226, fig. 1.
Host: *Acridotheres t. tristis* (Linne), [India]; on the same host Ansari, 1955. *Proc. 7th Pak Sci. Conf. Agric.*, : 54, [India? : Punjab], Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 400 & Ansari, 1957. *Indian J. Ent.*, (1956), 18 (4) : 433.
20. **unicolor** (Piaget), 1880, (*Menopon*). *Pediculines* : 471, pl. 38 fig. 5.
Host: (*Phasianus torquata*) = *Phasianus colchicus torquatus* Gmelin, [India : Captive bird], Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 (4) : 232, as *Menopon unicolor* Piaget.

64. Menopon Nitzsch, 1818

Menopon Nitzsch, 1818, *Germer's Mag. Ent.*, 3 : 299. Type species: subsequent designation (Johnston & Harrison, 1911. *Proc. Linn. Soc. N.S.W.*, 36 : 327): "*M. gallinae* Linne, (Syn. *M. trigonocephalum* Olfers & *M. pallidum* N.)".

abdominale Piaget, 1880. See *Menacanthus*.
 acutovulvatum Piaget, 1881. See *Chapinia*.
 anaspilum Nitzsch, 1866. See *Myrsidea*.
 annulatum Giebel, 1874. See *Menacanthus*.
 breviceps Giebel, 1874. See *Cuculiphilus*.
 brunneum Nitzsch, 1861. See *Menacanthus*.
 camelinus Nitzsch, 1861. See *Menacanthus*.
 cathartaepapae Nitzsch, 1861. See *Cuculiphilus*.
 concretum Piaget, 1880. See *Pseudomenopon*.
 crocatum Nitzsch, 1866. See *Austromenopon*.
 cucullare Nitzsch, 1818. (*Liotheum* s. g. *Menopon*). See *Myrsidea*.
 cursorius Giebel, 1874. See *Austromenopon*.
 cyrtostigma Kellogg & Chapman, 1902. See *Myrsidea*.
 femorale Piaget, 1880. See *Eucolpocephalum*.
 fulvofasciatum Piaget, 1880. See *Kurodia*.

1. ***gallinae* (Linne), 1758, (*Pediculus*). *Syst. Nat. ed.* 10 : 613.**

Hosts: ***Gallus gallus*** [domesticus] (Linne), [India : Calcutta], Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 (4) : 232, as *Menopon pallidum*; on the same host, [India? : Punjab], Ansari, 1943. *Indian J. Ent.*, 5 (1 & 2) : 130 & Ansari, 1951. *Proc. nat. Inst. Sci. India*, 17 (2) : 166; ***Gallus gallus murghi*** Robinson & Kloss, [India : Sikkim; Nepal], ***G. gallus gallus*** (Linne), [Burma], ***G. lafayetti*** Lesson, [Sri Lanka (Ceylon)] & ***G. sonneratti*** Temminck, [India], Emerson, 1954, *Ann. Mag. nat. Hist.*, (12) 7 : 225, fig. 8; (Wildchickens), [Southeast Asia], Emerson, 1956. *J. Kans. ent. Soc.*, 29 (2) : 77, pl. 10 figs. 1-3. ***Caloperdix o. oculate*** (Temminck), [probably from Burma], Price and Elbel, 1969. *J. Kansas ent. Soc.*, 42 (3) : 338.

gonophaeum Burmeister, 1838. See *Menacanthus*.
 icterum Burmeister, 1838. See *Austromenopon*.
 insolitus Kellogg & Paine, 1914. See *Myrsidea*.

2. ***interpositus* Ansari, 1951. *Proc. nat. Inst. Sci. India*, 17 (2) : 167, fig. 16.**

Host: *Francolinus pondicerianus interpositus* Hartert, [Pakistan : Lyallpur]; also Emerson, 1954. *Ann. Mag. nat. Hist.* (12) 7 : 227, fig. 9.

isostomum Nitzsch, 1866. See *Myrsidea*.

3. *Jellisoni* Emerson, 1954. *Ann. Mag. nat. Hist.*, (12) 7 : 230, fig. 10.

Host: *Galloperdix bicalcarata* (J. R. Forster), [Sri Lanka (Ceylon)].

leucoxanthum Burmeister, 1838. See *Holomenopon*.

longipes Giebel, 1874. See *Kurodaia*.

mesoleucum (Nitzsch), 1818. (*Liotheum* s. g. *Menopon*). See *Myrsidea*.

monochromateum Kellogg & Paine, 1914. See *Menacanthus*.

nigrum Kellogg & Paine, 1912. See *Myrsidea*.

pallidulum Neumann, 1912. See *Menacanthus*.

(4) *pallidum* (Nitzsch), 1818. (*Liotheum* s. g. *Menopon*). *Nomen novum* for 'Pulex capi Redi' and 'Pediculus gallinae Panzer'.=no. 1.

phaeostomum Nitzsch, 1866. See *Amyrsidea*.

5. *productum* Piaget, 1880. *Pediculines* : 461.

Hosts: (*Acomus erythrophthalmus*)=*Houppifer erythrophthalmus* (Raffles), ♀ 5167/16. Error. *Philopterus* sp).

(*A. pyronotus*) *H. pyronotus* G. R. Gray, *Lophura diardi* Bonaparte, [India : no history], (*Phasianus ellioti*) *Syrmaticus* (*Calophasis*) *ellioti* (Swinhoe), *Lophura ignita* (Shaw), [India: Calcutta], *Gallus sonnerati* Temminck, [India : Bangalore]. Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 (4) : 231.

quadrifasciatum Piaget, 1880. See *Myrsidea*.

setigerum Blagoveshtchensky, 1948. *Holomenopon*.

snodgrassi Kellogg & Kuwana, 1902. See *Cuculiphilus*.

spiniferum Piaget, 1885. See *Menacanthus*.

spiniger Enderlein, 1909. See *Heterodoxus*.

6. *spinulosum* Giebel, 1874. *Insecta epizoa* : 293.

Host: *Polyplectron bicalcaratum bicalcaratum* (Linne), [Burma], Emerson, 1954. *Ann. Mag. nat. Hist.*, (12) 7 : 227, figs. 1. 2.

stramineus Nitzsch, 1818. See *Menacanthus*.

subaequale Piaget, 1880. See *Amyrsidea*.

subrotundatus Piaget, 1880. See *Eidmanniella*.

substitutum Harrison, 1916. See *Amyrsidea*.

temporalis Piaget, 1885. See *Ciconiphilus*.

thoracicum Giebel, 1874. See *Myrsidea*.
 titan Piaget, 1880. See *Piagetiella*.
 trithorax Piaget, 1885. See *Myrsidea*.
 unicolor Piaget, 1880. See *Menacanthus*.
 ventrale Nitzsch, 1866. See *Amyrsidea*.

65. Meromenopon Clay & Meinertzhagen, 1941

Meromenopon Clay & Meinertzhagen, April, 1941, *Ann. Mag. nat. Hist.*, (11) 7 : 333, Type species : *Meromenopon meropis* Clay & Meinertzhagen.

1. **meropis** Clay & Meinertzhagen, April, 1941. *Ann. Mag. nat. Hist.*, (11) 7 : 336, figs. 3, 4.

Host: *Merops apiaster* Linne, [Afghanistan].

66. Meropoecus Eichler, 1940.

Meropoecus Eichler, 1940, *Zool. Anz.*, 130 : 102. Type species : *Docophorus meropis* Denny.

1. **caprai** Conci, 1941. *Boll. Soc. ent. Ital.*, 73 : 102. pl. 1 figs. 6, 7.

Host: (*Merops viridis*)=*Merops o. orientalis* Latham

[India : Isola Elephanta (Bombay)].

2. **meropis** (Denny), 1842 (*Docophorus*). *Mon. Anopl. Brit.*, 46 : 101, pl. 4 fig. 4.

Host: *Merops apiaster* Linne, [Afghanistan], (Slide in B. M. (Nat. Hist.).

3. **smithi** Emerson, 1956. *Ent. News.* 67 : 118, pl. 1 figs. 1, 2, & 3.

Host: *Merops l. leschenaulti* Vieillot, [Burma : Arakan].

Mjöberginirmus Eichler, 1944

Mjöberginirmus Eichler, 1944, *Stettin. ent. ztg.*, 105 : 85. Type species : *Nirmus obliquus* Mjöberg.

The genus is retained for the time being under *Quadriceps*.

67. Mulcticola Clay & Meinertzhagen, 1938

Mulcticola Clay & Meinertzhagen, 1938, *Entomologist*, 71 : Type species : *Esthiopterum hypoleucum* (Denny).

1. **deignani** Emerson and Elbel, 1957. *Canad. Ent.*, 89 (9) : 420, figs. 1-3, 10.

Host: *Caprimulgus macrurus albonotatus* Tickell, (Nepal)

(2) *indicus* Tendeiro, 1962. *Bol. Cult. Guine. Portug.*, (66) 17: 371=no.4.

3. *minutus* Emerson & Elbel, 1957. *Canad. Ent.*, 89 (9) : 422. fig. 5, 7.

Host: *Caprimulgus a. asiaticus* (Latham), [India: (Deccan), Andhra Pradesh].

4. *orientalis* Tendeiro, 1962. *Bol. Cult. Guine Portug*, (66) 17: 346,, 367, 370-371, 372, fig. 6; photos 21-22.

Host: (*Caprimulgus m. monticolus*) = *Caprimulgus affinis monticolus* Franklin, [India: (Deccan) Andhra Pradesh] as *Mulcticola indicus* Tendeiro.

68. *Myrsidea* Waterston, 1915

Myrsidea Waterston, 1915, *Ent. mon. Mag.*, 51 : 12. Type species : *M. victrix* Waterston.

For fuller synonymy attention is invited to Hopkins & Clay, 1952. *A. Check List of the Genera & Species of Mallophaga* : 227; Hopkins & Clay, 1952. Additions and corrections to the Check list of Mallophaga, Pt. I.-*Ann. Mag. nat. Hist.*, (12) 6 : 434-448; Hopkins & Clay, 1955. Additions and corrections to the Check list of Mallophaga, Pt. II -*Ann. Mag. nat. Hist.*, (12) 8 : 177-190; Zlotorzyska 1964. Mallophaga parasitizing Passeriformes and Pici.-*Acta parasit. Pol.*, 12 : 165-192; Clay, 1966. Contributions towards a revision of *Myrsidea* Waterston (Menoponidae: Mallophaga) I. *Bull. Br. Mus. nat. Hist. (Ent.)*, 17 (8) : 329-395.

1. *amandava* Clay, 1970. *H. D. Srivastava Commem. vol.*; 565, fig. 5.

Host: (*Amandava* [*amandava*=*Estrilda amandava* (Linne)], [India : Hyderabad, A. P.].

2. *anaspila* (Nitzsch), 1866, (*Menopon*). *Z. ges. NatWiss.*, 27 : 119.

Host: (*Corvus corax laurencei*)=*Corvus corax subcorax* Severtzov, [Pakistan], Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Agric.*; 52; also Ansari, 1956. *Indian J. Ent.*, (1955) 17(3) : 399, & Ansari, 1957. *Indian J. Ent.*, (1956), 18 (4) : 432.

3. *assamensis* Tandan, 1972. *Bull. Br. Mus. nat. Hist. (Ent.)*, 27 (7): 390, pl. 1 fig. 57; pl. 2 fig. 63; text-figs. 5, 24, & 44.

Host: *Garrulax l. leucolophus* (Hardwicke), [India : Dehra Dun].

4. *bakttitar* (Ansari) 1951, (*Neomenopon*). *Proc. nat. Inst. Sci. India*, 17(2) : 169, fig. 17.

- Host: (*Pterocles exustus erlangeri* (Neumann)), [Pakistan : Lyallpur]. (Error. Probably *Corvus corvus splendens* Vieillot. Clay, 1965. *Proc. R. ent. Soc. Lond.*, (B), 34(9-10) : 122).
5. **bharat** Tandan & Clay, 1971. *Trans. R. ent. Soc. Lond.*, 123 (2): 216, figs. 3, 14, & 34.
Host: **Turdoides malcolmi** (Sykes), [India : Bharatpur, (Rajputana) Rajasthan, & Deccan, Hyderabad (A. P.)]
6. **bhutanensis** Tandan, 1972. *Bull. Br. Mus. nat. Hist. (Ent.)*, 27(7): 385, pl. 2 fig. 62; figs. 18, 22, & 46.
Host: **Garrulax ruficollis** (Jardine et Selby), [Bhutan] Somchi; India: Kangpokpi, Manipur].
7. **birmensis** Klockenhoff, 1969. *Zool. Anz.*, 183 (5/6): 397, figs. 12-14.
Host: **Corvus macrorhynchos levaillanti** Lesson, [Burma : Myitkyina].
8. **brunnea** (Nitzsch), 1866, (*Menopon*). *Z. ges. Natwiss.*, 28 : 120.
Host: **Nucifraga caryocatactes hemispila** Vigors, [India : Kulu (Kangra Valley); Pakistan : Lyallpur], Ansari, 1951. *Proc. nat. Inst. Sci. India* 17 (2) : 176; also Ansari, 1956. *Indian J. Ent.*, (1955) 17 (3) : 400. & Ansari, 1957. *Indian J. Ent.*, (1956), 18 (4) : 432.
9. **chilchil** Ansari, 1951. *Proc. nat. Inst. Sci. India*, 17 (2): 181, fig. 21.
Host: (*Argya c. caudata*) **Turdoides c. caudatus** (Dumont), [Pakistan: Lyallpur]; *Acridotheres t. tristis* (Linne). Error, [Pakistan : Lyallpur]; **Turdoides c. caudatus** (Dumont), [India : Indore, (Rajputana) Rajasthan; Pakistan : Peshawar & Sind], Tandan & Clay, 1971. *Trans. R. ent. Soc. Lond.*, 123 (2) : 219, pl. 1 fig. 6; figs. 4, 5, 15, 36, & 37.
10. **clayae** Klockenhoff 1969. *Zool. Anz.*, 183 (5/6) : 393, figs. 9, 11, & 31.
Host: **Corvus macrorhynchos culminatus** Sykes, [India: Mahim, Bombay, & Trivandrum, Kerala; Sri Lanka (Ceylon) : Namunukula & Uva Hills]; also Klockenhoff, 1969. *Sond. aus. Z. F. Zool. Syst. u. Evol.*, 7 (1) : 53-58.

11. **cornicis** (De Geer), 1778, (*Ricinus*). *Mem. Hist. Ins.*, 7 : 76, pl. 4 fig. 1.
 Host: **Corvus** [corone] **cornix** Linne, [India : Gilgit], Kellogg & Paine 1914. *Rec. Indian Mus.*, 10 (4) : 242, as *Menopon mesoleucum* Nitzsch; (*Corvus frugilegus tschusii*) **Corvus** f. **frugilegus** (Linne), (*C. corax laurencei*) **Corvus corax subcorax** Severtzov & C. s. **splendens** Vieillot, [India ? : Punjab], Ansari 1951. *Proc. nat. Inst. Sci. India* 17(2) : 174.
12. **cucullaris** (Nitzsch), 1818, (*Liotheum* s. g. *Menopon*). *German's Mag. Ent.*, 3 : 300. *Nomen novum* for Redi's "pollino del storno bianco"
 Host: (*Sturnus vulgaris humii*) = **Sturnus vulgaris indicus** Blyth, [India], Ansari, 1951. *Proc. nat. Inst. Sci. India*, 17(2) : 185.
13. **cyrtostigma** (Kellogg & Chapman,) 1902, (*Menopon*). *J. N. Y. ent. Soc.*, 10 : 65, fig. 1.
 Host: **Lonchura punctulata** (Linne), [India : Hyderabad, A. P., Nepal], Clay, 1970. *H. D. Srivastava Commen. vol.* : 565, pl., 1 fig. 3; pl. 2 figs. 4-6.
14. **dukhunensis** Ansari, 1951. *Proc. nat. Inst. Sci. India*, 17 (2): 174, fig. 18.
 Host: **Motacilla alba dukhunensis** Sykes, [India: Kulu].
15. **flavirostratus** Ansari, 1951. *Proc. nat. Inst. Sci. India*, 17 (2): 174.
 Host: (*Urocissa f. flavirostris*) **Kitta f. flavirostris** (Blyth), [India : Kulu].
16. **himalayensis** Klockenhoff, 1969. *Zool. Anz.*, 183 (5/6) : 386, figs. 6-7.
 Host: **Corvus macrorhynchos intermedius** Adams, [India : Bihar, & U. P.], as *M. shirakii himalayensis*, Klockenhoff, 1969. *Sond. aus Z. f. Zool. Syst. u. Evol.*, 7(1): 53-58.
17. **insolita** (Kellogg & Paine), 1914, (*Menopon*). *Rec. Indian Mus.*, 10 (4) : 238, fig. 4.
 Host: **Corvus** [splendens] **insolens** Hume, [Burma: Mergui].

18. **ishizawai** Uchida, 1926 *J. Coll. Agric. Tokyo*, 9 : 8, fig. 2.
Host: *Zoothera d. dauma* (Latham), [India : Kohima], Clay, 1966. *Bull. Br. Mus. nat. Hist. (Ent.)*, 17 (5) : 379, figs. 18, 46, 62, & 72, pl. 2 fig. 1.
19. **isostoma** (Nitzsch), 1866, (*Menopon*). *Z. ges. Natwiss.*, 27 : 119.
Host: (*Corvus frugilegus tschusii*) **Corvus f. frugilegus** Linne, [India : Punjab], Ansari, 1956. *Indian J. Ent.*, 17 (3) : 399, & Ansari, 1957. *Indian J. Ent.*, (1956), 18 (4) : 432.
- (20) **kulensis** Ansari, 1951. *Proc. nat. Inst. Sci. India* 17 (2) : 190, fig. 25 = no. 41.
- (21) **lyallpurensis** Ansari, 1951. *Proc. nat. Inst. Sci. India*, 17 (2) : 185, fig. 23 = no. 9.
22. **macraidoia** Tandan, 1972. *Bull. Br. Mus. nat. Hist. (Ent.)* 27, (7) : 400, pl. 1 fig. 58 figs. 7, 8, 16, 31.
Hosts: **Garrulax a. albogularis** (Gould), [India : Punjab, Nepal], & **G. a. whistleri** Baker, [India : Lachung; Sikkim].
23. **manipurensis** Tandan, 1972, *Bull. Br. Mus. nat. Hist. (Ent.)*, 27 (7) : 377, pl. 1 fig. 55; figs. 3, 13, 35, & 48.
Host: **Garrulax squamatus** (Gould), [India : Assam; Kangpokpi, Manipur].
- (24) **mesoleuca** (Nitzsch), 1818, (*Liotheum* s. g. *Menopon*). *Germer's Mag. Ent.*, 3 : 300. *Nomen novum* for *Ricinus cornicis* De Geer = no. 11.
25. **nigra** (Kellogg & Paine) 1911, (*Menopon*). *Bull. ent. Res.*, 2 : 151, pl. 5 figs. 4, 4a & 4b.
Host: **Corvus [s.] splendens** Vieillot, [India : Calcutta, Guna (M. P.), & Trivandrum (Kerala); Nepal], Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10(4) : 242, as *Menopon nigrum* K. & P; same host, [India : Calcutta], Kellogg & Nakayama, 1915. *Rec. Indian Mus.*, 11 (1) : 139, as *M. nigrum*. K. & P.
26. **nuristaniensis** Klockenhoff, 1969. *Zool. Anz.*, 183, (5/6) : 389, figs. 8, 33, & 34.

- Host:** *Corvus macrorhynchos intermedius* Adams, [Afghanistan: Nuristan]; as *M. shirakii nuristamensis* also, Klockenhoff, 1969. *Sond. aus. z. f. Zool. Syst. u. Evol.*, 7(1) : 53-58.
- 27. orientalis** Tandan, 1972. *Bull. Br. Mus. nat. Hist. (Ent.)*, 27(7) : 398, pls. 2 fig. 64; figs. 6, 15, 25, 40 & 49.
- Host:** *Garrulax p. pectoralis* (Goûld), [Burma : Myitkyina, Kachin State; India : Kongpokpi, Manipur].
- 28. patkaiensis** Tandan, 1972. *Bull. Br. Mus. nat. Hist. (Ent.)* 27 (7) : 394, figs. 20, 23, 47, & 54.
- Host:** *Garrulax leucolophus patkaicus* Reichenow, [Burma: Myitkyina, Kachin State].
- 29. peninsularis** Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Agric.* : 53.
- Host:** (*Dicrurus macrocerus peninsularis*) = *Dicrurus adsimilis* probably *albirictus* (Hodgson), [Pakistan]; also Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3): 400, & Ansari, 1957. *Indian J. Ent.*, (1956), 18(4) : 433, figs. 27-34.
- 30. pycnonoti** Eichler, 1947. *Ark. Zool.*, 39A (2) : 18.
- Hosts:** *Pycnonotus cafer* (Linné)? *P. flavescens* Blyth?, & *P. jocosus* (Linne) ?, [Bhutan], Emerson, 1973. In : *Some ectoparasites of the birds of Asia* : 117, (Several species of the hosts belonging to the genera *Hypsipetes* & *Pycnonotus*, from different countries were mentioned under the species, of which the above three species may occur near the country under discussion).
- 31. quadrifasciata** (Piaget), 1880, (*Menopon*). *Pediculines* : 440, pl. 35 fig. 6.
- Host:** *Passer domesticus indicus* Jardine & Selby, [Pakistan: Lyallpur], Ansari, 1951. *Proc. nat. Inst. Sci. India*, 17 (2) : 150.
- 32. salimalii** Tandan & Clay, 1971. *Trans. R. ent. Soc. Lond.*, 123(2) : 222, pl. 1 fig. 2; figs. 6, 20, 39 & 40.
- Host:** *Turdoides earlei* [Blyth], [India: Delhi; Pakistan : Sind].

33. **satbhai** Ansari, 1951. *Proc. nat. Inst. Sci. India*, 17 (2) : 178, fig. 20.

Hosts: (*Turdoides terricolor terricolor*) = **Turdoides striatus** (Dumont), [Pakistan : Lyallpur]; same host, [India: Aurangabad (Maharashtra), (Rajputana) Rajasthan, & U. P.; Nepal; Pakistan: Punjab/, **T. striatus sindianus** (Ticehurst), [Pakistan : Sind], **T. striatus somevillei** (Sykes), [India ; Bombay Lucknow, (UP.)] Tandan & Clay, 1971. *Trans. R. ent. Soc. Lond.*, 123 (2) : 213, pl. 1 fig. 1; figs. 1, 2, 11, 12, 19, & 21-33.

34. **sehri** Ansari, 1951. *Proc. nat. Inst. Sci. India*, 17 (2) : 177, fig. 19.

Host: (*Trochalopteron lineatum grisescentior*) = **Garrulax lineatus lineatus** (Vigors), [India: Kulu]; also, Tandan. 1972. *Bull. Br. Mus. nat. Hist. (Ent.)*, 27 (7) : 374, pl. 2 fig. 59; figs. 10, 21, & 39.

35. **shirakii** Uchida, 1920. *Annot. Zool. Jap.*, 9 : 645.

Two subspecies, viz., **himalayensis** and **nuristaniensis** were described by Klockenhoff from the regions included in this list (*vide* items 16 & 26).

36. **sikkimensis** Tandan, 1972. *Bull. Br. Mus. nat. Hist. (Ent.)*, 27 (7) : 382, pl. 2 fig. 61; figs. 11, 19, & 51.

Host: **Garrulax striatus sikkimensis** (Ticehurst), [India: Chungtang, Sikkim].

37. **sindianus** Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Agric.* : 53.

Host: **Dicrurus h. hottentottus** (Linne), [Bangla desh: Rangamatil]; also in Ansari, 1956. *Pak. J. Sci. Res.*, 8 (2) : 58, figs. 8-10, & Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 400.

38. **singularis** Tandan, 1972. *Bull. Br. Mus. nat. Hist. (Ent.)*, 27(7) : 382 pl. 1 fig. 56; figs. 4, 12, 14, 17, 32, 45, & 53.

Host: **Garrulax s. subunicolor** (Blyth), [India : Chungtang & Lachen, Sikkim].

39. **splendens** Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Agric.*, : 53.

Host: **Corvus s. splendens** Vieillot, [Pakistan]; also in Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 399.

40. **srivastavai** Clay, 1970. *H. D. Srivastava Commem.* vol.: 563, pl. figs. 1-2; pl. 2 figs. 1-3, & 5; figs. 1-4.
 Host: **Lonchura malabarica** (Linne), [Pakistan: Sind]; also, [India], Emerson, 1973. In : *Some ectoparasites of the birds of Asia* : 117
41. **sultanpurensis** Ansari, 1951. *Proc. nat. Inst. Sci. India*, 17 (2): 183, fig. 22.
 Hosts: (*Myophonus coeruleus temminckii*) = **Myiophoneus caeruleus temminckii** (Vigors), [India : Kulu]; *Ceryle lugubris guttulata* Stejneger (Error), [India : Kulu], Ansari, 1951. *Proc. nat. Inst. Sci. India*. 17 (2): 190, fig. 25, as *M. (Alcediniphilus) kuluensis* Ansari; **Myiophoneus caeruleus temminckii** (Vigors), [Afghanistan; India : Kulu] Clay, 1966. *Bull. Br. Mus. nat. Hist. (Ent.)* 17(8): 382, figs. 4, 47, 63; pl. 2 fig. 2. (Dr Clay inadvertently referred to Kulu under Pakistan).
42. **thoracica** (Giebel), 1874, (*Menopon*). *Insecta epizoa* : 287.
 Hosts: **Turdus ruficollis atrogularis** Jerocki, [India: (Rajputana) Rajasthan] & **T. bouboul** (Latham), [Nepal], Clay, 1966. *Bull. Br. Mus. nat. Hist. (Ent.)*, 17 (8): 342, figs. 1, 5, 8, 25-27, & 64; pl. 1 figs. 1, 5, & 6.
43. **trithorax** (Piaget), 1885, (*Menopon*). *Pediculines Supplement*: 97, pl. 10 fig. 8.
 Host: **Corvus macrorhynchus** Wagler, [Bangladesh : Harbanga, Chittagong], Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Agric.*; 58; also in Ansari, 1956. *Pak. J. Sci. Res.*, 8(2) : 59, & Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 400.

Neocolpocephalum Ewing, 1933

- Ferrisia** Uchida, 1926 (nec Fullaway, 1923), *J. Coll. Agric. Tokyo*, 9 (1) : 43.
 Type species : *Colpocephalum turbinatum* Denny.
Neocolpocephalum Ewing, 1933, *J. parasit.*, 20 : 65. *Nomen novum* for *Ferrisia* Uchida.
 Inseparable from *Colpocephalum*.

69. *Neomenopon* Bedford, 1920

- Neomenopon* Bedford, 1920, *Parasitology*, 12 : 120. Type species (by monotypy) : *N. pteroclurus* Bedford.

bakttitar Ansari 1951. See *Myrsidea*.

70. *Neophilopterus* Cummings, 1916

Neophilopterus Cummings, 1916, *Proc. Zool. Soc. Lond.*, 1916 : 660.

Type species : *Docophous tricolor* Nitzsch.

1. *phillipsi*, Hajela, 1970. *Ent. mon. Mag*; 106 : 22, figs. 1-8.

Host: *Ibis l. leucocephalus* (Pennant), [Sri Lanka (Ceylon): Northern Hambantota]; on the same host, [India], Emerson, 1973. In : *Some ectoparasites of the birds of Asia* : 93.

71. *Neopsittaconirmus* Conci, 1942

Neopsittaconirmus Conci, 20 v. 1942, *Boll. Soc. Ent. Ital.*, 74 : 37.

Type species : *N. borgiolii* Conci.

1. *chandabani* (Ansari), 1947, (*Psittaconirmus*). *Proc. nat. Inst. Sci. India*, 13 (6) : 273, fig. 6.

Host: *Psittacula eupatria nipalensis* (Hodgson), [Pakistan: Lyallpur].

2. *lybartota* (Ansari), 1947, (*Psittaconirmus*). *Proc. nat. Inst. Sci. India*, 13 (6) : 275, fig. 7.

Host: (*Psittacula krameri manillensis*) = Probably *Psittacula krameri borealis* (Neumann), (Pakistan : Lyallpur).

Neumannia Uchida, 1926 (*nec* Trouessart, 1888)

Neumannia Uchida, 1926, (*nee* Trouessart, 1888), *J. Coll. Agric. Tokyo*, 9 : 27.

Type species : *Neumannia okadai* Uchida.

A synonym of *Uchida*, and inseparable from *Menacanthus*.

72. *Nigronirmus* Zlotorzyska, 1964

Nigronirmus Zlotorzyska, 1964, *Acta Parasitol. Polonica*, 12 (24) : 248. Type species : *Nirmus limbatus* Burmeister.

1. *munia* (Ansari), 1955, (*Brueelia*). (*nec. muniae* Eichler, 1957). *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 56.

Host: (*Uroloncha malabarica*) = *Lonchura malabarica* (Linne), [Pakistan]; also Ansari, 1956. *Indian J. Ent.* (1955), 17 (3) : 395 & Ansari, 1958. *Indian J. Ent.* 20(1) : 56, figs. 49-56; New combination- (cf. Lakshmi-narayana, 1968. *Oriental Ins.*, 2 (1) : 98.)

2. **parae** (Ansari), 1955, (*Brueelia*). *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 57.

Host: (*Anthus richardi rufulus*) = *Anthus novaseelandiae richardi* Vieillot [Pakistan]; also in Ansari, 1956. *Indian J. Ent.* (1955), 17 (3) : 395 & Ansari, 1958. *Indian J. Ent.*, 20 (1) : 58, fig. 58, as *Brueelia parae* Ansari.

3. **plocus** Lakshminarayana, 1968. *Oriental Ins.*, 2 (1) : 99, figs. 1 & 2 & 2a.

Host: *Plocus philippinus burmanicus* Ticehurst. [India; Salt Lakes (West Bengal)].

4. **xanthocollis** (Ansari), 1955, (*Brueelia*). *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 56.

Host: (*Gymnoris x. xanthocollis*) = *Petronia x. xanthocollis* (Burton), [Pakistan]; also Ansari, 1956. *Indian J. Ent.* (1955), 17 (3) : 396 & without host record, Ansari, 1958. *Indian J. Ent.*, 20 (1) : 57 fig. 57, as *Brueelia xanthocollis* Ansari. New Combination, (cf. Lakshminarayana 1968. *Oriental Ins.* '2 (1) : 98.)

Nirmoides Eichler, 1944

Nirmoides Eichler, 1944, *Stettin. ent. ztg.*, 105 : 81. Type species : *Docophorus antennatus* Piaget.

For the present retained in *Quadriceps*.

Nirmus Hermann, 1804

Nirmus Hermann, 1804, *Mem. Apterolog.*, : 12. *Nomen novum* for *Ricinus* De Geer. Type species (by subsequent designation), Neumann, 1906. *Bull. Soc. Zool. Fr.*, 20 (56): *Ricinus fringillae* De Geer.

Rejected (*vide Bull. Zool. Nomencl.* 1962, 19 (2) : 91-96) opinion 627 (6) a.

Nirmus Nitzsch, 1818 (*nec.* Hermann, 1804)

Nirmus Nitzsch, 1818. (*nec.* Hermann, 1804). *Germar's Mag. Ent.*, 3 : 291. Type species (by subsequent designation, Johnston & Harrison, 1911, *Proc. Linn. Sec. N.S.W.*, 36 : 326) : "*Degeeriella discocephalus* Nitzsch" Rejected (*vide Bull. Zool. Nomencl.*, 1962, 19 (2) : 91-96) opinion 627 (6) b.

- actophilus Kellogg & Chapman, 1899. See *Lunaceps*.
 acutofasciatus Piaget, 1880. See *Pectinipygus*.
 albescens Piaget, 1890. See *Buceronirmus*.
 anagrapsus Nitzsch, 1866. See *Quadriceps*.
 annulatus Denny, 1842. See *Quadriceps*.
 argulus Burmeister, 1838. See *Brueelia*.
 bicuspis Nitzsch, 1874. See *Quadriceps*.
 biguttatus Kellogg & Paine, 1914. See *Brueelia*.
 biocellatus Piaget, 1880. See *Brueelia*.
 brunneus Nitzsch, 1866. See *Quadriceps*.
 cingulatus Denny, 1842. See *Carduiceps*.
 crinitus Rudow, 1869. See *Lipeurus*.
 cursorius Mjöberg, 1910. See *Brueelia*.
 cyclothorax Burmeister, 1838. See *Brueelia*.
 cllipticus Nitzsch, 1866. See *Quadriceps*.
 frater Piaget, 1880. See *Degeeriella*.
 fulicus Denny, 1842. See *Rallicola*.
 fulvus Giebel, 1874. *Degeeriella*.
 furvus Burmeister, 1838. See *Quadriceps*.
 fuscus Denny, 1842. See *Degeeriella*.
 hemichrous Nitzsch, 1866. See *Quadriceps*.
 heterotypus Meignin, 1880. See *Lagopoecus*.
 holophaeus Burmeister, 1838. See *Lunaceps*.
 hoplopteri Mjöberg, 1910. See *Quadriceps*.
 iliaci Denny, 1842. See *Brueelia*.
 latirostris Burmeister, 1838. See *Cuculicola*.
 lotus Nitzsch, 1866. See *Quadriceps*.
 lugens Giebel, 1874. See *Rallicola*.
 marginalis Burmeister, 1838. See *Allobrueelia* & *Brueelia*.
 marginallus Nitzsch, 1866. See *Allobrueelia* & *Brueelia*.
 marginata Burmeister, 1838. See *Allobrueelia*, & *Brueelia*.
 melanophrys Nitzsch, 1866. See *Uppicola*.
 mundus Nitzsch, 1866. See *Maculinirmus*.
 mystax Giebel 1874. See *Rallicola*.
 nigromarginatus Piaget, 1880. See *Cuclotogaster*.
 nigrosignatus Piaget, 1880. See *Brueelia*.
 nisus Giebel, 1866. See *Degeeriella*.
 ochropi Denny, 1842. See *Quadriceps*.
 olivaceus Burmeister, 1838. See *Brueelia*.
 pallidus Piaget, 1880. See *Brueelia*.
 punctatus Burmeister, 1838. See *Quadriceps*.
 quadrisetaceum Piaget, 1880. See *Quadriceps*.
 ravus Kellogg, 1899. See *Quadriceps*.

regalis Giebel, 1886. See *Degeeriella*.
rufus Burmeister, 1838. See *Degeeriella*.
scalaris Piaget, 1880. See *Carduceps*.
sellatus Rudow, 1870 (*nec.* Burmeister, 1838). See *Lunaceps*.
semifissus Nitzsch, 1866. See *Quadriceps*.
signatus Piaget, 1880. See *Quadriceps*.
stenopyx Burmeister, 1838. See *Acidoproctus*.
subcuspidatus Burmeister (*nec.* Piaget, 1880). See *Capraiella*.
subtilis Nitzsch, 1874. See *Brueelia*.
turmalis Denny, 1842. See *Otidoecus*.
uncinosus Burmeister, 1838. See *Brueelia*.
varius Burmeister, 1838. See *Brueelia*.
vittatus Giebel, 1874. See *Degeeriella*.
vulgatus Kellogg, 1896. See *Brueelia*.
zonarius Nitzsch, 1866. See *Carduceps*.

Nitzschia Denny, 1842 (*nec.* Baer, 1827)

Nitzschia Denny, 1842, (*nec.* Baer, 1827), *Mon. Anopl. Brit.* : 230.

Type species (by monotypy) : *N. burmeisteri* Denny. A pre-occupied name.
 An absolute synonym of *Dennyus*.

Minor Kellogg & Paine, 1914. See *Dennyus*.

73. *Nitzschiella* Kéler, 1939

Nitzschiella Kéler, 1939, *Nova Acta Leop.-Carol.* (n. F.), 8:65.

Type species : *Coloceras menadensis* Piaget. (c.f. Tendeiro 1969 *Rev. Cienc. vet.* Laurence Marques, (A) 2 : 1-124, 81 Photos.)

1. **orientalis** Tendeiro, 1969. *Rev. Cienc. vet.* (A) 2 : 74 Photos 39-42 & 63.

Host: ***Streptopelia orientalis agricola*** (Tickell), [India: Assam]. (Slide in Br. Mus. nat. Hist. Ent.)

2. **piriformes** Tendeiro, 1969. *Rev. Cienc. vet.* (A) 2: 20 figs. 2, photos 3-6 & 52.

Host: ***Chalcophaps i. indica*** (Linne), [India : Sikkim].
 (Slide from Andaman is also available in Br. Mus. nat. Hist. Ent.)

74. *Nosopon* Hopkins, 1940

(Genus C. Clay, 1947, *Proc. Zool. Soc. Lond.*, 117 : 463).

Nosopon Hopkins, 1950, *Ann. Mag. nat. Hist.*, (12) 3 : 239. Type species: *Menopon "fulvofasciatum var. minor"* Piaget.

1. **chanabensis** (Ansari), 1951 (*Columbimenopon*). *Proc. nat. Inst. sci. India*, 17 (2) : 133, fig. 2.

Host: *Gyps himalayensis* Hume, [Pakistan: Lyallpur].

2. **clayae** Price & Beer, 1963. *J. Parasitology*, 49 (3) : 522, figs. 1 & 2.

Host: *Pernis ptilorhynchus* (Temminck), [Burma].

Oedicnemiceps Eicher, 1943

Oedicnemiceps Eichler, 1943, *Zool. Anz.*, 141 : 59. Type species : *Docophorus annulatus* Nitzsch in Denny sensu Piaget, 1880, *Pediculines* : 364, pl. LIV f: 5.".

This genus for the time being considered inseparable from *Quadriceps*.

Olivinirmus Zlotorzzycka, 1974

Olivinirmus Zlotorzzycka, 1964. *Acta Parasitol. Polonica*, 12 (24) : 246.

Type species : *Nirmus glandarii* Denny.

Probably this will fall as a synonym of *Brueelia*.

Oncophorus Piaget, 1880

Oncophorus Piaget, 1880. (nec. Rudow, 1870), *Pediculines* : 213.

Type species (by subsequent designation) : *Oncophorus bisetosus* Piaget.

See *Rallicola*.

75. *Otidoecus* Bedford, 1931

Otidoecus Bedford, 1931, *Rep. vet. Res. S. Afr.*, 17 : 285. Type species : *O. dimorphus* Bedford.

1. **antilogus** (Nitzsch), 1866, (*Lipeurus*). *Z. ges. Natwiss.*, 28 : 383.

Host: (*Houbara* (*Otis*) *macqueeni*)=***Chamydotis undulata macqueeni*** (J. E. Gray), [Pakistan: (Bhawalnagar) Bhawalnagar & Lahore]. Kellogg & Nakayama, 1915. *Rec. Indian Mus.*, 11 (1) : 139, as *Lipeurus antilogus* Nitzsch.

2. **turmalis** (Denny), 1842, (*Nirmus*). *Mon. Anopl. Brit.*, 48, 114, pl. 6. fig. 10.

Host: (*Eupodotis edwardsi*)=***Choriotis nigriceps*** (Vigors), [India], (Slide in B. M. (Nat. Hist.).

Oulocrepis Kéler, 1939

Oulocrepis Kéler, 1939, *Nova Acta Leop.-Carol.* (n.F.) 8 : 97.

Type species : *Gonlodes dissimilis* 'Nitzsch'.

Inseparable from *Goniodes*.

76. *Oxylipeurus* Mjöberg, 1910

Oxylipeurus Mjöberg, 1910, *Ark. Zool.*, 6 : 910. Type species: *Lipeurus inaequalis* Piaget.

1. **appendiculatus** (Piaget), 1880, (*Lipeurus*). *Pediculines*: 356, pl. 28, fig. 8.

Host: (*Megapodius n. nicobariensis*)=*Megapodius freycinet nicobariensis* Blyth, [India : Nicobar & Katchall Is] Clay, 1938. *Proc. Zool. Soc. Lond.* (B), 108 : 160.

burmeisteri (Taschenberg), 1882, See *Reticulipeurus*.

2. **connectens** Clay, 1938. *Proc. Zool. Soc. Lond.* (B) 108: 166. pl. 9 fig. 3.

Host: *Galloperdix s. spadicea* (Gmelin). [India: Nilgiris], *crossoptilum* Clay, 1938. See *Reticulipeurus*.

3. **dentatus** (Sugimoto), 1934, (*Lipeurus*). *Taiwan nochikusau*, 2 : 2 figs. 1-12.

Host: *Gallus gallus murchi* Robinson & Kloss, [India : Sikkim], Clay, 1938. *Proc. Zool. Soc. Lond.* (B), 108 : 181; Wild chicken, [Southeast Asia], Emerson, 1956, *J. Kans. Ent. Soc.*, 29 (2) : 78, pl. 11 figs. 1-3.

- (4). **denticlypeatus** (Sugimoto), 1935, (*Lipeurus*). *Zoological Record* (Insecta), 72 : 419. Quotation of name altered by Sugimoto in reprint (i.e.) *Nomen novum* for *dentatus* Sugimoto = no. 3.

himalayensis (Rudow), 1869. See *Reticulipeurus*.

ithaginis Clay, 1938. See *Reticulipeurus*.

longus (Piaget), 1880. See *Reticulipeurus*.

pucrasia Clay, 1938. See *Reticulipeurus*.

tetraophasis Clay, 1938. See *Reticulipeurus*.

5. **tropicoperdix** Clay, 1938. *Proc. Zool. Soc. Lond.*, 108: 164, figs. 29 a-c, pl. 9 fig. 2.

Host : *Tropicoperdix c. chloropus* (Blyth), [Burma], (Ripley 1961 not reported this species.

6. **unicolor** (Piaget), 1880, (*Lipeurus*). *Pediculines* : 354, pl. 28. fig. 6.

Host: (*Arborophiia rufigularis*) = *Arborophila rufogularis* (Blyth), [India : (Jorpokri) Jorpakuri(E. Himalaya)], Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 (4): 221, A. t. *torqueola* (Valenciennes), [India: Sikkim]. A. t. *batemani* (Ogilvie-Grant). [Burma], A. t. *millardi* (Baker), (Central Himalaya), A. r. *rufogularis* (Blyth), [India : Sikkim], A. *rufogularis intermedia* (Blyth), [Burma], A. r. *tickelli* (Hume), [Burma: Tenasserim] & (*A. rufogularis atrogularis*) = *A. atrogularis* (Blyth), [India: Assam], Clay, 1938. *Proc. Zool. Soc. Lond.* (B) 108 : 163, fig. 29d.

77. *Pachyskelotes* Kéler, 1939

Pachyskelotes Keler, 1939. *Nova Acta Leop.-Carol.* (n. F.), 8 : 55.

Type species : "*Goniodes orthopleurus* Nitzsch"

1. **neumannia** (Kellogg & Paine), 1914, (*Goniodes*). *Rec. Indian Mus.*, 10 (4) : 221, pl. 15 figs. 6, 7.

Host: *Argusianus argus* (Linne), [India : No history], Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10(4) : 221, pl. 15, figs. 6 & 7, as *Goniodes neumannia* K. & P.

Painjunirmus Ansari, 1947

Painjunirmus Ansari, 1947, *Proc. nat. Inst. Sci. India*, 13 (6) : 285.

Type species : *P. pengya* Ansari.

A synonym of *Brueelia*.

Paradoxuroecus Conci, 1942

Paradoxuroecus Conci, 1942, *Boll. Soc. ent. Ital.*, 74 : 141 Type species: *P. juccii* Conci.

A synonym of *Felicola*.

78. *Paragoniocotes* Cummings, 1916

Paragoniocotes Cummings, 1916, *Ann. Mag. nat. Hist.*, (8) 17 : 101.

Type species (by subsequent designation, Harrison, 1916, *Parasitology* 9 : 23) : *P. gripocephalus* Cummings.

1. *sp.* (?) Ansari, 1941. *Proc. nat. Inst. Sci. India*, 13(6) : 236.

Hosts: (*Psittacula krameri manillensis*) = Probably *Psittacula krameri borealis* (Neumann) & *Halcyon s. smyrnensis* Linne (?), [Pakistan : Lyallpur].

79. Pectinopygus Mjöberg, 1910

Pectinopygus Mjöberg, 1910, *Ark. Zool.*, 6 (13) : 95. Type species : *Lipeurus pullatus* N.

1. **acutofasciatus** (Piaget), 1880, (*Nirmus*). *Pediculines* : 172, pl. 14 fig. 5.

Host: (*Anhinga melanogaster*) *Anhinga rufa melanogaster* Pennant, [India : Lucknow], Tandan, 1955. *Ann. Mag. nat. Hist.*, (12) 8:428, figs. 17-22; same host, [Burma: Shingbuiyang; India: Hyderabad, (A. P.), N. W India, Rajasthan], Clay, 1973. *Bull. Br. Mus. nat. Hist. (Ent.)*, 29(4) : 209, pl. 1 fig. 6; pl. 3 fig. 15; figs. 1, 9 & 4.

2. **excornis** (Blagoveshtchensky), 1940, (*Philichthyophaga*). *Mag. Parasit. Leningr.*, 8 : 67, 88, fig. 20.

Host: **Phalacrocorax niger** (Vieillot), [India: Lucknow], Tandan, 1952. *Ann. Mag. nat. Hist.*, (12) 8 : 298, figs. 1-7, as *Pectinopygus* (*P.*) *makundi* Tandan (spelled as *mukundi* in the legends to the figures and corrected subsequently, in Tandan, 1955. *Ann. Mag. nat. Hist.*, (12) 8 : 433); **Haliator pygmeus** (Pallas), [Afghanistan], Clay, 1973. *Bull. Br. Mus. nat. Hist. (Ent.)*, 29 (4): 208, fig. 9; **P. niger** (Vieillot), [India], Emerson, 1973. In : *Some ectoparasites of the birds of Asia*: 95, as *P. makundi* Tandan.

3. **makundi** Tandan, 1952. *Ann. Mag. nat. Hist.*, (12) 8 : 298, figs. 1-7 -no. 2.

4. **sulae** (Rudow), 1869, (*Lipeurus*). *Beitr. Kenntn. Malloph.*; 43.

Host: (*Sula fiber*) = *Sula leucogaster plotus* (Forster), [South Seas].

Pediculus Linne, 1758

Pediculus Linne, 1758, *Syst. Nat. ed.* 10 : 610. Type species : (by subsequent designation) *P. humanus* Linne.

Though the genus *Pediculus* now belongs to the sub order Siphunculata or Siphunculophthirina (=Anoplura auct. since the majority of the earlier mallophagan species have been described under this genus Hopkins & Clay (1952). *Check list of the Genera & Species of Mallophaga*) found it necessary to list it for convenience sake. The present

author also followed the same principle in listing out those species referred in this work.

anseris Linne, 1758. See *Anaticola*.
 bovis Linne, 1758. See *Damalinia*.
 bidentatus Scopoli, 1763. See *Campanulotes*.
 caponis Linne, 1758. See *Lipeurus*.
 circi Fourcroy, 1785. See *Laemobothrion*.
 columbae Linne, 1758. See *Columbicola*.
 corvi Linne, 1758. See *Philopterus*.
 crassicornis Scopoli, 1763. See *Anaticola*.
 dentatus Scopoli, 1763. See *Anaticola*.
 fringillae Scopoli, 1772. See *Philopterus*.
 fulicae Linne, 1758. See *Incidifrons*.
 gallinae Linne, 1758. See *Menopon*.
 hiaticulae O. Fabricius, 1780. See *Quadriceps*.
 hirundinis Linne, 1761. See *Dennyus*.
 maximus Scopoli, 1763. See *Laemobothrion*.
 moschatae Linne, 1758. See *Acidoproctus*.
 mustelae Schrank, 1803. See *Trichodectes*.
 ocellatus Scopoli, 1763. See *Philopterus*.
 ortygometrae Schrank, 1781. See *Rallicola*.
 ovis Linne, 1758. See *Damalinia*.
 pavonis Linne, 1758. See *Goniodes*.
 pilosum Scopoli, 1763. See *Pseudomenopon*.
 plataleae Linne, 1758. See *Ardeicola*.
 querquedulae Linne, 1758. See *Trinoton*.
 rubeculae Schrank, 1776. See *Ricinus*.
 sternae Linne, 1758. See *Saemundssonina*.
 strigis Pontoppidan, 1763 (*nec* J. C. Fabricius, 1775, & O. Fabricius, 1780). See *Strigiphilus*.
 sturni Schrank, 1776. See *Sturnidoecus*.
 tantali J. C. Fabricius, 1798. See *Ardeicola*.
 tinnunculi Linne, 1758. See *Laemobothrion*.
 totani Schrank, 1803. See *Actornithophilus*.
 upupae Schrank, 1803. See *Upupicola*.
 vulturis J. C. Fabricius, 1775. See *Laemobothrion*.

80. *Penenirmus* Clay & Meinertzhagen, 1938.

Penenirmus Clay & Meinertzhagen, 1938, *Entomologist*, 71 : 73. Type species;
Pediculus albiventris Scopoli.

Picophilopterus Ansari, 1947, *Proc. nat. Inst. Sci. India*, 13(6) : 265.
 Type species : *Picophilopterus tuktolae* Ansari.

1. **irritans** (Ansari), 1955, (*Sturnidoecus*). *Proc. 7th Pak. Sci. Conf. Sec. Biol.*: 60.

Host **Saxicola torquata indica** (Blyth), [Pakistan]; also Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 396, & Ansari, 1959. *Indian J. Ent.*, (1958), 20 (2) : 79, figs. 105-109; also Zlotorzyska, 1974. *Acta Parasitol. Polonica*, 12 (24) : 272.

ornatus (Nitzsch) 1866, *sensu* Ansari, 1947. See *Philopterus*.
raji Ansari, 1947. See *Sturnidoecus*.

subflavescens Geoffroy, *sensu* Ansari, 1947. See *Philopterus*.

2. **tuktola** (Ansari), 1947, (*Picophilopterus*). *Proc. nat. Inst. Sci. India*, 13(6) : 265, fig. 4.

Host: **Picus s. squamatus** Vigors, [India : Kulu].

81. **Perineus** Harrison, 1936

Perineus Harrison, 1936, In Thompson, *Ann. Mag. nat. Hist.*, (10) 18 : 41.

Type species : *Lipeurus nigrolimbatus* Giebel.

1. **hyalinus** (Neumann), 1911, (*Lipeurus*). *Brit. antarct. Exped.*, 1907—09, 2 : 21, pl. 3 fig. 1.

Host: **Diomedea exulans** (Linne), [South Indian Ocean].

Peripetasma Timmermann, 1954.

Peripetasma Timmermann, 1954, *Zool. Anz.*, 152 : 167. Type species : *Peripetasma altoasiaticum* Timmermann.

For the time, considered inseparable from *Quadriceps*.

Philichthyophaga Harrison, 1935

Philichthyophaga Harrison, 1935, in Thompson, *Ann. Mag. nat. Hist.*, (10) 16 : 150. Type species : *Lipeurus brevicornis* Denny.

A subgenus of *Pectinopygus*.

82. **Philopterus** Nitzsch, 1818.

Philopterus Nitzsch, 1818, *German's Mag. Ent.*, 3 : 281, 288. Type species (by subsequent designation) Neumann, 1906. *Bull. Zool. Fr.*, 20 : 58) : *Philopterus* (*Docophorus*) *ocellatus* N.

Docophorus Eichler, 1944, *Stettin ent. Ztg.*, 105 : 80. Type species : *Docophorus communis* Nitzsch var. *passeris* Piaget.

Bitrabeculus Uchida, 1948, *Japan med. J.*, 1 : 318. Type species : *Docophorus singularis* Kellogg.

1. **alexanderkoenigi** (Eichler), 1953, (*Docophorulus*). *Bonner Zool. Beitrage*, 4 : 337, fig. 2.

Host: **Galerida cristata chendoola** (Franklin), [Pakistan], Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.*, 59, as *Sturnidoecus chendoola* Ansari; also, Ansari, 1956. *Indian J. Ent.*, (1955), 17(3) : 396, & Ansari, 1959. *Indian J. Ent.*, (1958), 20 (2) : 79, figs. 100-104; also of. Zlotorzycka, 1964. *Acta Parasitological Polonica*, 12 (37) : 406, figs. 2a, as *D. alexandrokoenigi* Eichler.

2. **atratus** Nitzsch, 1818, *Germar's Mag. Ent.*, 3 . 209. *Nomen novum* for Redi's "*Pollino del corvo*".

Hosts: **Corvus splendens** Vieillot [India : Calcutta, Guna (M. P.), & Trivandrum], (*C. insolens*) **C. splendens insolens** Hume, [Burma : Katha, Mergui], **C. macro-rhynchus** Wagler, [India : Gilgit; Upper Burma], **C. corax** Linne, [India : Ladakh], & (*C. umbrinus*)—**C. corax ruficollis** Lesson, [Pakistan : Baluchistan], Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10(4) : 233, as *Docophorus atratus* Nitzsch; (*C. frugilegus tschusii*) **C. f. frugilegus** Linne, [Pakistan], Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 57; also Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 395, & Ansari, 1958. *Indian J. Ent.*, 20 (2) : 58.

baculus Nitzsch, 1818. See *Columbicola*.

3. **benedictae** Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 59.

Host: **Megalaima virens marshallorum** Swinhoe, [Pakistan], (inadvertantly spelled also as *binedictae*, & *binedicate*) also in Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 396, & Ansari, 1958. *Indian J. Ent.*, 20 (1) : 62, fig. 84.

4. **bijae** Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 57.

Host: **Lanius schach erythronotus** (Vigors), [Pakistan]; also in the same host, [Pakistan : Jatti (Tatta Dist.) Karachi, & Lyallpur], Ansari, 1956. *Pakistan J. Sci. Res. Res.*, 8 (1) : 16, figs. 25-29; & Ansari, 1956. *Indian J. Ent.*, (1955), 17(3) : 396, & Ansari, 1958. *Indian J. Ent.*, 20(1) : 60, figs. 64-65.

capistratus Neumann, 1912. See *Alcedoecus*,

- (5). *chendoola* Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.*: 59. = no. 1.
6. *corvi* (Linne), 1758, (*nec* Packard, 1870), (*Pediculus*). *Syst. Nat.* ed. 10 : 612.
- Hosts: (*Corvus corax laurencei*) *Corvus corax subeorax* Severtzov, (*C. frugilegus tschusii*) *C. f. frugilegus* Linne, *C. s. splendens* Vieillot, [Pakistan: Lyallpur], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13(6) : 272.
7. *crassipes* (Burmeister), 1838, (*Docophorus*). *Handb. Ent.*, 2 : 425.
- Hosts: (*Pica rustica*) *Pica p. bactriana* Bonaparte, [India: Punjab], Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10(4) : 234, as *Docophorus crassipes* Nitzsch; *Nucifraga caryocatactes hemispila* Vigors, [India : Kulu; Pakistan : Lyallpur], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13(6) : 271.
8. *excisus* Nitzsch, 1818. *Germar's Mag. Ent.*, 3 : 390. *Nomen novum* for *Pediculus hirudinis* Schrank, 1803, *nec* Linne, 1761.
- Host. *Hirunda rustica* Linne, [India : Lucknow], Tandan, 1955. *Ann. Mag. nat. Hist.*, (12) 8 : 421, figs. 8-12, as *P. excisus microsomaticus* Tandan.
9. *extraneus* (Piaget), 1885 (*Docophorus*). *Pediculines Supplement* : 3, pl. 1 fig. 4.
- Host: *Corvus m. macrorhynchus* Wagler, [Bangladesh : Chittagong Dist.]; also Ansari, 1956, *Pakistan J. Sci. Res.*, 8 (1) : 17, & Ansari, 1956. *Indian J. Ent.*, (1955), 17(3) : 396.
- falcicornis* Nitzsch, 1818. See *Goniodes*.
10. *fringillae* (Scopoli), 1772 (*nec* Denny, 1842), (*Pediculus*). *Ann. V. Hist. nat.*, 125; (Clay & Hopkins, 1951. *Bull. Br. Mus. nat. Hist. (Ent.)*, 2 (1) : 32, figs. 43, & 44; pl. 3 fig.
- Hosts: (*Turdoides t. terricolor*)—*Turdoides striatus* (Dumont) (*Argya c. caudata*) = *T. c. caudatus* (Dumont), (*Molpastes cafer intermedius*) = *Pycnonotus cafer intermedius* Blyth, (*Molpastes l. leucogenys*) = *P. l. leucogenys* (Gray), (*Cyanosylvia s. suecica*) = *Erithacus svecicus* (Linne), *Saxicoloides fulcata cambaiensis* Latham, *Lanius excubitor lahtora* (Sykes) (probably material from this host may be identical as no. 12),

L. schach erythronotus Vigors (probably material from this host may be same as no. 4), (*Phylloscopus collybitus tristis*)=*Phylloscopus collybita tristis* Blyth, *Emberiza brunniceps* Brandt, (probably material from this host may be no. 27), *Motacilla alba dukhunensis* Sykes, & *Galerida cristata chendoola* (Franklin) probably specimens from this host may be identical with no. 1), [Pakistan : Lyallpur], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13(6) : 268, as *Penenir-mus subflavescens* (Geoffroy); *Passer domesticus indicus* Jardine & Selby, [Pakistan], Ansari, 1955. *Proc. 7th Pap. Sci. Conf. Sec. Biol.*:58; also in Ansari, 1956. *Indian J. Ent.*' (1955), 17 (3) : 396, & Ansari, 1958. *Indian J. Ent.*, 20(1), .61; *Motacilla alba dukhunensis* Sykes, [Pakistan], Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 59; also Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3): 396, & Ansari, 1958. *Indian J. Ent.*, 20 (1): 62, as *Philopterus passerinus* (Denny).

- (11). *fulvus* (Burmeister), 1838, (*Docophourus*). *Handb. Ent.*, 2 425. -no. 13.

12. *fuscicollis* (Burmeister), 1838, (*Docophorus*). *Handb. Ent.*, 2 . 425.

Host: *Lanius excubitor lahtora* (Sykes), [Pakistan], Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 57; also, Ansari, 1956. *Indian J. Ent.*, (1955), 17(3) : 395, & Ansari, 1958. *Indian J. Ent.*, 20 (1) : 59.

13. *garruli* Boisduval & Lacordaire, 1835. *Faune ent. Environs, Paris* : 120.

Hosts: (*Urocissa flavirostris*) *Kitta f. flavirostris* (Blyth)? [India : Ghoom (?), E. Himalaya, Kashmir; Pakistan : Murree], (*Dendrocitta rufa*) *Dendrocitta vagabunda parvula* Whitlser & Kinnear, [India : Cachar, Assam, & Calcutta], (*D. himalayensis*) *D. formosae himalayensis* Blyth, (India: [Darjilling) Darjeeling], *Garrulus lanceolatus* Vigors, [Pakistan : Murree], (*Nucifraga multipunctata*) *N. caryocatactes multipunctata* Gould, [India : Gilgit], & (*Pica rustica*) *Pica pica bactriana* Bonaparte, [India : Ladakh], Kellogg & Paine, 1914. *Rec. Indian Mus.* 10(4): 234, as *Docophorus fulvus* Nitzsch; (*Urocissa erythrorhyncha occipitalis*)

Kitta erythrorhyncha occipitalis Blyth, & (*Dendrocitta rufa*) *Dendrocitta vagabunda* (Latham), [Pakistan : Lyallpur], (material from the last named species may be same as no. 24), Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13(6) : 272.

14. **guttatas** (Denny), 1842, (*Docophorus*). *Mon. Anopl. Brit.*; 41, 67, pl. 3 fig. 8.

Host: **Corvus monedula** Linne, [India : Gilgit], & **C. macro-rhynchus** Vigors, [Nepal], Kellogg & Paine, 1914, *Rec. Indian Mus.*, 10(4) : 234, as *Doc guttatus* Nitzsch. *hologaster* Nitzsch, 1818. See *Goniocotes*.

15. **kalkalichi** Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 57.

Host: (*Dicrurus macrocercus peninsularis*)=**Dicrurus adsimilis** (Bechstein) (probably **albirictus** (Latham) [Pakistan]; also on the same host, [Pakistan : Jatti (Tatta Dist.), Layallpur], Ansari, 1956. *Pakistan J. Sci. Res.*, 8 (1) : 17, figs. 30-32; Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 396, & Ansari, 1958. *Indian J. Ent.* 20 (1) : 60.

16. **lahorensis** Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 57.

Host: **Corvus s. splendens** Vieillot, [Pakistan]; also in Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 395, & Ansari, 1958. *Indian J. Ent.*, 20 (1) : 58, figs. 59-63. *leontodon* Nitzsch, 1818. See *Sturnidoecus*. *luridus* Nitzsch, 1818. See *Fulicoffula*.

- (17). **microsomaticus** Tandan, 1955. *Ann. Mag. nat. Hist.*, (12) 8 : 421, figs. 12.=no. 8.

18. **ocellatus** (Scopoli), 1763, (*Pediculus*). *Ent. Carniolica* : 382.

Host: **Corvus splendens** Vieillot, [Nepal], Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10(4) : 234, as *Doc. rotundatus* Piaget; on the same host, [Pakistan : Lyallpur], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 271, (possibly this material may be same as no. 16).

19. **ornatus** (Nitzsch), 1866, (*Docophorus*). *Z. ges. Natwiss.*, 27 : 110.

Host : **Oriolus o. kundoo** Sykes, [Pakistan : Lyallpur], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13(6) : 269; also, Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 396, & Ansari, 1958. *Indian J. Ent.*, 20(1) : 62.

- (20). *passerinus* (Denny), 1842, (*Docophorus*). *Mon. Anopl. Brit.*, 47, 104, pl. 5 fig. 12.=no. 10.
punctifer Gervais, 1844. See *Degeeriella*.
- (21). *rotundatus* (Piaget), 1880, (*Docophorus* p. 47 nec p. 21 & p. 60).
 =no. 18.
22. *sclerotifrons* Tandan, 1955. *Ann. Mag. nat. Hist.*, (12) 8 : 417, figs. 1-7.
 Host: (*Cinnyris a. asiatica*) = *Nectarina a. asiatica* (Latham), [India : Lucknow].
squalidus Nitzsch, 1776. See *Anaticola*.
sturni (Schrank), 1776, sensu Ansari, 1947. See *Sturnidoecus*.
subflavescens Geoffroy, sensu Ansari, 1947. Descriptive phrase' & not a name. cf. Hopkins & Clay, 1952. *Check List of the Genera & species of Mallophaga*. =no. 10.
tadornae Gervais, 1844. See *Holomenopon*.
23. *thryptocephalus* (Kellogg & Paine), 1914, (*Docophorus*). *Rec. Indian Mus.*, 10(4) : 232, pl. 14, fig. 1.
 Host: (*Graculus graculus*) = *Pyrrhocorax graculus* (Linne), [India : Gilgit, Chitral].
tropica Sen, 1942. See *Craspedorrhynchus*.
tuktola Ansari, 1947. See *Penenirmus*.
24. *vagabunda* Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.*: 52.
 Host: *Dendrocitta vagabunda pallida* (Blyth), [Pakistan]: also in Ansari, 1956. *Pakistan J. Sci. Res.*, 8(1) : 18; figs. 33-38, & Ansari, 1956. *Indian J. Ent.*, (1955), 17(3) : 396.
- (25). *vittuti* Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Biol.*: 52. also Ansari, 1956. *Pakistan J. Sci. Res.*, 8(1) : 19, fig. 39. =no. 26.
26. *vittati* Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.*: 52.
 Host: *Lanius vittatus* Valche, [Pakistan : Karachi], also in Ansari, 1956. *Pakistan J. Sci. Res.*, 8(1) : 19, fig. 39; & Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) 396. (Misspelt as *vittuti* in the first two works).
27. *zohrae* Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 58.
 Host: (*Emberiza brunniceps*) = *Emberiza brunniceps* Brandt, [Pakistan]; Also Ansari, 1956. *Indian J. Ent.*, (1955),

17 (3) : 396, & Ansari, 1958. *Indian J. Ent.*, 20(1): 61. figs. 76-83.

Physostomum Nitzsch, 1818

Physostomum Nitzsch, 1818, *German's Mag. Ent.*, 3 : 302. Type species (by subsequent designation) Harrison, 1916 : 24) : "*Ricinus nitidissimum* Nitzsch = *fringillae* De Geer".

An absolute synonym of *Ricinus* De Geer.

Piagetia Picaglia, 1884

Piagetia Picaglia, 1884 (nec Ritsema, 1874, *Atti Soc. Nat. Mat. Modena*, (3) 2 : 104. Type species (by subsequent designation, Harrison, 1916 : 24) : *P. ragazzii* Picaglia.

A synonym of *Piagetiella* Neumann.

83. *Piagetiella* Neumann, 1906

Tetrophalmus Grosse, 1855 (nec Hope, 1845), *Z. Wiss. Zool.*, 42 : Type species (by monotypy) : *T. chilensis* Grosse.

Piagetia Picaglia, 1884 (nec. Ritsema, 1874), *Atti. Soc. Nat. Mat. Modena*, (3) 2 : 104. Type species (by subsequent designation, Harrison, 1916 : 24) : *P. ragazzii* Picaglia.

Piagetiella Neumann, 1906. *Bull. Soc. Zool. Fr.*, 20 : 60. *Nomen novum* for *Piagetia* Picaglia.

1. **titan** (Piaget), 1880, (*Menopon*). *Pediculines* : 503, pl. 40 fig. 7.

Host: ***Pelecanus onocrotalus*** Linne, [India]. (Slide in B. M. (Natural History); also, [India : (Rajputana) Rajasthan], Price, 1970. *Canad. Ent.*, 102 (4) : 396, figs. 12, 19, 23, 31, & 40.

84. *Picicola* Clay & Meinertzhagen, 1938

Picicola Clay & Meinertzhagen, 1938, *Entomologist*, 71 : 74, figs. 1 & 2.
Type species : *Picicola praeposterus* Clay & Meinertzhagen.

1. **mississippiensis** (McGregor), 1917, (*Lipeurus*). *Psyche Camb.*, *Mass.*, 24 : 107, pl. 1 figs. 1, & 5.

Hosts: (*Dryobates sindeanus*) ***Dendrocopos assimilis*** (Blyth), [Pakistan : Peshawar], Clay & Meinertzhagen, 1938. *Entomologist*, 71 : 74, figs. 1 & 2, as *P. praeposterus* C. & M.; ***D. darjellensis*** (Blyth), [India : Sikkim], ***D. assimilis*** (Blyth), [Pakistan], & ***D. m. macei*** (Vieillot), [India], Dalglish, 1969. *Proc. R. ent. Soc. Lond.*, (B), 38 (7-8) : 112, fig. 15.

- (2). *praeposterus* Clay & Meinertzhagen, 1938. *Entomologist*, 71 : 74, figs. 1 & 2 = no. 1.

Picophilopterus Ansari, 1947

Picophilopterus Ansari, 1947, *Proc. nat. Inst. Sci. India*, 13(6) : 165.

Type Species : *Picophilopterus tuktola* Ansari.

Inseparable from *Penenirmus*.

Picusphilus Ansari, 1951

Picusphilus Ansari, 1951, *Proc. nat. Inst. Sci. India*, 17 (2) : 163, Type species : "*Cuculiphilus (Picusphilus) tirkhan* Ansari".

Erected as a subgenus of *Cuculiphilus*. The subgeneric type species is now included under the genus *Colpocephalum*.

Proneptis Timmermann, 1953

Proneptis Timmermann, 1953, *Bombus*, 78/79 : 331. Type species : *Proneptis semifissus* (Nitzsch).

For the time being retained under the genus *Quadriceps*.

Pseudocolpocephalum Qadri, 1936

Pseudocolpocephalum Qadri, 1936, *Z. Parasitenk.*, 8 : 640. Type species : *P. uchldi* Qadri.

Inseparable from *Colpocephalum*.

85. Pseudomenopon Mjöberg, 1910

Pseudomenopon Mjöberg, 1910, *Ark. Zool.*, 6(13) : 50. Type species : *Menopon tridens* 'N'.

1. **concretum** (Piaget), 1880, (*Menopon*). *Pediculines* : 481, pl. 38, fig. 9.

Host : *Porphyrio* [*Porphyrio*] *poliocephalus* (Latham), [India: (Rajputana) Rajasthan], Price, 1974. *Ann. ent. Soc. Amer.*, 67(1) : 78, fig. 32.

2. **dolium** (Rudow), 1869, (*Colpocephalum*). *Z. ges. NatWiss.*, 34 : 393.

Host : (*Colymbus cristatus*) = *Podiceps c. cristatus* Linne, & (*Poliocephalus ruficollis*) = *Podiceps ruficollis* (Pallas), [India], Price, 1974. *Ann. ent. Soc. Amer.*, 67(1) : 73, fig. 26.

3. **jacinoti** Tendeiro, 1965. *Revta Estud. Gerais Univ. Mocambique Laurencio Marques*, (4) 2(8) : 23.

Host : *Hydrophasianus chirurgus* (Scopoli), [Sri Lanka (Ceylon)]. (Price, 1974. *Ann. ent. Soc. Amer.*, 67(1) : 73-74, however, considered this species conspecific with no. 6).

4. **lanceolatum** Tendeiro, 1965. *Revta Estud. Gerais Univ. Mocambique, Laurengo Marques*, (4) 2 (8) : 41.

Host: *Metopidius indicus* (Latham), [India],; also Price 1974. *Ann. ent. Soc. Amer.*, 67 (1) : 82, figs. 8, 19, & 35.

5. **phoenicuri** Price, 1974. *Ann. ent. Soc. Amer.*, 67(1) : 79, fig. 28.

Host : *Amaurornis phoenicurus* (Pennant), [India].

6. **pilosum** (Scopoli), 1763, (*Pediculus*). *Ent. Carniolica*: 384.

Hosts : *Fulica atra* Linne, & *Gallinula chloropus* (Linne)' [India], Emerson, 1973. In : *Some ectoparasites of the birds of Asia* : 118. *Gallinula chloropus* (Linne), [India], *Hydrophasianus chirurgus* (Scopoli), [India : (Rajputana), Rajasthan ; Sri Lanka (Ceylon)], and *Amaurornis phoenicurus* (Pennant), [India : (Rajputana) Rajasthan] Price, 1974. *Ann. ent. Soc. Amer.*, 67(1) : 73, figs., 1-6, 11, 18, 21-22;

7. **poliocephalus** Qadri, 1936. *Z. Parasitenk.*, 8 : 638, fig. 1.

Hosts : *Porphyrio* [Porphyrio] *poliocephalus* (Latham), and *Capella* sp. (?), [India]; (Price, 1974. *Ann. ent. Soc. Amer.*, 67(1) : 78, considered however, this species conspecific with no. 1).

86. *Psittaconirmus* Harrison, 1915

Psittaconirmus, Harrison, 1915, *Parasitology*, 7 : 402. Type species : (by monotypy) : *P. australis* Harrison.

chandabani Ansari, 1947. See *Neopsittaconirmus*.

lybartota Ansari, 1947. See *Neopsittaconirmus*.

87. *Quadriceps* Clay & Meinertzhagan, 1939

Quadriceps Clay & Meinertzhagan, 1939, *Ann. Mag. nat. Hist.* (11) 4 : 453. Type species : *Degeeriella vanelli* (Denny).

Koeniginirmus Eichler, 1940, *Zool. Anz.*, 130 : 101. Type species : "*Koeniginirmus punctatus* (Nitzsch in Burmeister, 1838, Jedoch sensu A. Koenig)".

Oedicnemiceps Eichler, 1943, *Zool. Anz.*, 141 : 59. Type species : *Docophorus annulatus* Nitzsch in Denny. *Sensu* Piaget, 1880, *Pediculines* : 364; pl. LIV, f. 5."

- Glareolites* Eichler, 1944, *Stettin. ent. Ztg.*, 105 : 80. Type species : *Nirmus ellipticus* Nitzsch.
- Mjöberginirmus* Eichler, 1944, *Stettin. ent. Ztg.*, 105 : 85.
Type species : *Nirmus obliquus* Mjöberg.
- Nirmoides* Eichler, 1944, *Stettin. ent. Ztg.*, 105 : 81.
Type species : *Docophorus antennatus* Piaget.
- Szidatiella* Eichler, 1944, *Stettin. ent. Ztg.*, 105 : 81. Type species : *Docophorus elongatus* Piaget.
- Haematophagus* Timmermann, 1950, *Fauna Islandica*, 2 : 1.
Type species : *Quadriceps haematopi* (Denny).
- Rhombiceps* Eichler, 1952, *Zool. Anz.*, 149 : 77. Type species : *Nirmus recurvirostrae* (Linne).
- Cirro-phthirius* Timmermann, 1953, *Bombus*, 78/79 : 330 : Type species : *Cirro-phthirius recurvirostrae* (Linne). Absolute synonyms of *Rhombiceps* Eichler.
- Cistellatrix* Timmermann, 1953, *Bombus*, 78/79 : 331. Type species : *Cistellatrix decipiens* (Denny).
- Proneptis* Timmermann, 1953, *Bombus*, 78/79 : 331. Type species : *Proneptis semifissa* (Nitzsch).
- Peripetasma* Timmermann, 1954, *Zool. Anz.*, 152 : 167. Type species : *Peripetasma altoasiaticum* Timmermann.
- Timmarimanniceps* Eichler & Zlotorzycka, 1964, *Dtsch. ent. Zeitschr.*, (n. F.) (4-5) : 319. Type species : *Nirmus phalaropi* Denny.
- Carrikericeps* Eichler & Zlotorzycka, 1964, *Dtsch. ent. Zeitschr.*, (n. F.) 11 (4-5) : 320. Type species : *Quadriceps punensis* Carriker.
- Chadriceps* Zlotorzycka, 1967, *Pol. Pismo Ent.*, 37 (4) : 728. Type species : *Pediculus hiatriculae* O. Fabricius.
- Anousceps* Zlotorzycka, 1967, *Pol. Pismo Ent.*, 730. Type species : *Nirmus separatus* Kellogg & Kuwana.
- Himantophagus* Zlotorzycka, 1967, *Pol. Pismo Ent.*, 733. Type species : *Nirmus hemichrous* Nitzsch.

Since the publication of Hopkins & Clay's checklist (1952) and additions (1952 & 1953) this genus has been further revised. For the present, all the new genera have been placed under *Quadriceps*, some of which may be accepted as valid genera and some can be considered as subgenera.

1. **altoasiaticum** (Timmermann), 1954, (*Peripetasma*). *Zool. Anz.*, 152 : 168, figs. 6 & 7.
Host : *Ibidorhyncha struthersi* Vigors, [India : Himalaya; China : Tibet], cf. Zlotorzycka, 1967. *Pol. Pismo Ent.*, 37 (4) : 732, as *Peripetasma altoasiaticum* Timmermann.
2. **anagrapsus** (Nitzsch), 1866, (*Nirmus*). In Giebel's *Z. ges. Nat-Wiss.*, 28 : 376.

Host : (*Sterna aurantia* Gray. Error). Probably *Chlodonla hybrida indica* (Stephens), or *C.leucoptera* (Temminck). (vide Hopkins & Clay, 1953 *Ann. Mag. nat. Hist.*, (12) 6 : 444), [India Lucknow], Tandan, 1951. *Anns Mag. nat. Hist.*, (12) 4 : 807, figs. 5-8 as *Q. thapari*, Tandan. Cf. Zlotorzyska, 1967, *Pol. Pismo Ent.*, 37 (4) : 761 as *Koeniginirmus (Laminonirmus) nycthemerus* (Burmeister).

3. **annulatus** (Denny), 1842, (*Nirmus*). *Mon. Anopl. Brit.*; 51, 132, pl. 8 fig. 5.

Host: *Burhinus oedicnemus* (Linne), [India], (Slide in B. M. Natural History) cf. Zlotorzyska, 1967. *Pol. Pismo Ent.* 37 (4): 740, taf. 8 photos 3 & 4 and taf. 9 photo 1.

4. **bicuspis** (Nitzsch), 1874, (*Nirmus*). In Giebel's *Insecta epizoa* : 155, pl. 5 figs. 11 & 12.

Host: *Charadrius dubius* Scopoli, [India], (Slide in B. M. Natural History); cf. Zlotorzyska, 1967. *Pol. Pismo Ent.*, 37 (4): 711, taf. 2 photo 3 & taf. 5 photo 3.

5. **brunneus** (Nitzsch), 1866, (*Nirmus*). In Giebel's *Z. ges. NatWiss.*, 28 : 373.

Host: *Dromas ardeola* Paykull, [India], Zlotorzyska, 1967. *Pol. Pismo Ent.*, 37 (4) : 739.

- (6). **clypeatus** (Kellogg & Paine), 1914, (*Nirmus*). *Rec. Indian Mus.*, 10 (4) : 237, pl. 14 fig. 3. = no. 27.

7. **conformis** (Blagoveshtchensky), 1948, (*Degeeriella*). *Mag. Parasit. Leningr.*, 8 : 56, 84, fig. 14.

Host: *Tringa totanus totanus* (Linne), [India; Nepal]. (Slide in B. M. Natural History) cf. Zlotorzyska, 1967. *Pol. Pismo Ent.*, 37 (4) : 713, taf. 4 photo 4.

- (8). **cursorius** (Mjöberg), 1910, (*Nirmus*). *Ark. Zool.*, 6 (13) : 141, pl. 1 fig. 4 = no. 19.

9. **dasi** Tandan, 1952. *Ann. Mag. nat. Hist.*, (12) 5 : 464.

Host: (*Lobivanellus i. indicus*) = *Vanellus i. indicus* (Boddaert), [India]; on the same host, [Pakistan], Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 50; also in Ansari, 1956. *Indian J. Ent.*, 17 (3) : 398 & Ansari,

1959. *Indian J. Ent.*, (1958), 20 (2) : 98; cf. Zlotorzycka, 1967. *Pol. Pismo Ent.*, 37 (4) : 713.

10. **ellipticus** (Nitzsch) 1866, (*Nirmus*). In Giebel, *Z. ges. NatWiss*, 28 : 371.

Hosts: **Glareola pratinicola** (Linne), and **G. lactea** Temminck, [India], Emerson, 1973. In : *Some ectoparasities of the birds of Asia* : 98.

11. **furvus** (Burmeister), 1838, (*Nirmus*.) *Handb. Ent.*, 2 : 427.

Hosts: **Tringa ochropus** Linne, & **Himantopus h. himantopus** Linne (probably no. 13), [Pakistan : Lyallpur], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 201; cf. Zlotorzycka, 1967. *Pol. Pismo Ent.*, 37 (4) : 715, taf. 1 photo 2, taf. 4 photo 1 & taf. photo 2; **Tringa erythropus** (Pallas), [India], Emerson, 1973. In : *Some ectoparasites of the birds of Asia* : 98, also on *T. erythropus* (Pallas) [India : (Rajaputana) Rajasthan]. (Slide in B. M. Nat. Hist.)

12. **grallarius** Timmermann, 1954. *Z. Parasitenk.*, 16 : 201.

Host: (*Chettusia leucura*) **Vanellus leucurus** (Lichtenstein), [India]; cf. Zlotorzycka, 1967. *Pol. Pismo Ent.*, 37(4) : 716, as *Q. hoplopteri grallarius* Timmermann.

13. **hemichrous** (Nitzsch), 1866, (*Nirmus*). In Giebel's *Z. ges. NatWiss.*, 28 : 372.

Host: **Himantopus h. himantopus** (Linne), [Pakistan], Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 50; also in Ansari, 1956. *Indian J. Ent.* (1955), 17 (3) : 399 & Ansari, 1959. *Indian J. Ent.* (1958), 20 (2) : 98. cf. Zlotorzycka, 1967. *Pol. Pismo Ent.*, 37 (4) : 734, as *Himantophagus hemichrous* (Nitzsch).

14. **hiaticulae** (O. fabricius), 1780, (*nec*. Denny. 1842), (*Pediculus*). *Fauna groenlandica* : 220.

Host: (*Lobivanellus i. indicus*) = **Vanellus i. indicus** (Boddaert), [Pakistan : Lyallpur], Ansari, 1947. *Proc. nat. Inst. Sci. India*. 13 (6) : 278; of. Zlotorzycka, 1967. *Pol. Pismo Ent.*, 37 (4) : 729, as *Chadriceps hiaticulae* (O. Fabricius).

holophaeus (Burmeister), 1838. *Sensu* Ansari, 1947. See *Lunaceps*.

15. **hoplopteri** (Mjöberg), 1910, (*Nirmus*). *Ark. Zool.*, 6 (13) : 137, fig. 74, pl. 5 fig. 6.

Host: (*Hoplopterus duvaucelii*) = *Vanellus spinosus duvaucelii* (Lesson), [Nepal], (Slide in B. M. Natural History). cf. Zlotorzycka, 1967. *Pol. Pismo Ent.*, 37 (4) : 716.

16. **insignis** Timmermann, 1952. *Zool. Anz.*, 148 : 82.

Host: *Sterna aurantia* J. E. Gray, [India: (Deccan) Andhra Pradesh] also on the same host, [Burma : India], cf. Zlotorzycka, 1967. *Pol. Pismo Ent.*, 37 (4) : 759., as *Koeniginirmus (Laminonirmus) insignis* (Timmermann).

17. **kekra** Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 276.

Host: *Gelochelidon n. nilotica* (Gmelin), [Pakistan: Lyallpur]; cf. Zlotorzycka, 1967. *Pol. Pismo Ent.*, 37 (4) : 767 as *Koeniginirmus kekra* (Ansari).

18. **lahorensis** Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.*: 50.

Host: *Philomachus pugnax* Linne, [Pakistan: Lahore]; also Ansari, 1956. *Indian J. Ent.*, (1958), 17 (3): 399 & Ansari, 1959. *Indian J. Ent.*, (1958), 20 (2): 99 figs. 221-226; cf. Zlotorzycka, 1967. *Pol. Pismo Ent.*, 37 (4) : 726.

19. **lotus** (Nitzsch), 1866, (*Nirmus*). *Z. ges. NatWiss.*, 28 : 371.

Host: *Cursorius cursor* (Latham), [Pakistan: Lyallpur], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6): 278, as *Q. cursorius* Nitzsch; also on the same host, [Pakistan: Lahore], Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.*: 50; also in Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3): 398 & Ansari, 1959. *Indian J. Ent.*, (1958), 20 (2) 98., cf. Zlotorzycka, 1967. *Pol. Pismo Ent.*, 37 (4): 742, as *Glareolites lotus* (Nitzsch).

lyallpurensis Ansari, 1951. Emerson, 1973. In: *Some ectoparasites of the birds of Asia*: 99. Inadvertant entry. Relates to *Actornithophilus*.

20. **ochropi** (Denny), 1842, (*Nirmus*). *Mon. Anopl. Brit.*, 53, 134, pl. 11 fig. 22.

- Host: **Tringa ochropus** Linne, [Pakistan], Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.*: 50; also in Ansari, 1958. *Indian J. Ent.* (1958), 20 (2) : 98; cf. Zlotorzyska 1967. *Pol. Pismo Ent.*, 37 (4): 719. (One slide from Aligarh Muslim University, Qadri's colls., and labelled as *Degeeriella ochropi* is available in Z. S. I.
21. **punctatus** (Burmeister), 1839, (*Nirmus*). *Handb. Ent.*, 2 : 428.
 Host: (*Dendrocitta rufa*) = **Dendrocitta vagabunda parvula** Whistler & Kinnear, [India: Calcutta], Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 (4): 236, as *Nirmus punctatus*; cf. Zlotorzyska, 1967. *Pol. Pismo Ent.* 37 (4) : 751, taf. 11 photo 11 & taf. 13 photo 3, as *Keoniginirmus* (*Koeniginirmus*) **punctatus** (Burmeister)
22. **quadrissetaceus** (Piaget), 1880, (*Nirmus*). *Pediculines* : 668, pl. fig. 5.
 Host: **Rostratula benghalensis** (Linne), (Slide in B. M. Natural History) [Asia], cf. Zlotorzyska, 1967. *Pol. Pismo Ent.*, 37 (4).
23. **ravus** (Kellogg), 1899, (*Nirmus*) *Occ. Pap. Calif. Acad. Sci.*, 6 : 14, pl. 2 fig. 1.
 Host: (*Actitis hypoleuca* (?)) **Tringa hypoleucos** Linne, [Nepal], (Slide in B. M. Natural History); cf. Zlotorzyska 1967. *Pol. Pismo Ent.*, 37 (4) : 721.
24. **semifissus** (Nitzsch), 1866, (*Nirmus*). In Giebel's *Z. ges. NatWiss.* 28 : 372.
 Host: **Himantopus h. himantopus** (Linne), [Pakistan], Ansari 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.*: 50; also in Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) 399 & Ansari, 1959. *Indian J. Ent.* (1958), 20 (2) : 98. cf. Timmermann, 1953. *Bombus*, 78/79:331 & Zlotorzyska, 1967. *Pol. Pismo Ent.*, 37 (4): 732, as *Proneptis semifissa* (Nitzsch).
25. **semipalmatus** Timmermann, 1955. *Ann. Mag. nat. Hist.*, (12) 8; 525, fig. 11.
 Host: **Limnodromus semipalmatus** (Blyth), [India]; [South Asia], cf. Zlotorzyska, 1967. *Pol. Pismo Ent.*, 37(4):723.

26. **signatus** (Piaget), 1880, (*Nirmus*). *Pedicullines*: 186, pl. 15 fig. 8.
 Host: **Himantopus h. himantopus** Linne, [India ? : Loc, not cited], Ansari, 1947. *Proc. nat. Inst. Sci. India*. 13 (6) : 273. Probably error.
27. **similis** (Giebel), 1866, (*Nirmus*). *Z. ges. NatWiss.*, 28: 374.
 Host: (*Corvus corone*. Error). Probably **Tringa nebularia** (Gunnerus), [Kashgar, E. Turkestan], Kellogg & Paine, 1914. *Rec. India Mus.*, 10 (4) : 237, pl. 14 fig. 3 as *N. clypeatus* K & P., cf. Hopkins & Timmermann, 1954 *Trans. R. ent. Soc. Lond.*, 105 (8) : 139, fig. 6; pl. 1 figs. 5-6. **Tringa nebularia** (Gunnerus), [India], Emerson, 1973. In : *Some ectoparasites of the birds of Asia* : 99. cf. Zlotorzycka, 1967. *Pol. Pismo Ent.*, 37 (4) : 723, taf. 4 photo 3.
28. **sinensis** Timmermann, 1954. *Z. Parasitenk.*, 16 : 203, fig. 10.
 Host: (*Microsarcops cinereus*) = **Vanellus cinereus** (Blyth) [East Asia; Nepal], Zlotorzycka, 1967. *Pol. Pismo Ent.*, 37 (4) : 724.
- (29). **thapari** Tandan, 1951. *Ann. Mag. nat. Hist.*, (12) 4: 807, figs. 5-8.=no. 2.

88. **Rallicola** Johnston & Harrison, 1911

Oncophorus Piaget, 1880 (*nec* Rudow, 1970), *Pedicullines* : 213. Type species : (by subsequent designation) : *O. bisetosus* Piaget.

Rallicola Johnston & Harrison, 1911, *Proc. Linn. Soc. N.S. W.*, 36 : 324.

Type species : "*O. attenuatus* N."

- (1). **clayae** Tandan, 1951. *Ann. Mag. nat. Hist.*, (12) 4 : 810, figs. 9-13. =no. 6.
2. **fulicae** (Denny), 1842, (*Nirmus*). *Mon. Anopl. Brit.*; 50, 125, pl. 9 fig. 2.
 Host: **Fulica a. atra** Linne, [India], (Slide in B. M. (Nat. History)); also, Emerson, 1973. In : *Some ectoparasites of the birds of Asia* : 100.
3. **indicus** Emerson, & Elbel, 1961. *Ent. News.*, 72(5) : 130, figs. 1 & 2.
 Host: **Metopidius indicus** (Latham), [India : Lucknow & Moirang, Manipur]; also, [India], Emerson, 1973. In : *Some ectoparasites of the birds of Asia* : 100.

4. **lugens** (Giebel), 1874, (*Nirmus*). *Insecta epizoa* : 170.

Host: (*Porphyrio poliocephalus poliocephalus*) **Porphyrio** [*Porphyrio*] **poliocephalus** (Latham), [India], Emerson, 1955. *Ann. ent. Soc. Amer.*, 48(4) : 296, figs. 24.

5. **mystax** (Giebel), 1874 (*Nirmus*), *Insecta epizoa* : 301. *Nomen novum* for *Nirmus intermedius* Giebel, 1874, *nec* Nitzsch, 1866.

Host: **Porzana fuscus bakeri** Hartert, [India : Nalbani, Sah Lakes, West Bengal], Lakshminarayana, 1972, *Indian J. Anim. Sci.*, 42 (10) : 861.

6. **ortygometae** (Schrank), 1781, (*Pediculus*). *Enum. Ins., Austr., Indig.* : 503.

Host: **Amaurornis phoenicurus chinensis** (Boddaert), [India : Lucknow], Tandan, 1951. *Ann. Mag. nat. Hist.*, (12) 4: 810, figs. 9-13, as *R. clayae* Tandan; also, [India] Emerson, 1955. *Ann. ent. Soc. Amer.*, 48 (4) : 290, figs. 10, as *R. ortygometae clayae* Tandan.

7. **sulcatus** (Piaget), 1880, (*Oncophorus*). *Pediculines* : 218, pl. 18 fig. 5.

Host: **Hydrophasianus chirurgus** (Scopoli), [India; Sri Lanka (Ceylon)]. (Slide in B. M. (Natural History)).

8. **thompsoni** Tendeiro, 1965. *Revta Estud. Gerais Univ., Mocambique, Laurencio Marques*, (4) 2(6) : 127.

Host : **Porphyrio porphyrio** (Linne), [India], Emerson, 1973. In: *Some ectoparasites of the birds of Asia* : 100.

9. **unguiculatus** (Piaget), 1880, (*Oncophorus*). *Pediculines* : 67, pl. 55 fig. 8.

Host: **Centropus sinensis** (Stephens), [India; Nepal; Sri Lanka (Ceylon)], (Slide in B. M. (Natural History)).

89. **Reticulipeurus** Kéler, 1958

Reticulipeurus Kéler, 1958, *Deutsche Ent. Zeitschr.*, n. F., 5 : 332. Type species : *R. tetraonis* (Grube).

Megalipeurus (s. g.), Kéler, 1958, *Deutsche Ent. Zeitschr.*, n. F., 5 : 327. Type species : *Lipeurus unicolor* Piaget.

1. **burmeisteri** (Taschenberg), 1882, (*Lipeurus*). *Nova Acta Leop.-Carol.*, n. F., 44 : 170, pl. 6 fig. 4.

Hosts: *Lophophorus impejanus* (Latham), [India : Sikkim; Nepal], *L. lhuysii* St. Hilarie & Verreaux [Burma : Upper Minho], *L. scalteri* Jerdon [China : Yunnan], *Tragopan b. blythii* (Jerdon), [India : Assam], *T. t. temminckii* (J. E. Gray), [China : Szechwan], *T. caboti* (Gould), [China : Fokien], Clay, 1938. *Proc. Zool. Soc. Lond.*, (B) 108 : 169, figs. 31, 32a, & 33a; as *Oxylipeurus himalayensis burmiesteri* (Taschenberg); also on the same hosts, [Burma; India; Nepal], Overgaard, 1943. *Ent. Medd.*, 23 : 9.

2. **crossoptilon** (Clay), 1938, (*Oxylipeurus*). *Proc. Zool. Soc. Lond.*, (B), 108: 173, pl. 10 fig. 1.

Host: *Crossoptilon c. crossoptilon* (Hodgson), [China: Szechwan], as *Oxylipeurus baileyi crossoptilon*.

3. **himalayensis** (Rudow), 1869, (*Lipeurus*). *Beitr. Zurkenntniss der Mallophagen* : 33.

Host: *Tragopan melanocephalus* (J. E. Gray), [India : Kashmir], Clay, 1938. *Proc. Zool. Soc. Lond.*, (B), 108: 106, fig. 32b, as *Oxylipeurus himalayensis* (Rudow).

4. **ithaginis** Clay, 1938. *Proc. Zool. Soc. Lond.*, (B), 108: 173, pl. 13 fig. 1.

Host : *Ithaginis l. cruentus* (Hardwicke) [India : Sikkim] as *Oxyliperus baileyi ithaginis* Clay. The host locality is not cited while describing this species.

5. **longus** (Piaget), 1880 (*Lipeurus*). *Pediculines*: 370, pl. 29 fig. 8.

Host: *Tragopan satyra* (Linne), [India : Calcutta], Kellogg & Nakayama, 1915. *Rec. Indian Mus.*, 11 (1) : 139, as *L. longus* Piaget; on the same host, [India ; Sikkim] Clay, 1938. *Proc. Zool. Soc. Lond.*, (B), 108 : 171, figs. 33b, & 35a, as *Oxylipeurus longus* (Piaget); also [India : Sikkim], Overgaard, 1943. *Ent. Medd.*, 23 : 9.

6. **megalops** (Piaget), 1880, (*Lipeurus*). *Pediculines*: 675, pl. 56, fig. 8.

Host: *Rollulus roulroul* (Scopoli), [India: Sikkim]. (A slide from Burma is available in B. M. (Natural History).

7. **mesopelios** (Nitzsch), 1866, (*Lipeurus*). In Giebel's *Z. ges. NatWiss.*, 28 : 379.

Host: **Chrysolophus amherstiae** (Leadbeater), [Tibet], Clay, 1938. *Proc. Zool. Soc. Lond.*, (B), 108:174, figs. 35b, & d; pl. 11 fig. 1.

8. **nitzschi** Kéler, 1958. *Deutsche Ent. Zeitschr.*, n. F., 5: 333, figs. 14, 16, 43, & 52.

Host: **Arborophila t. torqueola** (Valenciennes), [India: Assam & Sikkim], (Slide available in B. M. (Natural History)).

9. **pucrasia** (Clay), 1938, (*Oxylipeurus*). *Proc. Zool. Soc. Lond.*, (B), 108 : 174, pl. 9, fig. 6.

Host: **Pucrasia m. macrolopha** (Lesson), [India: Himalaya], as *Oxylipeurus baileyi pucrasia* Clay; *Pucrasia m. macrolopha* (Lesson), [India : nr Simla], Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10(4): 221, as *Lipeurus intermedius* Piaget; (Slide of K. & P. material is available in the Z. S. I., collections and found identical with *pucrasia* Clay. *Vide* Lakshminarayana, 1970. *Ph. D. Thesis: Systematic studies on Mallophaga on birds and mammals*, Agra University, Agra : 282, pl. 17 figs. 10-11; pl. 18 figs. 3-4).

10. **robustus** (Rudow), 1869, (*Lipeurus*). *Beitr. Zur Kenntnis Malloph.* : 32.

Host: (*Gennaeus nycthemerus*) = **Lophura leuconalana** (Latham), [Burma ; India: Sikkim], (Slide available in B. M. (Natural History)).

11. **tetraophasis** (Clay), 1938, (*Oxylipeurus*). *Proc. Zool. Soc. Lond.*, (B), 186, fig. 40; pl. 13 fig. 3.

Host: **Tetraophasis obscurus obscurus** (J. Verreaux), [China: Yunnan], **T. o. szechenyii** Madarasz, [China : Szechwan & Yunnan].

Rhombiceps Eichler, 1952

Rhombiceps Eichler, 1952, *Zool. Anz.*, 149 : Type species : *Nirmus recurvirostris* (Linne).

The genus is placed for the time being under *Quadriceps*.

90. *Rhynonirmus* Thompson, 1935

Rhynonirmus Thompson, 1935, *Parasitology*, 27 : 281 Type species : *Lipeurus infuscatus* Osborn.

1. **stenurae** Timmermann, 1955. *Ann. Mag. nat. Hist.*, (12) 8 : 513, fig. 13.

Host: **Capella stenura** (Bonaparte), [India; Nepal, & Sri Lanka (Ceylon)]

91. **Ricinus** De Geer, 1778

Ricinus De Geer, 1778. *Mem. Hist. Inst.*, 7 : 69. Type species by designation (Neumann, 1906. *Bull. Soc. Zool. Fr.*, 20 : 56) : **Ricinus fringillae** De Geer.

Nirmus Hermann, 1804, *Mem. Apterolog.* : 12. *Nomen novum* for **Ricinus** De Geer (Rejected and placed on official index)

Physostomum Nitzsch, 1818, *Germar's Mag. Ent.*, 3 : 302. Type species : (by subsequent designation, Harrison, 1916, *Parasitology*, 9 : 24) : "**R. nitidissimum** Nitzsch = **fringillae** De Geer"

1. **balati** Rheinwald, 1968. *Mitt. Hamburg Zool. Mus. Inst.*, 65 : 272. figs. 25 a-f.

Host: (**Phylloscopus nitidus viridanus** (?)) **Phylloscopus trochiloides viridanus** Blyth, [Nepal], (**Seicercus b. burkei**) **Seicercus burkii burkii** (Burton), [Nepal], **canis** De Geer, 1778. See *Trichodectes*. **cornicis** De Geer, 1778. See *Myrsidea*.

2. **fringillae** De Geer, 1778. *Mem. Hist. Ins.* 7 : 71, pl. 4 figs. 5-8.

Hosts: **Emberiza a. aureola** Pallas, [India : Moirang (Manipur); Nepal]; **Acanthis flavirostris** (Linne), [Afghanistan]; **Prunella s. strophiatea** (Blyth), [India : Lachung : Sikkim]. Rheinwald, 1968, *Mitt. Hamburg Zool. Mus. Inst.*, 65 : 202, figs. 1a-c, 2a-e, 3a-c, 5 & 35.

gallinae De Geer, 1778. See *Goniocotes*.

3. **ivanovi** Blagoveshtchensky, 1951. *Paras. Zborn*, 13 : 283, figs. 5, 5a.

Host: (**Montifringilla brandti**) = **Leucosticte brandti** Bonaparte [India; Lachen, Sikkim], Rheinwald, 1968, *Mitt. Hamburg Zool. Mus. Inst.*, 299, figs. 33 a-e.

lari De Geer, 1778. See *Trinoton*.

4. **meinertzhageni** Rheinwald, 1968. *Mitt. Hamburg Zool. Mus. Inst.*, 65 : 288, figs. 30 a-f.

Hosts: **Anthus novaeseelandiae richardi** Vieillot, [India : (Dekkan) Deccan], **A. n. rufulus** Vieillot, [Burma : Mandalay, India : Bombay; Nepal], **A. s. similis**

Jerdon, [India: Baroda], and **A. godlewskii** (Taczanowski), [Sri Lanka (Ceylon): (Mullaition), Mullaittivao (North Province)].

5. **rubeculae** (Schrank), 1776, (*Pediculus*). *Beytr. Naturgesch.*: 115, pl. 5 fig. 4.

Hosts: **Erithacus s. svecicus** (Linne), [India : Bombay], **Saxicola caprata** (Linne), [India : Kangla Tongli (Manipur)], **Monticola solitarius longirostris** (Blyth), [Afghanistan], Rheinwald, 1968, *Mitt. Hamburg. Zool. Mus. Inst.*, 65 : 264, figs. 22a-f, 23 & 24.

6. **serratus** (Durrant), 1906, (*Physostomum*). *Ohio Nat.*, 6: 528, fig. 1B.

Hosts: **Galerida cristata** (Linne) ssp., [India : Poona], **G. c. magna** Hume, [Afghanistan], **Calandrella cinerea**, [*brachydactyla* (Leisler)], = **C. cinera longipennis** (Eversmann) (cf. Ripley, 1961: 263, footnote) [Pakistan: Bahawalpur], **Ammomanes deserti orientalis** (Zarudny & Lowden) (?), [Afghanistan], **Emberiza cia par** Hartert, [Afghanistan: Kabul; Pakistan; Bahawalpur], **E. c. yunnanensis** Sharpe, [China]. Rheinwald, 1968, *Mitt. Hamburg Zool. Mus. Inst.*, 65 : 229, figs. 10 a-f, & 11.

- (7) **thoracicus** (Piaget), 1880 (*nec* Packard, 1870), (*Physostomum*). *Pediculines* : 606, pl. 51, fig. 1. = no. 8.

8. **tinctus** Harrison, 1916. *Parasitology*, 9: 68. *Nomen novum* for **R. thoracicus** (Piaget), 1880 (*nec* Packard, 1870)

Host: (*Hypsipetes m. mccllellandi*) = **Hypsipetes virescens mccllellandi** Horsfield, [Nepal], Rheinwald, 1968, *Mitt. Hamburg. Zool. Mus. Inst.*, 65: 293, figs. 31a-f.

92. *Saemundssonina* Timmermann, 1935

Saemundssonina Timmermann, 1935, *Zool. Anz.*, 114 : 97. Type species : *Philopterus gonothorax* (Giebel).

1. **hopkinsi** Clay, 1949. *Amer. Mus. Novit.*, no. 1409: 18, figs. 10, 13, 15 & 21.

Host: **Sterna aurantia** J.E. Gray, [Burma : Myitkyina; India: Deccan; Nepal].

2. sterna (Linne), 1758, (*Pediculus*.) *Syst. Nat.* ed. 10 : 612.

Host: *Gelochelidon n. nilotica* (Gmelin), [India: (Rajputana) Rajasthan; Sri Lanka (Ceylon)], Clay, 1949. *Amer. Mus. Novit.*, no. 1409: 4, figs. 1-3, 16, 22 & 23, also Lakshminarayana, 1972. *Angew. parasitol.*, 13 : (1) : 52, 53.

93. Spironrimus Zlotorzyska, 1964

Spironirmus Zlotorzyska, 1964, *Acta Parasitol. Polonica*, 12 (24) : 261. Type species : *Nirmus nebulosus* Burmeister.

1. chitlatilyar (Ansari), 1955, (*Brueelia*). *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 55.

Host: (*Sturnus vulageris humii*) = *Sturnus vulgaris indicus* Blyth, [Pakistan]; also Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 395 & Ansari, 1958. *Indian J. Ent.*, 20 (1): 52, figs. 35-36.

2. gulabitilyar (Ansari), 1955, (*Brueelia*). *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 54.

Host: *Sturnus r. roseus* (Linne), [Pakistan] : also Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3): 395 & Ansari, 1958. *Indian J. Ent.*, 20 (1): 52, figs. 25-34, as *Brueelia. gulabitilyar*, Ansari.

Stenocrotaphus Kéler, 1939

Stenocrotaphus Kéler, 1939, *Nova Acta Leop.-Carol.*, (n. F.). 8 : 124.

Type species : *Goniocotes gigas* Taschenberg.

Inseparable from *Goniodes*.

94. Strigiphilus Mjöberg, 1910

Strigiphilus Mjöberg, 1910, *Ark. Zool*, 6 (13) : 132. Type species: *Docophorus heterocerus* N.

Eustrigiphilus Ewing, 1926, *Proc. ent. Soc. Wash.*, 28 : 148. Type species : *Philopterus ceblebrachys* (Nitzsch).

1. aitkeni Clay, 1960. *J. Ent. Soc. Qd.*, 5: 12, figs. 5, 7, 9, 11, pl. 2.

Host: *Tyto novaehollandiae castanops* (Gould), [India: Raipur], (This host species has not been referred to within Indian limits in Ripley, 1961. *Synopsis of the Birds of India and Pakistan*, Bombay nat. Hist. Soc. Publ.,..... . Lakshminarayana).

2. **boomae** Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.*, : 44.
Host: *Otus bakkamoena plumipes* (Hume), [Pakistan]; also Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3): 397 & Ansari, 1959. *Indian J. Ent.*, (1958), 20 (2): 88, figs. 159, & 160.
3. **bramae** (Qadri), 1935, (*Eustrigiphilus*). *Z. Parasitenk.*, 8: 236, fig. 8.
Host: *Athene brama*, [*indica* (Franklin)], [India].
4. **cursor** (Burmeister), 1838, (*Docophorus*). *Handb. Ent.*, 2: 426.
Host: *Asio o. otus* (Linne), [Pakistan], Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.*, : 43, also Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 397, & Ansari, 1959. *Indian J. Ent.*, (1958), 20 (2): 88.
5. **goniodicerus** Eichler, 1949. *Beitr. tax. Zool.*, 1: 11. *Nomen novum* for *Docophorus heteroceros* Nitzsch, 1861 nec. Grube, 1851.
Host: *Bubo bubo bengalensis* (Franklin), [Pakistan], Ansari, 1953. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* 44; also Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3): 397 & Ansari, 1959. *Indian J. Ent.*, (1958), 20 (2) : 88.
- (6) **heteroceros** (Nitzsch), 1861, (nec. Grube, 1851). In Giebel's *Z. ges. NatWiss*, 18 : 527. = no. 5.
7. **macrogenitalis** Emerson & Elbel, 1957. *Proc. Biol. Soc. Wash.* 70: 197, figs. 4, 9.
Host: *Glaucidium cuculoides rufescens* Baker, [India : Oating ?) Assam] [same as above and also [India: Dikchu, Sikkim], Clay, 1974. *J. Ent.*, (B) 42 (2) : 141, figs. 1, 2, 8, 13, 19.
8. **nudipes** (Piaget), 1880, (*Docophorus*). *Pediculines*; 26 pl. 1 fig. 6.
Host: *Asio o. otus* (Linne), (Pakistan), Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.*: 43, also Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3): 397 & Ansari, 1959. *Indian J. Ent.*, (1958), 20 (2): 87.
9. **rostratus** (Burmeister), 1838, (*Docophorus*). *Handb. Ent.*, 2 : 427
Host: *Tyto alba stertens* Hartert, [Pakistan], Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.*: 43; also Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 397, & Ansari, 1959. *Indian J. Ent.*, (1958), 20 (2) : 87,

10. **strigis** (Pontoppidan), 1763, (*Pediculus*), *Danske Atlas*, 1 : 699, pl. 30.

Host: *Bubo bubo bengalensis* (Franklin), [Pakistan], Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 43; also Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 397 & Ansari, 1959. *Indian J. Ent.*, (1958), 20 (2) : 88.

95. *Struthiolipeurus* Cummings, 1916

Struthiolipeurus Cummings, 1916, *Proc. Zool. Soc. Lond.*, 1916 : 679.

Type species : "*Struthiolipeurus asymmetricus* Piaget"

This is not a genus from India in strict sense although reported from India.

1. **stresemanni** Kéler, 1960, *Zool. Anz.*, 165 (11/12) : 451, figs. 1, 2, 4, 5, 7, 8, & 10.

Host: *Rhea* sp., [India : Calcutta Zoo], Lakshminarayana, 1970, In *Ph.D. Thesis, Systematic studies on Mallophaga on birds & mammals*, Agra University, Vol. I : 298; vol. II : pl. N. figs. 6-7; pl. 21 figs. 1-3; also Lakshminarayana, 1973. *Angew. Parasitol.*, 14 (4) : 227.

96. *Sturnidoecus* Eichler, 1944

Sturnidoecus Eichler, 1944. *Stettin. ent. Ztg.*, 105: 81. Type species : "*Docophorus leontodon* Nitzsch, *Sensu* Piaget, 1880".

1. **acutifrons** Ansari, 1967. *Pak. jour. Hlth.*, 1: 8 & 31.

Host: (*Sturnia m. malabarica*) = *Sturnus m. malabaricus* (Gmelin), [India: Mysore; Nepal].

2. **affinis** (Piaget), 1880. (*Docophorus*). *Pediculines*: 67, pl. 5 fig. 3.

Host: *Acridotheres t. tristis* Linne [Pakistan], Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.*, 161; also in Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 397 & Ansari, 1959. *Indian J. Ent.*, (1958) 20 (2) : 82; (*Aethiopsar f. fuscus* & *A. f. javanicus*) *Acridotheres f. fuscus* (Wagler) & *A. javanicus* Cabanis, [Nepal], Ansari, 1967. *Pak. jour. Hlth.*, 1: 8 & 31.

3. **atharae** Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.*: 61.

Host: (*Cyanosylvia s. subcica*) = *Erithacus s. svecicus* (Linne), [Pakistan]; also Ansari, 1956. *Indian J. Ent.*

- (1955), 17(3) : 396, & Ansari, 1959. *Indian J. Ent.* (1958), 20 (2) : 82 figs. 118-119.
4. **avinus** Ansari, 1967. *Pak. jour. Hlth.*, 1: 9 & 31.
Host: **Acridotheres t. tristis** (Linne), [India: (Rajputana) Rajasthan; Nepal; Pakistan; Lyallpur], as *S. bannoo avinus* Ansari.
 5. **bannoo** Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 62.
Host: **Acridotheres ginginianus** (Latham), [Pakistan]; also in Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 397 & Ansari, 1959. *Indian J. Ent.*, (1958), 20(2) : 84, figs. 129-136; [India: (Rajputana) Rajasthan; Pakistan: Lyallpur], Ansari, 1967. *Pak. jour. Hlth.*; 1: 8, 9 & 31; on the same host, [India], Emerson, 1973. *In some ectoparasites of the birds of Asia*: 103.
 6. **bituberculatus** (Giebel), 1874. (*Docophorus*). *Insecta epizoa*: 90.
Host: (*Dicrurus maerocercus peninsularis*) = **Dicrurus adsimilis macrocercus** Vieillot, [Pakistan], Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 59; also Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 396, & Ansari, 1959. *Indian J. Ent.*, (1958), 20 (2) : 79.
 7. **capensis** (Giebel), 1874, (*Docophorus*). *Insecta epizoa* : 90.
Hosts: **Sturnus contra superciliaris** (Blyth), [India: Assam], Ansari, 1967, *Pak. jour. Hlth.*, 1: 8, 32.
 8. **capitis** Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.*: 61.
Host: (*Saxicoloides fulicata cambainensis*) = **Saxicoloides fulicata cambaiensis** (Latham), [Pakistan]; also Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 397, & Ansari, 1959. *Indian J. Ent.*, (1958), 20 (2) : 82, figs. 120-128.
chendoola Ansari, 1955. See *Philopterus*.
 9. **chilchil** Ansari, 1956. *Proc. 7th Pak. Sci. Conf. Sec. Biol.*: 59.
Host: (*Argya c. caudata*) = **Turdoides caudatus caudatus** (Dumont), [Pakistan]; also Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 396, & Ansari, 1959. *Indian J. Ent.*, (1958), 20 (2) : 77, figs. 85-92.
 10. **fragilis** Ansari, 1967. *Pak. Jour. Hlth.*, 1: 8, 32.
Host: (*Acridotheres tritis melanosternus*) = **A. tristis melanosternus** Legge, [Ceylon].

11. **graculae** (Piaget), 1880, (*Docophorus*). *Pediculines* : 67, pl. 5 fig. 2.
 Host: (*Urocissa occipitalis*) = *Kitta erythrorhyncha occipitalis* (Blyth) (probably error), [Nepal], Kellogg & Paine, 1914. *Rec. Indian Mus.*, 10 (4) : 234, as *Doc. leontodon* var. *graculae* Piaget.

12. **guldum** Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 59.
 Host: (*Molpastes haemorrhoidalis intermedius*) = *Pycnonotus cafer* (Linne) (either sub sp. *humayuni* Deignan or *intermedius* Blyth (. Lakshminarayana), [Pakistan]; also Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) 396; & Ansari, 1959. *Indian J. Ent.*, (1958), 20 (2) 78, figs. 93-98.
irritans Ansari, 1955. See *Penenirmus*.

13. **laticephalum** Ansari, 1967. *Pak. Jour. Hlth*; 1: 8, 9, 31.
 Host: (*Aethiopsar albocinctus*) = *Acridotheres albocinctus* Godwin-Austen & Walden, [India: Manipur], as *S. bannoo laticephalum* Ansari.

- (14) **leontodon** (Nitzsch), 1818, (*Philopterus* s.g. *Docophorus*). *Germar's Mag. Ent.*, 3 : 290. *Nomen novum for Pediculus sturni* Schrank) *sensu* Kellogg & Paine, 1914. = no. 11.

15. **pastoris** (Denny), 1842, (*Docophorus*). *Mon. Anopl. Brit.*, : 43, 77, pl. 4 fig. 3.
 Host: (*Pastor roseus*) = *Sturnus roseus* (Linne), [Pakistan], Ansari, 1955. *Proc. 7th Pak. Sci. Cong. Sec. Biol.* : 61; also Ansari, 1956. *Indian J. Ent.*, (1958), 20 (2) : 83; also on the same host, [India: (Deccan) Andhra Pradesh; Pakistan: Lyallpur], Ansari, 1967. *Pak. Jour. Hlth.*, 1: 7, & 34.

16. **raji** (Ansari), 1947, (*Penenirmus*). *Proc. nat. Inst. Sci. India*, 13 (6) : 269, fig. 5.
 Host: (*Gymnoris x. xanthocollis*) = *Petronia x. xanthocollis* Burton, & *Passer domesticus indicus* Jardine & Selby, [Pakistan : Lyallpur].

17. **saleimi** Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 60.
 Host: *Oenanthe picata* (Blyth), [Pakistan]; also Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3) : 396, & Ansari, 1959. *Indian J. Ent.*, (1958), 20 (2) : 80, figs. 110-117.

18. **sturni** (Schrank), 1776, (*Pediculus*). *Beytr. Naturgesch.*: 118, pl. figs. 11-14.

Hosts: (*Pastor roseus*) = **Sturnus roseus** (Linne), (*Sturnus vulgaris humii*) = **Sturnus vulgaris indicus** Blyth, (*Temenuchus pagodarum*) = **Sturnus pagodarum** (Gmelin), *Acridotheres t. tristis* (Linne), and *A. ginginianus* (Latham, [Pakistan : Lyallpur], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 273, as *Philoptyerus sturni* (Schrank) (May have been based on composite species) : also on (*Sturnus vulgaris humii*) = **Sturnus vulgaris indicus** Blyth, [Pakistan], Ansari; 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.*: 61; also Ansari, 1956. *Indian J. Ent.*, (1955), 17 (3): 397, & Ansari, 1959. *Indian J. Ent.*, (1958), 20 (2) : 83. *S. v. humii* Brooks, [Pakistan: Lyallpur], Ansari, 1967. *Pak. Jour. Hlth.*, 1: 7 & 35.

19. **zoophilic** Ansari, 1967. *Pak. Jour. Hlth.*, 1: 8 & 36.

Host: (*Sturnopaster sinensis sinensis*) = ? **Sturnus sinensis** (Gmelin), [India: Bihar; Nepal].

97. **Syrrhaptoecus** Waterston, 1928

Syrrhaptoecus Waterston, 1928, *Proc. Zool. Soc. Lond.*: 237. Type species (by subsequent designation, Hopkins, 1950, *Ann. Mag. Nat. Hist.*, (12) 3 : 235) : *S. uncinus* Waterston.

1. **alchatae** (Rudow), 1869, (*nec* Rudow, 1870). (*Lipeurus*.) *Beitr. Kenntn. Malloph.* : 36.

Host: **Pterocles alchata** (Linne), & (*Eremialector indicus*) **Pterocles indicus** (Gmelin), [India: Gurgaon Dist. (Punjab)], Waterston, 1928. *Proc. Zool. Soc. Lond.* 1: 344, fig. 1a.

2. **angulatus** Waterston, 1928. *Proc. Zool. Soc. Lond.*, 1 : 353, figs, 6a, 8a, 9b, & 9d.

Host: (*Eremialector indicus*) = **Pterocles indicus** (Gmelin) [India: Gambhur, Gurgaon Dist. (Punjab)].

3. **emahusaini** Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6): 281, fig. 9.

Host: (*Pterocles exustus hindustan*) **Pterocles exustus erlan-geri** Neumann, [Pakistan : Lyallpur].

4. **falcatus** Waterston, 1928. *Proc. Zool. Soc. Lond.*, 1 : 345, figs. 2a & 10b.

Hosts: (*Pterocles senegallensis*) *Pterocles e. exustus* Temminck, [India : Ahmadnagar (Maharashtra), North India, Wadali (Gujarat)] cf. Hopkins & Clay, 1952 : 346; (*P. exustus hindustan*) *P. exustus erlangeri*, Neumann, [Pakistan : Lyallpur], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 283.

5. *mitratus* Waterston, 1928. *Proc. Zool. Soc. Lond.*, 1 : 348., figs. 4a & 9a.

Host: (*Eremialector coronatus*) = *Pterocles coronatus saturatus* Kinnear, [India : Kashgar; Pakistan; Erie hills & Shikarpur (Sind)].

6. *pallasi* Waterston, 1928. *Proc. Zool. Soc. Lond.*, 1 : 353. fig. 5a.

Host: (*Eremialector orientalis*) = *Pterocles orientalis* (Linne), [India : nr. Fazilka (Punjab)].

7. *tibetanus* Waterston, 1928. *Proc. Zool. Soc. Lond.*, 1:342, fig. 3b.

Host: *Syrrhaptes tibetanus* Gould, [India: Ladakh & Karakorum (Jammu & Kashmir)].

Szidatiella Eichler, 1944

Szidatiella Eichler 1944, *Stettin. ent. Ztg.*, 105 : 81. Type species : *Docophorus elongatus* Piaget.

For the present retained under *Quadriceps*.

Tetrophthalmus Grosse, 1885

Tetrophthalmus Grosse, 1885 (*nec* Hope, 1845), *Z. Wiss. Zool.*, 42 : 534. Type species (by monotypy) : *T. chilensis* Grosse.

Synonymous with *Piagetiella* Neumann.

Timmermanniceps Eichler & Zlotorzyska, 1964

Timmermanniceps Eichler & Zlotorzyska, 1964, *Dtsch. ent. Zeitschr.*, (n. F.), (4-5) : 319. Type species : *Nirmus phalaropi* Denny. The genus is retained for the present under *Quadriceps*.

Traihoriella Ansari, 1947

Traihoriella Ansari, 1947, *Proc. nat. Inst. Sci. India*, 13 : 290. Type species : *T. punjabensis* Ansari.

Inseparable from *Brueelia*.

98. Trichodectes Nitzsch, 1818

Trichodectes Nitzsch, 1818, *Germar's Mag. Ent.*, 3 : 294. Type species : (by subsequent designation, Johnston & Harrison, 1911. *Proc. Linn. Soc' N. S. W.*, 36 : 326) : '*T. canis* De Geer (= *T. latus* N.)'

1. **canis** (De Geer), 1778, (*Ricinus*). *Mem. Hist. Inst.*, 7 : 81, pl. 4 fig. 16.

Hosts: **Canis familiaris** Linne, [Pakistan : Lyallpur], Ansari 1951. *Indian J. Ent.*, 13(2) : 133, fig. 42; (Jackal)
Canis aureus Linne, [India : Calcutta], Sen & Fletcher, 1962. *Vet. Ent. & Acarology in India*, I.C.A.R., New Delhi : 410, as *T. latus* Nitzsch;
Vulpes bengalensis Shaw, [Nepal: Dumkhauli, Nawal Parasi], Emerson, 1971, *J. med. Ent.*, 8 (6) : 622.

caprae Gurlt, 1843. See *Damalinia*.

2. **emeryi** Emerson & Price, 1974. *Proc. Biol. Soc. Wash.*, 87 (10) : 77, figs. 1-5.

Host: **Martes flavigula** [Boddaert], [Nepal : Sankhuwa Sabha].

equi Denny, 1842. See *Damalinia*.

forficula Piaget, 1880. *Damalinia*.

hemitragus Cummings, 1916. See *Damalinia*.

- (3) **latus** Nitzsch, 1818. *Germar's Mag. Ent.*, 3 : 296. *Nomen novum* for *R. canis* De Geer, 1778. = no. 1.

limbatus Gervais, 1844. See *Damalinia*.

muntiacus Seguy, 1948. See *Damalinia*.

4. **mustelae** (Schrank), 1803, (*Pediculus*). *Fauna Boica* : 186.

Host: **Mustela sibirica** Pallas, [Nepal : Phulung Ghyang, Nuwakot], Emerson, 1973. *J. Med. Ent.*, 8(6) : 622,
subrostratus Burmeister, 1838. *Felicola*.

***Tricholipeurus* Bedford, 1929**

Tricholipeurus Bedford, 1929, *Rep. vet. Res. S. Afr.*, 15 : 514. Type species : *T. aepycerus* Bedford.

Not separable from *Damalinia*. May be considered as subgenus.

99. Trinoton Nitzsch, 1818

Trinoton Nitzsch, 1818, *Germar's Mag. Ent.*, 3 : 300. Type species (by monotypy) : *Liotheum (Trinoton) conspurcatum* Nitzsch.

1. **casarcae** Eichler, 1942. *Stettin. ent. Ztg.*, 104; 98, fig. 8.
 Host: (*Casarca ferruginea*) = *Tadorna ferruginea* (Pallas), [Pakistan], Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Agric.* : 56; also in Ansari, 1956. *Indian J. Ent.* (1955), 17(3) : 400, & Ansari, 1957. *Indian J. Ent.*, (1956), 18(4) : 437.
2. **emersoni** Clay, 1963. *Mem. Qd. Brisbane*, 14 : 92, pls. 9-11.
 Host: *Dendrocygna javanica* (Horsfield), [India; Sri Lanka (Ceylon)].
- (3) **lari** (De Geer), 1778, (*Ricinus*), *Mem. Hist. Inst.*, 7 : 77, pl. 4 fig. 12.=no. 5.
4. **nyrocae** Eichler, 1943. *Stettin. ent. Ztg.*, 104 : 97, figs. 6 & 7.
 Host: (*Nyroca ferina*) = *Aythya ferina* (Linne), [Pakistan : Jati (Tatta Dist.)] Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Agric.* : 56; also in Ansari, 1956. *Pakistan J. Sci. Res.*, 8(2) : 59; Ansari, 1956. *Indian J. Ent.* (1955), 17 (3) : 400, & Ansari, 1957. *Indian J. Ent.*, (1956), 18 (4) : 435.
5. **querquedulae** (Linne), 1758, (*Pediculus*.) *Syst. Ent.*, ed. 10 : 612.
 Host: *Anas c. crecca* Linne, [India: (Rajputana) Rajasthan; Nepal], Clay & Hopkins, 1950. *Bull. Br. Mus. nat. Hist. (Ent.)*, 1 (3) : 243, figs. 26-28; pl. 2 fig. 2.; (*Nettion c. crecca*) = *Anas c. crecca* Linne, & (*Nyroca f. ferina*) = *Aythya f. ferina* (Linne), [Pakistan: Lyallpur]; Ansari, 1951. *Proc. nat. Inst. Sci. India*, 17 (2) : 171 (Probably material from *A. f. ferina* may be identical with no.4); *A. c. crecca* Linne, [Nepal], Clay & Hopkins, 1954. *Bull. Br. Mus. nat. Hist. (Ent.)*, 3 (6) : 239, as *Ricinus lari* De Geer syn. *T. querquedulae* (Linne); *Anas acuta* Linne, *A. clypeata* Linne, *A. crecca* Linne, *A. penelope* Linne, & *A. strepera* Linne, [India], Emerson, 1973. In: *Some ectoparasites of the birds of Asia* : 119.

100. *Turnicola* Clay & Meinertzhagen, 1938

Turnicola Clay & Meinertzhagen, 1938, *Entomologist*, 71 : 278. Type species : *Lipeurus angustissimus* Giebel.

1. **angustissimus** (Giebel), 1866, (*Lipeurus*). *Z. ges. NatWiss.*, 28 : 382.
Host: **Turnix suscitator** (Gmelin), [India; Nepal]. (Slide in British Museum (Natural History)).

101. *Turturicola* Clay & Meinertzhagen, 1937

Turturicola Clay & Meinertzhagen, 1937, *Entomologist*, 70 : 278, fig. 1b. Type species : *T. salimalii* Clay & Meinertzhagen.

1. **cruzesilvai** Tendeiro, 1965. *Jta. Invest. Ultramar*, (2) 32 : 25, figs. 17, 21, & 27.
Host: **Streptopelia senegalensis** (Linne), [India], (Slide in B. M. (Natural History)).

2. **salimalii** Clay & Meinertzhagen, 1937. *Entomologist*, 70 : 278, fig. 1b.

Hosts: **Streptopelia decaocta decaocta** (Frivaldszky), *Oenopelia t. tranquebarica* = *S. t. tranquebarica* (Hermann), [India : (Rajputana) Rajasthan]; **Columba livia intermedia** Strickland, *S. d. decaocta* (Frivaldszky), *S. chinensis suratensis* (Gmelin), *S. senegalensis cambayensis* (Gmelin), & On (*Turdoides t. terricolor*) = *Turdoides striatus 'indianus* (Ticehurst), (*Leucocirca aureola burmanica*) = *Rhipidura 'aureola burmanica* (Hume), *Acridotheres t. tristis* (Linne), *Passer domesticus indicus* Jardine & Selby, & (*Psittacula krameri manillensis*) Probably *P. krameri borealis* (Neumann), [Pakistan : Lyallpur], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 260. (The last named five species are apparently not the true hosts).

Uchida Ewing, 1930

Uchida Ewing, 1930, *Proc. biol. Soc. Wash.*, 43 : 125. *Nomen novum* for *Neumannia* Uchida, 1926 (*nec* Trouessart, 1888).

Inseparable from *Menacanthus*.

102. *Upupicola* Clay & Meinertzhagen, 1939

Upupicola Clay & Meinertzhagen, 1939, *Entomologist*, 72 : 164. Type species: "*Degeeriella melanophrys* (Nitzsch)".

- (1) **melanophrys** (Nitzsch), 1866, (*Nirmus*.) In Giebel's *Z. ges. NatWiss.*, 28 : 369. = no. 2.

2. **upupae** (Schrank), 1803, (*Pediculus*). *Fauna Boica*: 189 (= "upupae" Denny, 1842, (*Docophorus*). *Mon. Anopl. Brit.*: 45, 92, pl. 8 fig. 1).

Hosts: (*Upupa epops orientalis*) = *Upupa epops ceylonensis* Reichenbach, [Pakistan : Lyallpur], Ansari, 1947. *Proc. nat. Inst. Sci. India*, 13 (6) : 283, as *U. melanophrys* (Nitzsch); also in Ansari, 1955. *Proc. 7th Pak. Sci. Conf. Sec. Biol.* : 45; Ansari, 1956. *Indian J., Ent.*, (1955), 17 (3) : 397, & Ansari, 1959. *Indian J. Ent.*, (1958), 20 (2) : 91, as *U. upupae* (Schrank); *U. e. epops* Linne, [India; Pakistan], Clay & Hopkins, 1960. *Bull. Br. Mus. nat. Hist. (Ent.)*, 12 figs. 13-18; pl. 2 figs. 1 & 2.; *U. epops* Linne, [India], Emerson, 1973. In: *Some ectoparasites of the birds of Asia*: 104.

Virgula Clay, 1941

Virgula Clay, 1941 (nec Simpson, 1900), *Parasitology*, 33 : 119. Type species: *Goniodes meleagridis* (Linne).

A synonym of *Chelopistes* Kéler.

PART II — (HOST INDEX)

CLASS A : AVES

- I : Rheiformes
- II : Podicipediformes
- III : Procellariiformes
- IV : Pelecaniformes
- V : Ciconiiformes
- VI : Phoenicopteriformes
- VII : Anseriformes
- VIII : Falconiformes
- IX : Galliformes
- X : Gruiformes
- XI : Charadriiformes
- XII : Columbiformes
- XIII : Psittaciformes
- XIV : Cuculiformes
- XV : Strigiformes
- XVI : Caprimulgiformes
- XVII : Apodiformes
- XVIII : Coraciiformes
- XIX : Piciformes
- XX : Passeriformes

CLASS B : MAMMALIA

- I M : Marsupialia
- II M : Carnivora
- III M : Proboscidea
- IV M : Perissodactyla
- V M : Artiodactyla

(* Those marked with this sign are captive specimens (or species not given in Ripley, 1961 for Aves.)

A. CLASS : AVES**SUBCLASS : NEORNITHES****SUPERORDER : NEOGNATHAE****ORDER I : RHEIFORMES****Family (1) : RHEIDAE**

- * 1. *Rhea* sp. (95.1)

ORDER II : PODICIPEDIFORMES**Family (1) : PODICIPEDIDAE**

- (1) *Colymbus cristatus*. See II (i) : 2.
- 2. *Podiceps c. cristatus* (Linne) (85.2)
- 3. *Podiceps ruficollis capensis* Salvadori (10.1; 85.2)
- (4) *Poliocephalus ruficollis*. See II (i) : 3.

ORDER III : PROCELLARIFORMES**Family (i) : DIOMEDEIDAE**

- *1. *Diomedea exulans* (Linne) (81 1)

Family (ii) : PROCELLARIIDAE

- *2. *Pterodroma brevirostris* (Lesson) (14.1)

ORDER IV : PELECANIFORMES**Family (i) : PELECANIDAE**

- 1. *Pelecanus onocrotalus* Linne (83.1)

Family (ii) : SULIDAE

- (1). *Sula fiber*. See IV (ii) : 2.
2. *Sula leucogaster plotus* (Forster) (79.4)
3. *Sula sula* (Linne) (39.1)

Family (iii) : PHALACROCORACIDAE

- (1). *Haliaeator niger*. See IV (iii) : 2.
- *2. *Haliaeator pygmeus* (Pallas) (79.2)
3. *Phalacrocorax niger* (Vieillot) (39.2; 79.2)
- *4. *P. sulcirostris* (Brandt) (39.2)

Family (iv) : ANHINGIDAE

(Peters, 1931, Wetmore, 1951; Vaurie, 1965; & Storer, 1971, consider this family distinct from Phalacrocoracidae, unlike, Mayr & Amadon, 1951; & Ripley, 1961).

- (1). *Anhinga melanogaster*. See IV (iv) : 2.
- (2) *Anhinga rufa melanogaster* Pennant (79.1)

Family (v) : FREGATIDAE

1. *Fregata ariel* (G. R. Gray) (26.2)

ORDER V : CICONIIFORMES

Family (i) : ARDEIDAE

(Subfamily : ARDEINAE)

1. *Ardea purpurea* Linne (24.1)
2. *Ardeola grayii* (Sykes) (12.1; 12.2; 28.1)
3. *Bubulcus ibis coromandus* (Boddaert) (11.6; 24.1)
4. *Nycticorax n. nycticorax* (Linne) (24.1)

Family (ii) : CICONIIDAE

(Subfamily : CICONIINAE)

1. *Anastomus oscitans* (Boddaert) (11.9; 24.5; 26.22; 26.23)
2. *Ciconia e. episcopus* (Boddaert) (11.3; 24.5; 26.39)
- (3). *Dissoura e. episcopus*. See V (ii) : 2.
4. *Leptoptilos dubius* (Gmelin) (24.6; 26.7)
5. *L. javanicus* (Horsfield) (11 7; 24.6; 26.7)
6. *Xenorhynchus a. asiaticus* (Latham) (11 1; 24.5; 26.4)

(Subfamily : Mycteriinae)

7. **Ibis leucocephalus** (Pennant) (11 11; 24.3; 24.17; 70.1)

Family (iii) : THRESKIORNITHIDAE

(Subfamily : PLATALEINAE)

1. **Platalea l. leucordia** Linne [major Temminck & Schlegel]
(11 10; 26.26; 41 1; 54.3; 54.4)

(Subfamily : THRESKIORNITHINAE)

2. **Plegadis falcinellus** (Linne) (54.4)
 *3. **Pseudibis davisoni** (Hume) (11.2; 26.8)
 4. **P. papillosa** (Temminck) (11.4; 54.2)
 5. **Threskiornis melanocephala** (Latham) (11.8; 26.20; 54.1; 54.4)
 *6. **T. m. molucca** (Cuvier) (26.1)

ORDER VI : PHOENICOPTERIFORMES

(Mayr & Amadon, 1951; Vaurie, 1965; & Storer, 1971, conside, this order distinct, while, Peters, 1931, Wetmore, 1951; & Ripley, 1961r treated it as a family of Ciconiiformes.)

Family (i) : PHOENICOPTERIDAE

- (1). *Phoenicopus antiquorum*. See VI (i) : 2.
 2. **P. roseus** Pallas (9.3; 26.13; 26.28; 26.29)

ORDER VII : ANSERIFORMES

Family (i) : ANATIDAE

(Subfamilies & tribes are after Delacour, 1954-59).

(Subfamily : ANSERINAE)

(Tribe : Dendrocygnini)

1. **Dendrocygna javanica** (Horsfield) (1 1; 99.2)
 *2. **D. viduata** (Linne) (1.3)

(Tribe : Anserini)

3. **Anser anser** (Linne) (8.1)
 4. **A. indicus** (Latham) (8.1)

(Subfamily : ANATINAE)

(Tribe : Tadornini)

(5) *Casarca f. ferruginea*. See VII (i) : 6.6. *Tadorna ferruginea* (Pallas) (8.3; 8.6; 9 1; 9.4; 54.4; 99.1)

(Tribe : Anatini)

(7) *Anas boschas*. See VII (i) : 6.8. *A. acuta* Linne (8.3; 99.5)9. *A. clypeata* Linne (8.3; 99.5)10. *A. crecca* Linne (8.3; 8.7; 99 5)11. *A. Penelope* Linne (8.3; 99.5)12. *A. p. platyrhynchos* Linne (8.3)13. *A. querquedula* Linne (53.1; 53.3)14. *A. strepera* Linne (8.3; 99.5)

(Tribe : Aythyini)

15. *Aythya f. ferina* (Linne) (8.3; 8.5; 9.1; 9.2; 99.4; 99 5?)16. *Netta rufina* (Pallas) (1.2; 8.3; 53.2)(17) *Nyroca f. ferina*. See VII (i) : 15.

(Tribe Cairninini)

18. *Sarkidornis melanotos* (Pennant) (8.2; 53.2)*Species indeterminate*

(19) Dun bird (Probably VII (i) : 15).

(20) Domestic duck (33.2)

(21) Unidentified duck (Probably a teal) (8.4)

ORDER VIII : FALCONIFORMES

Family (i) : ACCIPITRIDAE

(Subfamilies after Peters, 1931)

(Subfamily : ELANINAE)

1. *Elanus caeruleus vociferus* (Latham) (36.3)

(Subfamily : PERNINAE)

2. *Aviceda jerdoni* (Blyth) (58.6)(3). *Baza jerdoni*. See VIII (i) : 2.(4) *Pernis apivorus ruficollis*. See VIII (i) : 6.5. *P. ptilorhynchus* (Temminck) (36.7; 74.2)6. *P. ptilorhynchus ruficollis* Lesson (26.3; 36.7)

(Subfamily : MILVINAE)

(7). *Milvus melanotis*. (Error). Probably VIII (i) : 50.

8. *Milvus migrans* (Boddaert) [govinda Sykes] (26.39; 29.6; 31.2; 36.5; 36.12; 36.16; 58.6)
9. *M. migrans lineatus* (J. E. Gray) (26.39; 58.6)
10. *Haliastur indus* (Boddaert) (26.9; 26.15; 26.39; 36.11; 36.12; 58.6)

(Subfamily : ACCIPITRINAE)

11. *Accipiter badius* (Gmelin) (26.41; 36.8; 58.6)
12. *A. nisus* (Linne) (36.9)
13. *A. trivirgatus indicus* (Hodgson) (36.15)
14. *A. t. peninusulae* Koelz (36.15)
15. *Neophorn percnopterus* (Linne) (3.3; 26.25; 43.1)

(Subfamily : Buteoninae)

16. *Aquila chrysaetos* (Linne) (43.7)
17. *A. clanga* Pallas (58.10)
18. *A. heliaca heliaca* Savigny (36.2; 43.7; 43.7; 58.10)
19. *A. n. nipalensis* (Hodgson) (26.14; 43.7)
20. *A. pomarina* C. L. Brehm [hastata (Lesson)] (36.2; 43.7; 58.10)
21. *A. rapax* (Temminck) (36.4)
22. *A. rapax vindhiana* Franklin (43.7)
- *23. *Butastur liventer* (Franklin) (36.1)
24. *B. teesa* (Franklin) (36.1; 36.5)
- (25) *Buteo burmanicus burmanicus*. See VIII (i) : 26.
26. *Buteo buteo* Linne (*burmanicus* Hume) (26.39; 57.2)
27. *Buteo rufinus rufinus* [Cretzschmar] (58.6)
28. *Haliaeetus leucoryphus* (Pallas) (26.39; 36.12; 58.10)
- (29) *Hieaaetus pennatus*. See VIII (i) : 31.
- (30) *Hieraaeti pennatus*. See VIII (i) : 31.
31. *Hieraaetus pennatus* (Gmelin) (26.42; 29.5; 43.8; 58.6)
- (32) *Hieraaetus ponnatus*. See VIII (i) : 31.
33. *Ichthyophaga ichthyaetus* (Horsfield) (36.4)

(Subfamily : AEGYPIINAE)

33. *Aegypius monachus* (Linne) (3.1; 26.27; 43.5; 43.6)
34. *Gypaetus barbatus* (Linne) [*aureus* (Hablizl)] (26.5; 36.9; 58.10)
35. *Gyps bengalensis* (Gmelin) (30.1; 33.6; 43.4; 58.10)
36. *G. fulvus* (Hablizl) (43.5; 58.10)
37. *G. himalayensis* Hume (3.3; 26.11; 43.2; 43.5; 58.10 74.1)

- 38. *G. indicus* (Scopoli) (26.39; 43.5; 58.10)
- (39) *Pseudogyps bengalensis*. See VIII (i) : 35.
- (40) *Sarcogyps calvus*. See VIII (i) : 41.
- 41. *Torgos calvus* (Scopoli) (43.3; 58.10)
- 42. *Vultur cinereus*. See VIII (i) : 33.
- 43. *V indicus*. See VIII (i) : 38.

(Subfamily : CIRCINAE)

- 44. *Circus aeruginosus* (Linne) (36.5; 58.6)
- 45. *C. melanoleucos* (Pennant) (36.5)

(Subfamily : CIRCAETINAE)

- (46) *Circaetus ferox*. See VIII (i) : 47.
- 47. *Circaetus g. gallicus* (Gmelin) (29.7; 58.6).
- (48) *Spilornis cheela albidus*. See VIII (i) : 50.
- 49. *S. c. cheela* (Latham) (36.4)
- 50. *S. c. melanotis* (Jerdon) (29.3; 36.4)

Family (ii) : FALCONIDAE

(Subfamily : POLIHIERACINAE)

- *1. *Microhierax caerulescens burmanicus* Swann (44.1)

(Subfamily : FALCONINAE)

- (2) *Cerchneis tinnunculus interstinctus*. See VIII (ii) : 13.
- 3. *Falco biarmicus cherrug* J. E. Gray (36.13)
- 4. *F. b. jugger* J. E. Gray (26.41; 36.13; 58.8)
- (5) *F. cherrug*. See VIII (ii) : 3.
- 6. *F. c. chicquera* Daudin (29.1; 36.5)
- (7) *F. c. chiquera*. See VIII (ii) : 6.
- (8) *F. jugger*. See VIII (ii) : 4.
- 9. *F. naumanni* Fleischer (36.13)
- 10. *F. peregrinus* Tunstall (36.13)
- 11. *F. subbuteo* Linne (36.13)
- 12. *F. tinnunculus* Linne (26.41; 36.13; 58.8)
- 13. *F. tinnunculus interstinctus* McClelland (36.13)

ORDER IX : GALLIFORMES

Family (i) : MEGAPODIIDAE

- 1. *Megapodius freycinet nicobariensis* Blyth (48.9; 76.1)
- (2) *M. n. nicobariensis*. See IX (i) : 1.

Family (ii) : PHASIANIDAE

- (1) *Acomus erythrophthalmus*. See IX (ii) : 43.
- (2) *A. pyronotus*. See IX (ii) : 44.
3. *Alectoris graeca chukar* (J. E. Gray) (48.14)
- *4. *A. g. falki* Hartert (48.14)
5. *A. g. pallescens* (Hume) (31.2; 47 1; 48.14)
6. *Ammoperdix griseogularis* (J. F. Brandt) (48.2)
- (7) *Arboricola rufogularis*. See IX (ii) : 9.
8. *Arborophila rufogularis* (Blyth) (48.22; 48.31; 76.6)
9. *A. rufogularis intermedia* (Blyth) (48.31; 76.6)
- *10. *A. r. tickelli* (Hume) (31.3; 48.22; 48.31; 76.6)
11. *A. torqueola batemani* (Ogilvie-Grant) (48.22; 76.6)
12. *A. t. millardi* (Baker) (48.22; 48.31; 76.6)
13. *A. t. toroqueola* (Valenciennes) (48.22; 48.31; 76.6; 89.7)
- *14. *Argusianus argus* (Linne) (7 5; 48.12; 77.2)
- 14a. *Bambusicola fytchii* Anderson (48.29)
- *15. *Caloperdix o. oculatea* (Temminck) (7 1; 60.8; 60.12; 64.1)
16. *Catreus wallichii* (Hardwicke) (48.32)
- *17. *Chrysolophus amherstiae* (Leadbeater) (48 7; 60.3; 89.6)
- *18. *C. pictus* (Shaw) (48.8)
19. *Coturnix coromandelica* (Gmelin) (48.3)
20. *C. coturnix* (Linne) (31 1; 48.2; 63.1)
21. *C. coturnix chinensis* (Linne) (48.33)
22. *Crossoptilon c. crossoptilon* (Hodgson) (48.16; 60.6; 89.2)
- *23. *Diardigallus diardi* Bonaparte (47.2; 48.6)
- (24) *Excalfactoris c. chinensis*. See IX (ii) : 21.
25. *Francolinus f. asiae* Bonaparte (47 5; 60.2; 63.9)
26. *F. f. henrici* Bonaparte (31 7; 60.2)
27. *F. gularis* (Temminck) (37.35)
28. *F. pintadeanus* (Scopoli) (60.1)
29. *F. pondicerianus interpositus* Hartert (64.2)
30. *Galloperdix bicalcarata* (J. R. Forster) (64.3)
31. *G. s. spadicea* (Gmelin) (76.2)
32. *Gallus gallus* [domesticus] (Linne) (31.2; 47 3; 47.6; 48.15; 48.20; 60.2; 60.7; 63.18; 64.1)
33. *G. g. murghi* Robinson & Kloss (48 15; 60.2; 64.1; 76.3)
34. *G. lafayettii* Lesson (48 15; 60.2; 64.1)
35. *G. sonneratii* Temminck (31.4; 48.15; 60.2; 64.1; 64.5)
- (36) *Gennaues albicristatus*. See IX (ii) : 55
- (37) *G. andersoni*. See IX (ii) : 52.
- (38) *G. melanotus*. See IX (ii) : 58.
- (39) *G. nycthemerus horsfieldi*. See IX (ii) : 57 & 60

- (40) *G. n. oatesi*. See IX (ii) : 59.
- (41) *G. swinhoii*. See IX (ii) : 42.
- *42. *Hierophasis swinhoii* (Gould) (60.2)
- *43. *Houppifer erythrophthalmus* (Raffles) (7.4; 48.26; 64.5?)
- *44. *H. pyronotus* G. R. Gray (64.5)
- 45. *Ithaginis c. cruentus* (Hardwicke) (48.15; 48.24; 89.3a)
- *46. *I. cruentus clarkei* Rothschild (48.24)
- *47. *I. c. geoffroyi* Verreaux (48.24)
- 48. *Lerwa lerwa* (Hodgson) (23.1; 59.2)
- 49. *Lophophorus impejanus* (Latham) (48.17; 48.27; 59.1; 60.4; 89.1)
- *50. *L. lhuysii* St. Hilarie & Verreaux (89.1)
- 51. *L. sclateri* Jerdon (59.1; 89.1)
- *52. *Lophura andersoni* (Elliot) (47.2)
- *53. *L. diardi* Bonaparte (64.5)
- *54. *L. ignita* (Shaw) (48.26; 64.5)
- 55. *L. leucomelana hamiltonii* (J. E. Gray) (47.2; 48.8; 48.29; 60.5)
- 56. *L. leucomelana lathami* (J. E. Gray) (48.6; 48.29; 60.5)
- 57. *L. leucomelana leucomelana* (Latham) (48.8; 48.29; 60.5; 89.9)
- 58. *L. leucomelana melanota* (Hutton) (7.4; 48.8; 60.2)
- *59. *L. leucomelana oatesi* (Oglivie-Grant) (48.29; 60.5)
- (60) *L. nyctemerus horsfieldi*. See IX (ii) : 56.
- 61. *Pavo cristatus* Linne (7.2; 7.3; 26.34; 47 7; 47.8; 47.9; 47 10; 48.28; 48.30)
- 62. *P. cristatus* Linne [*nigripennis* Sclater] (47.9; 48.30; 60.2; 60.10)
- 63. *P. muticus* Linne (26.36)
- 64. *Perdicula a. asiatica* (Latham) (31.5)
- *65. *Phasianus colchicus torquatus* Gmelin (48.15; 60.9; 63.20?)
- (66) *Phasianus soemmeringii scintillans*. See IX (ii) : 73.
- (67) *P. torquatus*. See IX (ii) : 65.
- 68. *Polyplectron bicalcaratum* (Linne) (48.26; 64.6)
- 69. *Pucrasia macrolopha biddulphi* Marshall (48.23; 48.29)
- 70. *P. m. macrolopha* (Lesson) (48.29; 89.8)
- *71. *Rollulus roulroul* (Scopoli) (48.10; 89.5)
- *72. *Syrmaticus* (*Calophasis*) *elliotti* (Swinhoe) (64.5)
- *73. *S. (Graphophasianus) soemmeringi scintillans* Gould (47.2; 48.15)
- *74. *Syrmaticus humiae burmanicus* (Oates) (48.21)
- 75. *S. h. humiae* (Hume) (48.21)
- 76. *Tetraogallus h. himalayensis* G. R. Gray (31.6; 48.11)

- 77. **T. tibetanus equilonifer** R. & A. Meinertzhagen (48.11)
- 78. **T. tibetanus tibetanus** Gould (48.11)
- *79. **Tetraophasis o. obscurus** (J. Verreaux) (26.35; 89.10)
- 80. **Tragopan b. blythi** (Jerdon) (48.34; 89.1)
- *81. **T. caboti** (Gould) (48.34; 89.1)
- 82. **T. melanocephalus** (J. E. Gray) (48.37; 89.4)
- 83. **T. satyra** (Linne) (48.34; 89.4)
- 84. **T. temminckii temminckii** (J. E. Gray) (48.34; 89.1)
- *85. **Tropicoperdix c. chloropus** (Blyth) (76.5)
- 86. **Black minorca** (48 15; 60.7)
- 87. **Wild chicken** (60.2; 63 15; 64.1)

ORDER X : GRUIFORMES

Family (i) : TURNICIDAE

- 1. **Turnix suscitator** (Gmelin) (100.1)

Family (ii) : GRUIDAE

(Subfamily : GRUINAE)

- 1. **Anthropoides virgo** (Linne) (40.1; 50.1)
- 2. **Grus antigone antigone** (Linne) (40.2; 50.2)
- 3. **G. grus** (Linne) (50.3)
- 4. **G. nigricollis** Przevalski (50.3)

(Subfamily : BALEARICINAE)

- *5. **Balearica pavoni [c] na** (Linne) (50.5)

Family (iii) : RALLIDAE

(Subfamily : RALLINAE)

- 1. **Amaurornis phoenicurus chinensis** (Boddaert) (87.6)
- 2. **A. phoenicurus phoenicurus** (Pennant) (85.5; 85.6)
- 3. **Gallinula chloropus** (Linne) (85.6)
- (4) **Porphyrio poliocephalus poliocephalus**. See X (iii) : 5
- 5. **P. porphyrio poliocephalus** (Latham) (85.1; 85.7; 88.4)
- 6. **P. p. porphyrio** (Linne) (88.8)
- 7. **Porzana fuscus bakeri** Hartert (88.5)

(Subfamily : FULICINAE)

- 8. **Fulica a. atra** Linne (42.1; 46.1; 55.1; 85.6; 88.2)

Family (iv) : OTIDIDAE

1. ***Chlamydotis undulata macqueenii*** (J. E. Gray) (75.1)
2. ***Choriotis nigriceps*** (Vigors) (75.2)
- (3) ***Houbara (Otis) macqueeni***. See X (iv) : 1

ORDER XI : CHARADRIIFORMES

(Families & subfamilies are after, Peters, 1934; Wetmore, 1951; Mayr & Amadon, 1951; Storer, 1971)

Family (i) : JACANIDAE

1. ***Hydrophasianus chirurgus*** (Scopoli) (85.3; 85.6; 88.7)
2. ***Metopidius indicus*** (Latham) (85.4; 88.3)

Family (ii) : ROSTRATULIDAE

1. ***Rostratula benghalensis*** (Linne) (87.22)

Family (iii) : CHARADRIIDAE

(Subfamily : VANELLINAE)

(Ripley, 1961 included this subfamily under Charadriinae)

- (1) ***Chettusia gregaria***. See XI (iii) : 8.
- (2) ***C. leucura***. See XI (iii) : 10.
- (3) ***Hoplopterus duvaucelii***. See XI (iii) : 12.
- (4) ***Lobipluvia indicus***. See XI (iii) : 9.
- (5) ***L. malabarica***. See XI (iii) : 11.
- (6) ***Microsarcops cinereus***. See XI (iii) : 7.
7. ***Vanellus cinereus*** (Blyth) (87.28)
8. ***V. gregarius*** (Pallas) (2.7)
9. ***V. i. indicus*** (Boddaert) (2.4; 87.9; 87 14)
10. ***V. leucurus*** (Lichtenstein) (2.7; 13.4; 87 12)
11. ***V. malabaricus*** (Boddaert) (2.4)
12. ***V. spinosus duvaucelii*** (Lesson) (87 15)

(Subfamily : CHARADRIINAE)

13. ***Charadrius dubius*** Scopoli (2.7; 87.5)

Family (iv) : SCOLOPACIDAE

(Ripley, 1961, considers this family as a subfamily of Charadriidae)

(Subfamily : TRINGINAE)

1. *Limosa lapponica* (Linne) (2.5)
2. *L. limosa* (Linne) (2.13; 13.5; 21 1)
3. *Numenius a. arquata* (Linne) (2.9; 13.1)
- *4. *N. minutus* (Gould) ? (13.1)
5. *Tringa erythropus* (Pallas) (2.5; 87.11)
6. *T. hypoleucos* Linne (87.23)
7. *T. nebularia* (Gunnerus) (2.8; 87.27)
8. *T. o. ochropus* Linne (2.6; 2.15; 13.3; 13.7 ?; 87 11; 87.20)
9. *T. stagnatilis* (Bechstein) (2.15)
10. *T. totanus totanus* (Linne) (2.15; 87 7)

(Subfamily : ARENARIINAE)

11. *Arenaria interpres* (Linne) (2.10)

(Subfamily : SCOLOPACINAE)

12. *Capella* sp. (85.7 ?) (Error)
13. *C. stenura* (Bonaparte) (90.1)
14. *Limnodromus semipalmatus* (Blyth) (87.25)

(Subfamily : EROLIINAE)

15. *Calidris m. minutus* (Leisler) (2.17; 21.3; 61.1; 61.3)
- (16). *Erolia m. minuta*. See XI (iv) : 15.
17. *Limicola falcinellus* (Pontoppidan) (61.4)
18. *Philomachus pugnax* (Linne) (2.11; 21.2; 61.2; 87 18)

Family (v) : RECURVIROSTRIDAE

(Subfamily : IBIDORHYNCHINAE)

1. *Ibidorhyncha struthersii* Vigors (2.2; 87 1)

(Subfamily : RECURVIROSTRINAE)

2. *Himantopus h. himantopus* (Linne) (2.3; 2.12; 2.13; 13.3; 13.6; 87 11?; 87 13; 87.24; 87.26)

Family (vi) : DROMADIDAE

1. *Dromas ardeola* Paykull (87.4)

Family (vii) : BURHINIDAE

1. **Burhinus oedienemus** (Linne) (87.3)
2. **Esacus magnirostris recurvirostris** (Cuvier) (2.14)

Family (viii) : GLAREOLIDAE

(Subfamily : CURSORIINAE)

1. **Cursorius cursor cursor** (Latham) (13.2; 87 19)

(Subfamily : GLAREOLINAE)

2. **Glareola lactea** Temminck (87 10)
3. **G. pratincola** (Linne) (87 10)

Family (ix) : LARIDAE

(Subfamily : STERNINAE)

1. **Chlidonias hybrida indica** (Stephens) (87.2)
2. **C. leucoptera** (Temminck) (87.2)
3. **Gelochelidon n. nilotica** (Gmelin) (87 17; 92.2)
4. **Sterna aurantia** J. E. Gray (87 16; 92.1)

ORDER XII : COLUMBIFORMES**Family (i) : PTEROCLIDIDAE**

- (1) *Eremialector coronatus*. See XII (i) : 5.
- (2) *E. indicus*. See XII (i) : 9.
- (3) *E. orientalis*. See XII (i) : 10.
4. **Pterocles alchata** (Linne) (87 1)
5. **P. coronatus** [* *saturatus* Kinnear] (97.5)
6. **P. exustus erlangeri** (Neumann) (68.4 (Error); 87.3; 97.4)
- (7) *P. e. hindustan*. See XII (i) : 6.
- *8. **P. e. exustus** Temminck (97.4)
9. **P. indicus** (Gmelin) (97 1; 97.2)
10. **P. orientalis** (Linne) (97.6)
- (11) *P. senegallensis*. See XII (i) : 8.
12. **Syrrhaptes tibetanus** Gould (97 7)

Family (ii) : COLUMBIDAE

(Subfamily : TRERONINAE)

- (1) *Crocopus p. phoenicopterus*. See XII (ii) : 3.
- (2) *Sphenurus sphenurus*. See XII (ii) : 5.

3. **Treron phoenicoptera** (Latham) (27.2; 27 11)
4. **T. pompadora** (Gmelin) (27.4)
5. **T. sphenura** (Vigors) (27.4)

(Subfamily : COLUMBINAE)

6. **Chalcophaps indica** (Linne) (27 7; 73.2)
7. **Columba hodgsonii** Vigors (25a.1; 27.9).
8. **C. leuconota leuconota** Vigors (19.3)
- *9. **C. livia** [domestica] Gmelin (26.18; 26.39; 27.2)
- *11. **C. vitiensis** Quoy & Gaimard (27.7)
12. **Macropygia unchall** (Wagler) (27.5)
13. **M. U. tubalia** (Blyth) (25a.23)
14. **Streptopelia chinensis** (Scopoli) (25.2)
15. **S. chinensis ceylonensis** (Reichenbach) (15.1)
16. **S. c. suratensis** (Gmelin) (25.3; 25.5; 27.2; 27.6; 101.2)
17. **S. decaocta** (Frivaldzsky) (19.1; 25.5?; 25.6; 27.2; 27.3; 52.1; 101.2)
18. **S. orientalis** (Latham) (27.10)
19. **S. o. agricola** (Tickell) 73.1)
20. **S. senegalensis** (Linne) ssp.? (101 1)
21. **S. senegalensis cambayensis** (Gmelin) (27.2, 27.12; 101.2)
22. **S. t. tranquebarica** (Hermann) (27.2; 27.8; 101.2)

ORDER XIII : PSITTACIFORMES

Family (i) : PSITTACIDAE

(Subfamily : PSITTACINAE)

1. **Psittacula eupatria nipalensis** (Hodgson) (71.1)
2. **P. krameri borealis** (Neumann) (38.1; 56.1; 71.2?; 78.1; 101.2 (Error))
- (3) **P. k. manillensis** (Bechstein) (Error). Probably XIII (i): 2. (56.1)

ORDER XIV : CUCULIFORMES

Family (i) : CUCULIDAE

(Subfamily : CUCULINAE)

1. **Cacomantis merulinus** (Scopoli) (33.8)
2. **C. sonneratii** (Latham) (33.8)
3. **Clamator j. jacobinus** (Boddaert) (32.1; 32.3; 33.8; 34.1)

4. **Cuculus varius** Vahl (32.3; 33.9)
- (5). **Hierococcyx varius**. See XIV (i) : 4.
6. **Eudynamys s. scolopacea** (Linne) (32.2; 32.5)
7. **Surniculus lugubris** (Horsfield) (33.8)

(Subfamily : PHAENICOPHAENIAE)

- 8. **Rhopodytes diardi** (Lesson) (33.8)

(Subfamily : CENTROPODINAE)

9. **Centropus sinensis sinensis** (Stephens) (26.31; 33 8; 88.9)

ORDER XV : STRIGIFORMES

Family (i) TYTONIDAE

(Peters, 1940; Wetmore, 1951; & Storer, 1971 consider this family distinct, while Mayr & Amadon, 1951; & Ripley, 1961, placed this as a subfamily of Strigidae)

1. **Tyto alba stertens** Hartert (57 5; 94.9)
- 2. **T. novaehollandiae castanops** (Gould) (94.1)

Family (ii) : STRIGIDAE

(Subfamily : BUBONINAE)

(After Peters, 1940. Ripley, 1961 included the species under Striginae)

1. **Athene brama indica** (Franklin) (26.24; 94.3)
2. **Bubo bubo bengalensis** (Franklin) 57.3; 94.5; 94.10)
3. **Glaucidium cuculoides** (Vigors) (57 1)
4. **G. c. rufescens** Baker (94.7)
5. **Otus b. bakkamoena** Pennant (26.24)
6. **O. b. plumipes** (Hume) (94.2)

(Subfamily : STRIGINAE)

7. **Asio o. otus** (Linne) (94.4; 94.8)

ORDER XVI : CAPRIMULGIFORMES

Family (i) : CAPRIMULGIDAE

(Subfamily : CAPRIMULGINAE)

1. **Caprimulgus affinis monticolus** Franklin (67.4)
2. **Caprimulgus a. asiaticus** Latham (67.3)

3. **C. macrurus albonotatus** Tickell (67 1)
4. **C. m. monticolus**. See XVI (i) : 1.

ORDER XVII : APODIFORMES

Family (i) : APODIDAE

(Subfamily : CHAETURINAE)

(Ripley, 1961 included this subfamily under Apodinae)

1. **Chaetura gigantea indica** Hume (37.2)
(Subfamily : APODINAE)
2. **Apus affinis affinis** (J. E. Gray) (37.3)
3. **A. affinis nipalensis** (Hodgson) (37.3)
4. **A. affinis singalensis** Madarász (37.3)
5. **A. melba bakeri** Hartert (37.5)
- *6. **A. melba tuneti** Tschusi (37.5)
- (7) **Cypselus affinis**. See XVII (i) : 2.
8. **Cypsiurus parvus batasiensis** (J. E. Gray) (37 1)
- (9) **Micropus affinis**. See XVII (i) : 2.
- (10) **M. melba bakeri**. See XVII (i) : 5.
- (11) **M. melba tuneti**. See XVII (i) : 6.

ORDER XVIII : CORACIIFORMES

Family (i) : ALCEDINIDAE

(Subfamily : CERYLINAЕ)

1. **Ceryle lugubris guttulata** Stejneger (68.41. Error)
2. **C. rudis leucomelanura** Reichenbach (5.2)

(Subfamily : ALCEDININAE)

3. **Alcedo atthis [ispida]** (Linne) (5.1)

(Subfamily : DACELOININAE)

4. **Halcyon s. smyrnensis** (Linne) (4.1; 4.2; 5.1; 5.3)

Family (ii) : MEROPIDAE

1. **Merops apiaster** Linne (65.1; 66.2)
2. **M. l. leschenaulti** Vieillot (66.3)
3. **M. o. orientalis** Latham (66.1)
- (4) **M. viridis**. See XVIII (ii) : 3.

Family (iii) : CORACIIDAE

(Subfamily : CORACIINAE)

1. **Coracias b. benghalensis** (Linne) (20.1; 20.2; 20.3)

Family (iv) : UPUPIDAE

1. **Upupa epops ceylonensis** Reichenbach (102.2)
2. **U. e. epops** Linne (102.2)
- (3) **U. e. orientalis**. See XVIII (iv) : 1.

Family (v) : BUCEROTIDAE

1. **Aceros nipalensis** (Hodgson) (18 1).
- *2. **Anthracoceros albirostris leucogaster** (Blyth) (22.1).
3. **A. malabaricus** (Gmelin) (22.1).
- (4) **Buceros malabaricus**. See XVIII (v) : 3.
- (5) **B. nepalensis**. See XVIII (v) : 1.
6. **Tockus birostris** (Scopoli)

ORDER XIX : PICIFORMES

Family (i) : CAPITONIDAE

1. **Megalaima virens marshallorum** Swinhoe (17.32; 82.3)

Family (ii) : PICIDAE

(Subfamily : PICINAE)

1. **Dendrocopos assimilis** (Blyth) (84.1)
2. **D. darjellensis** (Blyth) (84.1)
3. **D. m. macei** (Vieillot) (84.1)
- (4) **Dryobates sindianus**. See XIX (ii) : 1.
5. **Picus s. squamatus** Vigors (26.37; 80.2)

ORDER XX : PASSERIFORMES

Family (i) : ALAUDIDAE

- *1 **Ammomanes deserti orientalis** (Zaurdny & Lowden) (91.6)
- (*2) **Calandrella cinerea brachydactyla** (Leisler). See XX (i) : 3.
3. **C. cinerea longipennis** (Eversmann) (91.6)
4. **Gallerida cristata** (Linne) S. Sp.? (91.6)
5. **G. cristata chendoola** (Franklin) (82.1; 82.10 ?)
6. **G. c. magna** Hume (91.6)

Family (ii) HIRUNDINIDAE

(Subfamily : HIRUNDININAE)

1. **Hirundo rustica** Linne (82.8)

Family (iii) : LANIIDAE

(Subfamily : LANIINAE)

1. **Lanius excubitor lahtora** (Sykes) (63.3; 82.107; 88.12)
2. **L. schach erythronotus** (Vigors) (82.4; 82.10 ?)
3. **L. vittatus** Valenciennes (17 31; 82.26)

Family (iv) : ORIOLIDAE

1. **Oriolus o. kundoo** Sykes (62.1; 82.19)

Family (v) : DICRURIDAE

1. **Dicrurus adsimilis albirictus** (Hodgson) ? (68.29)
2. **D. a. similis macrocerus** Vieillot (17 11; 82.15; 96.4)
3. **D. h. hottentottus** (Linne) (68.37)
- (4) **D. macrocerus**. See XX (v) : 2.
- (5) **D. m. peninsularis**. See XX (v) : 1.

Family (vi) : STURNIDAE

(Subfamily: STURNINAE)

1. **Acridotheres albicinctus** Godwin - Austen & Walden (96.13)
2. **A. fuscus** Walger (96.2)
3. **A. ginginianus** (Latham) (17 13; 17 17; 96.5; 96.5; 96.18)
4. **A. tristis melanosternus** Legge (96.10)
5. **A. t. tristis** (Linne) (17.8; 17 17; 63.17; 63 19; 68.9 (Error). 96.2; 96.4; 96.18; 101.2 (Error);
- (6) **Pastor roseus** See XX (vi) : 10
- 7 **Sturnus contra superciliaris** Blyth (96.7)
8. **S. malabaricus** (Gmelin) (96.1)
9. **S. pagodarum** (Gmelin) (17.30; 96.18)
10. **S. roseus** (Linne) (17 17; 63.6; 93.2; 96.15; 96.18)
11. **S. sinensis** (Gmelin) (96.19)
- (12). **S. vulgaris humii**. See XX (vi) : 13.
13. **S. vulgaris indicus** Blyth (63.8; 68.12; 93.1; 96.18)
- (14). **Temenuchus pagodarum**. See XX (vi) : 9.

Family (vii) : CORVIDAE

1. **Corvus corax** [corax?] Linne (63.5; 82.2)
- (2) *C. corax laurencei*. See XX (vii) : 4.
3. **C. corax ruficollis** Lesson (82.2)
4. **C. corax subcorax** Severtzov (17.2, 17 3; 17.42; 26.10; 63 5; 68.2; 68 11; 82.6)
- *5. **C. cornix cornix** Linne (17.4; 68.11)
6. **C. corone** [* corone] Linne (17.42)
7. **C. corone orientalis** Eversmann (17.42)
- (8) *C. coronoides intermedius*. See XX (vii) : 13.
9. **C. f. frugilegus** Linne (17.40; 17.42; 62.5; 63.10; 68.11; 68.19; 82.2; 82.4)
- (10) *C. f. tschusii*. See XX (vii) : 9.
11. **C. macrorhynchos** Wagler ssp.? (17.28; 26.10; 68.43; 82.2; 82.9; 82.14;)
12. **C. m. culminatus** Sykes (68.10)
13. **C. m. intermedius** Adams (17.34; 68 16; 68.26)
14. **C. m. levaillanti** Lesson (68.7)
15. **C. monedula** Linne (17.42; 82.14)
16. **C. splendens** Vieillot (17.28; 17.34; 17.42; 26.10; 63.12; 68.4; 68.11; 68.25; 68.39; 82.2; 82.6; 82.16; 82.18)
- *17. **C. [splendens] insolens** Hume (26.10; 68.17; 82.2)
18. **C.s. zugmayeri** Laubmann (17.34)
19. **Dendrocitta formosae himalayensis** Blyth (6.4; 82.13)
- (20) *D. himalayensis*. See XX (vii) : 19.
21. **D. vagabunda pallida** (Blyth) (17.22; 82.13; 82.24)
22. **D. v. parvula** Whistler & Kinnear (6.4; 17.22; 82.13; 87.21)
- (23) *D. v. pollida*. See XX (vii) : 22.
- (24) *D. rufa [vagabunda]*. See XX (vii) : 22.
25. **Garrulus lanceolatus** Vigors (63.13; 82.13)
- (26) *G. glandarius lanceolatus*. See XX (vii) : 25.
- *27. **G. leucotes** Hume (17.25)
- (28) *Graculus graculus*. See XX (vii) : 39.
29. **Kitta erythrorhyncha occipitalis** (Blyth) (6.4; 82.13; 96.7)
30. **K. flavirostris cucullata** (Gould) (17 16)
31. **K. f. flavirostris** (Blyth) (6.4; 68.15; 82.13)
- (32) *Urocissa (e.) occipitalis*. See XX (vii) : 29.
- (33) *U. f. cucullata*. See XX (vii) : 30
- (34) *U. f. favirostris*. See XX (vii) : 31.
35. **Nucifraga caryocatactes hemispila** Vigors (68.8)
36. **N. c. multipunctata** Gould (17.23; 82.13)
37. **Pica pica bactriana** Bonaparte (17.6; 17.28; 17.42; 82.7; 82.13)

- (38) *Pica rustica*. See XX (vii) : 37.
 39. *Pyrrhocorax g. graculus* (Linne) (17 5; 82.23)

Family (viii) : PYCNONOTIDAE

- (1) *Hypsipetes m. mcClellandi*. See XX (viii) : 2.
 2. *H. virescens mcClellandi* Horsfield (91.8)
 (3) *Molpastes cafer intermedius*. See XX (viii) : 7.
 (4) *M. haemorrhous intermedius*. See XX (viii) : 7.
 (5) *M. l. leucogenys*. See XX (viii) : 10.
 6. *Pycnonotus c. cafer* (Linne) (68.30?; 96.8)
 7. *P. cafer intermedius* Blyth (17 15; 63.7; 82.10)
 8. *P. flavescens* Blyth (68.30 ?)
 9. *P. jocosus* (Linne) (68.30)
 10. *P. l. leucogenys* (Gray) (63 16; 82.10)

Family (ix) : MUSCICAPIDAE

(Subfamily : TIMALIINAE)

- (1) *Argya c. caudata*. See XX (ix) : 16.
 2. *Cutia n. nipalensis* Hodgson (17.20)
 3. *Garrulax a. affinis* Blyth (17 18)
 (4) *G. a. affine*. See XX (ix) : 3.
 5. *G. albogularis albogularis* (Gould) (17.36; 68.22)
 6. *G. a. whistleri* Baker (68.22)
 7. *G. l. leucolophus* (Hardwicke) (68.3)
 8. *G. l. patkaicus* Reichenow (68.28)
 9. *G. lineatus lineatus* (Vigors) (6.4; 17.35; 68.34)
 10. *G. p. pectoralis* (Gould) (17.37; 68.27)
 11. *G. r. ruficollis* (Jardine & Selby) (17.43; 68.6)
 12. *G. squamatus* (Gould) (17 12; 68.23)
 13. *G. striatus sikkimensis* (Ticehurst) (17 1; 17.26; 68.36)
 14. *G. s. subunicolor* (Blyth) (17.4; 17.27; 68.38)
 (15) *Trochalopteron lineatum griseiventor*. See XX (ix) : 9.
 16. *Turdoides c. caudatus* (Dumont) (17.9; 17.32; 68.9; 82.10; 96.6)
 17. *T. earlei* (Blyth) (68.32)
 18. *T. malcolmi* (Sykes) (68.5)
 (19) *T. somervillei*. See XX (ix) : 21.
 20. *T. striatus sindianus* (Ticehurst) (17.32; 68.33; 82.10; 101.2 ?)
 21. *T. striatus somervillei* (Sykes) (17.21; 68.33)
 (22) *T. terricolor terricolor*. See XX (ix) : 20.

(Subfamily : MUSCICAPINAE)

23. **Rhipidura aureola burmanica** (Hume) (101.2. Error)

(Subfamily : SYLVIINAE)

24. **Phylloscopus collybita tristis** Blyth (82.10)
 (25) *P. collybitus tristis*. See XX (ix) : 24.
 (26). *P. nitidus viridanus*. See XX (ix) : 27.
 27. **P. trochiloides viridanus** Blyth (91 1)
 (28). *Seicerus b. burkei*. See XX (ix) : 29.
 29 **S. b. burkii** (Burton) (91 1)

(Subfamily : TURDINAE)

- (30). *Cyanosylvia s. suecica*. See XX (ix) : 32.
 31. **Enicurus m. maculatus** Vigors (63.11)
 32. **Erithacus s. svecicus** (Linne) (82.10; 91 5; 96.2)
 33. **Grandala c. coelicolor** Hodgson (17 14)
 34. **Monticola solitarius longirostris** (Blyth) (91.5)
 (35). *Myiophoneus t. temminckii*. See XX (ix) : 36.
 36. **Myiophonus caeruleus temminckii** (Vigors) (8.3; 17.29; 68.41)
 (32). *M. coerileus temminckii*. See XX (ix) : 36.
 38. **Oenanthe picata** (Blyth) (17.46; 96.12)
 39. **Saxicola caprata** (Linne) (91.6)
 40. **Saxicola torquata indica** (Blyth) (62.1; 80.1).
 41. **Saxicoloides fulicata cambaiensis** (Latham) (17 7; 17.44; 82.10; 96.5)
 42. **Turdus boulboul** (Latham) (68.42)
 43. *T. dauma*. See XX (ix) : 48.
 (44). *T. merula nigropelios*. See XX (ix) : 45.
 45. **T. m. nigropileus** (Lafresnaye) (17.29)
 46. **T. rufcollis atrogularis** Jarocki (17 19; 68.42)
 47. **Zoothera dauma aureus** (Holandre) (6.1)
 48. **Z. d. dauma** (Latham) (6.1; 68.18)
 49. **Z. marginata** [parvula Delacour] (17.45)
 50. **Z. m. monticola** (Vigors) (17 38)

Family (x) : PRUNELLIDAE

1. **Prunella s. strophinata** (Blyth) (91.2)

Family (xi) : MOTACILLIDAE

1. **Anthus godlewskii** (Taczanowski) (91.4)

2. **A. novaeseelandiae richardi** (Viellot (17.10; 72.2; 91.4)
3. **A. n. rufulus** Vieillot (91.4)
- (4) **A. richardi rufulus** sensu Ansari. Probably **XX** (ii): 2.
5. **A. s. similis** Jerdon (91.4)
6. **Motacilla alba dukhunensis** Sykes (68.14; 82.10)

Family (xii) : NECTARINIDAE

1. **Nectarina a. asiatica** (Latham) (82.22)

Family (xiv) : PLOCEIDAE

(Subfamily : PASSERINAE)

- (1) **Passer domesticus indicus** Jardine & Selby (17.39; 63.26; 68.31; 82.10; 101.2 (Error)
2. **Petronia x. xanthicollis** (Burton) (17 10; 72.4; 96.11)
- (3). **Gymnor[h]is x. xanthicollis**. See **XX** (xiv) : 2.

(Subfamily : PLOCEINAE)

4. **Ploceus philippinus burmanicus** Ticehurst (72.3)

(Subfamily : ESTRILDINAE)

- (5). **Amandava amandava**. See **XX** (xiv) : 6.
6. **Estrilda amandava** (Linne) (68.1)
7. **Lonchura malabarica** (Linne) (17.44; 68.40; 72.1)
8. **L. punctulata** (Linne) (68.13)

Family (xv) : FRINGILLIDAE

(Subfamily : CARDUELINAE)

1. **Acanthis flavirostris** (Linne) sp. (?) (91.2)
2. **Leucosticte brandti** Bonaparte (91.3)
- (3). **Montifringilla brandti**. See **XX** (xv) : 2.

Family (xvi) : EMBERIZIDAE

1. **Emberiza a. aureola** Pallas (91.2)
2. **E. bruniceps** Brandt (82.10; 82.27)
3. **E. cia par** Hartert (91.6)
4. **E. c. yunnanensis** Sharpe (91.6)

B. CLASS MAMMALIA

ORDER I M : MARSUPIALIA

Family (i) : MACROPODIDAE

(Subfamily : MACROPODINAE)

- *1. **Macropus rufus** (Desmarest) (16.1)

ORDER II M : CARINVORA

(Suborder : FISSIPEDA)

Family (i) : CANIDAE

1. **Canis familiaris** Linne (51.1; 98.1) (Domestic dog)
- *2. **Cuon javanicus** (Desmarest) (35.5)
- (3) **Cyon** [alpinus] *duchunensis*. See II M (i) : 2.
- (4) **Cyon** *duchunensis*? See II M (i) : 2.
5. **Vulpes bengalensis** Shaw (98.1)

Family (ii) : MUSTELIDAE

(Subfamily : LUTRINAE)

- *1. **Lutra pruneri** (Error). See I M (i) : 1.

(Subfamily : MUSTELINAE)

2. **Martes flavigula** (Boddaert) (98.2)
3. **Mustela sibirica** Pallas (98.3)

Family (iii) : VIVERRIDAE

(Subfamily : PARADOXURINAE)

1. **Paguma larvata grayi** (Bennett) (45.1)
- (2) **Paradoxurus grayi**. See (ii) M (iii) : 1.

(Subfamily : HERPESTINAE)

3. **Herpestes auropunctatus** Hodgson (45.2)
4. **H. edwardsi** (Geoffroy) (45.2)

Family (iv) : FELIDAE

11 (Subfamily : FELINAE)

1. *Felis catus* Linne (45.3) (Domestic cat)

ORDER III M : PROBOSCIDEA

Family (i) : ELEPHANTIDAE

1. *Elephas maximus ceylonicus* (Blainville) (49.1)
2. *E. m. maximus* Linne (49.1)

ORDER IV M : PERISSODACTYLA

Family (i) : EQUIDAE

(Subfamily : EQUINAE)

- *1. *Equus asinus* Linne (34.4)
2. *E. caballus* Linne (34.4) (Domestic horse)
3. *E. caballus* X *E. asinus* (34.4) (Mule)

ORDER V M : ARTIODACTYLA

Family (i) : CERVIDAE

(Subfamily : CERVINAE)

1. *Axis axis* Erxleben (35.5)

(Subfamily : MONTIACINAE)

1. *Muntiacus muntzak* (Zimmermann) (34.7; 34.9)

Family (ii) : BOVIDAE

(Subfamily : BOVINAE)

- *1. *Bos indicus* Linne (34.1)
2. *B. taurus* Linne (34.1) (Domestic cattle)

(Subfamily : CAPRINAE)

1. *Capra hircus* Linne (34.2; 34.8; 34.10)
- (2) *Hemitragus jemlahicus*. See V M (ii) : 3.
3. *H. jemlaicus* (Hamilton & Smith) (34.6)
4. *Nemorhaedus goral* (Hardwicke) (34.3)

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 37.1; 37.2; 37 3; 37 5; 39.1 (?); 39.2; 40.1; 40.2; 41 1; 42.1;
 42.2; 43.1; 43.2; 43 3; 43.4; 43 5; 43.6; 43.7; 46.1; 47.1; 47.2;
 47.3; 47.6; 47 7; 48.8; 47 9; 47 10; 48.2; 48.3; 48.6; 48.8; 49.9;
 48.11; 48.12 (?); 48.14; 48.15; 48.17; 48.20; 48.22; 48.23; 48.24;
 48.26; 48.27; 48.28; 48.29; 48.30; 48.31; 48.32; 48.33; 48.34; 48.35;
 48.37; 49.1; 50.1; 50.2; 50.3; 50.5; 51 1; 53.2; 53.4; 54.1; 54.3;
 54.4; 55.1; 56.1; 57 2; 57 3 (?); 57.4; 58.6; 58.8; 58.10; 59.1; 59.2;
 60.2; 60.4; 60.7; 69.9; 60.10; 61.2; 61.4; 61.5; 63.2; 63.5; 63.12;
 63.13; 63.16; 63.18; 63 19; 63.20; 64.1; 64.5; 66.1; 67.3; 67.4;
 68.1; 68.3; 68.5; 68.6; 68.7; 68.9; 68.10; 68.11; 68.12; 68.13; 68.14;
 68.15; 68.16; 68.18; 68.19; 68.22; 68.23; 68.25; 68.27; 68.30; 68.32;
 68.33; 68.34; 68.36; 68.38; 68.40; 68.41; 68.42; 70.1; 72.3; 73.1;
 73.2; 74.1; 74.2; 75.2; 76.1; 76.2; 76.3; 76.6; 77.2; 79.1; 79.2;
 80.2; 82.1; 82.7; 82.8; 82.13; 82.14; 82.22; 82.23; 83.1; 84.1; 85.1;
 85.2; 85.4; 85.5; 85.6; 85.7; 87 1; 87.2; 87.3; 87.4; 87.5; 87.7;
 87.9; 87 10; 87.12; 87 16; 87.20; 87.21; 87.25; 87.26; 87.27; 88.2;
 88.3; 88.4; 88.5; 88.6; 88.7; 88.8; 88.9; 89.1; 89.3; 89.3a; 89.4;
 89.5; 89.7; 89.8; 89.9; 90.1; 91.2; 91.3; 91.4; 91.5; 91.6; 92.1;
 92.2; 94. 1; 94.3; 94.7; 95.1; 96.1; 96.4; 96.5; 96.7; 96.13; 96.15;
 96.19; 97 1; 97.2; 97.4; 97 6; 97 7; 98.1; 99.2; 99.5; 100.1; 101.1;
 101.2; 102.2.

NEPAL :

6.4; 17 16; 17 18; 17.22; 17.28; 17.34; 17.36; 18.1; 22.1; 22.2;
 25.2; 26.34; 26.39; 27.4; 27.5; 27.10; 33.5; 35.1; 35.3; 35.5;

35.6; 35.8; 36.1; 36.7; 36.8; 36.12; 36.13; 37.3; 40.1; 45.2; 47 7; 47.8; 48.8; 48.17; 48.22 (?); 48.29; 48.31 (?); 48.32 (?); 48.35; 51 1; 53.1; 53.3; 60.5; 60.10; 63.5; 64.1; 67.1; 68.13; 68.22; 68.25; 68.42; 82.14; 82.18; 87.7; 87 15; 87.23; 87.28; 88.9; 90.1; 91.1; 91.4; 91.8; 92.1; 96.1; 96.2; 96.4; 96.11; 96.19; 98.1; 98.2; 98.4; 99.5; 100.1.

PAKISTAN :

2.12; 2.15; 2.17; 3.1; 3.3; 4.1; 5.1; 5.2; 5.3; 6.4; 8.3; 8.6; 8.7; 9.1; 9.4; 11.6; 13.2; 13.3; 13.6; 13.7; (?); 17.2; 17 7; 17.8; 17.9; 17.10; 17 11; 17 13; 17 15; 17.17; 17.22; 17.30; 17.31; 17.32; 17.34; 17.35; 17.42; 17.44; 17.46; (?); 19.1; 20.1; 20.2; 21.2; 21.3; 24.1; 25.5; 26.10; 26.11; 26.31 (?); 26.41; 26.42; (?); 27.2; 27.8; 27.12; 29.1; 29 5; 29.6; 29.7; 31 1; 31.2; 31.7; 32.1; 32.2; 32.3; 33.8; 33.9; 34.1; 35.2; 35.4; 36.1; 36.5; 36.9; 36.13; 38.1; 43.8; 45.3; 46.1; 47 5; 48.2; 48.3; 49.1; 52.1; 55.1; 57.4; 57.5; 58.6; 58.8; 60.2; 60.12; 61 1; 61.2; 61.3; 61.4; 62.1; 63.1; 63.3; 63.4; 63.5; 63.8; 63.9; 63.10; 63.11; 63.12; 63.17; 63.18; 64.2; 68.2; 68.4; 68.8; 68.9; 68.29; 68.31; 68.32; 68.33; 68.39; 68.40; 71 1; 71.2; 72.1; 72.2; 72.4; 74.1; 74.2; 75.1; 78.1; 80.1; 82.1; 82.2; 82.3; 82.4; 82.6; 82.7; 82.10; 82.12; 82.13; 82.15; 82.16; 82.18; 82.19; 82.24; 82.26; 82.27; 84.1; 87 11; 87 13; 87.14; 87.17; 87 18; 87.19; 87.20; 87.24; 91.6; 93.1; 93.2; 94.4; 94.5; 94.8; 94.9; 94.10; 96.2; 96.3; 96.4; 96.5; 96.6; 96.8; 96.9; 96.12; 96.15; 96.16; 96.17; 96.18; 97 3; 97.4; 97 5; 98 1; 99.1; 99.4; 99.5; 101 1; 102.2.

SOUTH INDIAN OCEAN :

81.1.

SOUTH SEAS :

79.4.

SRI LANKA :

1.1; 1.3; 2.8; 2.10; 2.13; 2.15; 15.1; 22.1; 26.2; 26.17; 26.20; 26.21; 26.24; 26.39; 27.4; 28.1; 33.8; 36.5; 36.11; 36.13; 37 1; 37.3; 37 5; 39.2; 42.2; 48.15; 51.1; 58.6; 60.2; 64.1; 64.3; 68.10; 70.1; 85.3; 88.7; 88.9; 90.1; 91.4; 92.2; 96.10; 99.2.

RUSSIA : KASHGAR (TURKESTAN) :

87.27.

TREMATODE FAUNA OF RAJASTHAN, INDIA, PART 2, FAMILIES CATHAEMASIIDAE, ECHINOSTOMATIDAE & PARAMPHISTOMIDAE

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INTRODUCTION

In the first paper of this series this author (1970) reported the occurrence of 15 species of trematodes belonging to 14 genera and 9 families collected from western districts of Rajasthan viz. Barmer, Bikaner, Jaisalmer, Jodhpur and Nagaur. Subsequently, some more collections were made. In this paper are reported one species belonging to Cathaemasiidae, 6 species to Echinostomatidae and 4 species to Paramphistomidae. Excepting *Paryphostomum indicum*, the other ten species are reported for the first time from Rajasthan.

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SYSTEMATIC ACCOUNT

FAMILY CATHAEMASIIDAE Fuhrmann

1. *Cathaemasia dollfusi* Travassos

1951. *Cathaemasia dollfusi* Travassos, *Arq. Zool. Estado S. Paulo*, 7 : 474-477.

Material : 6 exs., *Ibis leucocephala*, oesophagus, Nimli village (District Jodhpur), 20.ix.'70, P. D. Gupta coll.

Measurements: Length of body 10.5-12*; width of body 5-6; collar $1.014-1.092 \times 1.575-1.638$; oral sucker $0.858-1.014 \times 0.967-1.154$; ventral sucker $1.560-1.918 \times 1.606-1.872$; prepharynx 0.015-

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* All measurements in millimetres.

0.187; pharynx 0.405-0.452 $\times$ 0.374-0.421; oesophagus 0.312-0.717; anterior testis 1.138-1.169 $\times$ 2.340-3.088; posterior testis 1.138-1.513 $\times$ 1.794-2.542; ovary 0.514-0.670 $\times$ 0.468-0.951.

Distribution: Rajasthan: Jodhpur. Elsewhere: U. P. (INDIA). CONGO,

Remarks: These specimens resemble closely *C. dollfusi* Travassos (1951). The collar is feebly discernible with an uninterrupted row of collar spines. Stunkard and Gandall (1965) doubted that probably *C. dollfusi* is synonym of *C. seetali* Wesley (1943). The intestinal caeca in *C. seetali* are smooth where as in *C. dollfusi* and in the present material their outer margin is provided with a number of diverticulae almost through out their length. These two species also differ in other details like the extension of cirrus sac and comparative size of ovary in relation to body length. Therefore *C. dollfusi* is treated distinctly from *C. seetali*.

Family ECHINOSTOMATIDAE Poche

2. *Echinochasmus euryporus* (Looss), Dietz, 1910

1896. *Echinostomum euryporum* Looss, nec Looss, 1899, *Mem. Inst. Egypt*, 3: 144, tab. 9, fig. 93.

Material: 11 exs., *Circus aeruginosus*, intestine, Kharda Dam (Pali District), 16. xii. '70, P. D. Gupta coll.

Measurements: Length of body 2.073-2.796; width of body 0.460-0.575; oral sucker 0.040-0.066 $\times$ 0.053-0.079; ventral sucker 0.292-0.399 $\times$ 0.279-0.399; prepharynx 0.026-0.053; pharynx 0.066-0.079 $\times$ 0.053-0.079; oesophagus 0.133-0.266; ovary 0.079-0.133 $\times$ 0.079-0.133; anterior testis 0.186-0.306 $\times$ 0.239-0.399; posterior testis 0.292-0.345 $\times$ 0.212-0.319; cirrus sac 0.133-0.212 $\times$ 0.079-0.133.

Distribution: Rajasthan: Pali District (First record from India). Elsewhere: EGYPT, USSR.

3. *Paryphostomum indicum* (Bhalerao)

1927. *Testisacculus indicum* Bhalerao, *Proc. 14th Indian Sci. Congr.*, Pt. 3: 191.

1931. *Paryphostomum indicum* Bhalerao, *Parasitology*, 23: 99-102.

Distribution: Jaisalmer. Elsewhere: Northern India.

Remarks: Gupta (1970) reported its occurrence from intestine of *Varanus monitor* at Jaisalmer.

4. *Paryphostomum radiatum* (Dujardin) Dietz, 1910

1845. *Distomum (Echinostoma) radiatum* Dujardin, *Hist. Nat. Helm. intestinaus*, : 427.

Material: 4 exs., *Phalacrocorax* sp., intestine, Kharda Dam (Pali District), 30.ix.'70, P. D. Gupta coll.

Measurements: Length of body 5.985-7.805; width of body 1 116-1.514; oral sucker 0.093-0.172 $\times$ 0.133-0.226; pharynx 0.106-0.239 $\times$ 0.093-0.239; oesophagus 0.159-0.665; ovary 0.133-0.305 $\times$ 0.159-0.359; cirrus sac 0.226-0.399 $\times$ 0.119-0.199.

Distribution: *Rajasthan:* Pali District (First record from India)
Elsewhere : SRI LANKA, SOUTH AFRICA, JAPAN, EUROPE, U. S. S. R., AUSTRALIA, INDOCHINA, Inner Mongolia (CHINA).

Remarks: Acetabulum in some specimens has posterior sac like prolongations. One specimen has a cestode larva in its acetabulum.

5. *Mesorchis pendulus* (Looss) Dietz, 1909

1899. *Echinostomum pendulum* Looss, *Zool. Jahrb. Syst.*, 12 : 688-692.

Material: 1 ex. (damaged), *Anhinga melanogaster*, intestine, Kailana Lake (Jodhpur District), 10. vi.'65, P. D. Gupta coll.

Measurements: Body length 2.371; width 0.269; oral sucker 0.055 $\times$ 0.055; ventral sucker 0.130 diameter; pharynx 0.055 $\times$ 0.046; oesophagus 0.370; cirrus sac 0.139 $\times$ 0.083; anterior testis 0.176 $\times$ 0.176; posterior testis 0.279 $\times$ 0.186; ovary 0.065 $\times$ 0.083.

Distribution: *Rajasthan:* Jodhpur District (first record from INDIA).
Elsewhere: CATANIA, AFRICA, JAPAN and U.S.S.R.

Remarks: Yamaguti (1958) treats *Mesorchis* as synonym of *Stephanoprora* and assigns it to the subfamily Echinochasminae. Skrjabin and Bashkirova (1956) assign this species to the genus *Mesorchis* which is included in the subfamily Allechinostomatinae and they treat *Stephanoprora* as monotypic genus with *S. ornata* Odhner, 1902, as the type species. This author agrees with Yamaguti in assigning the genus *Mesorchis* to the subfamily Echinochasminae on the basis of dorsally interrupted row of collar spines.

6. *Patagifer wesleyi* Verma, 1936

1936. *Patagifer wesleyi* Verma, *Allahabad Univ. Stud.*, 12, Sci. Sec., (3) : 160-162.

Material: 24 exs., *Threskiornis melanocephala*, intestine, Chandelao village (Jodhpur District), 3. ix.'71, P. D. Gupta coll.

Measurements: Length of body 17.6-23.2; maximum width 1.6-2.3; 30 collar spines on each side. Oral sucker mostly transversely elongated but sometimes rounded, $0.255-0.333 \times 0.255-0.632$; ventral sucker $1.333-1.529 \times 1.254-1.587$; pharynx $0.252-0.333 \times 0.297-0.405$; oesophagus $0.921-1.372$; anterior testis $1.117-1.646 \times 0.392-0.686$; posterior testis $1.195-1.685 \times 0.372-0.646$; Mehli's gland complex $0.646-1.215 \times 0.496-0.823$; ovary $0.432-0.666 \times 0.306-0.594$.

Distribution : *Rajasthan:* Chandelao, District Jodhpur (First record from Rajasthan). *Elsewhere:* Gyanpur (District Varanasi and Fatehpur both in U. P. (INDIA)).

Remarks: *Patagifer srivastavai* Peter, 1954, known only by an abstract description, resembles so closely *P. wesleyi* in measurements and other details that the former is treated as synonym of the latter. Verma (1936) has mentioned presence of 30-31 spines on each side of the collar. Jain (1967) has reported 31 spines where as the present material has only 30 spines on each side of the collar.

7. *Nephrostomum ramosum* (Sonsino) Dietz, 1910

1895. *Echinostomum ramosum* Sonsino, *Monit Zool. Ital.*, 8 (6) : 123-124.

Material: 2 exs., intestine, egret, Kharda Dam (Pali district), 21.iv. 71 P. D. Gupta coll.

Measurements: Length of body 11.100-11.360; width 2.940-3.180; Number of collar spines 47.50; oral sucker $0.167 \times 0.176-0.186$; ventral sucker $1.460-1.512 \times 1.237-1.330$; pharynx $0.214-0.279 \times 0.186-0.241$; oesophagus $0.353-0.576$; ovary $0.279-0.418 \times 0.261-0.418$; anterior testis $0.734-0.744 \times 0.799-0.817$; posterior testis $0.632-0.697 \times 0.669-0.744$; cirrus sac $0.372-0.604 \times 0.409$. Genital pore in a opposition to the intestinal bifurcation.

Distribution: *Rajasthan:* Pali District (first record from India) *Elsewhere:* EGYPT, MADAGASCAR and NETHERLAND.

Family PARAMPHISTOMIDAE Fiscoeder

8. *Diplodiscus mehrai* Pande

1937. *Diplodiscus mehrai* Pande, *Proc. Indian Acad. Sci.*, 6(2) : 109-112, 113., 119, figs. 1-2.

Material: 2 exs., *Rana cyanophlyctis*, intestine, Chittrogarh, 7 X. '64, P. D. Gupta coll.

Measurements: Body length 1.920-2.200; width 0.244-0.279; oral sucker $0.279-0.334 \times 0.390-0.399$; oesophagus 0.158; testis 0.324×0.279 ; ovary $0.223-0.241 \times 0.209-0.214$; ova $0.111 \times 0.130 \times 0.065-0.083$.

Distribution: *Rajasthan:* Chittorgarh District (first record from Rajasthan). *Elsewhere:* Uttar Pradesh (INDIA) PHILIPPINES, KOREA and MANCHURIA.

Remarks: These specimens have genital opening at intestinal bifurcation, vitellaria only extracaecal, oesophagus short, oral diverticula reaching the intestinal bifurcation and the position of genads is somewhat definitely lateral. Singh (1954), considering position of genital pore of minor importance, has treated *D. mehrai* synonymous with *D. amphichrus*. Mukherjee and Chauhan (1967) agree with Singh. A detailed study may provide stable characters for separation of *D. mehrai* from *D. amphichrus* on the basis of position of genads, cirrus pouch and the genital opening. Present forms are tentatively assigned to *D. mehrai*.

9. *Ceylonocotyle scoliocoelium* (Fischöder) Näsmark, 1937

1904. *Paramphistomum scoliocoelium* Fischöder, *Zool. Jahrb. Syst.*, 20(5) : 463-468.

Material: Many exs., buffalo, rumen, zoo slaughterhouse, Jodhpur, 6.i.'71, P. D. Gupta coll.

Measurements: Body length 4.762-5.919; width 1.920-2.548; oral sucker 0.509-0.705 $\times$ 0.450-0.666; ventral sucker 0.705-1.234 $\times$ 0.784-1.234; oesophagus 0.392-0.646; anterior testis 0.588-0.960 $\times$ 0.860-0.980; posterior testis 0.666-0.744-0.725-1.274; ovary 0.372-0.392-0.359-0.431. Genital pore behind intestinal bifurcation.

Distribution: *Rajasthan:* Jodhpur (first record from Rajasthan) *Elsewhere:* INDIA (Punjab, U. P., W. Bengal), INDOCHINA, CELEBES, AFRICA, JAPAN, INDONESIA.

Remarks: All the specimens do not have rounded or transversely elongated testes.

10. *Ceylonocotyle nasmarki* Mukherjee

1963. *Ceylonocotyle nasmarki* Mukherjee, *Indian J. Helminth.*, 15 : 70-73.

Material: 1 ex., buffalo, rumen, zoo slaughterhouse, Kota, 25.x.'64, P. D. Gupta coll.

Measurements: Length of body, 5.060; width 2.780; oral sucker 0.560 diameter; ventral sucker 0.800 $\times$ 0.760; oesophagus 0.440; anterior testis 1.180 $\times$ 1.200; posterior testis 1.280 $\times$ 1.000; ovary 0.400 $\times$ 0.300.

Distribution: *Rajasthan:* Kota (first record from Rajasthan). *Elsewhere:* INDIA (Bareilly, U. P.).

11. *Cotytophoron indicum* Stiles and Goldberger

1910. *Cotytophoron indicum* Stiles & Goldberger, *Bull. Hyg. Lab. U. S. Publ. Hlth. Mar. Hosp. Serv.*, No. 60 : 63-73.

Material: 21 exs., goat, rumen, Banswara slaughterhouse, 17.iii. '72, P. D. Gupta coll.

Measurements: Body length 4.540-7.840; width 2.180-2.980; oesophagus 0.240-0.660; oral sucker $0.500-0.669 \times 0.460-0.820$; ventral sucker $1.400-1.640 \times 1.440-1.620$; genital sucker $0.340-0.400 \times 0.360-0.420$; anterior testis $0.200-1.160 \times 0.340-1.140$; posterior testis $0.200-1.080 \times 0.400-1.280$; ovary $0.200-0.300 \times 0.180-0.340$.

Distribution: *Rajasthan*: Banswara District (first record from Rajasthan). *Elsewhere*: U. P. and West Bengal.

SUMMARY

One species belonging to the family Cathaemasiidae, 6 species to Echinostomatidae and 4 species to Paramphistomidae are reported. All the species excepting *Paryphostomum indicum* are recorded for the first time from Rajasthan. *Paryphostomum radiatum*, *Echinochasmus euryporus*, *Mesorchis pendulus* and *Nephrostomum ramosum* are reported here for the first time from India.

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FIELD-ECOLOGICAL STUDIES ON MASS ERUPTION, SEASONAL LIFE-HISTORY, NOCTURNAL FEEDING AND ACTIVITY RHYTHM, AND PROTECTIVE BEHAVIOUR AND COLORATION IN THE SAL DEFOLIATOR, *LYMANTRIA MATHURA* (LEPIDOPTERA : LYMANTRIIDAE), IN SUB-HIMALAYAN FORESTS

By

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(7 Plates, 6 Text-figures, 3 Tables and an Appendix)

INTRODUCTION

Lymantria mathura Moore (Lepidoptera : Lymantriidae) is a moderate-sized moth (Pls. 1-3) which occurs all along the Indian Sub-Himalayas from western Uttar Pradesh to Assam, and also extends farther east to Southeast Asia. There is marked sexual dimorphism in size and colour. The male is smaller (wing expanse ♂♂ 35-40 mm. ♀♀ 75-95 mm), with the forewings brown and hindwings yellow. In females the forewings are white with dark markings, and the hindwings pink. In Indian forests this species is an important defoliator of 'sal' (*Shorea robusta*, a forest tree of great economic importance) and of a few other species of trees. In normal years it occurs in small numbers, but periodically its population erupts, and millions of caterpillars may be seen defoliating large stretches of forests. Although often referred to as a pest in literature on forest entomology (Stebbing, 1907, 1908; "India", 1931; Roonwal, 1953-57; S. M. Singh, 1954; Chaudhuri, 1962; Roonwal, Chatterjee and Thapa, 1962), its ecology and seasonal life-history are inadequately known.

The most serious eruption, that of 1953-54, in the Western Sub-Himalayas (the Doon Valley and some neighbouring forests of Uttar Pradesh) provided the opportunity for studying various aspects of its field-ecology. In the present account are presented field-ecological data on : the mass egg-laying (on 185 species of trees); the progress of the epidemic, and its decline in 1954 (mainly as a result of mass mortality caused by a polyhedral virus disease); the seasonal life-history; a rhythm of nocturnal feeding and activity in caterpillars; colour forms; and protective behaviour and coloration in caterpillars.

MASS ERUPTION IN THE SUB-HIMALAYAS

1. *The eruption of 1953-54*

In the middle of September 1953, evidence started coming in of a mass increase of moth population in the New Forest area near Dehra Dun (the Western Sub-Himalayas, c. 610 m altitude, Uttar Pradesh), and by the end of the month the whole forest was full of these moths, laying eggs in masses (Pl. 3) on trunks of hundreds of trees (Roonwal, 1953, preliminary note). These eggs hatched next spring and produced millions of caterpillars which were seen on the trunks of trees in New Forest as well as the neighbouring forests in the Dehra Dun and Saharanpur Forest Divisions, covering an area of over 1,000 km². In April the caterpillars and pupae were struck by a polyhedral (or "liquefying", virus disease which caused extremely high mortality, up to almost 99 per cent, and nearly wiped out the population. Very few moths emerged, and the eruption was over.

The 1953-54 eruption is the largest on record. It was not confined to the Western Sub-Himalayas, but extended as far east as West Bengal, some 1,200 km away, in the 'terai' and 'bhabar' forests of the Nimati Old Plantation of *Shorea robusta* in the Buxa Forest Division, as reported by Chaudhuri (1962) who found, in 1954, "millions and millions of larvae" defoliating sal.

2. *Mass egg-laying, and subsequent restriction of food-plants*

In normal years, *Lymantria mathura* lays eggs on, and defoliates, hardly half a dozen species (Beeson, 1941, 1961), viz., *Shorea robusta* (the principal food-plant), *Syzigium cumini* (syn. *Eugenia jambolana*), *Quercus incana*, *Q. serrata*, *Terminalia arjuna* and *T. myriocarpa*. During an epidemic eggs are laid on a much larger number of tree species (185 in the 1953 epidemic, vide Appendix), and the numerous white egg-mass patches form a conspicuous sight on the dark tree trunks in the forest. On most of these species the larvae die early, and ultimate defoliation occurs on barely 22 species of trees.

In the New Forest Survey over an area of about 10 km², egg-masses were recorded on 405 trees, the number varying from 1 to 223 egg-masses per tree. The broad preference for each species was determined on the basis of the number of egg-masses on a tree, but the prevalence of attack should also be kept in view. Thus, a species with fewer egg-masses but universal attack may perhaps be regarded as more preferred than one with more numerous egg-masses but with many trees free from attack. For a rough estimation, preferences were grouped into three classes as based on the average number of egg-masses per tree as follows (also vide Appendix):

Preference small (S)	:	Below 10 egg-masses per tree			
" moderate (M)	:	10-40	"	"	"
" great (G)	:	Above 40	"	"	"

On this basis, the moth showed for egg-laying a medium degree of preference for 23 species ("M" in Appendix), and great preference ("G") for the following seven species :

- Dipterocarpaceae : *Shorea robusta*
- Lauraceae : *Cinnamomum camphora*
- Meliaceae : *Cedrella toona*
- Myrtaceae : *Syzygium cumini* (syn. *Eugenia jambolana*)
- Rutaceae : *Aegle marmelos*
- Urticaceae : *Ficus racemosa* and *F. religiosa*

These eggs hatched next summer. An extensive survey of the New Forest area carried out in the first week of April 1954 (when larvae were already large, c. 20-75 mm long) showed the presence of larvae on only 22 species of trees amongst which they were especially abundant on the following six heavily defoliated species: *Acrocarpus fraxinifolius*, *Mangifera indica*, *Quercus incana*, *Shorea robusta*, *Syzygium cumini*, and *Terminalia myriocarpa*. The larvae survived on only a fraction of the 185 species on which they oviposited; on the others they died in the early stages. That there are definite host preferences is further suggested by the following observation in New Forest. In one place there are two straight rows, 6 m apart, of 18-24 m high trees, each about 3 m apart, of two species, viz., *Acrocarpus fraxinifolius* and an undertermined species, each alternating with the other. Larvae were present only on *A. fraxinifolius*, leaving the other species entirely untouched. Again, in April 1954, in a mixed forest not far from Dehra Dun (Mohand Range, Saharanpur Forest Division), *Shorea robusta* and *Syzygium cumini* were badly defoliated but the neighbouring trees of *Terminalia tomentosa* were untouched. Although the latter species is known to be one of the food-plants of *L. mathura*, it was apparently avoided in the presence of the preferred ones. So far, the following 32 species have been recorded as being defoliated by *Lymantria mathura* (the list includes new as well as old records):—

- Anacardiaceae : *Mangifera indica*.
- Apocynaceae : *Alstonia scholaris*.
- Celastraceae : *Eleodendron glaucum*.
- Combretaceae : *Anogeissus lalifolia*, *Terminalia arjuna*, *T. belerica*,
T. myrciocalpa, *T. pyrifolia* and *T. tomentosa*.
- Cupuliferae : *Quercus incana* and *Q. serrata*.
- Dipterocarpaceae : *Shorea robusta*.
- Euphorbiaceae : *Mallotus philippinensis*.
- Fagaceae : *Castanea sativa*.

Leguminosae :

- Caesalpineae : *Acrocarpus fraxinifolius*.
- Papilionaceae : *Butea monosperma* and *Pongamia glabra*.
- Lythraceae : *Duabanga sonneratioides*.
- Meliaceae : *Ammora rohituka*, *Cedrela toona* and *Melia azedarach*.
- Myrtaceae : *Syzygium cumini* (syn. *Eugenia jambolana*).
- Rosaceae : *Prunus puddum*. (Burma)

Rubiaceae : *Adina cordifolia* and *Anthocephalus cadamba*.

Sapindaceae : *Litchi chinensis*.

Sterculiaceae : *Sterculia alata*.

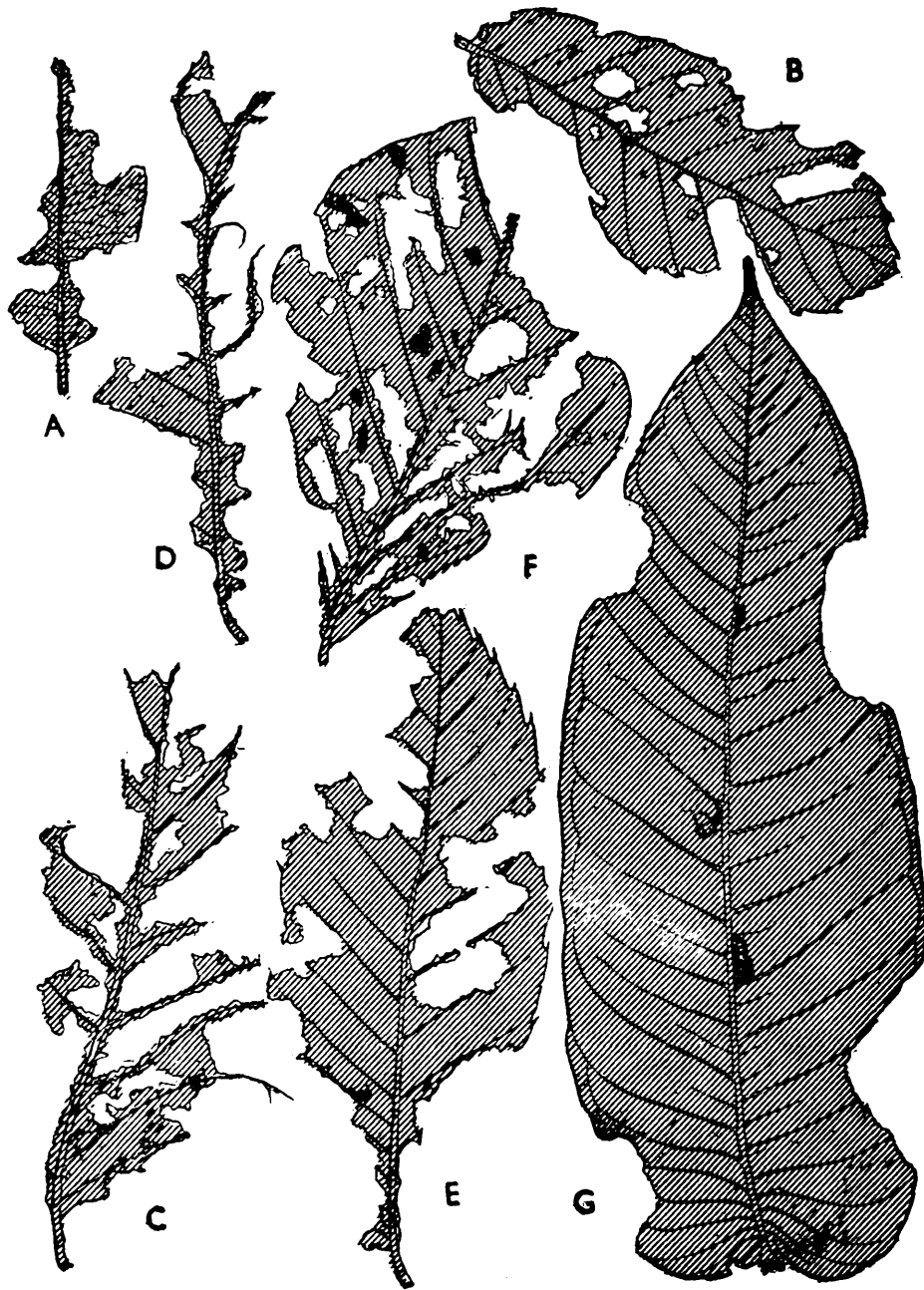
Tiliaceae : *Grewia sapinda*.

Urticaceae : *Artocarpus lakoocha*, *Ficus bengalensis* and *Morus alba*.

Interestingly, this list excludes four of the seven species on which heavy egg-laying took place in the 1953 eruption, viz., *Cinnamomum camphora*, *Aegle marmelos*, *Ficus racemosa* and *F. religiosa*.

Nature of feeding

The larvae eat mostly the green parts of the leaves, the thicker veins are generally avoided (Text-fig. 1).

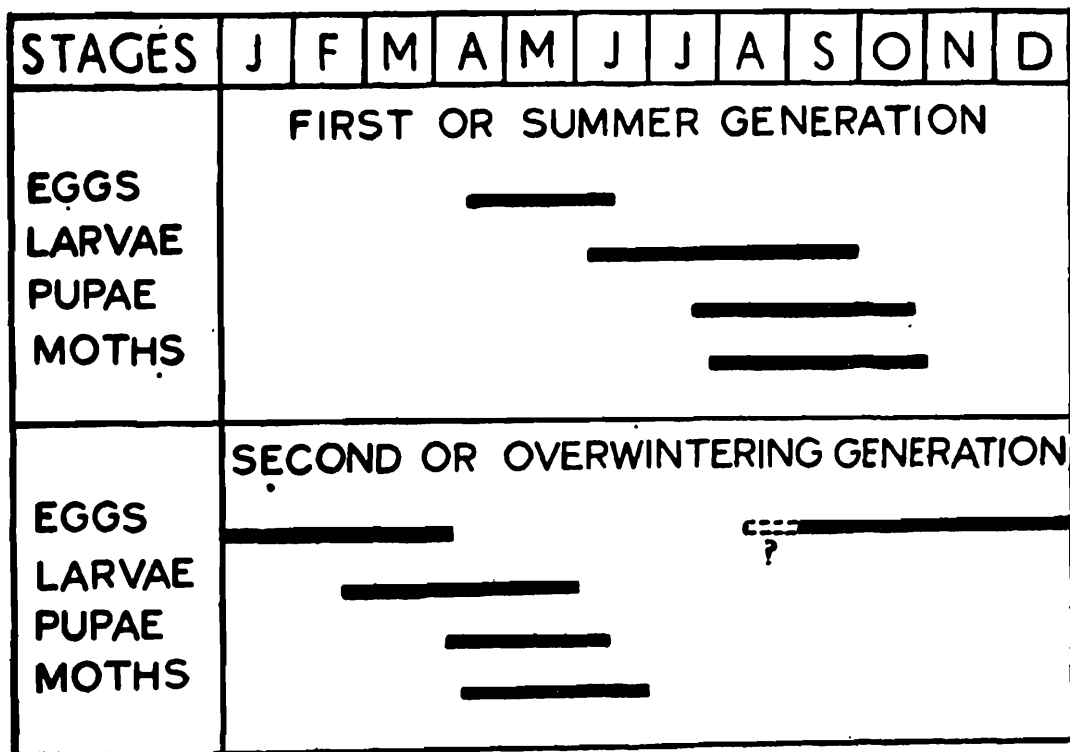


Text-fig. 1.—Pattern of defoliation by *Lymantria mathura* on leaves of various food-trees. Mostly the green parts are eaten. (Not to scale.) (A) *Syzygium cumini*. (B) *Quercus incana*. (C) *Shorea robusta*. (D) *Castania sativa*. (E) *Butea monosperma*. (F) *Terminalia myriocarpa*. (G) *Duabanga sonneratioides*.

SEASONAL LIFE-HISTORY

1. Number of annual generations (Table 1 and Text-fig. 2)

Little is known of the life-history of *Lymantria mathura* in India. Beeson (1941) mentions two broods in summer (with larvae in April and again in the rains, June-August), and a second generation in September-October. (In Japan, Nishigaya, 1918, studied the life-history on apple, but this was evidently of the subspecies *L. m. aurora* Butler.)



Text-fig 2.—*Lymantria mathura*. Chart to show life-history in the Western Sub-Himalayas (Dehra Dun forests, altitude 610 m).

The present study shows that in the Western Sub-Himalayas (Dehra Dun forests, altitude 610 m) *Lymantria mathura* has two annual generations (Table 1 and Text-fig. 2)—a short first or summer generation (April to October), and a long second or overwintering generation (September to June) with a diapause in the egg-stage.

Eggs are laid in masses on tree trunks. In both generations the larva undergoes five moults and has six instars. Larvae are gregarious. Pupation also occurs in groups of 40 or 50, usually in dark, protected places such as debris at the base of trees or behind signboards hanging from tree trunks, but sometimes also in exposed places.

Males are seen much less frequently than females and they die at least a week before the latter. Females are sluggish; after egg-laying, they can be seen sitting on tree trunks in groups of six or more near egg-masses. If disturbed, they slowly move away a little but do not fly

Table 1.—Seasonal life-history of *Lymantria mathura* in Western Sub-Himalayas from insectary rearings at Dehra Dun, supplemented by field observations. (For the presence of different developmental stages in nature, see Text-fig. 2.)

Egg-laying and hatching		Duration of larval stages and pupa (days)							Eclosion of moths	Death of moths
Egg-laying by moths of previous generation	Incubation period	I stage	II stage	III stage	IV stage	V stage	VI stage	Pupa		
FIRST OR SUMMER GENERATION (APRIL TO OCTOBER)										
Mid-April to mid-June	About 3-4 weeks (?)	3—4	3—5	4	3	6	?	7—12	End of July to 3rd week October	All dead by end of October
SECOND OR OVERWINTERING GENERATION (SEPTEMBER TO JUNE)										
Early September to end October	160—178	9—28	3—17	2—11	2—8	5—11	?	10—11	Mid- April to mid-June	All dead by end of June

(a) *The first or summer generation (April to October)*

Moths of the overwintering generation lay eggs from mid-April to mid-June; these eggs hatch in three to four weeks. There are six larval instars. Larvae are met with in the field from early June to end-September, and pupae from the third week of July to the third week of October. The durations of instars, in the Dehra Dun insectary, were as follows: Instar I, 3-4 days; II, 3-5; III, 4; IV, 3; V, 6; VI, (?). The pupal stage lasted from 7 to 12 days. Moths emerged from the end of July to the third week of October, and laid eggs from early August to the end of October; all were dead by the end of October.

(b) *The second or overwintering generation (September to June)*

Eggs laid in autumn (early September to mid-October) at first developed quickly, and in about six weeks the larva was fully formed, complete with its long hairs, and even the sclerites of the head and body were fully and deeply pigmented. The egg now had a dark appearance, with the dark sclerites showing through the translucent egg-wall. In this stage it entered a diapause of four to five months and hatched next spring (February to early April). The minimum period for this overwintering generation was about seven months; approximate individual periods (in days) were: egg 160, larval 27, pupal 10, and adult about 15 days. The various stages of the second generation continue to be met with in the field for nearly 10 months (Text-fig. 2) from early September to the end of June next year. Details are discussed below.

Hatching occurred next year (after a long overwintering diapause of the fully formed embryo in the egg) from the third week of February to the first week of April (18 February to 3 April). The incubation period was 160-178 days (166-168, in 45% of the cases). Larvae were met with in the field from the third week of February to about the end of May. The duration, in days, of the various instars was as follows (it shortened considerably as the weather warmed up):—

Instar I : 9-28 days. Hatchings of late February had longer (12-28 days, mostly 22), and those of March shorter durations (9-13 days, mostly 11).

Instar II : 3-17 (mostly 4-7).

Instar III : 2-11 (mostly 5-7).

Instar IV : 2-8 (mostly 5-7).

Instar V : 5-11 (mostly 6-7).

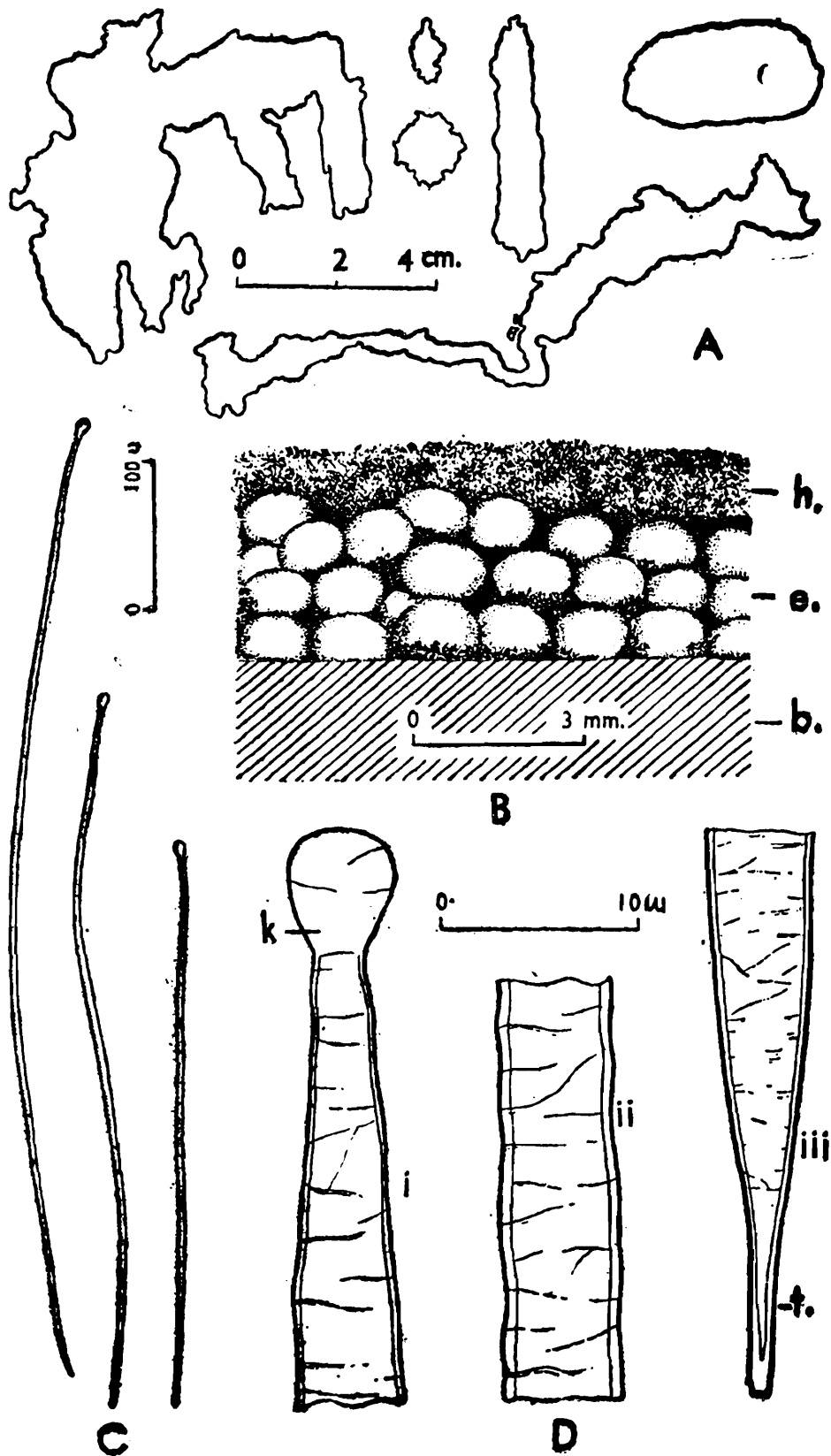
Instar VI : Not known (larvae died in large numbers due to a polyhedral disease). Mature larvae were common in the field throughout April.

The pupal stage lasted 10-11 days. Pupae were found from early April to mid-June, or later. Moths emerged from the second week of April to mid-June, or later. Eggs were laid from mid-April to the last week of June. All moths were dead by the end of June.

2. Egg-laying and hatching

Egg-laying

Eggs are laid on the bark of trees in flat, hair-covered egg-masses



Text-fig. 3.—*Lymantria mathura*. Egg-masses and covering hairs. (Adapted from Roonwal, 1954.) (A) Surface view of six egg-masses, to show different shapes and sizes. (B) Part of egg-mass, in transverse section. (C) Three hairs from hair covering of egg-mass. (D) Same, one hair, enlarged (i-iii, knobbed end, middle part, and truncated end respectively).

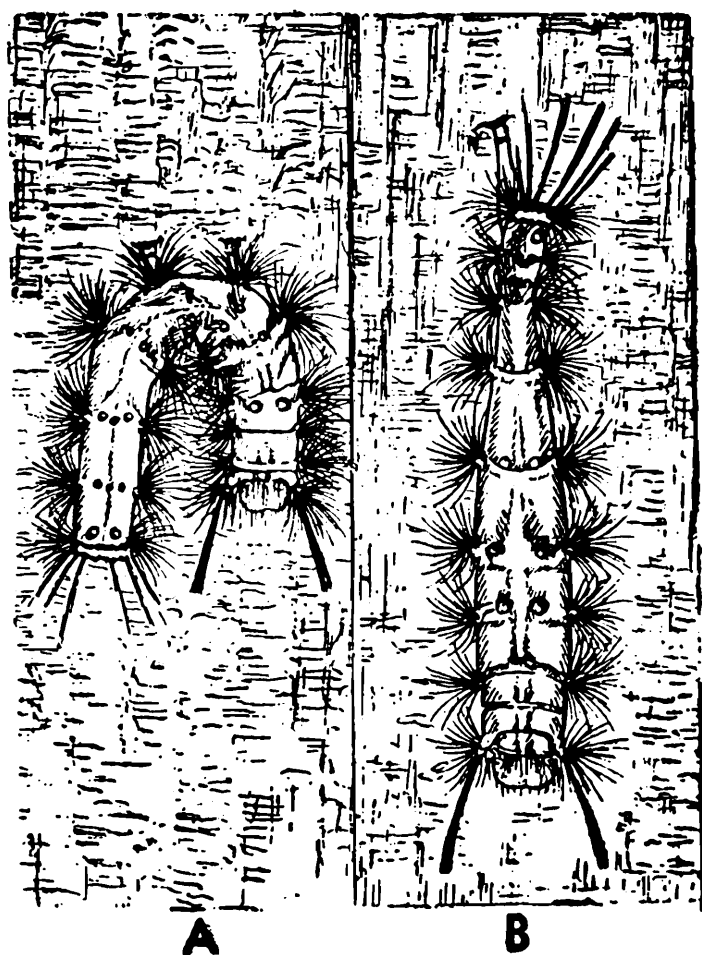
(Pls. 3 and 4; and Text-fig. 3). In normal years they are laid on a limited number of species, barely half a dozen, which are the common food-plants of larvae. In epidemic years, however, they may be laid on a large number of species (185 were recorded here in the 1953 epidemic) and, exceptionally, elsewhere such as on the upper surfaces of dried flowers and fruits, and even on brick walls and wire-netting. The female prefers a rough surface for laying, as shown by the following observations : In eucalyptus trees the bark is often either wholly or partly shed, exposing the smooth silver-grey trunk. Eggs were laid only on the rough, bark-covered portions. They were entirely absent on the smooth, barkless parts; trees wholly devoid of bark had no egg-masses at all. Eggs-masses are laid from ground-level up to about 18 m (60 ft.) of the trunk, but are most dense between the levels of 0.5 to 5 m. They are flat, of an ovoid-elongate or other shape, with irregular edges, and vary in extent from about 0.5×1 cm to 6×15 cm. From a distance the egg-masses are visible as characteristic white, fluffy patches against the dark-coloured bark (Pls. 3 and 4; and Text-fig. 3A). Each egg-mass contains about 50 to 1,200 or more eggs which are laid 2 to 4 layers deep directly on the bark (Text-fig. 3B). An egg-mass is covered over with a nearly one-millimetre, white thick felt-like covering composed of long, white, silken hairs. (According to Wileman, 1918, these hairs are shed by the female from the anal tuft. A similar habit was noted by Janjua, 1950, in another lymantriid, *Euproctis signata*, in Baluchistan.) The hairs are about 800-1200 μ long and 3.1-6.2 μ in diameter; one end is knob-like, the other pointed (Text-figs. 3C, D); a few such hairs are also mixed with the eggs. (For more details of hair structure, see Roonwal, 1954.) Freshly laid eggs (Pl. 4, Fig. 4) are rounded, have a flat base, the maximum and minimum diameters varying from 1.13-1.19 mm and 0.86-0.92 mm respectively.

After egg-laying the females are very sluggish and continue to rest for days near the egg-masses; having no proboscis, they take no food. If disturbed, they move away a little but do not fly; ultimately they die and drop to the ground.

Egg-mass after hatching

After the majority of eggs have hatched, an egg-mass presents a changed appearance. Firstly, the hair-covering which has hitherto (for several months in the case of the overwintering eggs) remained pure white, now becomes dull-coloured—a dirty cream and, in a few cases, with irregular patches of pale buff. Secondly, the hair covering is pierced by numerous rounded holes of varying diameters (c. 0.5-3 mm) through which the newly hatched larvae have escaped (Pl. 4, Figs. 7 and 8.) Beneath the thin, hole-pierced, hairy covering, there is

a flat, hollow space containing the remanants of egg-shells and a few remaining eggs which have not yet hatched.



Text-fig. 4.—*Lymantria mathura*. Two fully-grown female caterpillars, dying from polyhedral (or “liquefying”) disease, and hanging in characteristic positions by means of one or two prolegs. (A day later they were dead.) (A) Hanging by means of two of the middle prolegs. (B) Same, hanging by a single, hindmost proleg. (New Forest, Dehra Dun, mass eruption, April 1954. The disease killed millions of caterpillars and pupae and controlled the epidemic.)

For two to three weeks the young larvae remain in a dense group on the hair-covering, crawling slowly over it and sometimes underneath the covering. How, and whether, they feed during this period is not known. In the laboratory they were given fresh leaves and nibbled at them, but several hardly ate, and died; in nature there is considerable mortality in this early stage.

3. *The larval instars*

(Pl. 1, Figs. 5 and 6; Pl. 4, Figs. 3-6; Pls. 6 and 7)

The size and colour characteristics of the six larval stages are given below briefly; the various colour forms and protective coloration of the older larvae are discussed later.

Stage I. Length 3 mm; head-width 0.5 mm. Generally black dorsally; meso- and metathorax and segment 5 of abdomen brown; legs black; prolegs pale brown with a black patch externally.

Stage II. Length 5 mm; head-width 0.7 mm. Generally black dorsally; meso- and metathorax greyish; last abdominal segment pale brown with blackish tinge; rest as in Stage I.

Stage III. Length 13 mm; head-width 1.5 mm. Head brown; body black above, paler below; thoracic terga with yellow-brown spots; legs black, prolegs brown with a black external patch.

Stage IV. Length 20 mm; head-width 2.5 mm. Head above either black (brown distally) or pale green with black dots; sides brown; body black with white warts; meso- and metathorax with brown stripes anteriorly; legs and prolegs as in Stage III.

Stage V Length 30-40 mm; head-width 3.5 mm. Head above brown to grey, speckled with black; body black with many minute white spots; pro- and mesothorax with a transverse brown streak at the distal edge; ninth abdominal segment with a pair of prominent dorsal white spots; legs and prolegs reddish brown, the latter with a large black patch externally.

Stage VI. Length 60-85 mm; head-width 5-6 mm. With sexual dimorphism, females being longer (♂♂ 60-65 mm, ♀♀ 70-85 mm). Colour pattern similar to Stage V, but in ground-pattern three types recognizable, viz., grey-white, blackish-brown and intermediate (vide infra). Older larvae well "camouflaged" against tree trunks. (A morphological description has been given by Gardner, 1938.)

4. *The pupa*

(Pl. 1, Figs. 7 and 8)

The pupa is of the "obtect adecticus type", and the appendages are firmly soldered to the body. It is buff to dark brown, about 20-36 mm long, and shows sexual dimorphism; the female pupa is paler, larger and heavier than the male, as follows: *Female* : Buff to pale brown. Length (including hair tufts) 30-36 mm; maximum width 10-14 mm. Weight 0.88 gm (average of 18 pupae). *Male* : Very dark chocolate brown. Length (including hair tufts) 15-25 mm; maximum width 6-8 mm. Weight 0.14 gm (average of 53 pupae).

426 pupae of the second (overwintering) generation obtained in the field in April showed a preponderance of males (♂♂ 58%, ♀♀ 42%).

PREDATORS, PARASITES AND DISEASES

1. *Predators*

Caterpillars are cryptically coloured. They merge perfectly with the background (bark of tree trunks) and are almost impossible to detect when at rest (vide infra). During the eruption years, 1953-54, when caterpillars were present in millions in the Doon Valley forests, I saw only one case when a bird predator (the Common Myna, *Acridotheres tristis* (Linnaeus)) caught and ate a large caterpillar.

2. *Parasites*

Owing to heavy death by a polyhedral disease (vide infra), barely 3 %, or less, of the larvae survived in the breeding cages. The surviving larvae were rather heavily parasitised by some Hymenoptera (undetermined chalcids and a braconid, *Apanteles* sp.) and Diptera (undetermined tachinids). The pupae were moderately parasitised by tachinids.

3. *Polyhedral disease*

In the first week of April 1954, the larger caterpillars (4th to 6th instars) started dying by a "liquefying" or polyhedral virus disease which spread rapidly and drastically reduced the larval population. Death from this disease progressed rapidly, thus: April 2nd, 2 % of the population was affected; 9th, 8 %; 12th, 52 %; 14th, 99 %. By the middle of April nearly the entire larval population was wiped out. The disease was also prevalent among the pupae, but the incidence of deaths was lower (April 6th, 13 %, 22nd, 28 %). The disease occurred not only in the field but also in the insectary, having apparently been introduced from material brought in from the field. The symptoms and progress of the disease are as follows: Caterpillars become sluggish and stop feeding (as when they are about to pupate). Within 24 hours the body becomes limp and the caterpillars die. In these few hours the internal tissues decompose quickly and liquefy, and nothing is left except the outer cuticle. If the skin is pricked there oozes out a pale greenish white liquid which quickly turns dark brown or blackish purple on exposure to air. Dead caterpillars are seen hanging from tree trunks in a characteristic posture, by means of the crochets of either one or two prolegs (Pl. 5, Fig. 4; and Text-fig. 4). Pupae decompose in the same way as caterpillars.

The organism responsible for the disease was identified by the Virus Research Unit of the Molteno Institute, Cambridge, England, as a "rod-shaped virus infecting the nucleus of cells of the insect." The disease effectively controlled the moth epidemic, and there was no sign of any abnormal population in the immediately succeeding years.

The source of the infection is not known and may be latent, the infection becoming virulent and conspicuous in periods of population eruption. Evidence of latent infection in larvae has been adduced in other Lepidoptera also (Kovacevic, 1954).

NOCTURNAL FEEDING AND ACTIVITY RHYTHM IN CATERPILLARS

Freshly hatched caterpillars remain on the surface of the hairy covering of egg-masses (Pl. 4, Figs. 5 and 6) for about two weeks and apparently do not eat. After some time they move out slowly in search of tender leaves for food. Since in the case of tall trees, on whose trunks the eggs are often laid, the tiny larvae have to climb a great distance to reach the leafy crown, many die in the course of this journey. Even in laboratory cages there is considerably mortality.

1. *The nocturnal feeding and "migration"*

In the younger stages there is no fixed feeding time, and larval movements on tree trunks are irregular. By the fourth stage feeding occurs almost entirely at night, for which purpose the caterpillars crawl up the tree trunks. The daily nocturnal "migration" up and down the tree are regularly timed. They were closely observed in April when the caterpillars were well developed and mostly in the fifth and sixth stages.

Apart from short-term observations on many nights, sustained all-night observations on timings of the daily night movement were made on four successive nights (April 2, 3, 4, and 5) in New Forest, near Dehra Dun, on trees of *Acrocarpus fraxinifolius* Wight (Leguminosae : Caesalpineae). This is a tall tree with a straight bole, and grows to a height of about 21-24 m (c. 70-80 feet) or more. It has a girth (at breast height of 1.3-1.5 m, a crown-height of 3-6 m, and a spread of the same dimensions. The bark is thin, brownish grey and rather smooth. Tree heights were measured in the day along with those of smaller trees nearby to serve as markers during the night. A pair of field binoculars was used to observe the caterpillars lying high up. Night observations required the aid of a powerful electric torch. The following is a brief account of the principal findings.

Throughout the day the caterpillars remain at rest, closely packed in large irregular patches and strips on tree trunks (Pl. 5, Figs. 1-3), extending high up even to the main branches but totally absent on the leafy crown. A considerable proportion of the population is concentrated on the basal 1.5 metres of the trunk, where the average density is 629 caterpillars per square metre (Table 2). A large tree on the basal

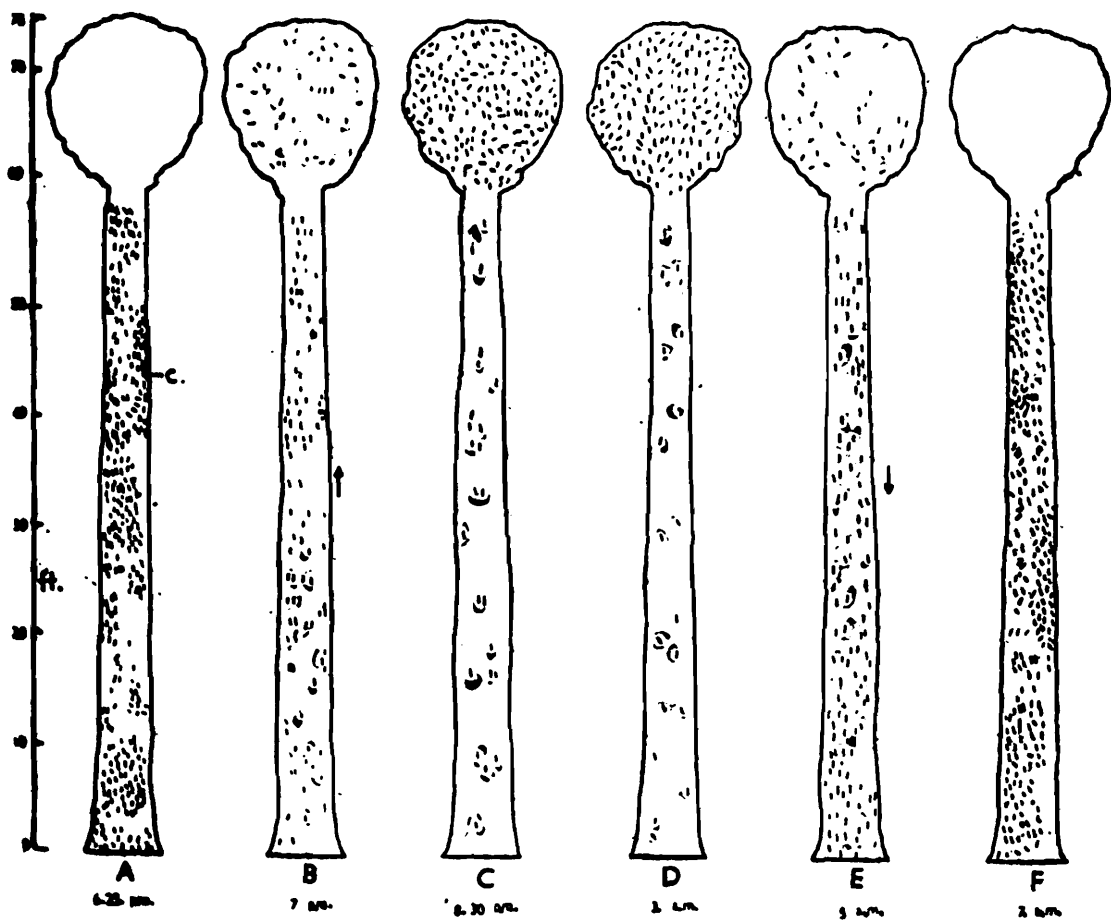
Table 2.—*Lymantria mathura*. Population of fully-grown caterpillars on lower portion (base to 1.5 m) of trunks of *Acrocarpus fraxinifolius* before and after the evening migration upward (New Forest. Dehra Dun, 3rd April 1954).

Tree No.	Girth (in m)		Surface area of trunk from base to 1.5 m (in sq. m.)	Number and density of caterpillars at 5 p.m.		Number etc. of caterpillars at 9 p.m.		Number etc. of caterpillars at 1 a.m.	
	At base	At 1.5 m		No. present	Density per sq. m.	No. present	% in terms of numbers present at 5 p. m. (col. 5)	No. present	% in terms of numbers present at 5 p.m. (col. 5)
1	2	3	4	5	6	7	8	9	10
1	2.1	1.5	2.4	1,368	570	287	21.1 %	267	19.5 %
2	1.9	1.2	1.9	1,140	600	206	18.1 %	201	17.6 %
3	2.1	1.5	2.3	1,173	510	287	24.5 %	283	24.2 %
4	1.9	1.3	2.0	1,671	836	264	15.8 %	247	14.8 %
Average			2.15	1,338	629	261.5	19.9 %	249.5	19 %

1.5 m harbours, on an average, of about 1,338 caterpillars, and an estimated seven or eight thousand on the entire trunk.

During the day time resting period, caterpillars assume a variety of positions (Pl. 5, Fig. 2) : some with the head pointing downward, others upward or to the side. The majority of them lie straight but a few may assume curved positions; all are closely adpressed against the bark. Most of them remain still, but an odd individual or two may be seen crawling sluggishly either upwards or downwards. When a caterpillar is touched with a stick, it either remains motionless or crawls a few centimeters away and then comes to a halt.

As dusk approaches some movement of the larvae is noticeable, and there is remarkable regularity in the timing of subsequent activity (Text-fig. 5). At about 6.25 p.m. all is still, but by 6.40 a few of the smaller caterpillars (fully-grown males and younger females) begin to show some activity : they twist and turn their bodies for a minute or two in a peculiar manner (described below), and then start crawling up the tree. By 7 p.m. a mass movement has developed and almost



Text-fig. 5.—*Lymantria mathura*. Rhythm of daily nocturnal "migration" of caterpillars to tree-crowns for feeding on leaves. Diagrammatic. The upward migration begins about 6.40 p. m., and is completed in an hour or so; the downward migration begins about 4.00-4.30 a.m. (a little before dawn), and is completed by about 7 a.m.

half the population is actively and purposefully crawling up the trunk. By 8.30 or 9 p.m. the bulk of the population has gone up and is vigorously feeding on the leaves high up, as indicated by the incessant dropping of excreta. On some trees the trunk is completely, or almost completely, bare by now, all the caterpillars having crawled up. On others, however, a small proportion of the population (about one-fifth, vide Table 2), remains unaffected by the mass movement and these individuals remain on the trunk throughout the night. Possibly, these apparently exceptional individuals either go up irregularly to feed, or have stopped feeding prior to pupation.

Feeding goes on vigorously throughout the night. At one a.m. in the morning the trunk is still almost deserted. From amongst those which had remained behind, a few caterpillars have ascended, but the number remaining is essentially unchanged. A few caterpillars slowly come down the trunk. Another odd caterpillar or two, may start to crawl upward. Overhead, the caterpillars are feeding vigorously and incessantly dropping excreta pellets. At 3 a.m. the scene is unchanged.

Shortly before dawn, the downward march begins. At first, about 4 a.m., the caterpillars come down the trunk in twos and threes, but quite fast; and shortly after, large numbers descend. By 5 a.m. an army of caterpillars is descending : some caterpillars have already come to a halt at various points on the trunk; others have reached the very bottom and are stationary; and the remainder are actively marching down. At 6 a.m. the downward march continues actively, but many, have already settled down on the trunk. By 7 a.m., practically the entire population is back on the trunk and is at rest and only an odd caterpillar or two is travelling downward. They will remain at rest throughout the day until the cycle of activity commences again at dusk.

The practical importance of this daily rhythm is that dusting of insecticides or banding of trees by means of sticky bands (to prevent caterpillars from going up the tree) (vide Roonwal, *et al.*, 1962) must be carried out during the day between the hours of eight in the morning (*i.e.*, after they come down from the tree-tops and have settled down to rest) and six in the evening (*i.e.*, before they start moving up).

In addition to these daily rhythmic movements up and down the same tree, which may be circadian, the caterpillars sometimes migrate from one tree to another in smaller numbers and for no apparent reason. In younger stages they sometimes hang by a silken thread from branches of trees and are blown with the wind to neighbouring trees, and thus they are spread from tree to tree.

Discussion: A somewhat similar but diurnal rhythm was noticed

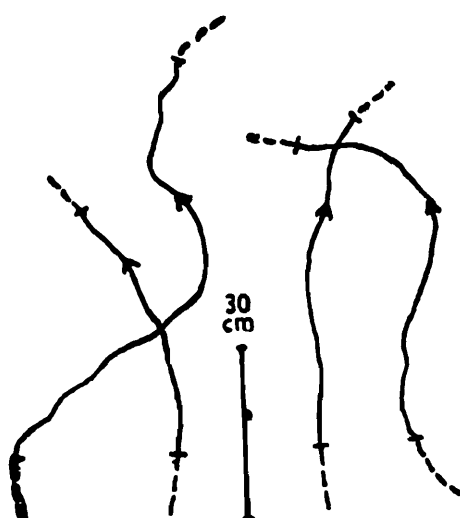
by D. Singh (1973) in another lymantriid, *Euproctis lunata* Walker, in India. The last instar larva is active in the morning and early afternoon, between 6.30 a.m. and about 3 p.m., the peak of activity lying between 8 a.m. and noon. During the inactive period, the larva simply rests on the host leaves (castor plant).

2. Peculiar body-movements of caterpillars

As mentioned above, immediately before starting on the evening march up the tree trunk, the caterpillars, which have been sitting still all day, undertake, for a minute or so, a peculiar and characteristic turning and twisting of the body as if they were toning up their muscles after the day-long stupor (reminding one of the yawning and stretching of a person on waking up after a long sleep). During these movements the middle portion of the body remains attached to the tree surface by means of either two or three of the middle prolegs of the abdominal segments 4, 5 and 6 (there are five pairs of prolegs : a pair each on segments 3, 4, 5, 6 and 10), while the anterior and posterior portions of the entire body are repeatedly bent toward each other and partly moved from side to side. No sooner is this process over, than the caterpillar starts on the upward march. Occasionally, after covering a little distance, it stops and repeats these movements.

3. Speed and direction of movement

The caterpillars crawl purposefully in an irregular, sinuous band (Text-fig. 6) whose general direction is upwards. At a stretch, about 40-90 cm are covered; then a halt of a few seconds to a minute or so is called, after which the march begins again. The average speed of



Text-fig.—*Lymantria mathura*. Portions of paths of progression of four full-grown caterpillars on a trunk during the evening ascent.

progression is 65.5 cm per minute, as judged from observations on four separate individuals (Table 3). At this rate, and assuming that a

Table 3.—*Lymantria mathura*. Speed of ascent of fully-grown caterpillars on trunk of *Acrocarpus fraxinifolius*. (New Forest, Dehra Dun, 5th April 1954.)

Sl. No.	Approximate length of caterpillar (cm)	Distance travelled (including curves) at a stretch in 1 minute (cm)
1	5	67
2	4	60
3	5	45
4	6	90

Average speed : 65.5 cm per minute

caterpillar travels straight up and not zig-zag, it will take a minimum of about 28 minutes to reach the top of a high tree, with a 18 m (or c. 60-foot) high bole, where it is to feed. If half as much time is added for the zig-zags, and another 20 minutes for halts after each stretch of journey, a fully-grown caterpillar, travelling from the base of the tree, would take at least an hour to reach the feeding area. For smaller caterpillars, the time taken must be considerably longer. On the downward journey at down, the caterpillars move appreciably faster, as judged visually.

COLOUR FORMS AND PROTECTIVE BEHAVIOUR AND COLORATION IN CATERPILLARS

1. Colour forms

Three main colour forms (Pls. 6 and 7) are found in mature caterpillars, the following proportions being noticed in 1,613 caterpillars examined : grey-white 66 %, intermediate 11 %, and blackish brown 23 %. The details of colour are described below briefly.

Form I (Grey-white) : Ground colour dirty white tinged with grey. Dorsal : Head white with numerous black or brown spots; frons with a longitudinal median black streak; rest of body grey-white, with numerous fine dots forming paired patches. A transverse yellow-brown streak present between pro- and mesothorax, and another in middle of metathorax; abdominal warts blackish; paired lateral papules on abdomen white, with tufts of long white and brown hairs. Long pencil-

like plumes of hairs on head and on end of abdomen black. Ventral: Brownish pink; legs and prolegs brown, the latter with a black patch externally.

Form II (Intermediate) : Dorsal : Ground colour pale brown, with a median white patch on abdominal terga 4 and 5. Ventral: As in Form I.

Form III (Blakish brown) : Dorsal : Ground-colour dark brown to almost black; numerous black spots visible in brown larvae but merged with ground-colour in darker ones; several small white dots present on abdominal terga 4 to the last, and large white patches on terga 4-6. Ventral : Ashy, suffused with a little pink in the median parts; rest as in Form I.

In the masses of caterpillars on tree trunks the various colour types are mixed on individual trees; this fact has a protective value by making detection by enemies difficult.

2. Protective behaviour and coloration

Although the masses of caterpillars are fully exposed during the day, they are completely free from the attention of birds which would normally make short work of them were they to detect their presence. Except an odd bird which caught and ate a caterpillar, no bird or any other vertebrate was ever seen predating on them.

The caterpillars show protective behaviour and coloration. They remain at rest on tree trunks throughout the day and seldom stir. At dusk they start crawling up the trees to feed on crown leaves, and descend at dawn. As mentioned above, the general colour of the mixed colour varieties forms a pattern which resembles the bark of trees very closely; this is especially so on the favoured host trees, *Shorea robusta* and *Acrocarpus fraxinifolius*. The resemblance to the background is so close to the human eye that although caterpillars were present in thousands in large patches on tree trunks, people passing within two metres of them often failed to notice them. Even children, who are usually very observant, missed them although every day they passed within two metres of the infested trees. The protective resemblance is especially perfect when the overall pattern, composed of different individual colour-forms, closely resembles the bark.

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SUMMARY

1. The process of initiation, progress and decline of the largest recorded epidemic (1953-54 eruption) of the Sal Defoliator, *Lymantria mathura*, in the Sub-Himalayas is described.

2. Though in normal years the defoliator is confined to barely half a dozen trees, in the 1953 eruption moths laid eggs, in the autumn of 1953, on as many as 185 different species; their list is given. However, the larvae survived only on 22 species.

3. The seasonal life-history was studied in the field as well as in the laboratory. Eggs are laid in small to large masses (each with about 50 to 1,200 eggs), which are covered by a thin layer of white material composed of long, thin microscopic hairs of a characteristic shape. There are five moults and six larval stages. In the Western Sub-Himalayas there are two annual generations—a first or summer generation (April to October) and a second or overwintering generation (September to June). The first generation eggs are laid from mid-April to mid-June, and hatch in 3 to 4 weeks. The second generation eggs are laid in autumn (early September to mid-October), then enter a diapause (with the embryo fully formed) and overwinter until they hatch in the following spring (February to early April).

4. The caterpillars have practically no predators, but are subject to fairly heavy parasitization by hymenopterous parasites. Both larvae and pupae are subject to serious attack by a polyhedral virus disease which spreads rapidly.

5. A precisely timed nocturnal feeding and “migratory” rhythm, which may be circadian, in mature caterpillars is described. The caterpillars rest during the day on tree trunks in large masses. At dusk they crawl up to the tree crown, feed there throughout the night and descend at dawn.

6. Just before the start of the upward march, and occasionally en route, caterpillars undergo, for a minute or two, a characteristic turning and twisting of the body.

7. The average speed of upward movement, including halts, is about 65.5 cm per minute; the downward movement is faster.

8. Three main colour forms are found in the mature caterpillars: a grey-white type which preponderates (66%), a dark, blackish-brown

type (23%) and an intermediate type (11 %). These types occur in mixed groups on tree trunks.

9. The caterpillars sit still in masses on tree trunks throughout the day, and move only at night. The dorsal and lateral colours perfectly match the background bark, making detection difficult even at short distances of a couple of metres. As a result, there are no bird or other vertebrate predators.

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APPENDIX

List of plants on which egg were laid by *Lymantria mathura* in the Western Sub-Himalayas (New Forest Estate and other forests in the Doon Valley, Uttar Pradesh, altitude 610 m) during the population eruption of September-October 1953. (1) Number of trees on which eggs- masses were seen and counted are mentioned within brackets. (2) Degree of preference (for egg-laying) was grouped into three classes, as based on the average number of egg-masses per tree, as follows :—

Small (S) : Below 10 egg-masses per tree.

Moderate (M): 10-40 „ „ „

Great (G): Above 40 „ „ „

Family (1) ANACARDIACEAE

1. *Lannea grandis* (Dennat) Engl. (1), S.
2. *Mangifera indica* Linn. (5), M. Mango.
3. *Rhus lancea* Linn. f. (1), S.
4. *Schinus dependens* Orteg. (1), S.
5. *Schinus terebinthifolius* Raddi (2), S.
6. *Sclerocarya birroea* Hoechst. (1), S.
7. *Semecarpus anacardium* Linn. f. (1), S.
8. *Spondias axillaris* Roxb. (1), S.

Family (2) ANONACEAE

9. *Uvaria hamiltonii* Hook. f. & Th. (2), S.

Family (3) APOCYNACEAE

10. *Alstonia scholaris* R. Br. (1), S.
11. *Thevetia nerifolia* Juss. (4), S.

Family (4) BIGNONIACEAE

12. *Jacaranda brasiliensis* Pers. (1), S.
13. *Jacaranda ovalifolia* R. Br. (5), M.
14. *Kigelia pinnata* DC. (1), S.
15. *Millingtonia hortensis* Linn. (1), S. Indian Cork-tree.
16. *Stereospermum chelonoides* DC. (1), S.
17. *Stereospermum suaveolens* DC. (1), S.
18. *Tecoma argentea* Bureau & K. Sch. (2), S.

Family (5) BORAGINACEAE

19. *Cordia myxa* Linn. (1), S. *Lasorā*.

Family (6) BURSERACEAE

20. *Boswellia serrata* Roxb. (1), S. *Salai*.
21. *Protium serratum* Engl. (syn. *Burserra serrata* Wall. ex Colebr.) (1), S.

Family (7) CASUARINACEAE

22. *Casuarina cunninghamiana* Miq. (5), M.
23. *Casuarina equisetifolia* Forst. (5), S. *Casuarina*.

Family (8) CELASTRACEAE

24. *Elaeodendron glaucum* Pers. (several), S. (Noticed in Thangaon forest near Dehra Dun.)

Family (9) COMBRETACEAE

25. *Anogeissus leiocarpa* Guill. & Perr. (2) S.
26. *Terminalia arjuna* Bedd. (2), M. *Arjun*.
27. *Terminalia belerica* Roxb. (1), S. *Baherā*.
28. *Terminalia chebula* Retz. (1), S. Myrabolan tree.
29. *Terminalia citrina* Roxb. (1), S.
30. *Terminalia paniculata* W. & A. (1), S.
31. *Terminalia tomentosa* W. & A. (3), S. *Sain*.

Family (10) CONIFERAE

32. *Cupressus arizonica* Greene (2), M.
33. *Cupressus cashmiriana* Royle (2), M.
34. *Cupressus torulosa* Don. (2), M. Himalayan cypress.
35. *Juniperus procera* Hoechst (2), S.
36. *Pinus caribaea* Mor. (3), S.

- 37. *Pinus longifolia* Roxb. (5), S. Chir pine, chir, chil.
- 38. *Pinus merkusii* Jungh & de Vriese (1), S. Tenasserim pine.
- 39. *Pinus thunbergi* Parl. (1), S.
- 40. *Podocarpus gracilior* Pilger (2), S.
- 41. *Taxus baccata* Linn. (5), S.

Family (11) CORNACEAE

- 42. *Marlea begoniaefolia* Roxb. (2), S.

Family (12) DILLENIACEAE

- 43. *Dillenia indica* Linn. (3) S.

Family (13) DIPTEROCARPACEAE

- 44. *Shorea robusta* Gaertn. f. (5), G. Sāl.

Family (14) EBENACEAE

- 45. *Diospyros embryopteris* Pers. (1), S.

Family (15) EUPHORBIACEAE

- 46. *Aleurites fordii* Hemsl. (5), S.
- 47. *Bischofia javanica* Blume (1), S. Kaen.
- 48. *Breynia rhamnoides* Muell. Arg. (1), S.
- 49. *Macaranga* sp. (5), S.
- 50. *Mallotus philippinensis* Muell. Arg. (1), S. Rohini.
- 51. *Manihot tweediana* Muell. Arg. (1), S.
- 52. *Putranjiva roxburghii* Wall. (2), S.
- 53. *Sapium sebiferum* Roxb. (1), S. Chinese tallow tree.

Family (16) FLACOURTIACEAE

- 54. *Gynocardia odorata* R. Br. (1), S.
- 55. *Oncoba spinosa* Forsk. (1), S.

Family (17) GNETACEAE

- 56. *Araucaria cookii* R. Br. (1), M.
- 57. *Araucaria cunninghamii* Ait. (5), M.

Family (18) GRAMINEAE

- 58. *Dendrocalamus giganteus* Munro (12 culms), M.
- 59. *Dendrocalamus strictus* Nees (3), S.

Family (19) GUTTIFERAE

- 60. *Mesua ferrea* Linn. (1), S.

Family (20) HYPERICINEAE

- 61. *Cratoxylon polyanthum* Korth. (1), S.

Family (21) JUGLANDACEAE

62. *Pterocarya stenoptera* DC. (2), S.

Family (22) LAURACEAE

63. *Cinnamomum camphora* Nees & Eberm. (1), G. Japan or Formosa camphor tree.

Family (23) LEGUMINOSAE

Subfamily (a) Caesalpineae

64. *Acrocarpus fraxinifolius* Wight (3), S.
 65. *Bauhinia anguina* Roxb. (6 shoots), S.
 66. *Bauhinia galpini* N. E. Br. (1), S.
 67. *Bauhinia hookeri* F. Muell. (1), S.
 68. *Bauhinia kurzii* Urban (1), S.
 69. *Bauhinia pubescens* DC. (2), S.
 70. *Bauhinia purpurea* Linn. (2), S.
 71. *Bauhinia regulosa* Wedd. (5), S.
 72. *Bauhinia retusa* Ham. (1), S. *Kanlā*.
 73. *Bauhinia variegeta* Linn. (4), S. *Kachnār*.
 74. *Caesalpinia sappan* Linn. (1), S. Sappan wood.
 75. *Cassia ferruginea* Schrad. ex DC. (1), S.
 76. *Cassia fistula* Linn. (5), S. *Amaltās*.
 77. *Cassia glauca* Lam. (1), S.
 78. *Cassia javanica* Linn. (5), S.
 79. *Cassia nodosa* Ham. (1), S.
 80. *Cassia spectabilis* DC. (2), S.
 81. *Gleditschia* sp. (1), S.
 82. *Peltophorum africanum* Sond. (2), S.
 83. *Peltophorum vogelianum* Walp. (2), S.
 84. *Poinciana regia* Bojer (3), S. Gold mohur.

Subfamily (b) Mimoseae

85. *Acacia arabica* Willd. (3), M. *Babul*.
 86. *Acacia auriculiformis* A. Cunn. (4), S.
 87. *Acacia catechu* Willd. (1), M. Cutch tree, *khair*.
 88. *Acacia confusa* Merr. (5), S.
 89. *Acacia eburnea* Willd. (1), S.
 90. *Acacia modesta* Wall. (1), S.
 91. *Albizzia chinensis* (Osbeck) Merr. (syn. *A. stipulata* Boir) (2), S. *Kalā siris*.
 92. *Albizzia procera* Benth. (3), S. *Safed siris*.
 93. *Enterolobium contortisiliquum* (Vell.) Morong (syn. *E. tembouva* Mart.) (2), M.
 94. *Parkia roxburghii* G. Don. (1), S.
 95. *Xylia dolabriiformis* Benth. (1), S. Ironwood of Burma.

Subfamily (c) Papilionateae

96. *Butea monosperma* (Lam.) Ktze. (syn. *B. frondosa* Koen. ex Roxb.) (2), S. *Dhak, palas*.

97. *Dalbergia latifolia* Roxb. (5), S. Indian rosewood, blackwood.
98. *Dalbergia sissoo* Roxb. (5), M. Shisham, sissu.
99. *Derris robusta* Bth. (1), S.
100. *Erythrina arborescens* Roxb. (1), S.
101. *Erythrina indica* Lam. (1), S. Indian coral tree.
102. *Erythrina suberosa* Roxb. var. *glabrescens* Prain (5), S.
103. *Lonchocarpus nitidus* Benth. (1), S.
104. *Milletia auriculata* Baker (1), S.
105. *Milletia tatraptera* Kurz. (1), S.
106. *Mundulea suberosa* Bth. (2), S.
107. *Ougenia dalbergioides* Benth. (2), S. Sāndan.
108. *Tipuana speciosa* Benth. (1), M.

Family (24) LYTHRACEAE

109. *Duabanga sonneratioides* Ham. (1), S.
110. *Lagerstroemia flos-reginae* Retz. (4), S.

Family (25) MAGNOLIACEAE

111. *Michelia champaca* Linn. (2), S. Champak.
112. *Michelia figo* (Lour.) Spreng. (syn. *M. fuscata* Blume) (2), S.

Family (26) MALPIGHIACEAE

113. *Zyrosnima crassifolia* H. B. & K. (2), S.

Family (27) MALVACEAE

114. *Bombax insigne* Wall. (1), S.
115. *Bombax malabaricum* DC. (= *Salmaalina malabarica*) (4), S. Cotton trees simal.
116. *Chorisia crispiflora* H. B. & K. (1), S.

Family (28) MELIACEAE

117. *Ammora rohituka* W. & A. (2), S. Sohāgā.
118. *Cedrela toona* Roxb. (5), G. Tun, toon, red cedar.
119. *Chloroxylon switenia* DC. (3), S. Satinwood.
120. *Dysoxylum binectariferum* Hook. f. (1), S.
121. *Heynea trijuga* Roxb. (2), S.
122. *Melia azedarach* Linn. (2), S. Bakain, drek, Persian lilac.
123. *Melia composita* Willd. (2), S.

Family (29) MORINGACEAE

124. *Moringa concanensis* Nimmo (1), S.
125. *Moringa pterygosperma* Gaertn. (2), S. Sanjnā.

Family (30) MYRTACEAE

126. *Callistemon viminalis* (Solaud) (5), S. Cheel.
127. *Callitris glauca* Lam. (2), S.
128. *Eucalyptus deglupta* Bl. (1), S.

- 129. *Eucalyptus resinifera* Sm. (2), S.
- 130. *Eucalyptus rostrata* Schlecht. (5), S.
- 131. *Eucalyptus torelliana* F. Muell. (2), S.
- 132. *Eugenia grandis* Wight. (1), S.
- 133. *Melaleuca ericifolia* Sm. (1), S.
- 134. *Melaleuca styphelioides* Sm. (1), M.
- 135. *Psidium guajava* Linn. (2), M. Guava.
- 136. *Syzygium cumini* Linn (syn. *Eugenia jambolana* Lam. (3) G. Jamun, black plum.

Family (31) PALMEAE

- 137. *Caryota mitis* Lour. (3), S.
- 138. *Caryota urens* Linn. (5). S. Indian sago palm.
- 139. *Phoenix sylvestris* Roxb. (5). M. Wild date palm, *khajur*.

Family (32) PANDANACEAE

- 140. *Pandanus furcatus* Roxb. (2), S.

Family (33) RHAMNACEAE

- 141. *Hovenia dulcis* Thumb. (1), M.
- 142. *Zizyphus incurva* Roxb. (1), S.

Family (34) ROSACEAE

- 143. *Eriobotrya japonica* Lindl. (1), S.
- 144. *Prunus communis* Huds. (4), S.
- 145. *Stranvaesia glaucescens* Lindl. (1), S.

Family (35) RUBIACEAE

- 146. *Adina cordifolia* Hook. (5), S. *Haldu*.
- 147. *Anthocephalus cadamba* Miq. (5), M. *Kadam*.
- 148. *Gardenia spetulifolia* Stapf. & Hutch. (1), S.

Family (36) RUTACEAE

- 149. *Aegle marmelos* Correa (1). G. *Bel*.
- 150. *Citrus decumana* Linn. (1), S. *Chakotra*.

Family (37) SALICINEAE

- 151. *Salix babylonica* Linn. (1), S.

Family (38) SANTALACEAE

- 152. *Santalum album* Linn. (2), S. Sandalwood.

Family (39) SAPINDACEAE

- 153. *Acer negundo* Linn. (1), S.
- 154. *Acer oblongum* Wall. (5), S.
- 155. *Aesculus punduana* Wall. (syn. *A. assamica* Griff.) (1), S.

- 156. *Litsea chinensis* Camb. (syn. *Nephelium litsea* Camb.) (5), S. *Litsea*.
- 157. *Sapindus drumondii* Hook. & Arn. (1), S.
- 158. *Sapindus mukorossi* Gaertn. (1), S.

Family (40) SAPOTACEAE

- 159. *Madhuca longifolia* (Koenig) MacBride var. *latifolia* (Roxb.) Chev. (syn. *Bassia latifolia* Roxb.) (1), S. *Mohwa*.

Family (41) SIMARUBACEAE

- 160. *Ailanthus excelsa* Roxb. (2), S. *Maharukh*.

Family (42) SOLANACEAE

- 161. *Dolichandrone falcata* Seem. (3), S.

Family (43) STERCULIACEAE

- 162. *Eriolaena hookeriana* W. & A. (1), S.
- 163. *Pterospermum acerifolium* Will. (2), S.
- 164. *Sterculia alata* Roxb. (5), S.
- 165. *Sterculia colorata* Roxb. (4), S.
- 166. *Sterculia pallens* Wall. (1), S.
- 167. *Sterculia villosa* Roxb. (2), S.

Family (44) TERNSTROEMIACEAE

- 168. *Schima wallichii* Choisy (5), S.

Family (45) TILIACEAE

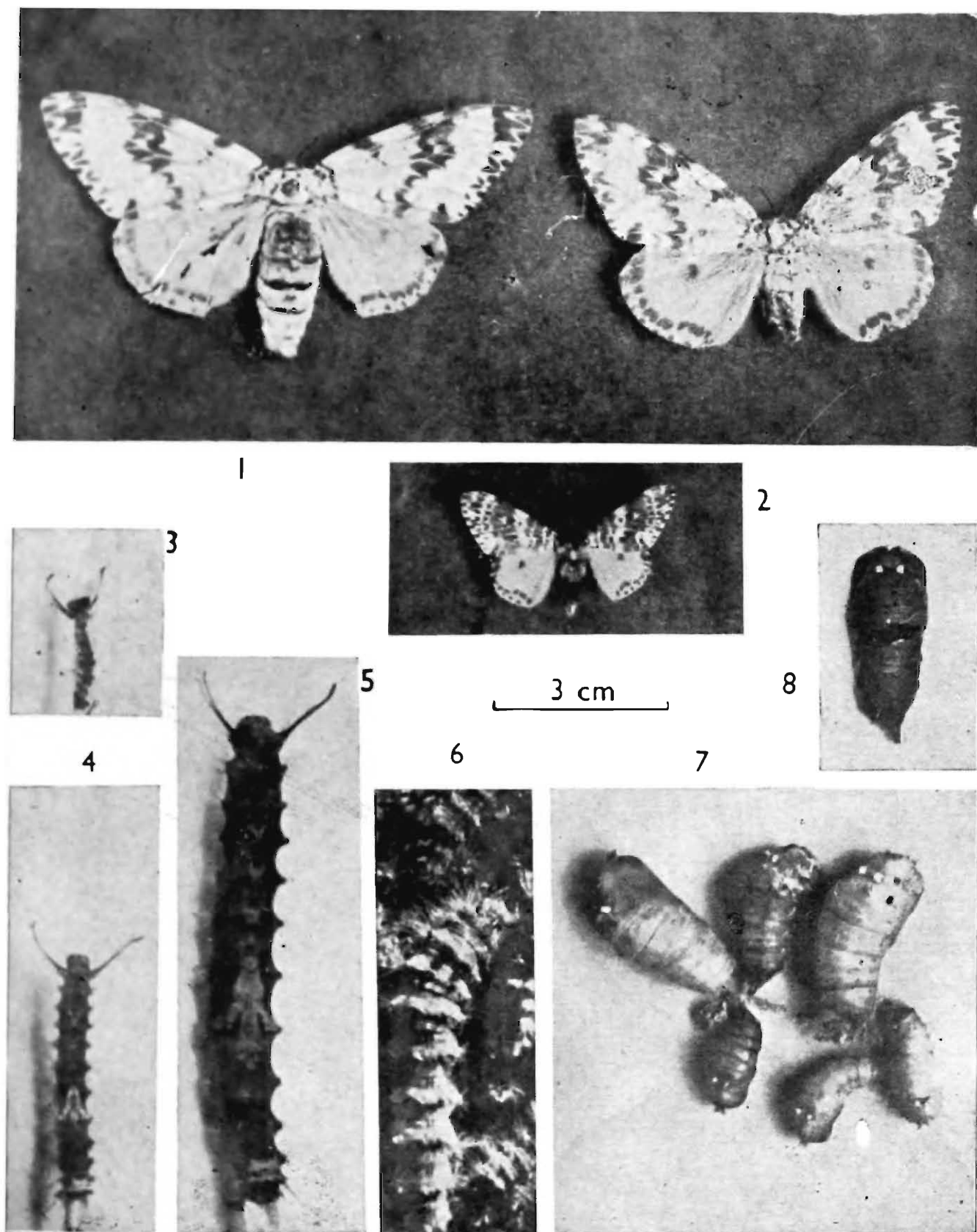
- 169. *Grewia subinaequalis* DC. (syn. *G. asiatica* Mast, in part, nec. Linn.) (1), S.
- 170. *Grewia* sp. (1), S. (In Thangaon forest near Dehra Dun.)

Family (46) URTICACEAE

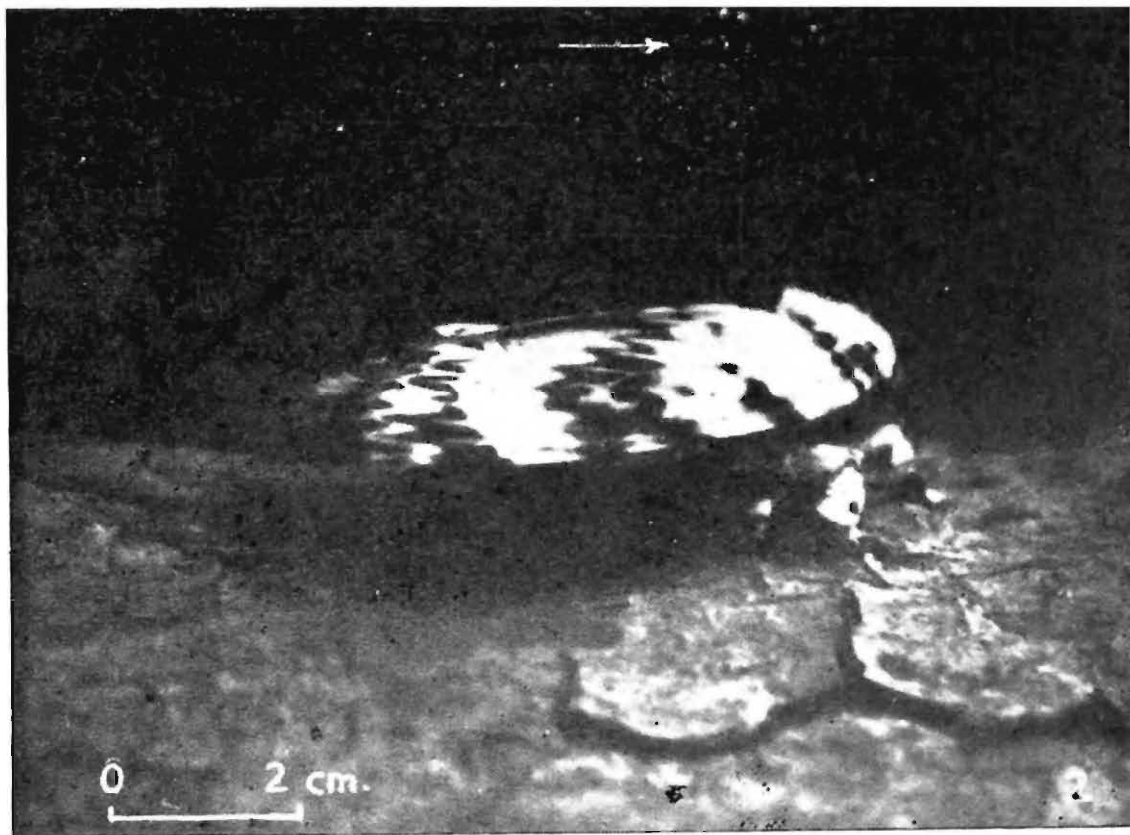
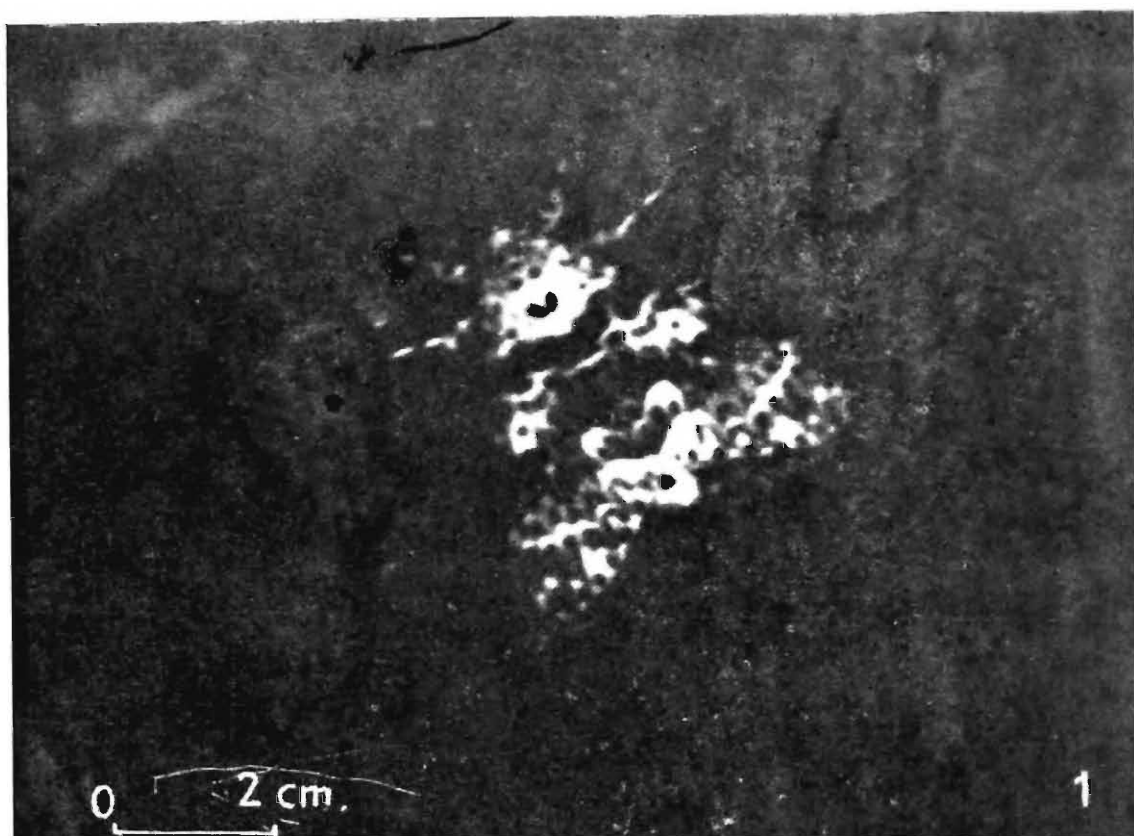
- 171. *Artocarpus integrifolia* Linn. f. (3), M.
- 172. *Artocarpus lakoocha* Roxb. (1), S. *Barhal*.
- 173. *Ficus bengalensis* Linn. (2). S. *Bar*, *bargad*.
- 174. *Ficus racemosa* Linn. (syn. *F. glomerata* Roxb.) (1), G.
- 175. *Ficus infectoria* Roxb. (1), S.
- 176. *Ficus religiosa* Linn. (1), G. *Pipal*.
- 177. *Maclura pomifera* Schnied. (1), S.
- 178. *Morus alba* Linn. (2), M. *Mulberry*.

Family (47) VERBENACEAE

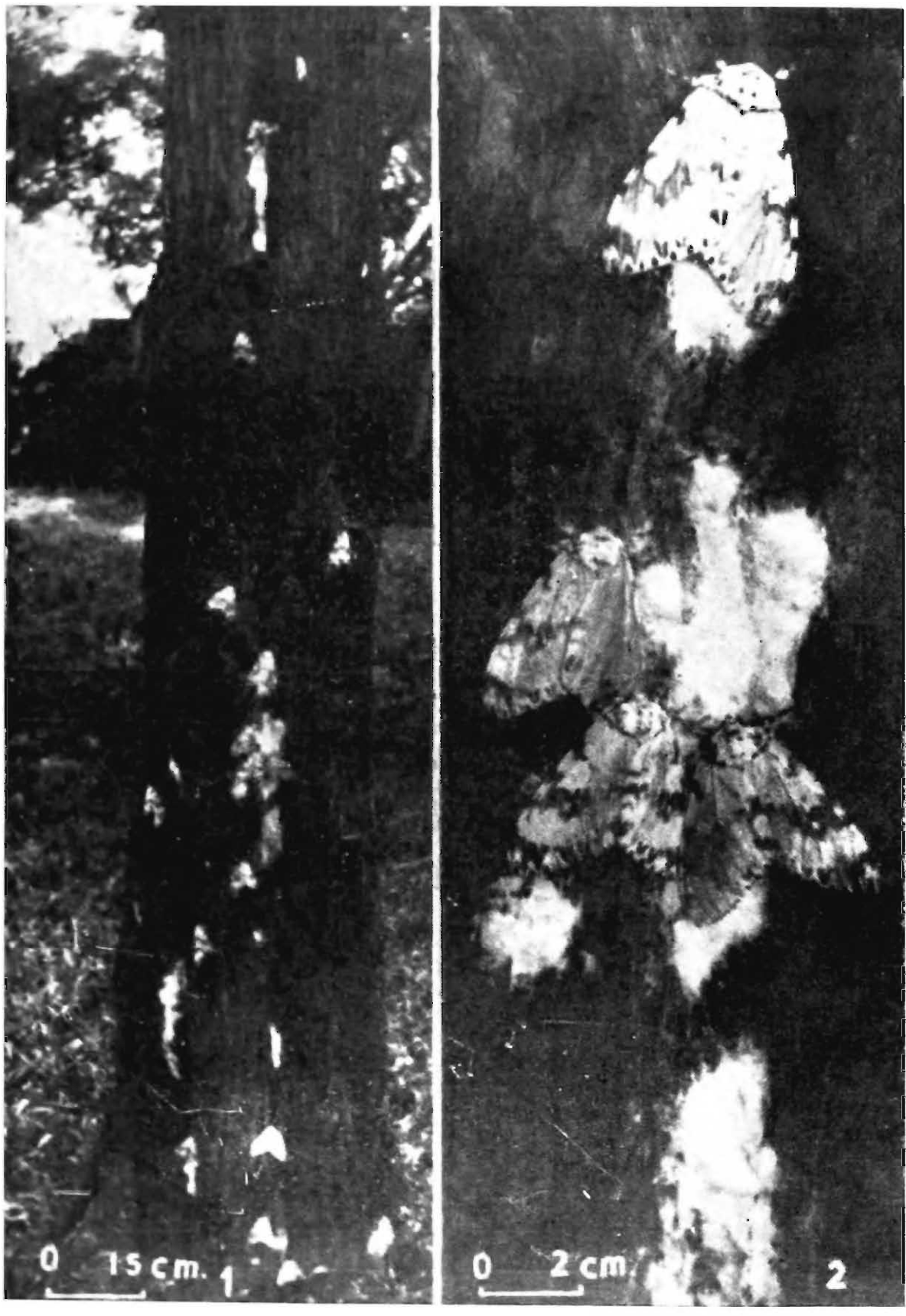
- 179. *Caryopteris mastacanthus* Sch. (1), S.
- 180. *Litharexylum quadrangulare* Jacq. (1), S.
- 181. *Premna mucronata* Roxb. (syn. *P. latifolia* Roxb.) (1), M. *Bakar*.
- 182. *Tectona grandis* Linn. (5), S. *Teak*.
- 183. *Tectona hamiltoniana* Wall. (3), S.
- 184. *Vitex negundo* Linn. (1), S.
- 185. *Vitex peduncularis* Wall. (1), S.



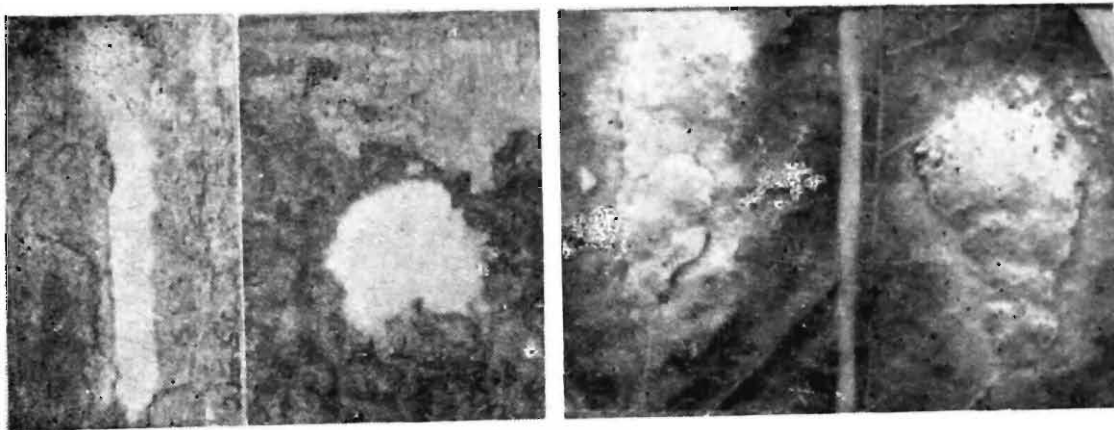
Lymantria mathura (New Forest, Dehra Dun), (1) Two ♀♀ Moths. (2) Moth ♂. (3, 4, 5) Larvae, blown and mounted (3, very young; 4, middle stage; 5, fully developed). (6) Mature larva, living. (7) A group of six pupae (upper larger three ♀♀; lower smaller three, ♂♂). (8) A ♀ pupal skin after emergence of moth.



Lymantria mathura (New Forest, Dehra Dun). Moths on tree trunks, in **natural** resting position (1) ♂, in dorsal view. (2) Side view of ♀ which always rests with **head**, pointing upwards (direction of arrow). [Also cf. Plate 3.]



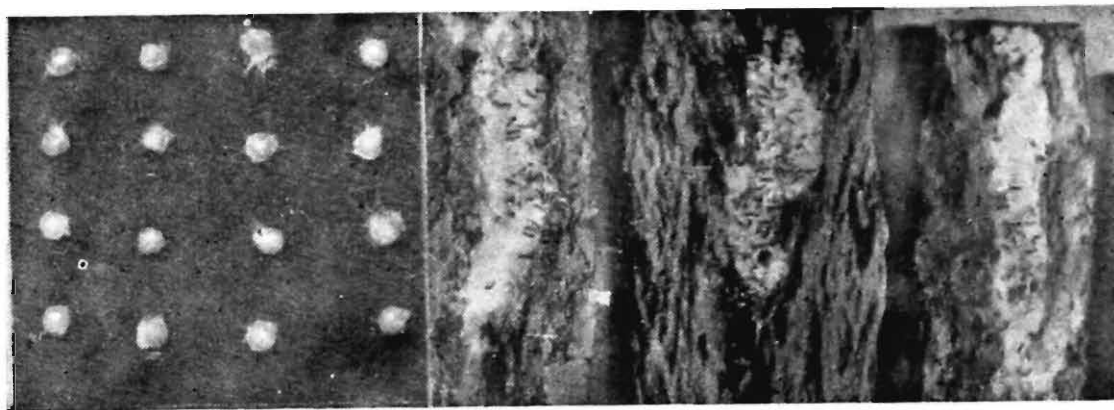
Lymantria mathura. (1) Female moths, laying eggs (in masses covered with white hairs) on trunk of *Juniperus procera*, New Forest, Dehra Dun, in an epidemic year, October, 1953). (2) Same, enlarged.



1

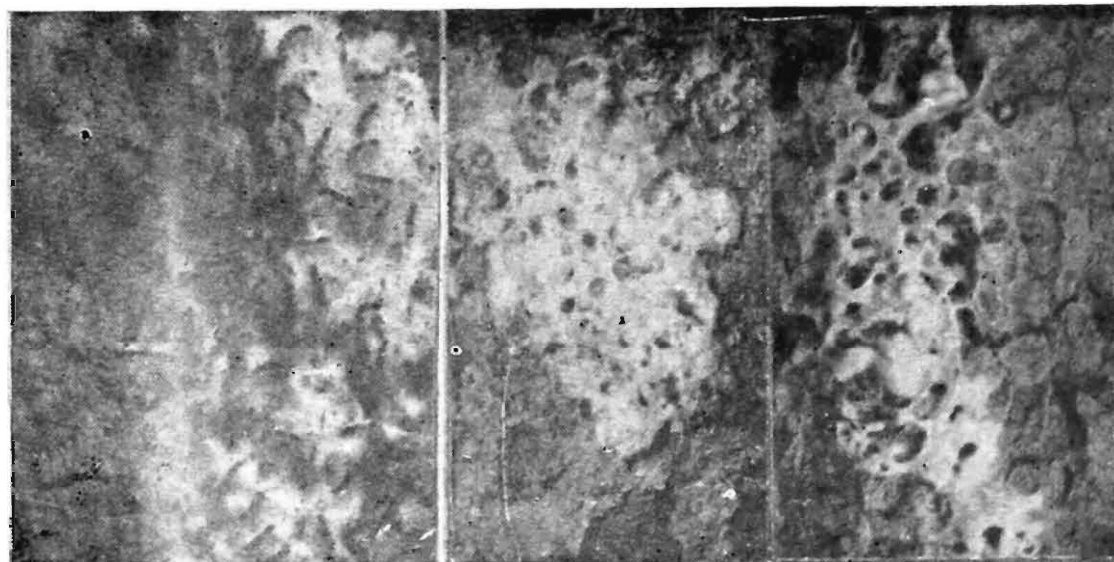
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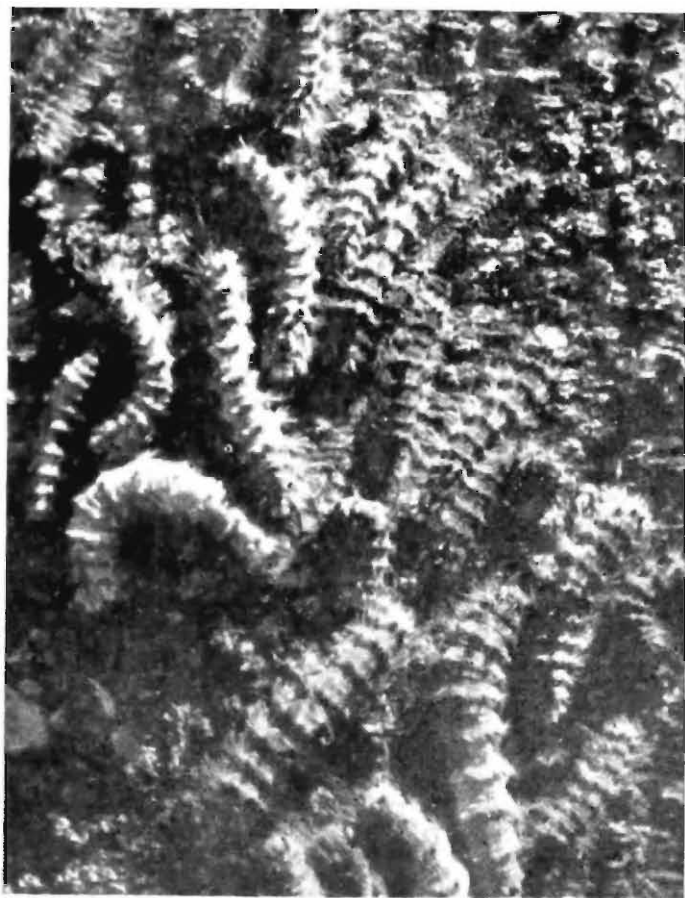
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1, 2 $\overbrace{\hspace{1.5cm}}^{3\text{ cm}}$ 3 $\overbrace{\hspace{1.5cm}}^{2\text{ cm}}$ 4 $\overbrace{\hspace{1.5cm}}^{1\text{ cm}}$ 5 $\overbrace{\hspace{1.5cm}}^{2\text{ cm}}$
6 $\overbrace{\hspace{1.5cm}}^{2\text{ cm}}$ 7, 8 $\overbrace{\hspace{1.5cm}}^{3\text{ cm}}$

Lymantria mathura. Egg-masses and hatching. (1, 2); Two freshly laid egg-masses. (3) Two older egg-masses, with eggs swollen and about to hatch (note nodule-like outlines of eggs.). (4) Eggs (some with hairs still adhering). (5) Three egg-masses with newly hatched larvae crawling on them. (6) Same; an egg-mass enlarged. (7, 8), Two egg-masses from which larvae have already emerged; note round emergence holes on the hair-covering.



1

2

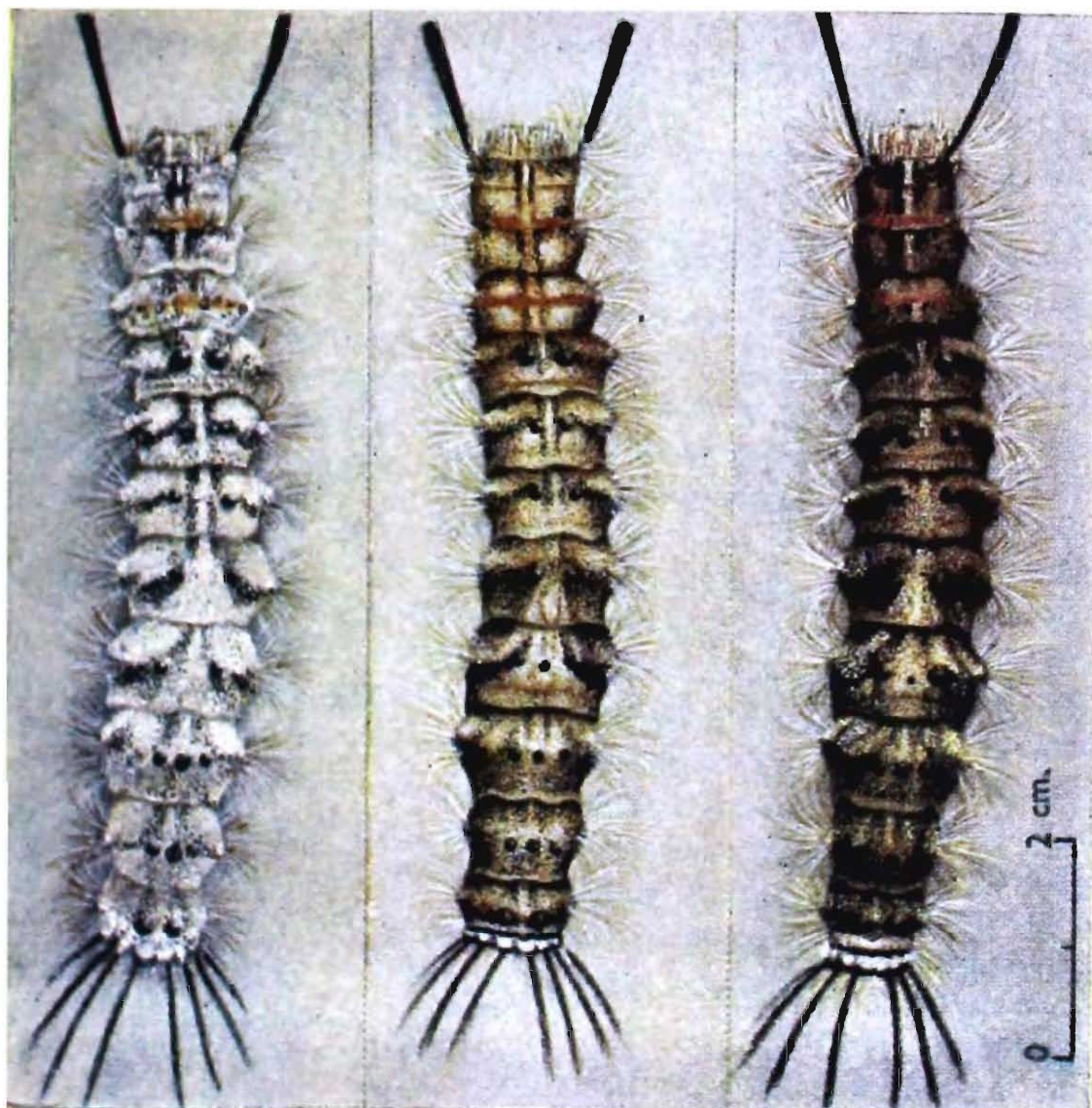


3



4

Lymantria mathura caterpillars during mass eruption (April, 1954) in the Western Sub-Himalayas (Dehra Dun forests). (1) Masses of mature caterpillars resting during the day on trunk of *Acrocarpus fraxinifolius*. (2) Same, a dense mass in closer view. (3) Same, another mass of caterpillars and pupae. (4) Dead caterpillars infected *en masse* by a polyhedral virus disease, hanging limp on tree trunk in characteristic positions [also cf. Text-fig. 4].



1

2

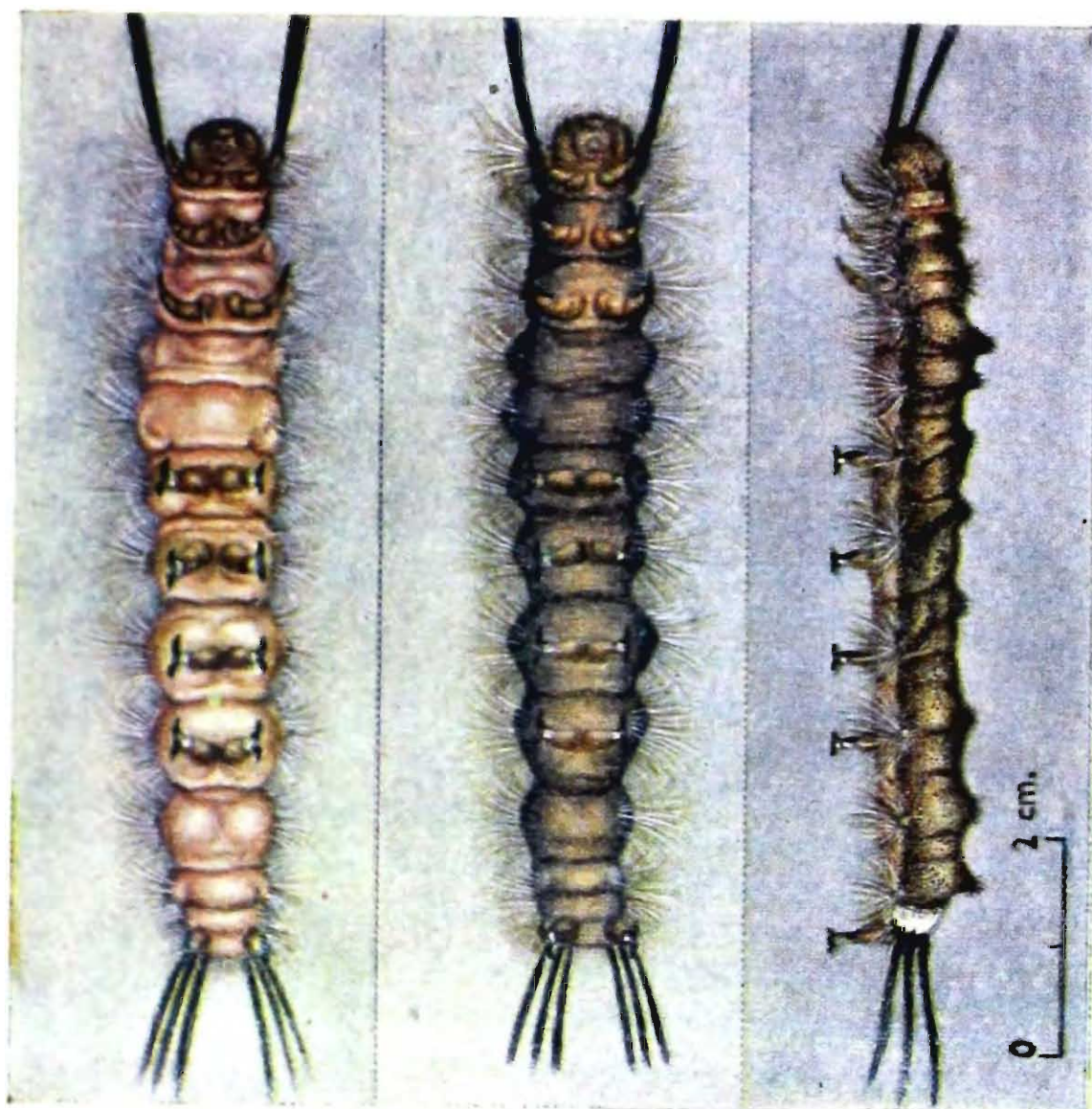
3

Colour forms of mature caterpillars of *Lymantria mathura* in the Western sub-Himalayas. Dorsal view.

1. Form I (Grey-white); 2. Form II (Intermediate); 3. Form III (Blackish-brown).

ROONWAL

PLATE VII



1

2

3

Colour forms of mature caterpillars *Lymantria mathura* in the Western sub-Himalayas.

1. Form I (Grey-white), Ventral view; 2. Form III (Blackish-brown), Ventral view; 3. Form II (Intermediate), Lateral view.

ON BIOLUMINESCENT *NOCTILUCA* SWARMS ASSOCIATED WITH THE MOVEMENT OF EXTENSIVE SHOALS OF FLYING-FISHES AND SCHOOLS OF DOLPHINS IN THE NORTHERN ARABIAN SEA IN FEBRUARY, 1974

By

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(With 1 Text-figure)

INTRODUCTION

During the oceanographic expedition on INS DARSHAK in the northern Arabian Sea from December 1973 to May 1974, a greenish colouration of the sea during the day and a bluish-green bioluminescence during the night caused by the swarming of the dinoflagellate *Noctiluca miliaris* Suriray was observed over an extensive area on the 18th and 19th February 1974, as the vessel moved along its cruise-track establishing Stations during the first lap (5.2.74 to 20.2.74) of the IIIrd Scientific Cruise. During the night of the 18th/19th February, 1974, this swarming bioluminescent phenomenon was associated with the movement of extensive shoals of flying-fishes and schools of dolphins from the relatively feeble bioluminescent areas located at the periphery of the 'bloom' towards the brighter zone of the bioluminescent region centered over the "CORIE HIGH" area. The swarming of *Noctiluca* and the associated greenish colouration-bioluminescent phenomenon had disappeared when this and adjoining areas were revisited from 23.2.1974 to 28.2.1974 during the second lap of the IIIrd Scientific Cruise. No evidence of dead, decaying or floating fishes and other marine organisms was observed. These observations are recorded in this paper.

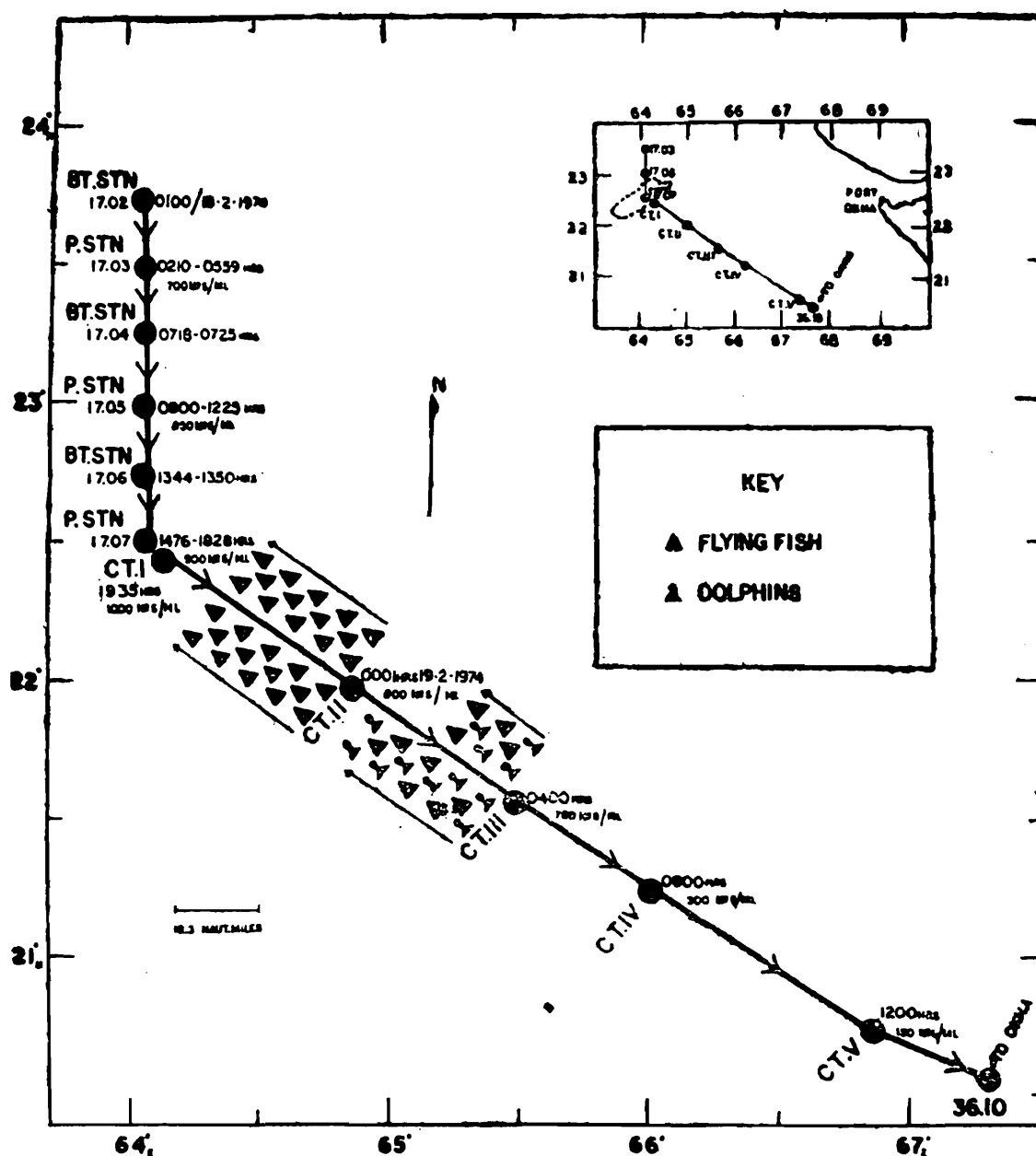


FIGURE EXPLANATION

Text-Fig. 1.—The cruise track of vessel, station positions with date and time, movement of flying-fish shoals and dolphin schools together with numbers of *Noctiluca* per standard surface subsamples of a ml.

B. T. STN. Bathythermograph Station, P. STN. Parameter Station, CT.I—V. Cruise Track Stations.

Arrow directed downwards indicates cruise track direction. Long arrow indicates direction of the movement of the fish shoals and dolphin schools.

Insert : Cruise track and stations positions in relation to shallow "CORIE HIGH" and Port Okha, India.

MATERIAL AND METHODS

Continuous observations during the night and day at the various Stations and also all along the cruise track (Text-fig. 1) were made to detect the extent of colouration of the sea surface by day, bioluminescence by night and the extent and direction of movement of the shoals

of flying-fishes and schools of dolphins. From the bridge of the INS DARSHAK, the range of visibility during this period using high power binoculars ranged from approximately 10 to 12 nautical miles.

Collections of surface, plankton (100-0 metres) and flying-fish samples were made at the Stations indicated in Table 1. Surface samples were collected with a compact sampler consisting of a rectangular metallic frame (55 cms $\times$ 15 cms) with a streamlined float provided with a stabilizing keel and fitted with a conical net of 190 cms. length made of bolting silk bearing 60 meshes to the linear centimetre. Plankton samples from 100-0 metres were collected with a "standard" net (50 cm. mouth diameter/225 cm. total net length/bolting silk-60 meshes per linear centimetre) hauled vertically at a speed of one metre/second over a davit. Details of the surface net are given by Daniel and Jothinayagam (in press) and those of the "Standard" plankton net by Sverdrup, Johnson and Fleming, 1942 and Daniel and Krishnamurthy (in press). The flying-fish samples were collected by hand nets. The total displacement volumes in millilitres and the numbers of each biconstituent occurring in the entire surface sample collected during a 5-minute haul and the entire plankton sample from 100-0 m. were analysed for estimating the number of organisms. The flying-fish samples were examined soon after capture to elucidate the major items of the diet; scrapings of luminescent particles adhering to the bodies and gills were examined microscopically for determining the cause of the luminescence. Samples of the surface, plankton and the flying-fishes were preserved in 5% neutral formalin for detailed laboratory studies. The dolphins could not be captured and were identified by their characteristic snouts, with the help of binoculars, as *Delphinus* sp.

OBSERVATIONS

The sea was first observed to be feebly luminescent with a bluish green glow from 0100 hrs of 18th February, 1974, when the vessel was cruising from Station 17.02 to 17.03 (Text-fig. 1). At Station 17.03, the luminescence at the sea surface was observed to be brighter, extending upto the range of visibility through a highpower binocular i.e. 10-12 nautical miles approximately. Thus, the actual extent of the luminescence phenomenon was at least 20 nautical miles across the ship's track. During the rest of the night, when the ship was cruising from Station 17.03 towards Station 17.04, the bioluminescence was observed to extend in an unbroken tract. After daybreak, the sea surface was observed to be greenish in colour, and this colouration extended upto the range of visibility through a field binocular, throughout the cruise-track. Station 17.05 was established at 08.00 hrs of 18th February when the sea surface was dark green. During the cruise from Station 17.05 to

17.07 (between 1230 and 1550 hrs), on 18th Feb. '74, the colour of the sea surface was dark green. Station 17.07 was located over the shallow "Corie High" at a depth of 522 metres when the sea surface was dark green (almost black). The ship left Station 17.07 at 1830 hrs. when bioluminescence was again noticed at the sea surface; as it became darker, the bioluminescence intensified, and at 1935 hrs shoals of flying-fishes were first observed moving against the ship's direction towards the 'CORIE HIGH' area, astern. These shoals were very extensive and extended upto the range of visibility through the field binocular *i.e.* 20 nautical miles across the ship's track. Station CT-I was established for studying this phenomenon.

At this Station, CT-I, the flying-fishes appeared to be luminescent. During the cruise from Station CT-I to Station CT-II (1950 to 0001 hrs) of 18th/19th February, the vessel was literally ploughing through extensive shoals of flying-fishes; these shoals were so closely packed that the sea appeared to be covered with these luminescent fishes. Schools of dolphins chasing the flying-fishes were sighted for the first time at 0001 hrs of 19th February, and this phenomenon extended upto the range of visibility through a field binocular. Station CT-II was now established. The bioluminescence-flying-fishes-dolphins phenomenon was observed to extend until 0400 hrs of 19th February, 1974, when Station CT-III was established. From Station CT-III onwards, the intensity of luminescence decreased and the flying-fish shoals and dolphin schools gradually disappeared. The ship cruised from Station CT-III and reached Station CT-IV at 0800 hrs of 19th February. The greenish colouration of the sea was still discernible and as the ship cruised from Station CT-IV towards CT-V, the greenish colouration of the sea gradually disappeared. At Station CT-V, established at 1200 hrs and at Station 36.10 established at 1350 hrs of 19th February, the sea surface did not show any trace of the greenish colouration.

(a) Constituents of surface and plankton (100-0 m) samples: Tables 2 and 3 give the total displacement volumes and of the numbers of organisms (*i.e.*, *Noctiluca*, *Ceratium*, *Peridinium*, Ostracods shrimps and other zooplankters including Amphipoda, copepoda, mysids, Polychaeta, pteropods, medusae and other decapod larvae) occurring in each haul, for the surface and plankton (100-0 m) samples respectively. From Tables 2 and 3 it is seen that *Noctiluca* was the dominant constituent and the other organisms were in comparatively insignificant numbers in the surface and plankton (100-0 m) hauls at all the stations sampled except Station 36.10, at which station in the surface hauls, the other zooplankton constituents (*i.e.*, Amphipoda, copepoda, mysids, Polychaeta, pteropods, medusae, and other decapod larvae) were dominant while *Noctiluca*, *Ceratium*, *Peridinium*, Ostracods and shrimps occurred

TABLE 1.—The location of each station, date and time of working, total depth, type of haul observations on luminiscence, colouration of the sea and sightings of shoals of flying fishes and schools of dolphins.

STATION	DATE	TIME (HRS)	LATITUDE N	LONGITUDE E	TOTAL DEPTH (m)	TYPE OF HAUL	REMARKS
17.03	18.2.74	0215—0220	23°30"00'	64°05"00'	2500	Surface	Luminiscence bright
17.05	"	0215—0219 0855—0900	" 23°00"00'	" 64°05"30'	" 1980	100—0 Surface	" Sea surface green
17.07	"	0857—0901 1550—1555	" 22°30"00'	" 64°04"30'	" 522	100—0 Surface	" Sea surface dark green
CT—I	"	1555—1600 1935—1940	" 22°29"30'	" 64°09"30'	" 1316	100—0 Surface	" Luminiscence very bright
"	"	"	"	"	"	Handnet	Flying fish shoals sighted
CT—II	19.2.74	0001—0006	21°59"30'	64°53"30'	1400	Surface	Luminiscence very bright
"	"	"	"	"	"	Handnet	flying fish shoals Dolphin schools sighted
CT—III	"	0400—0405	21°35"00'	65°30"30'	1540	Surface	Luminiscence bright
"	"	"	"	"	"	Handnet	Flying fish shoals Dolphin schools still present
CT—IV	"	0800—0805	21°14"00'	66°06"30'	1500	Surface	Sea surface with greenish hue
CT—V	"	1200—1205	20°44"00'	66°57"00'	1580	Surface	Sea surface without green colouration
36.10	"	1350—1355	20°35"00'	67°25"00'	1500	Surface	"

TABLE 2.—The total displacement volumes (ml) of each surface haul of 5 minute duration, with the number of organisms occurring each haul at the various stations.

NUMBER OF ORGANISMS PER FIVE MINUTE HAUL							
STA. NO.	TOTAL VOLUME ml.	NOCTILUCA	CERATUM	PERIDINIUM	OSTRACODS	SHRIMPS	OTHERS*
17.03	5.4	3800	54	43	43	65	915
17.05	2.0	1700	30	16	20	16	54
17.07	2.0	2000	24	10	24	12	—
CT—I	5.4	5400	81	27	32	11	—
CT—II	4.6	3680	55	28	55	18	23
CT—III	2.0	1400	30	20	24	24	16
CT—IV	1.6	480	16	19	24	32	19
CT—V	1.2	180	14	18	14	48	30
36.10	1.2	12	8	18	12	96	540

NOTE: * "Others" include Amphipoda, Copepoda, mysids, Polychaeta, pteropods, medusae, and other decapod larvae.

TABLE 3.—The total displacement volumes (ml) at plankton haul (100-0 m) with the numbers of organisms occurring in each haul at the stations.

NUMBER OF ORGANISMS PER VERTICAL HAUL FROM 100-0 m							
STA. NO.	TOTAL VOLUME ml.	NOCTILUCA	CERATUM	PERIDINIUM	OSTRACODS	SHRIMPS	OTHERS*
17.03	4.0	3000	80	60	240	48	120
17.05	8.5	6800	128	85	340	60	213
17.07	10.0	9500	150	80	400	160	200

NOTE: * "Others" include Amphipoda, Copepoda, mysids, polychaeta, pteropods, medusae, and other decapod larvae.

only in insignificant numbers. In the surface samples, the maximum number of 1000 *Noctiluca* per ml (*i.e.* 2000 Nos./2 ml. and 5400 Nos./5.4 ml.) occurred at Station 17.07 and CT-I, at which stations the sea surface was dark green (almost black) during the day, and intensely bioluminescent during the night. Relatively high numbers of *Noctiluca* ranging from 700 to 850 per ml (*i.e.* 3800 Nos./5.4 ml, 1700 Nos./2ml, 3680 Nos./4.6 ml, 1400 Nos./2 ml) occurred at Station 17.03, 17.05, CT. II & CT-III when the sea surface was greenish during the day and moderately bioluminescent during the night. At Station CT-IV, the *Noctiluca* occurred in a density of 480 nos/1.6 ml (*i.e.* 300 per ml) when the greenish hue of the sea surface was still discernible. At Stations CT-V and 36.10, the *Noctiluca* numbers were reduced to 180 nos./1.2 ml and 12 nos./1.2 ml *i.e.* 150 per ml and trace values respectively, when the sea surface was without any trace of the greenish colouration. These observations indicate that there was intense swarming of *Noctiluca* at the sea surface over the area traversed from Stations 17.03 to CT-IV, with the peak swarming over the shallow "Corie High" area. The occurrence of the other constituents in the surface and plankton (100-0 m) hauls in insignificant numbers at these Stations may be attributed to the swarming *Noctiluca* displacing the other phyto-and zoo-plankton constituents into insignificance.

(b) *Organisms contributing to the bioluminescence* : Analyses of the surface and plankton (100-0 m) hauls in the shipboard laboratory revealed that *Noctiluca* was mainly contributing to the bioluminescence along with the ostracod *Cypridina dentata*, the protozoan *Peridinium* sp., and the flagellate *Ceratium tripos*.

Scrapings of the luminescent particles on the bodies and gills of the flying-fishes when examined under a microscope revealed that the luminescence was caused by the adhering *Noctiluca* individuals, to these parts.

(c) *Species involved in the flying-fishes shoals*: The flying-fish samples were assigned to two species:

(a) *Hirundichthys coromandelensis* (Hornell)

(b) *Oxyporhamphus micropterus* (Val.)

of which the former species formed the bulk of the fish shoals. Examination of the stomach contents of both the species have confirmed that *Noctiluca* was an important item of their food.

(d) *Effect of this Noctiluca 'bloom' on marine life*: No signs of moribund, dead or decaying fish and/or other marine life were to be seen during the entire period of observations on the 18th, 19th, and later during the second lap (23rd to 28th Feb. '74) of the IIIrd Scientific Cruise, in the region affected by the swarming of *Noctiluca*. Hence it is inferred that the swarming of *Noctiluca* did not have any harmful

effects on the fish and other marine life. The movement of the flying-fishes is probably caused by the 'attraction factor' exhibited by the bioluminescing *Noctiluca* swarms, and support is available to this view because during the present series of observations it was noticed that the flying-fishes were definitely heading in large numbers directly to the most luminescent area, viz., the 'Corie High' region, which had the greatest density of *Noctiluca*.

REMARKS

The swarming of a variety of planktonic organisms such as diatoms, algae, flagellates and protozoans displacing the other phyto- and zoo-plankton constituents into insignificance and causing colouration of sea water is well known (Daniel, Nagabhushanam & Krishnamurthy, 1976). Some of these 'blooms', specially the dinoflagellates, exhibit bioluminescence at night (Hardy, 1956) and have often been reported to cause harmful effects on other marine life (Brongersma-Sanders, 1957; Prasad, 1953). In Indian waters, the dinoflagellates *Noctiluca miliaris* Suriray, *Chattonella subsalsa* (syn: *Hornellia marina* Subramaniam), *Ruttnera* sp., *Gymnodinium* spp., and *Gonyaulax* spp. are known to cause dense blooms (Prasad, 1953; Subramanyan, 1954, 1959; Prakash & Sarma, 1964). Of these, *Noctiluca miliaris* swarms have been recorded from several localities in the Indian Seas and have always been reported to cause harmful effects on other marine life (Aiyar, 1935; Devanesan, 1942; Panikkar, 1949; Bhimachar & George, 1950; & Prasad, 1953, 1958). Prasad (1953, p. 46) remarked, "from what had already been reported regarding the swarming of *Noctiluca* and its effect on fish and fisheries both along the east and west coasts of India together with the present observations and the report of the local fishermen it seems almost certain that whenever there is a *Noctiluca* swarm in the inshore waters the pelagic fishes avoided that area." The present observations show that the *Noctiluca* swarms have attracted shoals of flying-fishes in the oceanic region of the Arabian Sea, which is probably caused by the attraction factor of their bioluminescence during the night. The dolphins were chasing the shoals of flying-fishes, presumably for preying on them. Swarming of the *Noctiluca* over the 'Corie High' region may be attributed to the upwelling of nutrient rich water masses in this area during this period.

In Indian waters, the 'blooming' of the diatom, *Fragilaria oceanica* Cleve during the south-west monsoon on the west coast of India has been reported to be followed by a season of high landings of oil sardines (Nair & Subramaniam, 1955). As observed by Russell (1935) the importance of watching for possible correlation between the presence or absence of certain planktonic organisms with that of fish and larger

animals are necessary, underlining the need for further observations/record on swarming of bioluminescent organisms-fishes-other marine associations, in the inshore and oceanic regions of the tropical Indian Ocean.

ACKNOWLEDGEMENTS

The authors are grateful to Captain K. L. Chopra, Commanding Officer, Lt. Commander S. Issacs, Executive Officer, and all officers and Crew of the INS DĀRSHAK and other participating Scientists for help, several courtesies, technical discussions and for the collection of samples and data during the course of these investigations. The authors are also grateful to the Director Zoological Survey of India, Calcutta for facilities given and encouragement extended to undertake this work and for helpful suggestions in the preparation of the text which enabled us to complete it; and to Dr. A.G.K. Menon, Deputy Director, Zoological Survey of India, Madras for confirming the identification of the flying-fishes.

SUMMARY

In this paper, the swarming of *Noctiluca miliaris* Suriray causing greenish colouration of the Sea during the day and a bluish-green bioluminescence during the night in February, 1974 in the northern Arabian Sea observed to be associated with the movement of extensive shoals of two species of flying-fishes (i.e. *Hirundichthys coromandelensis* (Hornell) and *Oxyporhamphus micropterus* (Val.) and the dolphin, *Delphinus* sp. are reported. The effects of this *Noctiluca* 'bloom' on marine life in the light of recent reports are discussed.

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**NEMATODES FROM WEST BENGAL (INDIA) IV.
THREE KNOWN AND TWO NEW SPECIES OF
THE GENUS *DORYLAIMOIDES* THORNE
& SWANGER, 1936 (LEPTONCHIDAE :
DORYLAIMIDA)**

By

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Zoological Survey of India, Calcutta

(With 2 Text-figures)

INTRODUCTION

This is the fourth paper on the series "Nematodes from West Bengal (India)" which deals with three known and two new species of the genus *Dorylaimoides* Thorne & Swanger, 1936 belonging to the family Leptonchidae Thorne, 1935. The known species, viz. *Dorylaimoides parateres* Siddiqi, 1964, *D. pakistanensis* Siddiqi, 1964 and *D. modestus* Siddiqi, 1965, are being reported here for the first time from West Bengal.

It is to be noted that family Dorylaimoididae Siddiqi, 1969 and superfamily Leptonchoidea (Thorne, 1935) Ferris, 1971 are not recognized here.

***Dorylaimoides parateres* Siddiqi, 1964**

1964. *Dorylaimoides parateres* Siddiqi, *Nematologica*, 9 : 628.

1969. *Dorylaimoides parateres* Baqri & Jairajpuri, *Nematologica*, 15 : 419.

Measurements:

Females (2): L=1. 44-1. 61 mm; a=39-42; b=6.6-7.3; c=58-65;
V=¹⁰⁻¹¹ 44-46 ¹⁰⁻¹¹.

Habitat and locality: Soil around roots of paddy at Tufangunj—Cooch Behar Road, Tufangunj, District Cooch Behar.

***Dorylaimoides pakistanensis* Siddiqi, 1964**

1964. *Dorylaimoides pakistanensis* Siddiqi, *Nematologica*, 9 : 630.

Measurements:

Females (2): $L = 1.16-1.21$ mm; $a = 36-38$; $b = 6.0-6.4$; $c = 11-13$; $V = {}^{11-12}_{39-40} {}^{11-13}$.

Habitat and locality: Soil around roots of banana from Chakchaka, District Cooch Behar.

Dorylaimoides modestus Siddiqi, 1965

1965. *Dorylaimoides modestus* Siddiqi, *Nematologica*, 11 : 102.

Measurements:

Female (1) : $L = 1.04$ mm; $a = 45$; $b = 6.2$; $c = 19$, $V = {}^{36}_{12}$.

Habitat and locality: Soil around roots of litchi from Siliguri, District Jalpaiguri.

Dorylaimoides loofi sp. n.

(Text-fig. 1)

Holotype (♀) : $L = 0.73$ mm; $a = 29$; $b = 5.0$; $c = 32$; $V = {}^{134}_{714}$.

Paratype (♀) : $L = 0.78$ mm; $a = 30$; $b = 5.1$; $c = 31$; $V = {}^{134}_{812}$.

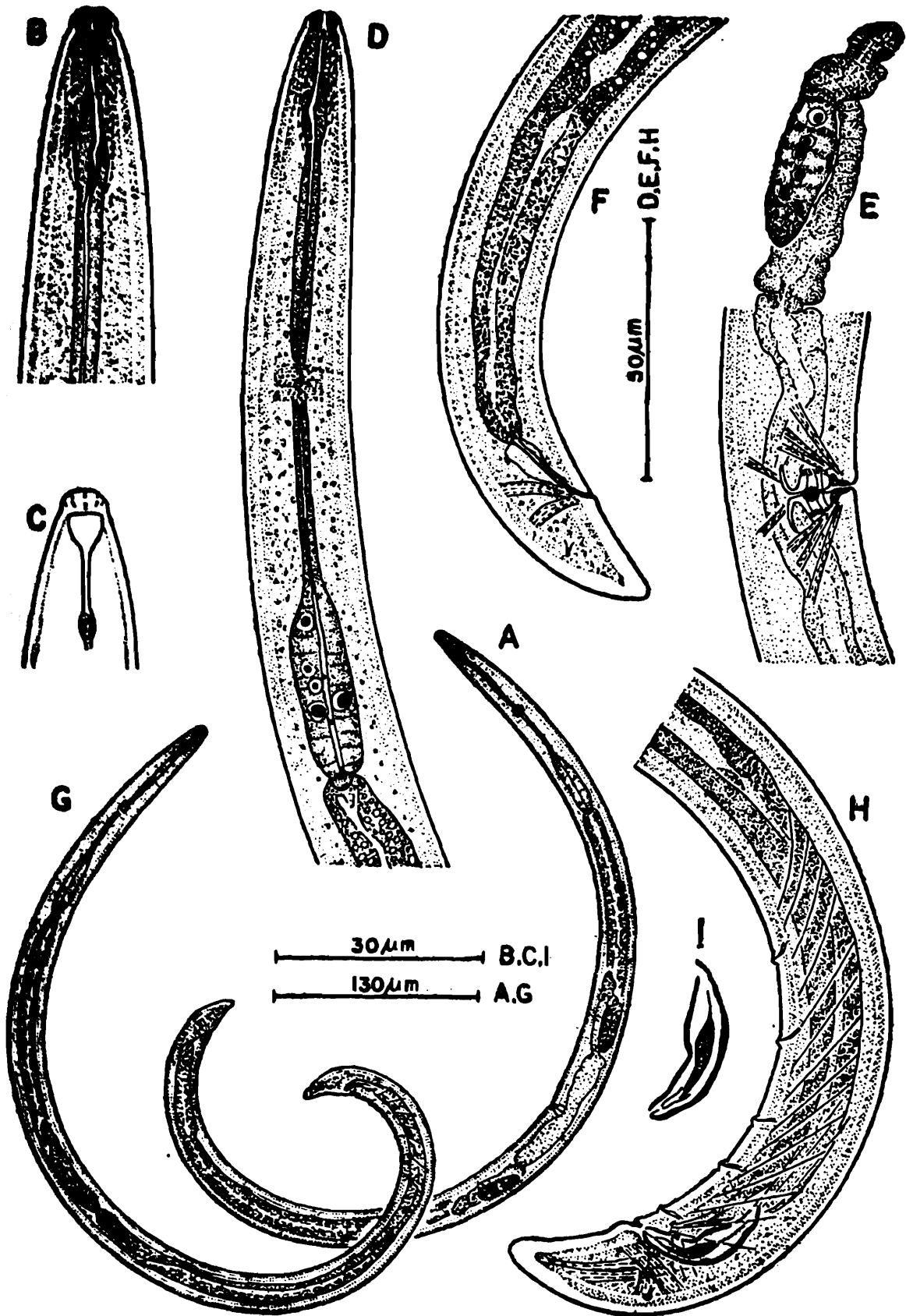
Paratype (♂) : $L = 0.72$ mm; $a = 31$; $b = 4.7$; $c = 30$; $T = 57$.

Description:

Female : Body 'C' shaped upon fixation, tapering slightly towards both extremities. Cuticle finely striated transversely; its thickness about $1\mu\text{m}$ in mid-body and $4\mu\text{m}$ at tail. Lateral chords granular, about $1/6$ th the body-width near middle. Ventral, dorsal and lateral body pores not distinct.

Lip region offset by a slight constriction from body, nearly rounded $1/3.5-1/3.0$ of body-width at base of oesophagus. Amphids stirrup shaped, apertures occupying $4-5\mu\text{m}$ or $65-69\%$ of the corresponding body-width and $3-4\mu\text{m}$ from anterior extremity. Sensillar pouches $15-17\mu\text{m}$ from amphidial apertures.

Odontostyle measures $7-8\mu\text{m}$ dorsally and $9-10\mu\text{m}$ ventrally or $1.1-1.2$ and $1.3-1.4$ lip region-width long dorsally and ventrally respectively, diverging at base; aperture about $2\mu\text{m}$ long. Thickness of odontostyle less than the cuticle-width in corresponding region. Guiding ring $5-6\mu\text{m}$ or $0.8-0.9$ lip region-width from anterior extremity. Odontophore curved, $13-14\mu\text{m}$ long. The anterior slender part of oesophagus gradually expands to form the basal expanded portion.



Text-fig. 1. *Dorylaimoides loofi* sp. n. : A-F. Female. A—Entire female, B—Anterior end, C—Surface view of anterior end, D—Oesophageal region, E—Anterior gonad, F—Posterior region. G—I. Male. G—Entire male, H—Posterior region, I—Spicule and lateral guiding piece.

The basal expanded portion of oesophagus occupying 24-26% of neck

region. Locations of oesophageal gland nuclei and their orifices as follows:

DO=76. 0-78.4	S ₁ N ₁ =86-89	S ₂ N=91-93
DN=78. 6-81.0	S ₁ N ₂ =88-90	S ₂ O=93-95
DO—DN=2.6		
K=82-92		K'=87-94

Nerve ring 71-77 μm or 46-49% of neck region from anterior end. Oesophago-intestinal disc absent. Cardia about 3 μm long, rounded, enveloped by intestinal tissue. Prerectum 62-70 μm or about 4 anal body-width long. Rectum 17-18 μm or about one anal body-width long.

Vulva a transverse slit. Vagina extending inward 12-13 μm or about 1/2 of the corresponding body-width; surrounded by sphincter, with moderately sclerotized distal region. Gonads didelphic, opposed. Uterus and oviduct separated by sphincter; oöcytes arranged in a single row except at growth region.

Tail conoid with blunt terminus, 23-25 μm or 1.4-1.5 anal body-width long; with one caudal pore on each side.

Male: Similar to female in general shape and morphology. Spicules 28 μm or about 1.5 anal body-width long, with a simple median piece. Lateral guiding pieces more or less rod-shaped, about 5 μm long. In addition to the adanal pair, four irregularly spaced ventromedian supplements; first ventromedian supplement anterior to spicule region. Sub-ventral papillae not distinct. Copulatory muscles 14, reaching anterior to supplement region. Spermatozoa elliptical, 3-4 μm long. Prerectum starting anterior to copulatory muscles, 92 μm or about five anal body-width long. Tail similar to female, 24 μm or slightly more than 1.3 anal body-width long; with one caudal pore on each side.

Differential diagnosis: *Dorylaimoides loofi* sp. n. comes close to *D. teres* Thorne and Swanger, 1936 in having diverging base of odontostyle and short conoid tail with blunt terminus but it differs from the latter in having a shorter body ($L=1.2-1.8$ mm in *D. teres*); longer oesophagus ($b=5.6-6.7$ in *D. teres*); shorter enlarged part of oesophagus (enlarged part about 1/3rd of total oesophageal length in *D. teres*); nearly rounded lip region; one caudal pore on each side (two caudal pores on each side in *D. teres*); ventromedian supplements spaced irregularly, the series starting anterior to spicula region in male (ventromedian supplements spaced regularly and series starts within range of spicula in *D. teres*).

The species is named after Dr. P.A.A. Loof.

Type specimens: Holotype along with paratype female and male mounted on slide WN 200/1.

Type habitat and locality: Soil around roots of banana from Fulbari, Tufanganj, District Cooch Behar; Q. H. Baqri Coll.

***Dorylaimoides siddiqii* sp. n.**

(Text-fig. 2)

Measurements:

Holotype (♀): L=1.22 mm; a=38; b=6.7; C=21; V= 1040^{12} .

Paratype (3♀): L=1.10-1.19 mm; a=35-37; b=5.7-6.5; c=20-21; V= $9-13$ 39-40 $10-13$

Paratype (♂): L=1.13 mm; a=38; b=6.1; c=28; T=60.

Description:

Female: Body ventrally curved in posterior half upon fixation, tapering slightly towards both extremities. Cuticle finely striated transversely; its thickness about 2 μ m in mid-body and about 4 μ m at tail. Lateral chords granular, 1/6th-1/5th the body-width near middle. Lateral, ventral and dorsal body pores not distinct.

Lip region offset from body by a slight constriction, 1/3.8-1/3.5 of body-width at base of oesophagus. Amphids stirrup-shaped, divided into two parts by a faint transverse line; apertures occupying about 5 μ m or 62-66% of the corresponding body-width, about 4 μ m from anterior end. Sensillar pouches 16-18 μ m from amphidial apertures.

Odonotostyle 8-9 μ m or 1.0-1.1 lip region width long, thickness less than the corresponding cuticle-width; aperture about 2 μ m. Guiding ring 6 μ m or about 0.8 lip region width from anterior end. Odonotophore curved, 11-13 μ m or 1.4-1.6 times the odontostyle length. Anterior slender part of oesophagus non-muscular while basal expanded part muscular, the two parts separated by a constriction. Basal expanded part of oesophagus occupying 27-30% of neck region in width. Locations of oesophageal gland nuclei and their orifices as follows:

DO=73.7-74.8

S₁ N₁ =84.0-87.8

S₂ O=91-93

DN=78.0-78.8

S₁ N₂ =85-89

S₂ N=92-94

DO-DN=3.2-5.0

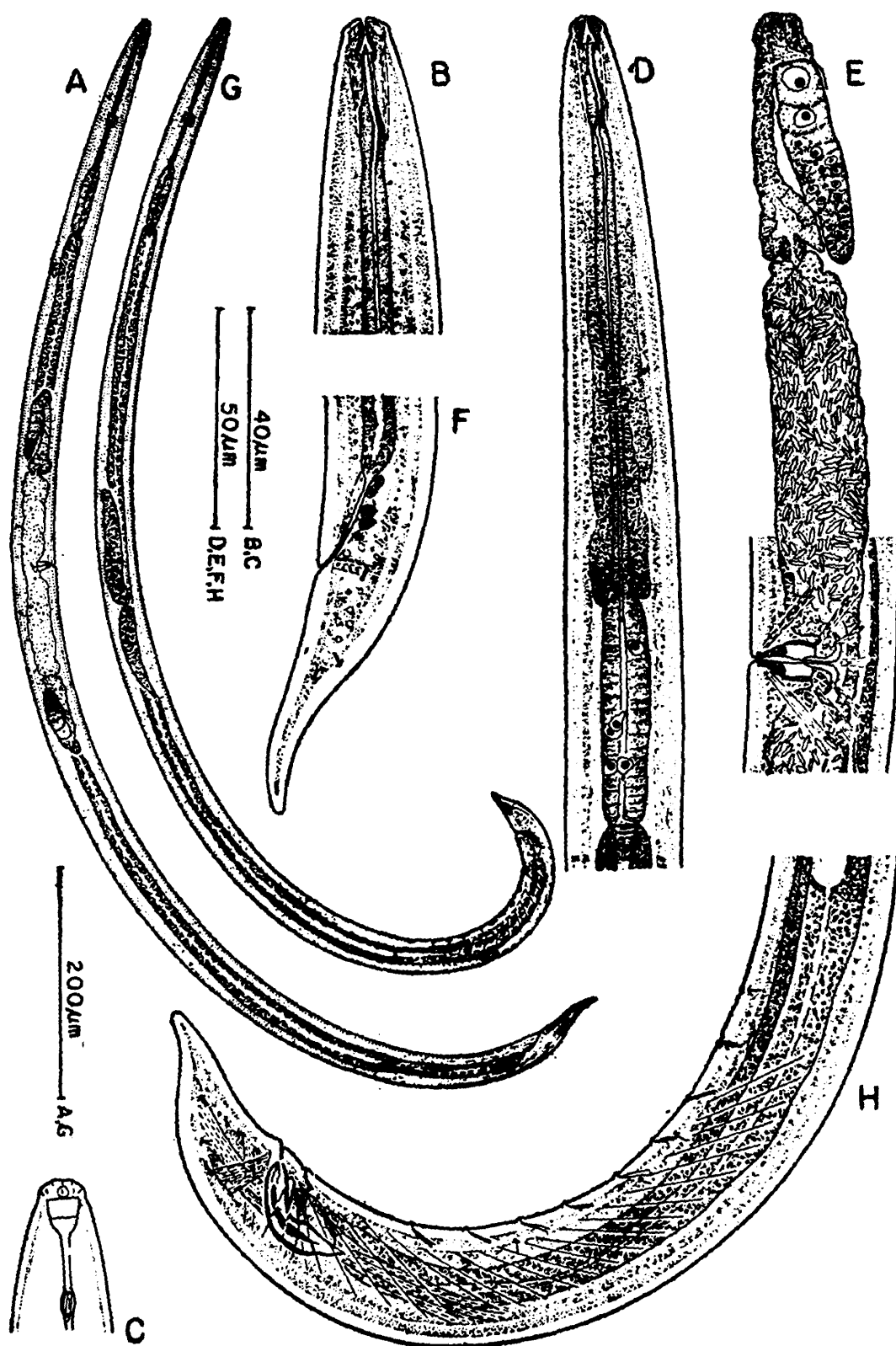
K=87-92

K'=80-86

Nerve ring 82-86 μ m or 43-46% of neck region from anterior end. Oesophago-intestinal disc absent. Cardia tongue-shaped, 5-7 μ m long,

enveloped by intestinal tissue. Prerectum 92-130 μm or 4.4-6.2 times the anal body-width long. Rectum 20-24 μm or about one anal body-width long.

Vulva a transverse slit. Vagina extending inward 17-20 μm or more than half corresponding body-width, with slightly sclerotized



Text-fig. 2. *Dorylaimoides siddiqii* sp. n.: A-F. Female. A—Entire female, B—Anterior region, C—Surface view of anterior region, D—Oesophageal region, E—Anterior gonad, F—Tail region. G—H. Male. G—Entire male, H—Posterior region.

distal region. Gonads didelphic, opposed. Uterus and oviduct separated by sphincter; uteri often packed with sperm; sperm elliptical, 4-5 μm long. Oöcytes arranged first in a single row then in double rows.

Tail elongate digitate, usually slightly bent dorsally, 53-59 μm or 2.5-2.8 anal body-width long; with two caudal pores on each side.

Male: Similar to female in general shape and morphology except that the posterior end curved more ventrally. Spicules 30 μm or about 1.4 anal body-width long, with a simple median piece. Lateral guiding pieces more or less rod-shaped, 4-5 μm long. In addition to the adanal pair, 8 regularly spaced ventromedian supplements. The first ventromedian supplement situated much anterior to spicula region. Only 4 subventral papillae could be observed. Copulatory muscles 23 in number, reaching up to 7th ventromedian supplement. Prerectum 170 μm or about 7.7 anal body-width long, starting much before supplement region. Tail similar to female but shorter, 41 μm or 1.9 anal body-width long; with two caudal pores on each side.

Differential diagnosis: In having elongate digitate tail and posterior end bent dorsally, *Dorylaimoides siddiqii* sp. n. comes close to *D. micoletzkyi* (de Man, 1921) Thorne & Swanger, 1936 but it differs from the latter in having offset lip region (lip region almost continuous with neck contour in *D. micoletzkyi*); differently shaped amphids (amphidial apertures wider and pouch without partition line in *D. micoletzkyi*); vulva without muscular labia (vulva with muscular labia in *D. micoletzkyi*); differently shaped vagina; in male first ventromedian supplement situated much anterior to spicula region (first ventromedian supplement situated within range of spicula in *D. micoletzkyi*), ventromedian supplements spaced regularly (ventro-median supplements spaced irregularly in *D. micoletzkyi*).

The species is named after Dr. M. R. Siddiqi.

Type specimens: Holotype along with paratype male on slide WN 201/1; 3 paratype females on slide WN 202/1.

Type habitat and locality: Soil around roots of litchi from Jalpaiguri More, Siliguri, District Jalpaiguri; Q. H. Baqri Coll.

SUMMARY

Dorylaimoides parateres Siddiqi, 1964; *Dorylaimoides pakistanensis* Siddiqi, 1964 and *Dorylaimoides modestus* Siddiqi, 1965 have been reported for the first time from West Bengal. Apart from these three known species, *Dorylaimoides loofi* sp. n. and *Dorylaimoides siddiqii* sp. n. have also been described.

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A REVIEW OF THE GENUS *XIPHINEMA* COBB, 1913 WITH DESCRIPTIONS OF SPECIES FROM INDIA

By

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(With 13 Text-figures)

INTRODUCTION

The present work gives an account of the morphology and systematics of *Xiphinema* species. The validity of subgenera and groups proposed by Cohn & Sher (1972), Roy & Gupta (1974) and Southey (1973) has been discussed. The descriptions of all the species of this genus so far recorded from India including first records of monodelphic species and one new species have been provided. It is for the first time that through this work the descriptions of all the Indian species of *Xiphinema* which are scattered in different journals have been brought together. Many of the diagnostic characters proposed in the original publications have been rechecked with the help of additional material comprising several populations from many parts of this country collected over the last several years. The description of each species is followed by a detailed discussion on its relationships, geographical distribution, economic importance, etc. Identification key to the nominal species of the genus *Xiphinema* known from the world has also been provided.

Observations were made on the specimens fixed in hot 4% formalin and processed to anhydrous glycerine by slow method.

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MORPHOLOGY OF *XIPHINEMA*

General Body Shape

The nematode species belonging to the genus *Xiphinema* Cobb, 1913 have long and slender bodies. The two sexes are similar in shape

and are almost of equal size. The body upon fixation may assume a variety of shapes which vary from slightly straight (*X. orthotenum*), or only slightly curved (*X. hygrophilum*) to a closed spiral shape (*X. americanum*), but the majority of the species take up a C-shaped, J-shaped or a loose spiral posture upon death or fixation. The body length ranges from 1.3 mm (*X. lambertii*) to 6.0 mm (*X. ingens*).

Cuticle and Hypodermis

Cuticle is marked with fine striae which can be detected only under very high magnification. The dorsal, ventral and lateral series of body pores are present. While dorsal and ventral pores are usually confined to the anterior end of the body, the laterals are present throughout the body length arranged either in single or double rows. The exact number and location of pores on the tail is very important for taxonomic purposes. The oblique striations, if present, can best be seen on tail, less clearly on the anterior end of the body, and rarely elsewhere. The thickness of the cuticle varies according to the region of the body, it is usually thickest on the tail.

The cuticle of *X. index* has revealed the presence of 8 layers when observed under electron microscope (*cf. Roggen et al.*, 1967). All the layers may not be present in all the species of *Xiphinema*, and if present, may not be visible on every region of the body in a particular species.

Hypodermis consists of a thin subcuticular layer and four small anucleate chords (2 laterals, 1 ventral and 1 dorsal). The hypodermis is separated from the cuticle by a cell membrane which forms invaginations penetrating the hypodermis.

Lip Region

The lip region may be continuous with the body (*X. zulu*) or slightly marked off (*X. diversicaudatum*) or may be clearly marked off from the rest of body (*X. opisthohysterum*). These differences are very useful in the identification of species. The contour of lip region may be truncated (*X. insigne/indicum*-form) or smooth (*X. monohysterum*).

The lip region consists of 6 lips of equal size, bearing a papilla each on the inner circlet and a papilla each on the outer circlet. The sub-dorsals, and subventrals (i.e., the 4 submedian lips) bear an additional papilla each. There are thus in all 16 papillae on the lip region. The papillae are innervated with nerve endings and consist of a number of centrally located nerve processes, most probably the dendrites which are surrounded by a membrane forming highly folded walls. These dendrites extend through a cuticular pore and their naked endings project for a small distance beyond the cuticle forming a papilla (*Roggen et al.*, l. c.).

Amphids are well developed, stirrup-shaped, covering about $1/2$ $3/5$ of the labial-width. The amphidial pouches contain sensillae. The finer structure of sensillae are similar to those of papillae except that the dendrites do not extend beyond the cuticle but remain enclosed in the amphidial pouch.

Feeding Apparatus

The feeding apparatus consists of odontostyle, odontophore, guiding sheath and guiding ring. They are described below.

The odontostyle or spear is well developed, long and attenuated. It develops in a cell located in one of the submedian walls of the anterior slender part of oesophagus. This is formed by a compact cylinder containing acentric tube which communicates with odontophore by a longitudinal slit. The odontostyle is forked at its junction with odontophore. Its length ranges from 58 μm (*X. lambertii*) to 208 μm (*X. filicaudatum*) but in majority of the species it is in the range of 100-130 μm .

The odontophore (spear extensions) is equally developed and provided with prominent flanges at the base. This portion which was believed to be a part of stoma (*cf.* Coomans, 1963) has clearly been shown with the help of electron microscopic studies (*cf.* Roggen *et al.*, 1967) to be intra-oesophageal structure formed by an outer cuticular layer of oesophagus and embedded in the oesophageal tissues. The odontophore becomes progressively wider and the longitudinal lumen running parallel to it assumes a squarish shape in cross section. Its lumen again becomes cylindrical when it joins the oesophageal lumen. Along with these changes in the lumen the extensions progressively become broader, thicker and triangular until the basal portion divides to form the three flanges.

A cuticularized piece referred to as 'mucro' but resembling the tip of spear and is supposed to represent a vestigial odontostyle (*cf.* Coomans & De Coninck, 1963) may often be present in one of the submedian walls of oesophagus of the adults as in *X. americanum*, *X. basiri*.

The guiding apparatus is present near the base of the odontostyle and consists of a fixed and a movable ring connected to each other. The position of fixed ring is usually constant for a species and thus is of taxonomic significance. The length of the guiding sheath is variable depending upon the position of the odontostyle. The electron microscopic studies by Roggen *et al.* (l. c.) have shown this ring to be formed by the inter-digitation of cuticular walls of stoma with the basement membrane covering the oesophagus and protractor muscles of spear which appear in the form of distinct annulus with electron dense centre

Z.S...17

at the base of thick cuticular walls of stoma. Its connection with the guiding sheath is thin and flexible. Anterior to the fixed guiding ring the guiding sheath is double and the surface next to the stomal wall is very much convoluted, but elsewhere it is smooth and fits closely with odontostyle. The guiding sheath becomes gradually thinner posteriorly and eventually fuses with odontostyle.

Digestive Organs

(i) *Oesophagus*: The oesophagus consists of an anterior slender part and a posterior expanded portion which is also known as basal bulb. The anterior part is very long, about $\frac{3}{5}$ th of the total oesophageal length and remains coiled when the odontostyle is withdrawn but straightens up during its protrusion. The lumen of the anterior part of the oesophageal bulb is rounded as in the slender part, but becomes tripartite behind the orifice of the dorsal oesophageal gland. The walls of the tripartite lumen are thickened, these thickenings disappear just above the oesophago-intestinal junction. Electron microscopic studies by Roggen *et al.* (l. c.) have shown that the lumen of oesophagus is formed by a double layered cuticle. The inner layer is thin and forms a continuous tube extending the entire length of oesophagus and lining the lumen of odontophore as well. It also separates the odontophore from the odontostyle and curves backward forming the guiding sheath and finally ending in an attachment with the guiding ring. The outer second layer of oesophageal lumen forms 6 rows of triangular platelets in the oesophageal bulb surrounding the tripartite lumen.

The oesophageal glands are located in the oesophageal bulb, opening into the oesophageal lumen usually near the gland nuclei. The ramified ducts of the glands run throughout the length of oesophageal bulb. The largest and the most conspicuous is the dorsal gland with its nucleus located near the anterior region of oesophageal bulb and its duct opening in the lumen just before the beginning of the tripartite platelets. There is a single pair of subventral gland nuclei, the second pair is represented only by their orifices. The position of gland nuclei and their orifices is important taxonomically (Loof & Coomans, 1972).

(ii) *Cardia*: It is usually well developed and extends into the anterior region of tubular intestine. It consists of two flaps, surrounding a slit-like aperture.

(iii) *Intestine*: It is sac-like, consisting of 5 or 6 cells in circumference at midbody. The truncated pyramidal cells which form the intestine are irregularly hexagonal at base enclosing a rather narrow lumen. In anterior most part of the intestine these cells are smaller while at intestine-prerectum junction, these cells become larger with irregular and narrow bases. Usually the intestinal lumen is slightly

wider at the ends, i.e., in anterior region and the region preceeding the junction with prerectum.

(iv) *Prerectum*: It is present in all the species and is separated from the intestine by a constriction. The cells of prerectum may or may not be different from those of intestine, thus often making it difficult to delimit the two regions. However, the epithelium of prerectum is usually more flattened.

(v) *Rectum*: It is dorso-ventrally flattened structure separated from the prerectum by a sphincter. The lumen of rectum is cuticularized and opens to the exterior through anus or cloaca as the case may be.

Nerve Ring

It encircles the anterior slender part of oesophagus at about 2/3rd of its length from the anterior end. In some species (*X. index*, *X. diversicaudatum*) there are two nerve rings instead of one, the first one located just posterior to the flanges of the odontophore, and the second one at its usual position (Goodey & Hooper, 1963).

Reproductive System

Although both the sexes occur, but it is only in some species (e.g., *X. diversicaudatum*) that the males are nearly as frequent as females. In species like *X. basiri* and *X. americanum* the males have been recorded only occasionally. Luc (1961) believes that species like *X. attorodorum* are perhaps protandric. The males are so rare in this genus or if present are so small in numbers that they would remain non-functional for the reproductive purposes. It, therefore, appears quite likely that a majority of the species are parthenogenetic.

(i) *Female reproductive organs*: The females are either didelphic, or monodelphic or pseudomonodelphic. The latter term was coined by Cohn & Sher (1972) for those species in which a genital branch lacks an ovary though having oviduct, uterus or parts of them. Southey (1973a) rejected this term on the suffix 'delphus' which refers to uterus rather than the gonad. Even in some didelphic species there is a tendency for the reduction of anterior sexual branch. In *X. insigne*, for example, the anterior ovary is very small and its capability of egg production is very much restricted, the uterus and oviduct are normally developed, but in *X. orbum* the entire anterior sexual branch is greatly reduced. *X. cubense* is the only species in which the posterior sexual branch is reduced. Each sexual branch of the female consists of an ovary, oviduct, uterus, vagina and vulva.

Ovary: Ovary is reflexed lying dorsal to the oviduct though occasionally this position may be reversed. A sac-like structure consistings

of spindle-shaped epithelial cells with a sheath of light coloured transversally striated connective tissue is present at the proximal or the reflexed end of the ovary. The ovary is telogonic, i.e., the proliferation of the germ cells takes place only at the apical end of the ovary.

Oviduct: It is subterminally connected to ovary in young females, but in older ones the distance between the proximal end of the ovary and the connection with oviduct is much larger. The lumen of the oviduct is narrow with the walls consisting of epithelial cells.

Sphincter: It divides the oviduct from the next region, i.e., the uterus. The sphincter is prominent in species like *X. basilgoodeyi*, *X. elongatum*, *X. index*, etc., and less so in *X. brevicolle*, etc.

Uterus: The proximal end of the uterus consists of a single layer of flattened or low columnar cells and is surrounded by a muscle layer with circular and oblique fibres. The distal region of uterus is enlarged and its lumen bordered with irregular cells which are glandular in nature. In bisexual species the spermatozoa are stored in the proximal part of the enlarged uterus as in *X. ebriense*, *X. diversicaudatum*, etc. In unfertilized females this region may be either expanded or slightly collapsed. The remaining part of the uterus may look very different in different species. It is usually partly constricted partly dilated, sometimes the entire region is dilated, constrictions usually occur near the vicinity of distal enlarged region.

'Z' organ: This structure was first described by Luc (1961) in *X. embriense* and is present at the junction of distal expanded part and proximal enlarged part of uterus. Luc (1975) has differentiated 2 types of 'Z' organs. The first type is the typical 'Z' organ which is usually quite distinct from the other parts of the uterus. It is provided with strong circular muscles and internal sclerotized walls finely striated longitudinally and having in its central lumen sclerotized, refringent apophyses which are well developed and often 4 in number. It is found in *X. embriense*, *X. hallei*, *X. imambaksi*, *X. rotundatum* and *X. manubriatum*. The second type is referred to as 'Z' pseudo organ which is not so distinct from the adjacent parts of uterus. It is provided with weakly developed muscles, sclerotization of uterine wall, is also weak or may be absent as are the longitudinal striations. There are no sclerotized apophyses but granules of various sizes, number, and forms. It has been recorded in *X. basiri*, *X. coxi*, *X. diversicaudatum*, *X. imitator*, *X. ingens*, *X. malagasi*, *X. marsupilami*, *X. parvistylus*, *X. pini*, *X. turcicum*, *X. variable* and *X. zulu*. The 'Z' organ of *X. pini* is interesting as it represents an intermediate condition between the two types with the uterine walls similar to 'Z' pseudo organ, while the internal bodies resembling the apophyses of a typical 'Z' organ.

The species *X. malagasi* and *X. spinuterus* exhibit a peculiar and different structure of uterus. In *X. spinuterus* the cylindrical part of the uterus is thin-walled with spines on the inner side which appear to be implanted on individual cells of the wall and are directed away from the vulva. In *X. malagasi* these spines are present only in the basal part of the 'Z' pseudo organ and on part of the length of the distal cylindrical part.

Vagina: The walls of the vagina are made up of a few cells which are larger in size. The vaginal lumen is lined with cuticle. The vaginal musculature is connected with that of the uterus, but it is usually thicker.

Vulva: This is ventral, usually a transverse slit formed by an invagination of the body cuticle and controlled by a set of muscles.

(ii) **Male reproductive organs:** The male genital branch consists of testis, vas deferens and cloaca.

Testis: The males are diorchic, with both the testes usually lying left to the intestine. Sometimes abnormal males with 1 or 3 testes are also found. One of the testes lies anteriorly, the other one directed posteriorly. The testes are telogonic, i.e., the proliferation of the germ cells takes place at the apical region. Each testis can be subdivided into a proximal germinal and a distal growth zone. The maturation of the sperm takes place at the end of growth zone.

Vas deferens: The testes are connected to each other by vas deferens which is made up of tubular and glandular regions. It is provided with obliquely arranged muscle bands (*X. basilgoodeyi*). The vas deferens is not differentiated into anterior slender and posterior ejaculatory duct. Posteriorly, it joins the intestine to form cloaca.

Cloaca: It is lined with cuticle and opens through the cloacal aperture on the ventral surface of the posterior region of the body.

Besides the primary sex organs described above, the males are also provided with accessory reproductive structures which consist of spicules, supplements, etc.

Spicules: The two spicules are similar in shape and size. The shape of the spicules may differ in the different species. They may be only slightly ventrally curved (*X. americanum*) or ventrally curved with a sharp curvature occurring in the middle (*X. basiri*). The spicules are distinctly cephalated in some species (*X. basiri*). Each spicule is guided in its movement by a set of protractor and retractor spicular muscles. The spicules may be further strengthened by accessory pieces. Lateral guiding pieces are present in *X. clavatum*, *X. pini*, etc.

Supplements: This consists of an adanal pair and a variable number of ventromedian papillae (one in *X. clavatum* three in *X. basilgoodeyi*, four in *X. pini*, eight in *X. mediterraneum*). The supplements may be

very distinct and elevated, and supplied with nerve endings as in *X. basiri* and *X. pini*, or may be rudimentary and indistinct, or reduced to indistinct pores as in *X. clavatum*.

The shape and length of spicules, the number and disposition of ventromedian supplements, the structure of lateral guiding pieces, etc. are fairly useful taxonomic characters in this genus.

Tails

The various species exhibit one of the largest intra-generic variations in length and shape of tail. It may vary from long attenuated tails with $c'=10-15$ (*X. filicaudatum*) to nearly hemispherical tails with $c'=0.6$ (*X. hygrophilum*). Its shape varies from long-attenuated (*X. filicaudatum*), long-conical (*X. insigne*), short conical with clavate terminus (*X. luci*), short conical (*X. americanum*), conoid digitate (*X. basiri*), conical rounded with a terminal peg (*X. index*), to regularly hemispherical (*X. arcum*) or rounded spatulate (*X. clavatum*). Inner surface of cuticle and tail tip may also vary. The length and shape of tail is one of the most important taxonomic characters in this genus.

SYSTEMATICS OF *XIPHINEMA*

Systematic Position of *Xiphinema*

Class NEMATODA

Subclass ADENOPHOREA

Order DORYLAIMIDA (de Man, 1876) Pearse, 1942

Suborder DORYLAIMINA (de Man, 1876) Pearse, 1942

Superfamily DORYLAIMOIDEA Thorne, 1934

Family LONGIDORIDAE (Thorne, 1935) Meyl, 1961

Subfamily XIPHINEMATINAE* Dalmasso, 1969

Genus *Xiphinema* Cobb, 1913

The genus *Xiphinema* was proposed by Cobb (1913) with *X. americanum* as its type species. Thorne (1939) placed this genus in the subfamily Longidorinae Thorne, 1935 along with *Longidorus* (Micoletzky, 1922) Filipjev, 1934 and *Longidorella* Thorne, 1939. Later, a fourth genus *Xiphinemella* Loos, 1950 was also added to this group. Chitwood (1957) synonymised Longidorinae with Tylencholaiminae Filipjev, 1934 owing to the similarities between *Xiphinemella* and *Longidorella* on one hand and the genera of Tylencholaiminae on the other. This synonymy was supported by Clark (1961). However, Meyl (1961) raised Longidorinae to familial rank and this view was as held by Thorne (1961). This family included only one subfamily Longidorinae and three genera, *Longi-*

*Xiphineminae emended

dorus, *Xiphinema* and *Longidorella*. Siddiqi *et al.* (1963) added one more genus *Paralongidorus* to this family. Jairajpuri & A. H. Siddiqi (1964) removed *Longidorella* from this group, placed it along with a new genus *Nordia*, and proposed a new subfamily Nordiinae under Dorylaimidae. Loos (1950) placed *Xiphinemella* in the subfamily Longidorinae, but Chitwood (1957), Clark (1961) and Goodey (1963) placed it in Tylencholaiminae. However, Baker (1962) included it in Longidorinae. Jairajpuri (1964) proposed a new subfamily Xiphinemellinae under the family Leptonchidae Thorne, 1935 for this genus and for *Botalium* Heyns, 1963. Siddiqi & Husain (1968) synonymised Xiphinemellinae with Tylencholaiminae and *Botalium* with *Xiphinemella*. However, Andrassy (1971) has considered Xiphinemellinae as a valid subfamily. Dalmasso (1969) proposed a new subfamily Xiphineminae (=Xiphinematinae emended) with *Xiphinema* as its type and only genus, a view which was upheld by Loof & Coomans (1972) chiefly on the basis of the differences in the positions of oesophageal gland nuclei and their orifices in *Xiphinema* and *Longidorus*/*Paralongidorus*. Very recently, S. H. Khan & Ahmad (1975) have raised Longidoridae to superfamily Longidoroidea with two families Longidoridae and Xiphinemidae (=Xiphinematidae emended), the former including *Longidorus* and *Paralongidorus* and the latter only *Xiphinema*. The proposal of the superfamily and the families seems premature at the moment since in genera like *Xiphinemella* and *Longidorella* the feeding apparatus is fairly similar to that of *Xiphinema* and *Longidorus*. It appears safer and appropriate to wait for further observations and findings in order to recognize Longidoroidea as a valid superfamily and Xiphinematidae as a family.

Diagnosis of Xiphinema

Body long and slender measuring not more than 6 mm. Amphids stirrup-shaped with slit-like apertures. Odontostyle long and attenuated, forked at the junction with odontophore. Odontophore provided with well developed flanges at base. Fixed guiding ring located near the base of odontostyle. Oesophageal bulb with 3 oesophageal gland nuclei, one dorsal and two subventrals, dorsal gland nucleus is larger than subventrals and is located near the orifice. Female genital tract didelphic or monodelphic or pseudomonodelphic, ovaries reflexed, uterus often showing peculiar differentiations. Males usually diorchic. Shape and length of tail very much variable.

Relationships of Xiphinema

Xiphinema is closely related to *Longidorus* (Micoletzky, 1922) Filipjev, 1934 and *Paralongidorus* Siddiqi *et al.*, 1963 but differs in the

shape of amphidial apertures, bifurcation of odontostyle at the junction with odontophore, in the positions of fixed guiding ring and oesophageal gland nuclei and their orifices. These differences are outlined below:

I. Form *Longidorus*.—

- i) In having slit-like amphidial apertures,
- ii) The odontostyle forked at the junction with odontophore,
- iii) The odontophore provided with basal flanges,
- iv) The fixed guiding ring located at the base of odontostyle,
- v) In having DO and DN closer and DN larger than S_1 VN.

II. From *Paralongidorus*.—

- i) The odontophore provided with basal flanges,
- ii) The odontostyle forked at the junction with odontophore,
- iii) The fixed guiding ring located at the base of odontostyle,
- iv) In having DO and DN closer and DN larger than S_1 VN.

Subdivisions of Xiphinema

The genus *Xiphinema* was proposed by Cobb (1913). Goodey (1936), Thorne (1937) and Schuurmans-Stekhoven & Teunissen (1938) described some new species of this genus. Loos (1949) described some species of this genus from Ceylon. However, it was only when Hewitt *et al.* (1958) showed that *X. index* transmits grapevine fanleaf virus that the nematologists became very much interested in the study of this group. Siddiqi (1959, '61 & '64) described some new and some known species from India. Luc (1958, '61, '73 & '75) described many new species from South Africa. Heyns (1965, '66 & '74) also described several new species from South Africa. Tarjan (1964) described two new species from America. Luc & Tarjan (1963) published a note on the systematics of *Xiphinema* in which they included 29 valid and 9 *species inquirendae*. Dalmasso (1969) described *Xiphinema* species of France and put them in 4 groups viz., *X. americanum* group, *X. italiae* group, *X. diversicaudatum* group and *X. basiri* group. He used the following characters for the differentiation of these groups:— Body length, head profile, posture of body upon fixation, tail shape and differentiation of female genital tract. Loof & Maas (1972) described several species of this genus from Surinam and also gave a dichotomus key for the separation of the nominal species.

Cohn & Sher (1972) proposed 8 subgenera under *Xiphinema*, viz., *Xiphinema*, *Radiphinema*, *Krugiphinema*, *Halliphinema*, *Elongiphinema*, *Basiphinema*, *Diversiphinema* and *Rotundiphinema*. The different species were grouped under these subgenera on the basis of the type of genital tract, position of vulva, presence or absence of 'Z' organ, body

length, tail shape and value of c' . The subgenera *Radiphinema* and *Krugiphinema* include species which lack either a complete anterior sexual branch or an anterior ovary. These subgenera include species which are short-tailed or long-tailed. The reduction of genital tract and the shortening of tail certainly have phylogenetic value. The regression of genital tract is evident by a line which can be traced from well developed ovaries as in *X. elongatum* to anterior genital branch completely missing as in *X. chambersi*. In between these two extremes we have species like *X. insigne* in which the anterior ovary is occasionally functional and *X. simillimum* having its anterior sexual branch reduced and lacking an ovary. The evolution of short-tailed species from those possessing long-tails is evident by the fact that all the intermediate shapes exist between short hemispheroid to long filiform tails. Also, the juveniles of almost all the species including long-tailed species have longer and thinner tails than their adults. Perhaps it was with this idea that Roy & Gupta (1974) added another new subgenus, *Filliphinema* for those species which have very long tails but were grouped under the subgenus *Krugiphinema*. They, however, included under the new subgenus only those species which have very long tails ($c'=6.3-15$) and retained all species having $c=0.6-3.5$ under *Krugiphinema*. Perhaps, it would have been better if they had differentiated the short-tailed species ($c' > 2.2$, e.g., *X. krugi*) from the long-tailed species ($c' < 2.2$, e.g., *X. simillimum*) under *Filliphinema*. If the subgenera are to be based only on the length and shape of tail, yet another subgenus has to be proposed for long-tailed species (e.g., *X. orthotenum*) of the subgenus *Radiphinema*.

The position of vulva in species of the subgenus *Xiphinema* is usually median or slightly postequatorial. In other subgenera which have didelphic species the position of vulva is greatly variable ($V=20-53$ in *Elongiphinema*, $34-52$ in *Rotundiphinema*). In those subgenera which have monodelphic or pseudomonodelphic (*Radiphinema* and *Krugiphinema*) species the value of V varies from 24-41%. It, therefore, becomes evident that the value of V overlaps in the different subgenera of this genus and thus is useless in the characterization of these subgenera.

The presence or absence of 'Z' organ was used to differentiate the subgenus *Diversiphinema* from other subgenera having didelphic genital tract and short tails keeping in view that this organ is present in some short-tailed species. Luc (1973) has shown the presence of this organ in long-tailed species also, e.g., in *X. hallei*. This organ is also present in *X. diversicaudatum* which is the type species of *Diversiphinema*. Thus this organ cannot be used for the differentiation of subgenera. Same is the case with total body length.

Thus, all the characters that were used by Cohn & Sher (1972) either overlap in different subgenera or are unrelated. The different subgenera have both long and short-tailed species and the genital tract in different stages of regression, e.g., *X. hygrophilum* under *Rotundiphinema* and *X. orbum* under *Elongiphinema*.

Southey (1973a), Luc & Dalmasso (1975) have objected to the subdivisions of *Xiphinema* as was proposed by Cohn & Sher (l.c.) on the grounds that the different subgenera do not show any definite phylogenetic relationship. Southey preferred to use the term 'groups' in place of subgenera which has no nomenclatorial involvement but is quite useful in assembling similar species into groups thereby facilitating their quick identification. These groupings are similar to that proposed by Cohn & Sher (1972) except for *Diversiphinema* which has been characterized only on the presence of protuberance on the tail. If we have to accept these groupings then another new subgenus has to be proposed for the sake of uniformity for those species of *Radiophinema* which have elongate-conoid or filiform tails. Roy & Gupta (1974) assigned *X. variable* to the subgenus *Xiphinema* but Southey (l. c.) to *Halliphinema* group. The present authors agree with Southey on the position of this species since all the species of *Xiphinema* have short tails, become spiral upon fixation, their ovaries are thick-walled, genital tracts are simple and short, the germinal cells of ovary do not divide during non-breeding season and the oöcytes do not pile up during this season. If reduction of reproductive potential, as evidenced by the regression of anterior sexual branch and the shortening of tails, are evolutionary trends in *Xiphinema*, which actually is the case, the species of this subgenus or group, viz. *X. americanum*, *X. opisthohysterum*, *X. mediterraneum*, *X. lambertii*, *X. neoelongatum* and *X. rivesi* are perhaps highly evolved species of the genus.

The present authors concur with Luc & Dalmasso (1975) that the 8 subgenera proposed by Cohn & Sher (l.c.) and one by Roy & Gupta (l. c.) under *Xiphinema* have no phylogenetic relationships. Also, the various characters used by them to separate these subgenera overlap. Consequently, the proposals are rather premature at this stage and it would be better to regard some of them only as groups or subdivisions of *Xiphinema* without attaching any taxonomic significance as was suggested by Southey (l. c.). Also, if these subgenera are accepted then perhaps we would have to review the systematics of many other genera of the Order Dorylaimida (e.g., *Dorylaimoides*, *Tylencholaimus*, *Tylencholaimellus*, *Basirotyleptus* etc., etc.) on similar lines which would account to creating more chaos rather than stability. The various species of *Xiphinema* can be regrouped under the following 5 subdivisions, primarily on the basis of tail shapes (long or short) and secondarily on

the regression and the nature of genital tract (short, simple or long and highly differentiated) and the piling up of oöcytes during non-breeding season. Only these characters have been taken for the grouping of different species since all the other characters which were used by Cohn & Sher, Southey and Roy & Gupta overlap to some extent as is mentioned above.

I. *Americanum*-Group

Species having short and simple genital tract in which both the sexual branches are equally developed, oöcytes do not pile up during non-breeding season, ovaries are thick-walled; and tails short ($c' = \text{less than } 2.2$).

This group includes all the species which were included by Cohn & Sher in the subgenus *Xiphinema* or group 5 of Southey.

Typical species : *X. americanum* Cobb, 1913

Other species : *X. brevicolle* Lordello & da Costa, 1961

X. opisthohysterum Siddiqi, 1961

X. mediterraneum Martelli & Lamberti, 1967

X. rivesi Dalmasso, 1969

X. inaequale Khan & Ahmad, 1976

X. lambertii Bajaj & Jairajpuri, 1976

X. neolongatum Bajaj & Jairajpuri, 1976

II. *Elongatum*-Group

Species which are perhaps most primitive having both the sexual branches and ovaries equally developed and functional, genital branches are long and differentiated, oöcytes pile up during non-breeding season, ovaries are thin-walled; tails tapering, narrow and elongate ($c' = \text{more than } 2.3$).

This group includes species which were placed under the subgenera, *Halliphinema* and *Elongiphinema* by Cohn & Sher and in group 3 and 4 of Southey. These subgenera are grouped together since no clear-cut differences exist between them and the characters used by Cohn & Sher for their differentiation, viz. position of vulva, tail shape and c' ratio ($V = 28-48$; tail conoid or elongate, $c' = 2.1-6.5$ in *Elongiphinema* and $V = 44-56$; tail conoid, elongate or filiform, $c' = 2.6-12$ in *Halliphinema*) overlap considerably. In this group those species have not been included in which the anterior ovary is either greatly reduced and only occasionally functional, or non-functional, e.g., *X. insigne* and *X. orbum*.

Typical species : *X. elongatum* Schuurmans-Stekhoven & Tounissen, 1938

Other species : *X. italiae* Meyl, 1953

X. hallei Luc, 1958

X. attorodorum Luc, 1961

X. flagellicaudatum Luc, 1961

X. nigeriense Luc, 1961

X. vanderlindei Heyns, 1962

X. zulu Heyns, 1965

X. dimorphicaudatum Heyns, 1966

X. variable Heyns, 1966

X. bergeri Luc, 1973

X. cavenessi Luc, 1973

X. douceti Luc, 1973

X. malagasi Luc, 1973

X. marsupilami Luc, 1973

X. spinuterus Luc, 1973

X. vitis Heyns, 1974

X. luci n. sp.

III. *Chambersi*-Group

Species having anterior sexual branch and ovary in different stages of regression or completely absent, including species in which anterior ovary is greatly reduced in size and is occasionally functional, oöcytes pile up during non-breeding season, ovaries are thin-walled; tails tapering, thin and elongate, c' more than 2.5.

This group includes long-tailed species of the subgenera *Radi-phinema* and *Krugiphinema*. These long-tailed species of the two subgenera are grouped together and separated from the short-tailed species of these subgenera in order to bring uniformity in the grouping since shortening of tail has definite phylogenetic significance.

Typical species : *X. chambersi* Thorne, 1939

Other species : *X. insigne* Loos, 1949

X. longicaudatum Luc, 1961

X. orbum Siddiqi, 1964

X. monohysterum Brown, 1968

X. simillimum Loof & Yassin, 1971

X. filicaudatum Loof & Maas, 1972

X. orthotenum Loof & Maas, 1972

IV *Rotundatum*-Group

Species in which both the sexual branches and ovaries are equally developed, genital branches are long and differentiated, oocytes pile

up during non-breeding season, ovaries are thin-walled; tails short, conoid, conoid-digitate or rounded with or without a protuberance, $c'=0.4-2.3$.

This group includes species which were placed under *Diversiphinema*, *Basiphinema* and *Rotundiphinema*. They have been grouped together since no clear-cut differences exist between these subgenera. They have short tails and 'Z' organ is also present. The presence or absence of a protuberance or peg is a variable feature. *X. arcum*, *X. hygrophilum* and *X. cubense* which have a reduced sexual branch are not included in this group.

Typical species : *X. rotundatum* Schuurmans-Stekhoven & Teunissen, 1938

Other species : *X. mammillatum* Schuurmans-Stekhoven & Teunissen, 1938

X. diversicaudatum (Micoletzky, 1927) Thorne, 1939

X. index Thorne & Allen, 1950

X. ebriense Luc, 1958

X. setariae Luc, 1958

X. basiri Siddiqi, 1959

X. coxi Tarjan, 1964

X. bakeri Williams, 1961

X. ifacolum Luc, 1961

X. longidoroides Luc, 1961

X. turcicum Luc & Dalmasso, 1963

X. basilgoodeyi Coomans, 1965

X. ingens Luc & Dalmasso, 1964

X. vuittenezi Luc, Lima, Weischer & Flegg, 1964

X. clavatum Heyns, 1965

X. imitator Heyns, 1965

X. paulistanum Carvalho, 1965

X. pini Heyns, 1965

X. macrostylum Esser, 1966

X. neovuittenezi, Dalmasso, 1969

X. pyrenaicum Dalmasso, 1969

X. sahelense Dalmasso, 1969

X. meridianum Heyns, 1971

X. parvistylus Heyns, 1971

X. imambaksi Loof & Maas, 1972

X. tropicale Zullini, 1973

X. manubriatum Luc, 1975

X. seredouense Luc, 1975

X. tarjani Luc, 1975

V *Radicicola*-Group

Species having one sexual branch shorter than the other, or reduced to an undifferentiated sac, or completely absent, oöcytes pile up during non-breeding season, ovaries are thin-walled, tails short, conoid, conoid-digitate or rounded ($c' = 0.4-2.3$).

This group includes all the short-tailed species of the subgenera *Radiphinema* and *Krugiphinema* and didelphic species in which one sexual branch is comparatively less developed.

Typical species : *X. radicicola*

Other species : *X. ensiculiferum* (Cobb, 1893) Thorne, 1937

X. brasiliense Lordello, 1951

X. krugi Lordello, 1955

X. arcum Khan, 1964

*X. denouden*i Loof & Maas, 1972

X. surinamense Loof & Maas, 1972

X. cubense Razjivin in Razjivin, O'Relly & Millan, 1973

X. hygrophilum Southey & Luc, 1973

X. loosi Southey & Luc, 1973

X. costaricense Lamberti & Tarjan 1974

KEY TO GROUPS AND SPECIES OF *XIPHINEMA*

During the last decade the number of new species of *Xiphinema* has considerably increased. Identification keys to species of this genus have been given from time to time by various authors. McLeod & Khair (1971) and Lamberti & Tarjan (1974) provided key to monodelphic species only. Loof & Maas (1972) gave a dichotomous key to all the species of *Xiphinema*. Cohn & Sher (1972) provided an identification key to all the species under the eight subgenera of *Xiphinema* which they proposed. Southey (1973a) gave a key to species of *Xiphinema* under various groups recognised by him along with their important biometric characters. Roy & Gupta (1974) have also provided a key to species grouped under nine subgenera. Luc & Dalmasso (1975) gave a polytomous key using a wider range of biometric characters. However, all these keys are not good enough to give quick and easy identification of species. In the present work a dichotomous key to five groups of *Xiphinema* and the various species under these groups has been given.

KEY TO GROUPS OF *Xiphinema*

1. Genital tract simple and only slightly differentiated, ovary thick-walled, oöcytes do not pile up during non-breeding season; tail short and conoid *americanum*-group
Genital tract well differentiated, ovary thin-walled, oöcytes pile up during non-breeding season; tail hemispheroid to long filiform. .2
2. Tail tapering, thin and elongate, c' more than 2.0 .3
Tail short and conoid, conoid-digitate or rounded, c' less than 2.0 .4
3. Anterior sexual branch and ovary in different stages of regression or completely absent, vulva usually pre-equatorial .*chambersi*-group
Anterior sexual branch and ovary equally developed, vulva usually equatorial. .*elongatum*-group
4. Anterior or posterior sexual branches in different stages of regression or completely absent*radicicola*-group
Anterior and posterior sexual branches normal and equally developed .*rotundatum*-group

KEY TO SPECIES OF *Xiphinema*I. *Americanum*-Group

1. Body slender (a=56-72); V=55-61 .2
Body robust (a=less than 50); V=48-55. .3
2. Odontostyle length avg. 80 µm; c=avg. 54; male with 5-8 ventromedian supplements .. .*mediterraneum*
Odontostyle length avg. 67 µm; c=avg. 62; male with 2 ventromedian supplements .*opisthohysterum*
3. Tail less than one anal body-width long. .*brevicolle*
Tail more than one anal body-width long. .4
4. Lip region offset by a constriction. .5
Lip region marked off by a depression. 7
5. Tail conoid-digitate; odontostyle length avg. 92 µm .*neolongatum*
Tail conoid or elongate-conoid; odontostyle length avg. less than 80 µm. .6
6. Odontostyle length avg. 78 µm; tail conoid .*americanum*
Odontostyle length avg. 62 µm; tail elongate-conoid. .. .*lambertii*
7. Female tail ventrally curved, male with 4 ventromedian supplements, first one located at about 1.5 times the distance between any two adjacent supplements from the adanal pair .. .*inaequale*
Female tail almost straight; male with 5-8 ventromedian supplements, first one at about the same distance as between any two adjacent supplements from the adanal pair. .*rivesi*

II. *Elongatum*-Group

1. Uterine walls with spines .2
Uterine walls without spines .3
2. Pseudo 'Z' organ present .*malagasi*
Pseudo 'Z' organ absent .*spinuterus*

3. 'Z' organ present	4
'Z' organ absent	7
4. Uterus with typical 'Z' organ.....	<i>halleyi</i>
Uterus with pseudo 'Z' organ	5
5. Tail long and filiform, c' more than 7.5.....	<i>marsupilami</i>
Tail elongate, c' less than 7.5.....	6
6. Odontostyle length avg. 68 μ m; c=avg. 55.....	<i>variable</i>
Odontostyle length avg. 98 μ m; c=avg. 29.....	<i>zulu</i>
7. V=less than 45	8
V=more than 45	10
8. Tail tip clavate, inner cuticular canal of tail stopping halfway to an inflated terminal part of tail tip. .	<i>bergeri</i>
Tail tip not clavate, inner cuticle of tail does not stop halfway.....	9
9. Inner surface of cuticle of tail forms a canal with a small vesicle at its end.....	<i>attorodorum</i>
Inner surface of cuticle of tail devoid of such a structure	<i>elongatum</i>
10. c'=less than 4.5	11
c'=more than 4.5	13
11. Tail tip clavate, inner surface of cuticle of tail forms a small vesicle at its end.....	<i>luci n. sp.</i>
Tail tip pointed, inner surface of cuticle does not form such a structure	12
12. Lip region distinctly expanded; odontostyle length avg. 114 μ m.....	<i>vitis</i>
Lip region only slightly expanded; odontostyle length avg. 95 μ m	<i>italiae</i>
13. Tail filiform, c=less than 12.....	<i>flagellicaudatum</i>
Tail elongate, c=more than 12.....	14
14. Lip region rounded	<i>cavenessi</i>
Lip region truncated.....	15
15. Body length avg. more than 3.2 mm; males frequent.....	16
Body length avg. less than 3.2 mm; males rare.....	17
16. Lip region expanded; tails showing no sexual dimor- phism	<i>vanderlindei</i>
Lip region not expanded; tails showing sexual dimor- phism	<i>dimorphicaudatum</i>
17. Tail tip rounded more often clavate, hyaline portion 58-64% of tail length	<i>nigeriense</i>
Tail tip pointed and never clavate, hyaline portion 18-29% of tail length.....	<i>douceti</i>

III. *Chambersi-Group*

1. Anterior sexual branch reduced and without an ovary.....	2
Anterior sexual branch reduced but with an ovary.....	7
2. Anterior sexual branch completely absent.....	3
Anterior sexual branch having uterus and oviduct and their parts	5
3. Lip region slightly offset; tail elongate-conoid or sub- digitate, c'=3.1-4.4.....	4
Lip region continuous; tail long and filiform, c'=avg.8.3.....	<i>orthotenum</i>

4. Tail elongate-conoid, $c' = \text{avg. } 4.4$. Tail subdigitate, $c' = \text{avg. } 3.1$.	<i>.chambersi</i> <i>.monohysterum</i>
5. Tail elongate-conoid. Tail filiform.	<i>.simillimum</i> .6
6. Body length avg. 4.4 mm; odontostyle length avg. 206 μm .. Body length avg. 2.9 mm; odontostyle length avg. 151 μm	<i>.filicaudatum</i> <i>.longicaudatum</i>
7. All organs of anterior sexual branch reduced; tail with 2 papillae, $c' = 2.7$.. All organs of anterior sexual branch normal except ovary which is reduced; tail with 3-4 papillae, $c' = 3.0-8.5$	<i>.orbum</i> <i>.insigne</i>

IV *Rotundatum*-Group

1. 'Z' organ present	2
'Z' organ absent	.. .16
2. Uterus with typical 'Z' organ.	.3
Uterus with pseudo 'Z' organ.	8
3. Female tail hemispheroid without a terminal peg.	...4
Female tail conoid-digitate or conical rounded with a terminal peg	.5
4. Odontostyle length avg. 150 μm ; vulva equatorial	<i>rotundatum</i>
Odontostyle length avg. 116 μm ; vulva pre-equatorial	<i>tropicale</i>
5. Inner surface of the cuticle of the tail tip forms a thin, regular 'blind canal' surrounded apically by a muff	<i>.ifacolum</i>
Inner surface of the cuticle of the tail does not form such a structure	6
6. $V = 40-46$	7
$V = 51-56$	<i>.manubriatum</i>
7. Body length avg. 2.0 mm; odontostyle length avg. 113 μm ; tail peg 10-13 μm long	<i>.ebriense</i>
Body length avg. 2.8 mm; odontostyle length avg. 127 μm ;	<i>.imambaksi</i>
8. Tail conoid-digitate, more than one anal-body width long	.9
Tail conoid or hemispheroid, one anal body-width long or less	12
9. Lip region offset by a constriction; odontostyle length less than 110 μm	10
Lip region marked off by a depression; odontostyle length more than 110 μm .	 11
10. Body length avg. 2.5 mm; odontostyle length avg. 97 μm ...	<i>.meridianum</i>
Body length avg. 2.8 mm; odontostyle length avg. 71 μm	<i>.parvistylus</i>

11. Vulva equatorial ($V = \text{avg. } 51$) *basiri*
 Vulva pre-equatorial ($V = \text{avg. } 44$) *coxi*
12. Body length avg. 2.2 mm; tail conoid or conoid-
 mammillate *imitator*
 Body length avg. more than 2.2 mm; tail rounded
 with or without a protuberance 13
13. Vulva pre-equatorial ($V = \text{avg. } 43$) *diversicaudatum*
 Vulva equatorial ($V = \text{avg. more than } 48$) 14
14. Odontostyle length avg. 110 μm ; inner surface of
 cuticle of tail extending in the clear zone of tail tip *pini*
 Odontostyle length avg. 156 μm ; inner surface
 of cuticle of tail not extending in the clear zone of
 tail tip 15
15. Female tail with internal mucro; males frequent; tail
 of first stage juvenile conoid *ingens*
 Female tail without internal mucro; males unknown;
 tail of first stage juvenile clavate *turcicum*
16. Body length less than 2.5 mm 17
 Body length more than 2.5 mm 19
17. Odontostyle length avg. 180 μm ; tail without a peg ..
 *macrostylum*
 Odontostyle length avg. 124 μm ; tail with a distinct
 peg 18
18. $V = \text{avg. } 52$ *tarjant*
 $V = \text{avg. } 43$ *paulistanum*
19. Odontostyle length avg. 154 μm *seredouense*
 Odontostyle length avg. less than 150 μm 20
20. Tail conoid or conoid digitate 21
 Tail hemispheroid with or without a protuberance 24
21. Tail conoid; $V = \text{avg. } 54$ *longidoroides*
 Tail conoid-digitate; $V = \text{avg. less than } 50$ 22
22. $V = \text{less than } 40$ *sahelense*
 $V = \text{more than } 40$ 23
23. Body length avg. 2.8 mm; odontostyle length avg.
 120 μm *setariae*
 Body length avg. 4.0 mm; odontostyle length avg.
 142 μm *bakeri*
24. Vulva always pre-equatorial ($V = \text{avg. } 40$) 25
 Vulva around equatorial ($V = \text{avg. } 47-52$) 26
25. Tail peg long and situated on the ventral part of the
 body *index*
 Tail peg short and situated along the axis of the body *mammillatum*
26. Tail with a distinct peg 27
 Tail without a distinct peg 28
27. Lip region expanded and offset by constriction; tail
 peg short *vuittenezi*
 Lip region neither expanded nor offset; tail peg long *basilgoodeyi*
28. Tail spatulate *clavatum*
 Tail hemispheroid 29

29. Body length avg. 2.8 mm; males frequent . . . *neovulttenezzi*
 Body length avg. 4.0 mm; males rare . . . *pyrenaicum*

V *Radicicola*-Group

1. Anterior sexual branch normal, posterior reduced . . . *cubense*
 Anterior sexual branch reduced, posterior normal. . . 2
2. Anterior sexual branch with an ovary. 3
 Anterior sexual branch without an ovary. 4
3. Body length 1.8 mm; odontostyle length avg. 150 μ m;
 V=avg. 38. *hygrophilum*
 Body length avg. 2.5 mm; odontostyle length avg.
 106 μ m; V=avg. 35. *arcum*
4. Anterior sexual branch completely absent. 5
 Anterior sexual branch lacking an ovary but having
 uterus and oviduct or only a uterine sac. 7
5. Tail hemispheroid less than one anal body-width
 long. *ensiculiferum*
 Tail conoid-digitate or rounded-digitate, more than one
 anal body-width long 6
6. Tail rounded-digitate, c' =avg. 1.4 *brasiliense*
 Tail conoid-digitate, c' =avg. 2.0. *radicicola*
7. Anterior genital tract usually more than 2 body-
 widths long and showing structural differentiation. 10
 Anterior genital tract usually less than 2 body-widths
 long and showing no structural differentiation 8
8. Lip region offset; tail convex-conoid to digitate *denoudeni*
 Lip region marked off; tail conoid to hemispheroid. 9
9. V=avg. 31; c =avg. 76 *loosi*
 V=avg. 37; c =avg. 107 *costaricense*
10. Lip region slightly offset; odontostyle length avg.
 127 μ m; tail hemispheroid in both adults and juveniles . . . *surinamense*
 Lip region continuous; odontostyle length avg.
 118 μ m; tail conoid in both adults and juveniles. *krugi*

NOT INCLUDED IN THE KEY

X. amarantum Macara, 1970: synonym of *X. sahelense* Dalmasso, 1969 (Macara, 1972); *X. arenarium* Luc & Dalmasso, 1963: synonymised with *X. italiae* Meyl, 1953 by Martelli *et al.*, (1966); *X. australiae* McLeod & Khair, 1971: synonym of *X. radicola* Goodey, 1936 (new synonymy); *X. brevicaudatum* Schuurmans-Stekhoven, 1951: transferred to *Longidorus* by Thorne (1961); *X. bulgariense* Stoyanov, 1964: synonym of *X. italiae* (Cohn & Sher, 1972); *X. campinense* Lordello, 1951: synonymised with *X. elongatum* Schuurmans-Stekhoven & Teunissen, 1938 by Tarjan & Luc (1963); *X. citri* Siddiqi, 1959: transferred to *Paralongidorus* by Siddiqi *et al.* (1963); *X. conurum* Siddiqi, 1964: synonym of *X. italiae* according to Cohn & Sher (l.c.); *X. ensiculiferoides* Cohn & Sher 1972: synonym of *X. ensiculiferum* (Cobb, 1893) Thorne, 1937 (Southey & Luc 1973); *X. indicum* Siddiqi, 1959: synonym of *X. indigne* according to Tarjan & Luc (l.c.) and Bajaj & Jairajpuri (1977); *X. itanhaense* Carvalho, 1962: synonymised with *X. brasiliense* Lordello, 1951 by Cohn & Sher (l.c.); *X. neoamericanum* Saxena *et al.*, 1973: synonym of *X. americanum* Cobb, 1913

(new synonymy); *X. paraelongatum* Altherr, 1958: synonym of *X. diversicaudatum* (Micoletzky, 1927) Thorne, 1939 according to Luc & Tarjan (1963); *X. saopaloense* Khan & Ahmad, 1975: synonym of *X. brevicolle* (Lamberti & Loof, 1977) and *X. pratense* Loos, 1949: synonymised with *X. elongatum* by Tarjan & Luc (l.c.).

Species Inquirendae

i) Because of inadequate description:

X. cylindricaudatum Schuurmans-Stekhoven & Teunissen, 1938, *X. dolichodorus* (de Man, 1907) Thorne & Swanger, 1936, *X. grande* Steiner, 1914, *X. lineum* (Grube, 1849) Thorne, 1939, *X. parasetariae* Luc, 1958, and *X. truncatum* Thorne, 1939.

ii) Species described on juveniles only.—

X. digicaudatus Schuurmans-Stekhoven, 1951, *X. effilatum* Schuurmans-Stekhoven, 1951, and *X. obtusum* Thorne, 1939.

iii) Due to absence of clear cut differences with the related species.—

X. vulgare Tarjan, 1964.

DESCRIPTIONS OF SPECIES OF *XIPHINEMA* FROM INDIA

Although the genus *Xiphinema* was proposed as early as 1913 but it was only in 1959 that Siddiqi reported some species of this genus from India. He reported *X. americanum* and *X. brevicaudatum* and described three new species, viz. *X. indicum*, *X. basiri* and *X. citri* from Aligarh, West Uttar Pradesh. Of these species, *X. brevicaudatum* and *X. citri* have been transferred respectively to the genera *Longidorus* and *Paralongidorus* and *X. indicum* has been synonymised with *X. insigne* Loos, 1949 by Tarjan & Luc (1963). Later on, Siddiqi (1961) described another new species, *X. opisthohysterum*, from Aligarh and reported *X. pratense* (= *X. elongatum*) from Banda and Madras. Jairajpuri & A. H. Siddiqi (1963) reported *X. brevicolle* for the first time from India. Siddiqi (1964) added another species, *X. orbum*, which was collected from Patna, Bihar. E. Khan described *X. arcum* from Ranikhet, U. P. Saxena *et al.* (1973) reported a new species *X. neoamericanum* from Ludhiana, Punjab and S. H. Khan & Ahmad (1975) described a species from Ranikhet, U. P. very close to *X. americanum-brevicolle* complex, first named it *X. neoamericanum* but changed the name to *X. inaequale*. Yadav & Verma (1967), Srivastava & Singh (1965), Prasad & Dasgupta (1964), Janarthanan *et al.* (1969), Sethi & Swarup (1969), F. A. Khan & A. M. Khan (1972) have also reported *X. basiri*, *X. americanum* and *X. insigne* from various parts of this country. Mukhopadhyaya & Haque (1974) have doubtfully recorded *X. index* from West Bengal. Recently, Bajaj & Jairajpuri (1976) have described *X. lambertii* and *X. neoelongatum*, two new species from India.

In the present work, all the species so far recorded from India have been thoroughly redescribed based on type material and on fresh material. Observations on the juvenile stages of most of the species have also been included. The relationships of these species with closely related species have also been discussed. The males of *X. opisthohysterum* and *X. inaequale* are described for the first time. Two monodelphic species, *X. radiculicola* and *X. ensiculiferum* are first records from India. *X. index* which was doubtfully recorded from West Bengal by Mukhopadhyaya & Haque (l. c.) is described from Srinagar. One new species of the genus, viz. *X. luci* is also described. All these Indian species described here can be grouped as follows:—

- (i) *americanum*-group.—*X. americanum*, *X. brevicolle*, *X. opisthohysterum*, *X. inaequale*, *X. lambertii* and *X. neoelongatum*.
- (ii) *elongatum*-group.—*X. elongatum* and *X. luci*.
- (iii) *chambersi*-group.—*X. insigne* and *X. orbum*.
- (iv) *rotundatum*-group.—*X. index* and *X. basiri*.
- (v) *radiculicola*-group.—*X. radiculicola*, *X. ensiculiferum*, *X. brasiliense* and *X. arcum*.

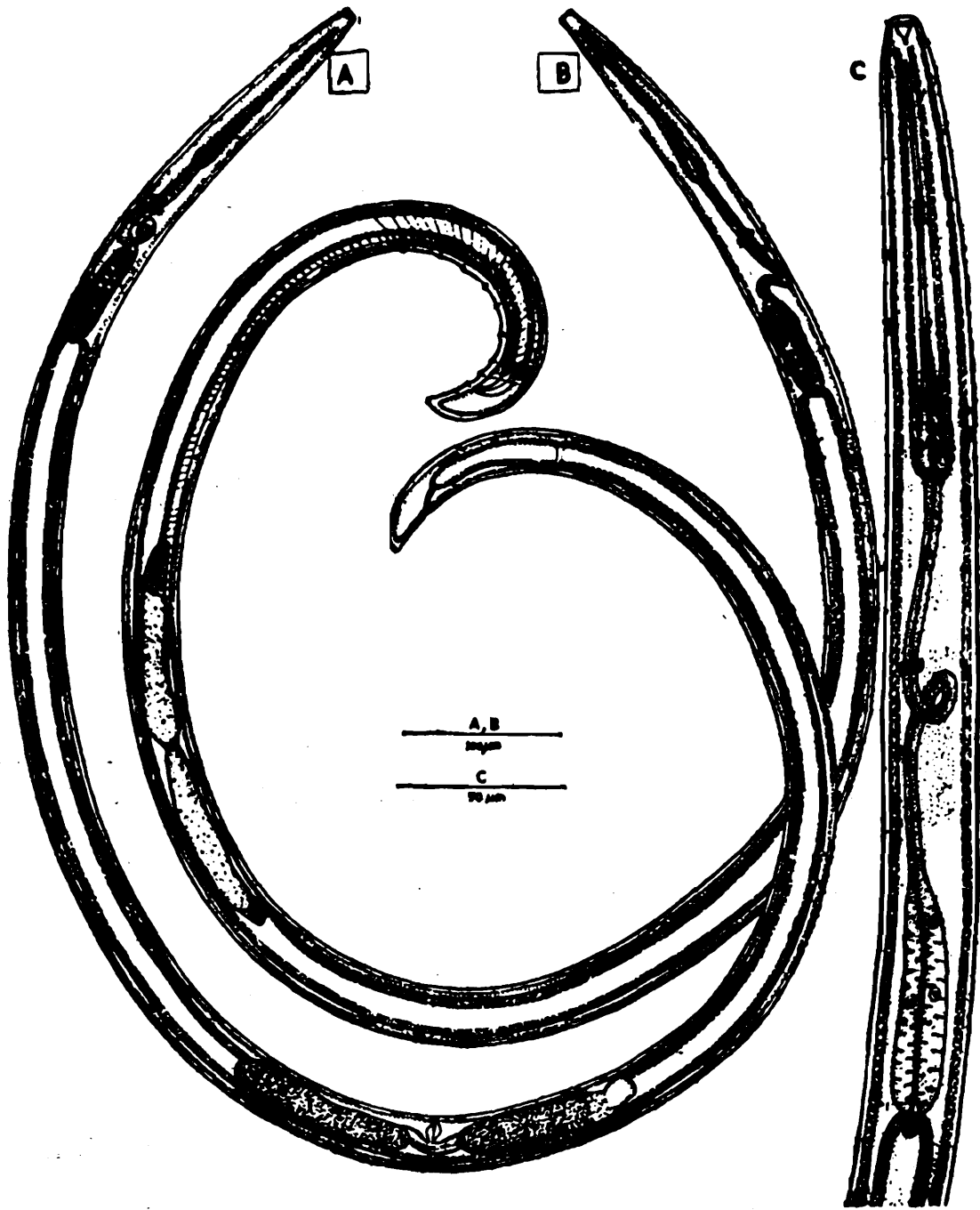
It is for the first time that through this work the descriptions of all the Indian species of *Xiphinema* which are scattered in different journals have been brought together. Many of the diagnostic characters proposed by the original authors have been rechecked with the help of additional material comprising of several populations from many parts of this country collected over the last several years. For every species described hereunder, detailed discussions have been provided giving its relationships, geographical distribution and economic importance, if already known.

1. *Xiphinema americanum* Cobb

(Text-figs. 1 & 2)

- 1913. *Xiphinema americanum*: Cobb, *J. Wash. Acad. Sci.*, 3 : 432.
- 1922. *Tylencholaimus americanus*: Micoletzky, *Arch. Naturg.*, (1921), Abt. A, 87 :
- 1939. *Xiphinema americanum*: Thorne, *Capita Zool.*, 8 : 110.
- 1949. *Xiphinema americanum*: Loos, *J. zool. Soc. India*, 1 : 23.
- 1950. *Xiphinema americanum*: Thorne, *Principles of Nematology*: 487.
- 1956. *Xiphinema americanum*: Tarjan, *Proc. helminth. Soc. Wash.*, 23 : 88.
- 1959. *Xiphinema americanum*: Siddiqi, *Proc. helminth. Soc. Wash.*, 26 : 155
- 1972. *Xiphinema americanum*: Siddiqi, *C.I.H. Description of Plant parasitic nematodes*, set 2, No. 29.
- 1973. *Xiphinema americanum*: Southey, *Manual Worksh. Nemat. Group. Assoc. appl. Biologists*: 48.
- 1973. *Xiphinema neoamericanum*: Saxena et. al., *Zool. Anz.* 191: 130.
- 1974. *Xiphinema americanum*: Hoyns, *Phytophylactica*, 6 : 157.

Dimensions: Aligarh citrus population: 4♀♀: $L=1.58-1.64$ mm; $a=41-44$; $b=5.1-6.1$; $c=43-55$; $V=48-51$; $G_1=12-18$; $G_2=12-18$; $c'=1.3-1.6$; Anterior end to guide ring= $62-65$ μm ; Odontostyle= $70-75$ μm ; Odontophore= $46-48$ μm ; $DO=10.5-12.5$; $DN=10.5-12.5$; $RS_1N=45-50$; $LS_1N=45-50$; $S_2O=78-82$.



Text-fig. 1.—*Xiphinema americanum* Cobb: (A) Entire female. (B) Entire male (C) Feeding apparatus and oesophagus.

2♂♂: $L=1.60-1.62$ mm; $a=43$; $b=5.4-5.8$; $c=48$; $c'=1.5$; Anterior end to spear guide ring= 64 μm ; odontostyle= $74-78$ μm ; Odontophore= 48 μm ; $DO=12$; $DN=12.5$; $RS_1N=46-54$; $LS_1N=46-54$; $S_2O=80$; Spicule Length= $33-38$ μm .

Dehra Dun mango population: 4♀♀: $L=1.60-1.70$ mm; $a=43$; $b=5.6$; $c=46-53$; $V=49-51$; $G_1=15-20$; $G_2=15-20$; $c'=1.5$; Anterior

end to spear guide ring=64 μm ; Odontostyle=73-75 μm ; Odontophore=48 μm ; DO=12.0; DN=13.5; RS₁N=48-52; LS₁N=48-52; S₂O=78-82.

Jaipur soursop population: 3♀♀: L=1.61-1.72 mm; a=42; b=5.4; c=45-55; V=50; G₁=13-17; G₂=12-15; c'=1.4-1.6; Anterior end to spear guide ring=63-66 μm ; Odontostyle=72-76 μm ; Odontophore 48 μm ; DO=12.5; DN=15; RS₁N=49-52; LS₁N=49-52; S₂O=80.

Kulu grass population: 3♀♀: L=1.56-1.68 mm; a=41-44; b=5.2-6.0; c=46-56; V=49-52; G₁=12-18; G₂=12-18; c'=1.4; Anterior end to spear guide ring=64 μm ; Odontostyle=76 μm ; Odontophore=48 μm ; DO=12.5; DN=13.5; RS₁N=50; LS₁N=50; S₂O=79.

Manipur mango population: 4♀♀: L=1.61-1.70 mm; a=41-43; b=5.3; c=48-52; V=50; G₁=13-18; G₂=13-15; c'=1.3-1.5; Anterior end to spear guide ring=64 μm ; Odontostyle=74-78 μm ; Odontophore=47 μm ; DO=10.5-11.5; DN=11.5-13.5; RS₁N=50; LS₁N=50; S₂O=80.

Srinagar rose population: 4♀♀: L=1.61-1.73 mm; a=45; b=5.5-6.3; c=46-59; V=49-53; G₁=16-22; G₂=16-22; c'=1.5-1.7; Anterior end to spear guide ring=63-66 μm ; Odontostyle=72-79 μm ; Odontophore=47-50 μm ; DO=10.5-11.0; DN=13.5; RS₁N=48-54; LS₁N=48-54; S₂O=80-83.

2♂♂: L=1.61-1.63 mm; a=43; b=5.8-6.2; c=48; c'=1.4-1.6; Anterior end to spear guide ring=64 μm ; Odontostyle=76-78 μm ; Odontophore=48 μm ; DO=12.0; DN=12.5; RS₁N=52-56; LS₁N=52-56; S₂O=80; Spicule length=35-40 μm

3L₁: L=0.63-0.68 mm; a=34-37; b=3.3-4.2; c=20-25; c'=2.3-2.7; Anterior end to spear guide ring=37 μm ; Functional odontostyle=40-42 μm ; Replacement odontostyle=49-51 μm ; Odontophore=33 μm ; DO=13; DN=14.2; RS₁N=51; LS₁N=52; S₂O=78.

4L₂: L=0.91-0.97 mm; a=41-44; b=3.3-3.9; c=25-29; c'=2.2-2.5; Anterior end to spear guide ring=40-44 μm ; Functional odontostyle=50-53 μm ; Replacement odontostyle=60-64 μm ; Odontophore=33 μm ; DO=16; DN=16; RS₁N=51; LS₁N=51; S₂O=75

4L₃: L=1.12-1.32 mm; a=46-50; b=4.0-4.8; c=30-38; c'=1.8-2.2; Anterior end to spear guide ring=50-57 μm ; Functional Odontostyle=55-60 μm ; Replacement odontostyle=70-75 μm ; Odontophore=33-36 μm ; DO=16; DN=17.5; RS₁N=52; LS₁N=52; S₂O=75.

5L₄: L=1.31-1.52 mm; a=44-48; b=4.7-6.3; c=44-48; c'=1.6-1.9; Anterior end to spear guide ring=54-60 μm ; Functional odontostyle=65-76 μm ; Replacement odontostyle=73-81 μm ; Odontophore

=41-48 μm ; DO=10.5-13.5; DN=10.5-13.5; RS₁N=48-56; LS₁N=48-56; S₂O=75-83.

Description: Female: Body upon fixation 'C' shaped with tapering extremities. Cuticle in two layers, thickest in the region of tail. Lateral chords about 1/4th of the midbody-width.

Lip region rounded, offset from the rest of body. Amphids stirrup-shaped with slit-like apertures which are nearly 3/5th of the labial-width and are located at the base of lip region. Odontostyle 8-9 labial-widths long, odontophore 1/1.6th of the odontostyle length. Fixed guiding ring is at 6-8 labial-widths from the oral aperture.

Basal bulb of oesophagus twice the corresponding body-width and 25% of neck length long. Positions of various oesophageal gland nuclei and their orifices as given above. Cardia short and conoid. Nerve ring surrounding the anterior slender part of oesophagus at about 2 labial-widths from the base of odontophore. Prerectum 5-7 times the anal body-width long and is distinguishable from the intestine in being narrow and in having fewer granules in its cells. Rectum about one anal body-width long.

Genital tract amphidelphic, each sexual branch consisting of a reflexed ovary, a distal narrow and a proximal expanded part of oviduct and a short uterus. Vagina is about one-third of the corresponding body-width long. Vulva at 48-53% of total body length from the anterior extremity.

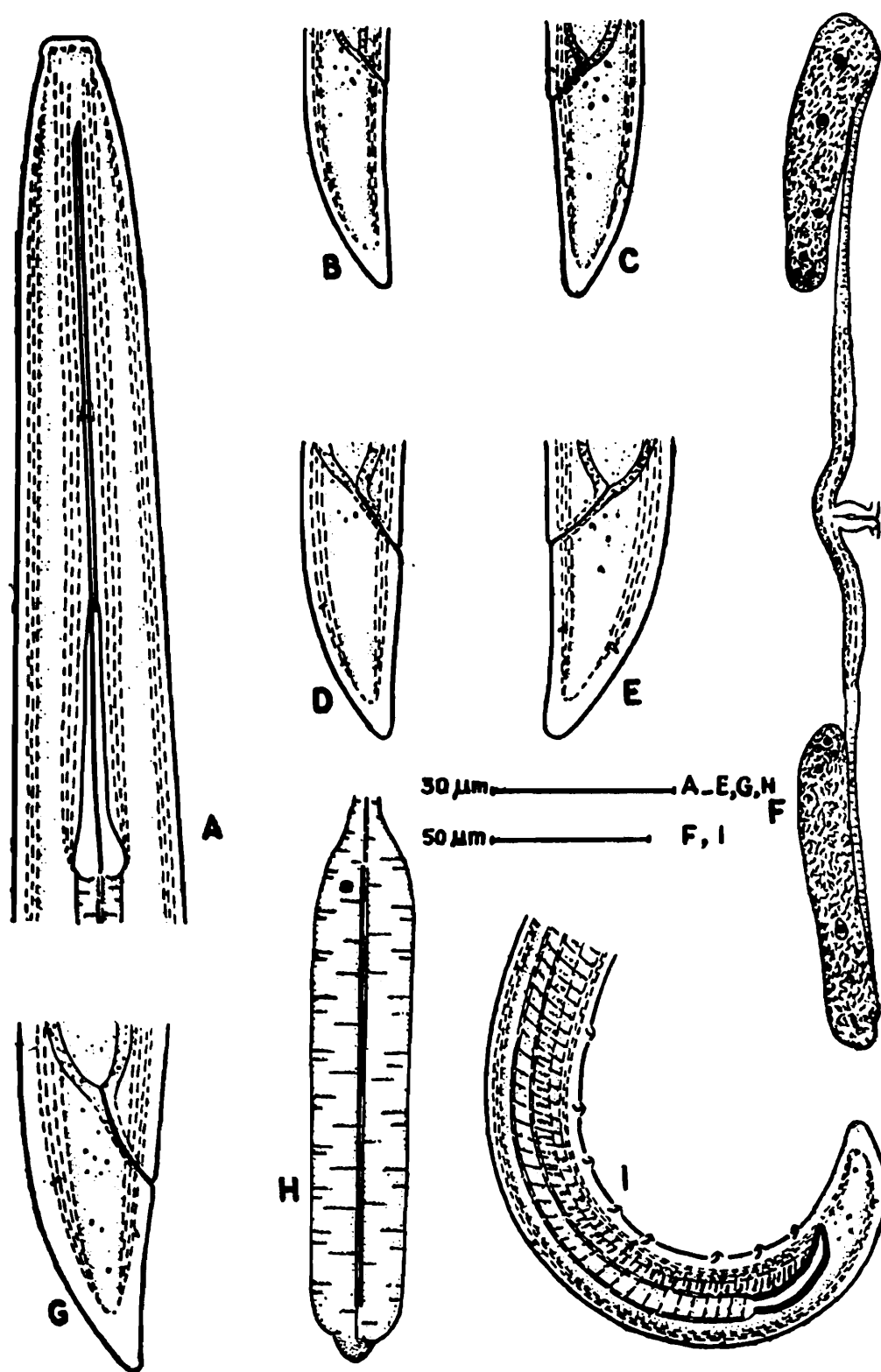
Tail short, convex-conoid, 1.4-1.6 times the anal body-width long and provided with 2 papillae on each side.

Male: The males collected in Aligarh and Srinagar resemble the females morphologically except for their more curved posterior extremity. Supplements consist of an adanal pair and a series of 5-7 ventromedians which are spaced as shown in Fig. 2, I. Spicules about 2 anal body-widths long. Lateral guiding pieces short and finger-like. Tail short and conoid, about 1.5 times the anal body-width long and provided with 2 papillae on each side.

Juveniles: The various juvenile stages differ from one another in total body length, length of odontostyles (both functional and replacement), position of fixed guiding ring from the anterior extremity, value of c' ratio and tail shape.

Hosts and localities: i. Soil around roots of *Citrus sinensis* from Jawahar Park, Aligarh; ii. *Mangifera indica* from Gandhi Park, Dehra Dun (U. P.); iii. *Anona squamosa* from Jaipur, Rajasthan, iv. Grasses (unidentified) from Mandi, Kulu (H. P.); v. *Mangifera indica* from Leikei (Manipur) and vi. *Rosa indica* from Shalimar Garden, Srinagar (J & K).

Remarks: The type species of *Xiphinema* was described by Cobb in 1913, Loos (1949) reported it from Sri Lanka. After the loss of the type material Tarjan (1956) designated a male neotype of the species.



Text-fig. 2—*Xiphinema americanum* Cobb : (A) Anterior extremity. (B-E) Tails of L_1 , L_2 , L_3 , & L_4 respectively. (F) Female genital tract. (G) Female tail. (H) Oesophageal bulb. (I) Male posterior extremity.

The present specimens from India as well as those described by Siddiqi (1959) are fairly similar to those of Cobb, Loos, and Tarjan, It is how-

ever, an exceedingly variable species and appears to comprise a collection of geographical isolates or closely related species (Tarjan, 1969).

Saxena *et al.* (1973) described a closely related new species, *X. neomericanum* from around the roots of *Prunus persica* from Ludhiana, Punjab. It was differentiated from *X. americanum* in having continuous lip region and a differently shaped convex-conoid tail with subarcuate terminus. The values of a, b, V, odontostyle length etc. are almost identical in the two species. The only difference being in the value of c (28:50) which appears to have been calculated wrongly in *X. neoamericanum*. These authors mention the tail to be as long as anal body-width which does not conform with the figure of the tail given by them. Also, the tail shapes of the two species are identical. *X. neoamericanum* in all probabilities is a junior synonym of *X. americanum*. Roy & Gupta (1974) have considered this species a *species inquirenda* as detailed information was not accessible to them. However, Luc & Dalmaso (1975) have considered *X. neoamericanum* a valid species perhaps on the basis of the description given by the authorst. Our efforts to obtain the type material from the authors to settle the question of the validity of species met with no success. Finally, we regard it a synonym of *X. americanum* untill proved otherwise.

X. americanum has been reported from North, Central and South America, Carribbean, Britain, West Africa, Sri Lanka, India, USSR, Japan, Australia, New Zealand. This species was first reported from India by Siddiqi (1959) who also designated a neotype from the population collected from Aligarh. The neotype was later on devalidated because it did not come from a locality close to the type locality. The species has also been reported from India by other authors (*cf.* Janar. thanan *et al.*, 1969; Sethi & Swarup, 1969; Sharma *et al.*, 1969).

X. americanum is known to act as a vector of tobacco ring spot (Fulton, 1962) and tomato ring spot viruses (Teliz *et al.*, 1966). Both these viruses infect a wide range of crops and weeds, but despite the cosmopolitan distribution of the vectors the outbreaks of these viruses have so far been restricted to the American continent. This apparent anomaly may be explained by the recognition of *X. americanum* as a species complex (Tarjan, 1969). As an ectoparsite it is known to be associated with the necrosis and distortion of feeding roots of laure-oak (Christie, 1952), necrosis and swelling of roots and general symptoms of decline in maple (Disanzo & Rhode, 1969), unthriftness of red clover (Noroton, 1967), black roots of strawberry (Perry, 1958), severe decline of periwinkle (Epstein & Baker, 1966), and general weakening and premature decline of various species of trees used in shelter belts in South Dakota (Malek, 1968).

2. *Xiphinema brevicolle* Lordello & Da Costa

(Text-fig. 3, G-J)

1961. *Xiphinema brevicolle*: Lordello & Da Costa, *Rev. Brasil. Biol.*, 21 : 363.
1963. *Xiphinema brevicolle*: Jairajpuri & Siddiqi, *Curr. Sci.*, 32 : 508.
1969. *Xiphinema brevicolle*: Cohn, *Nematologica*, 15 : 183.
1974. *Xiphinema brevicolle*: Heyns, *Phytophylactica*, 6 : 157.
1975. *Xiphinema saopaloense*: Khan & Ahmad, *Nematol. medit.*, 1 : 23.

Dimensions: 2 ♀ : L=2.0-2.2mm; a=41; b=7.5; c=76-80; V=51-53; G₁=8-12; G₂=8-12; c'=0.8-0.9; Anterior end to spear guide ring=71-75 µm; Odontostyle=99-103 µm; Odontophore=61-63 µm; DO=12; DN=15; RS₁N=51; LS₁N=52; S₂O=73-75.

Description: Female: Body upon fixation 'C' shaped with tapering extremities. Cuticle with fine radial striae, in 2 layers, thickest on tail. Lateral chords about 1/4 th of the midbody-width.

Lip region flattened, continuous with the rest of body. Amphids 'stirrup-shaped' with slit-like apertures which are about one-half of the labial-width. Odontostyle 8-9 labial-widths long, odontophore 1/1.5-1/1.6th of the odontostyle length. Fixed guiding ring is at 5-6 labial-widths from the anterior extremity.

Basal bulb of the oesophagus 1.5-2.0 times of the corresponding body-width and 30% of neck length long. Position of oesophageal gland nuclei and their orifices as given above. Cardia short and conoid. Nerve ring surrounding the anterior slender part of the oesophagus at about one labial-width from the base of odontophore. Prerectum indistinguishable from intestine. Rectum about one anal body-width long.

Genital tract amphidelphic, each sexual branch consisting of a reflexed ovary, a distal narrow and a proximal expanded part of oviduct, and a short uterus. Vagina about 1/3rd of the corresponding body-width long. Vulva at about 52% of total body length from the anterior extremity.

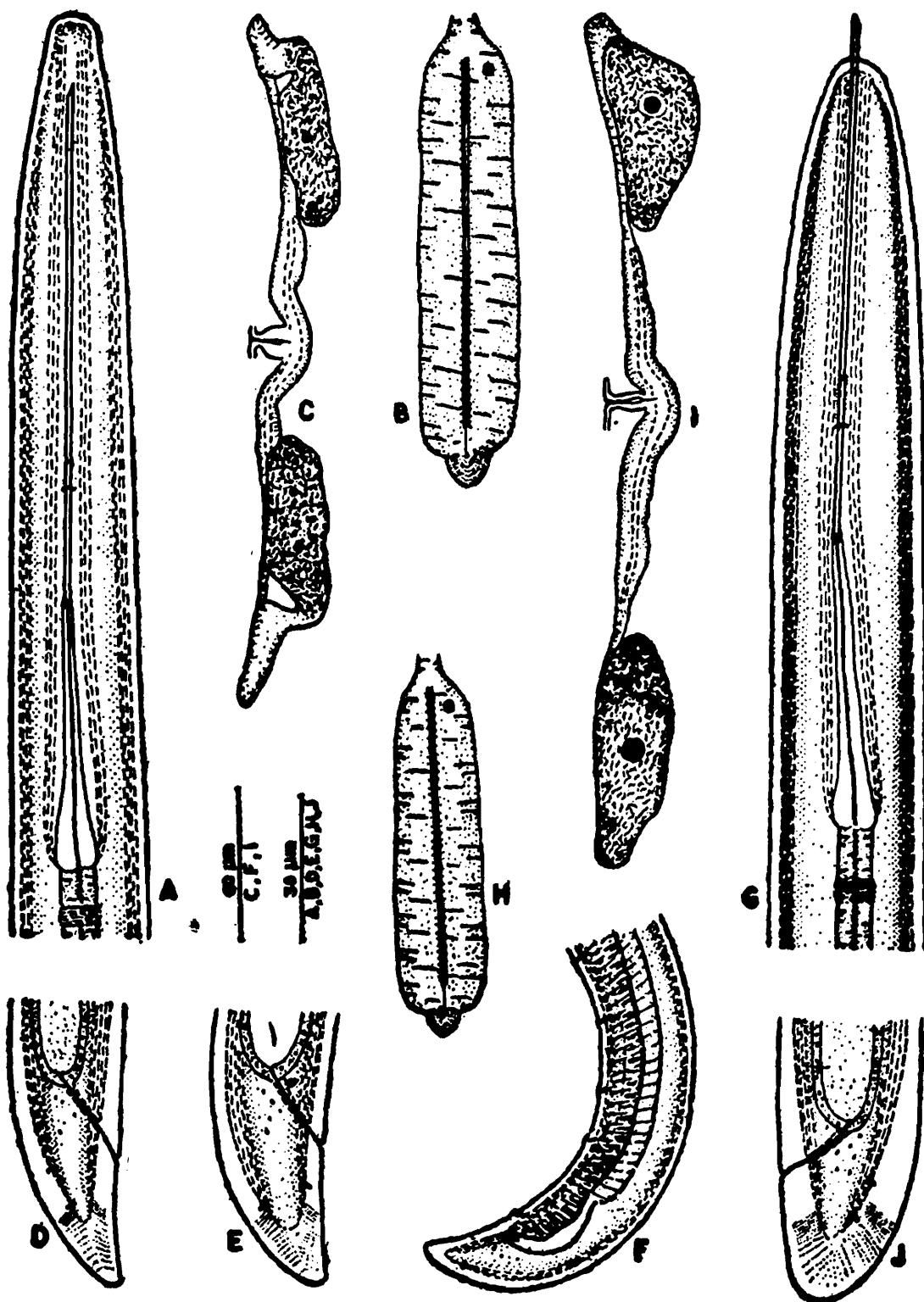
Tail short and rounded-conoid, its dorsal surface convex and ventral almost straight, about one anal body-width long and provided with 2 papillae on each side.

Male: Not found.

Host and locality: Soil around roots of *Berberis* sp., from Dalhousie, Himachal Pradesh.

Remarks: This species was described by Lordello & Da Costa (1961) from around the roots of *Coffea arabica* from Brazil. Jairajpuri & A. H. Siddiqi (1963) reported this species from around the roots of *Berberis*

sp., from Dalhousie, Himachal Pradesh, India. Cohn (1969) described the males of this species for the first time from Israel. It has also been reported from France, (Dalmasso, 1969), South Africa (Heyns, 1974) and Czechoslovakia (Liskova & Sabova, 1973). Heyns (l.c.) found that this species exhibits marked intraspecific variations which can be correlated with geographical distribution.



Text-fig. 3.—A—F *Xiphinema inaequale* (Khan & Ahmad): (A) Anterior extremity. (B) Oesophageal bulb. (C) Female genital tract. (D-E) Female tails. (F) Male posterior extremity. G-J *Xiphinema brevicolle* (G) Anterior extremity. (H) Oesophageal bulb. (I) Female genital tract. (J) Female tail.

Dalmasso (1969) described a new species, *X. rivesi* from France and differentiated it from *X. brevicolle* in being shorter and slender. But since the values of L and a are almost identical in both these species, the differences do not appear to be valid. In *X. brevicolle* there exists some doubt about the contour of lip region and tail shape. Our attempts to obtain some type material to confirm these characters met with no success. Lip region in specimens described by Lordello & Da Costa (l. c.) is slightly offset, tail is conoid with almost pointed terminus. Dalmasso (l. c.) who studied specimens from France described lip region to be slightly offset by a constriction which is not so pronounced and tail conoid with a rounded terminus. Specimens described by Jairajpuri & A. H. Siddiqi (l. c.) and those studied by the present authors from India have their lip region continuous with the rest of body and tail obtusely rounded. There is no alternative except to consider these differences as intraspecific variations, but it is quite likely that *X. brevicolle* may also represent a species-complex. This can only be ascertained by examination of the type material of this species and also by studying the variability among different populations of *Xiphinema* from the world which have been labelled as *X. brevicolle*.

3. *Xiphinema opisthohysterum* Siddiqi

(Text-fig. 4)

1961. *Xiphinema opisthohysterum* Siddiqi, Z. Parasitkde., 20 : 458.

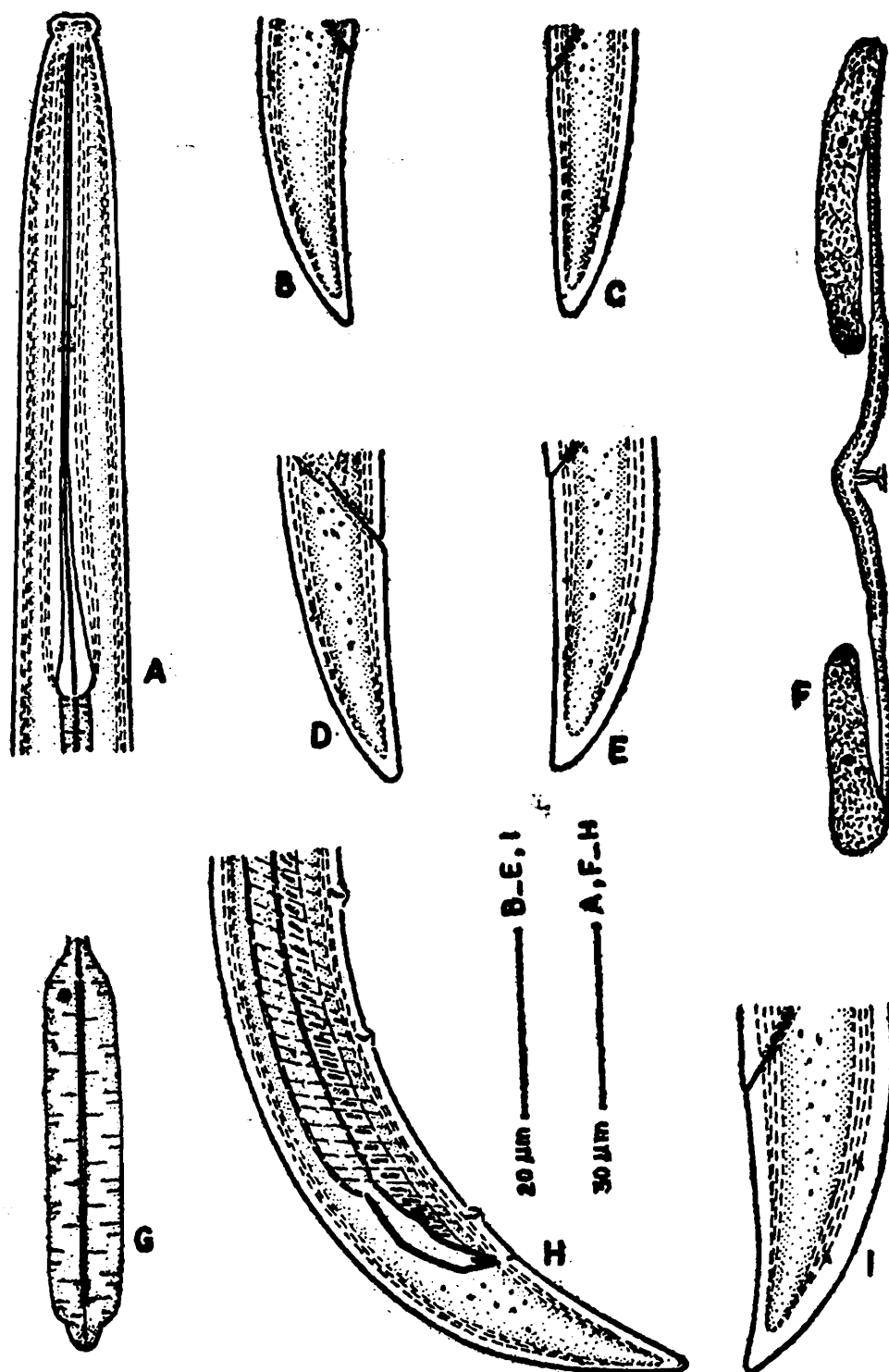
Dimensions: Aligarh citrus population: 5 ♀ ♀ : L=1.64-1.76 mm; a=60-65; b=6.5; c=52-57; V=60-61; G₁=13-15; G₂=13-15; c'=1.5-1.8; Anterior end to spear guide ring=53 µm; Odontostyle=64-68 µm; Odontophore=38 µm; DO=12.5-13.5; DN=13.5-14.5; RS₁N=48-52; LS₁N=48-52; S₂O=73.

Bareilly mango population: 5 ♀ ♀ : L=1.61-1.78 mm; a=59-68; b=6; c=52-59; V=58-62; G₁=10-16; G₂=10-16; c'=1.4-1.8; Anterior end to spear guide ring=51-55 µm; Odontostyle=62-68 µm; Odontophore=37-40 µm; DO=13.5; DN=14.5; RS₁N=48-51; LS₁N=48-51; S₂O=73-75.

3 L₁: L=0.69-0.73 mm; a=42-44; b=4.4-5.1; c=20-28; c'=2.5-3.0; Anterior end to spear guide ring=26-28 µm; Odontostyle (Functional)=31-33 µm; Odontostyle (Replacement)=42 µm; Odontophore=18-20 µm; DO=15.5; DN=16.0; 16.0; RS₁N=47; LS₁N=48; S₂O=66-69.

1 L₂: L=0.85 mm; a=54; b=4.5; c=32; c'=2.7; Anterior end to spear guide ring=35 µm; Odontostyle (functional)=41 µm; Odontostyle (replacement)=49 µm; Odontophore=24 µm; DO=15.5; DN=16.0; RS₁N=48; LS₁N=49; S₂O=70.

5 L₃: L=0.87-1.12 mm; a=54-65; b=4.5-5.3; c=34-36; c'=2.2-2.8; Anterior end to spear guide ring=44 μ m; Odontostyle (functional)=46-53 μ m; Odontostyle (replacement)=60-64 μ m; Odontophore=35-39 μ m; DO=11.5-13.5; DN=13.5-16.5; RS₁N=48-53; LS₁N=48-53; S₂O=69-75.



Text-fig. 4.—*Xiphinema opisthohysterum* Siddiqi: (A) Anterior extremity. (B-E) Tails of L₁, L₂, L₃ & L₄ respectively. (F) Female genital tract. (G) Oesophageal bulb. (H) Male posterior extremity. (I) Female tail.

8 L₄: L=1.41-1.54 mm; a=64-70; b=6.7-7.3; c=40-52; c'=2.0-2.6; Anterior end to spear guide ring=44-50 μ m; Odontostyle (functional)=55-63 μ m; Odontostyle (replacement)=66-68 μ m; Odon-

tophore=37-40 μm ; DO=11.5-13.5; DN=11.5-14.5; $\text{RS}_1\text{N}=50-55$; $\text{LS}_1\text{N}=50-53$; $\text{S}_2\text{O}=71-75$.

Bareilly sugar cane population: 3 ♀♀ : L=1.61-1.71 mm; a=65; b=6.5; c=54-59; V=61-62; $\text{G}_1=13-18$; $\text{G}_2=13-18$; $c'=1.6$; Anterior end to spear guide ring=51 μm ; Odontostyle=62-68 μm ; Odontophore=37-39 μm ; DO=12.5; DN=14.5; $\text{RS}_1\text{N}=50$; $\text{LS}_1\text{N}=50$; $\text{S}_2\text{O}=73$.

Nainital wild plant population: 5♀♀ : L=1.66-1.84 mm; a=66-77; b=6.4-6.7; c=55-59; V=58-62; $\text{G}_1=10-14$; $\text{G}_2=10-14$; $c'=1.4-1.8$; Anterior end to spear guide ring=51-55 μm ; Odontostyle=64-70 μm ; Odontophore=37-40 μm ; DO=12.5; DN=14.0; $\text{RS}_1\text{N}=48-53$; $\text{LS}_1\text{N}=48-53$; $\text{S}_2\text{O}=71-75$.

1 ♂ : L=1.68 mm; a=76; b=6.5; c=48; $c'=1.7$; Anterior end to spear guide ring=52 μm ; Odontostyle=64 μm ; Odontophore=46 μm ; DO=13.5; DN=14.0; $\text{RS}_1\text{N}=50$; $\text{LS}_1\text{N}=50$; $\text{S}_2\text{O}=70$; Spicule length=26 μm .

Pilibhit citrus population: 3 ♀♀ : L=1.68-1.75 mm; a=67-77; b=6.5; c=52-59; V=59-62; $\text{G}_1=12-17$; $\text{G}_2=12-17$; $c'=1.5-1.8$; Anterior end to spear guide ring=53 μm ; Odontostyle=62-67 μm ; Odontophore=38 μm ; DO=12.5-13.5; DN=13.5-14.5; $\text{RS}_1\text{N}=50$; $\text{LS}_1\text{N}=50$; $\text{S}_2\text{O}=71-75$.

Description: Female: Body upon fixation 'C' shaped, long and attenuated with tapering extremities. Cuticle in 2 layers. Lateral chords about 1/3rd of the midbody-width.

Lip region rounded, well set off from the rest of body. Amphids stirrup-shaped with slit-like apertures which are nearly 3/5th of the labial width. Odontostyle 7.0-7.5 labial-widths long, odontophore nearly 1/1.7-1/1.9th of the odontostyle length. Fixed guiding ring is at 6 labial-widths from the oral aperture.

Basal bulb of oesophagus 2.0-2.6 times of the corresponding body-width and 20% of neck length long. Position of oesophageal gland nuclei and their orifices as given above. Cardia short and conoid. Nerve ring surrounding the anterior slender part of oesophagus at about 2 labial-widths from the base of odontophore. Prerectum 8-12 times of the anal body-width long. Rectum about one anal body-width long.

Genital tract amphidelphic, each sexual branch consisting of a reflexed ovary, a distal narrow and a proximal expanded part of oviduct and a uterus. Vagina about 1/3rd of the corresponding body-width long. Vulva post-equatorial, about 58-62% of total body length from the anterior extremity.

Tail elongate-conoid, about twice the anal body-width long and provided with 2-3 papillae on each side.

Male: A single male was collected from around the roots of some wild plants (unidentified) from Kicha, Nainital. This resembles the females morphologically. Male genital tract is monorchic with single reflexed testis. The monorchic condition is considered here as an abnormality rather than a rule. Supplements consist of an adanal pair and 2 ventromedians which are spaced as shown in Text-fig. 4, H. Spicules about 1.5 anal body-widths long. Lateral guiding pieces small and finger-like. Tail more pointed than in females, about twice the anal body-width long and provided with 2 papillae.

Juveniles: The various juvenile stages differ from one another in total body length, length of odontostyles (both functional and replacement), position of fixed guiding ring from anterior extremity and in value of c' ratio.

Hosts and localities: Soil around roots of i. *Citrus sinensis* from gardens in front of Victoria Gate, Aligarh Muslim University, Aligarh, U. P. ii. *Mangifera indica* from Baheri, Bareilly, U. P. iii. *Saccharum officinarum* from Baheri, Bareilly, U. P. iv. Wild plants (unidentified) from Kicha, Nainital, U. P. and v. *Citrus limnoia* from Pota, Pilibhit, U. P.

Remarks: *X. opisthohysterum* was described by Siddiqi (1961) from this country based only on females. Stoyanov (1964) described from Bulgaria several females and a male of a species of *Xiphinema* and identified it as *X. opisthohysterum*, but this identification was not accepted by Martelli & Lamberti (1967) who redesignated it as *X. mediterraneum*. The view of Martelli and Lamberti was accepted by Cohn (1969) as well as Heyns (1974). The description of a male by the present authors is therefore the first record of this sex in *X. opisthohysterum*. This species has not been reported from outside India.

This species comes very close to *X. americanum* Cobb, 1913 and *X. mediterraneum* Martelli & Lamberti, 1967. Tarjan (1969) has stated that the range of various characters of *X. americanum* and *X. opisthohysterum* overlap and it is quite difficult to separate them from each other. The only important difference between the two species being the position of vulva which is further post-equatorial ($V=58-62$) in *X. opisthohysterum*. *X. opisthohysterum* is morphologically very similar to *X. mediterraneum* the only points of difference being the length of odontostyle (67:87) and of tails ($c=52:62$). Luc & Dalmasso (1975) have indicated that the two species might be synonyms, but the present discovery of a male of *X. opisthohysterum* helps in distinguishing it from the related species. The male of this species has only 2 ventro-median supplements against 5-8 in *X. americanum* and *X. mediterraneum*. However, even this distinguishing character shall have limited value because of the rarity of males in these species.

4. *Xiphinema inaequale* (Khan & Ahmad)

(Text-fig. 3, A-F)

1975. *Xiphinema neoamericanum*: Khan & Ahmad *Nematol medit.* 3 : 24.

Dimensions: Almora grass population: 5♀♀: L=1.7-1.9 mm; a=35-39; b=5.6-5.9; c=61-64; V=50-52; G₁=10-14; G₂=10-15; c'=1.1-1.4; Anterior end to spear guide ring=70-78 μm; Odontostyle=92-98 μm; Odontophore=53 μm; DO=9-12; DN=10-13; RS₁N=48-51; LS₁N=48-51; S₂O=71-77.

Chamba grass population: 6♀♀: L=1.8-2.0 mm; a=38-41; b=5.8-6.3; c=61-65; V=50-53; G₁=12-15; G₂=12-15; c'=1.2-1.5; Anterior end to spear guide ring=73-81 μm; Odontostyle=95-101 μm; Odontophore=51-55 μm; DO=11-15; DN=12-15; RS₁N=48-52; LS₁N=49-53; S₂O=77-84.

1♂: L=1.7 mm; a=37; b=5.2; c=63; c'=1.0; Anterior end to spear guide ring=86 μm; Odontostyle=97 μm; Odontophore=55 μm; DO=12; DN=15; RS₁N=51; LS₁N=51; S₂O=75; Spicule length=43 μm.

Mussoorie wild plant population: 4♀♀: L=1.8-2.0 mm; a=36-38; b=5.7-5.9; c=63; V=52; G₁=11-14; G₂=11-14; c'=1.1-1.3; Anterior end to spear guide ring=73 μm; Odontostyle=92-98 μm; Odontophore=53 μm; DO=10-12; DN=11-14; RS₁N=50; LS₁N=50; S₂O=80.

Palampur *Camellia* population: 3♀♀: L=1.9 mm; a=37-39; b=5.8; c=63; V=50-52; G₁=11-13; G₂=11-13; Anterior end to spear guide ring=75 μm; Odontostyle=93-96 μm; Odontophore=53 μm; DO=9-12; DN=10-12; RS₁N=51; LS₁N=51; S₂O=77-81.

Description: Female: Body upon fixation 'C' shaped with tapering extremities. Cuticle in 2 layers, thickest in the region of vulva and on tail. Lateral chords about 1/4th of the body-width near middle.

Lip region rounded, almost continuous with the rest of body. Amphids stirrup-shaped with slit-like apertures which are nearly 3/5th of the labial-width. Odontostyle 8.0-9.5 labial-widths long, odontophore nearly 1/8th of the odontostyle length. Fixed guiding ring is at 6.5-8.0 labial-widths from the oral aperture.

Basal bulb of oesophagus 2.0-2.5 times of the corresponding body-width and 20% of neck length long. Position of oesophageal gland nuclei and their orifices as given above. Nerve ring surrounds the anterior slender part of oesophagus at about one labial-width from the base of odontophore. Prerectum 4-5 anal body-widths long and is distinct.

guishable from the intestine in being narrow and in having fewer granules in its cells. Rectum about one anal body-width long.

Genital tract amphidelphic, each sexual branch consisting of a reflexed ovary, a distal narrow and a proximal expanded part of oviduct and a short uterus. Vagina about 1/3rd of the corresponding body-width long. Vulva at 48-53% of total body length from the anterior extremity.

Tail short and conoid, 1 1-1.5 anal body-widths long and provided with 2 caudal papillae on each side.

Male: A single male specimen was collected from soil around the roots of grasses (unidentified) from Banikhet, near Dalhousie, Chamba, H. P. Morphologically it is similar to the females except for more stronger curvature of its posterior end. Genital tract triorchic with two anteriorly directed and one reflexed testis. This triorchic condition is considered an abnormality rather than a rule. Supplements consist of an adanal pair and a series of 4 ventromedians which are spaced as shown in Text-fig. 3, F. Spicules about 1 5 anal body-widths long.

Tail short and conoid, about one anal body-width long, provided with 2 papillae on each side.

Hosts and localities: Soil around roots of i. grasses (unidentified from Ranikhet, Almora, U. P. ii. grasses (unidentified) from Banikhet, Chamba, H. P. iii. wild plant (unidentified) from Mussoorie, Dehra Dun, U. P. and iv. *Camellia sinensis* from Bandla Tea Estate, Palampur, H. P.

Remarks: *Xiphinema inaequale* first described as *X. neoamericanum* by S. H. Khan & Ahmad (1975) was later renamed *X. inaequale* as it was found to be a junior homonym of *X. neoamericanum* Saxena *et al.*, 1973. This species is very closely related to *X. americanum* and *X. brevicolle*. In fact, Luc & Dalmasso (1975) have synonymised it with *X. americanum* as the shape of lip region, and the position of guiding ring mentioned as points of difference between the two species by S. H. Khan & Ahmad are not acceptable to them. Loof & Lamberti (1976) also consider this species to be a synonym but of *X. brevicolle*. The study of the male of *X. inaequale* reported here for the first time shows that this species can be separated on the characters of male from both *X. americanum* and *X. brevicolle* (cf. Cohn, 1969). The males of these two species have robust spicules and the supplements consist of an adanal pair and a series of 5-8 ventromedians which are regularly spaced with the distance between adanal pair and the first supplement being equal to the space between any two adjacent ventromedians. In *X. inaequale* on the other hand the spicules are less robust and the first supplement is spaced at about twice the distance between any two adjacent ventromedians. The total number of ventromedians is also only 4.

5. *Xiphinema lambertii* Bajaj & Jairajpuri

(Text-fig. 5, F-J)

1976. *Xiphinema lambertii*: Bajaj & Jairajpuri, *Nematol. medit.*, 4 : 195

Dimensions: Dehra Dun piegon pea population: 6♀♀: L=1.31-1.41 mm; a=47-51; b=5.2-5.7; c=37-46; V=49-52; G₁=10-13; G₂=10-13; c'=1.6-1.9; Anterior end of spear guide ring=48-54 μm; Odontostyle=55-63 μm; Odontophore=39 μm; DO=12-15; DN=13-15; RS₁N=55-60; LS₁N=55-60; S₂O=75-80.

Bareilly mango population: 8♀♀: L=1.32-1.46 mm; a=47-51; b=5.4-5.9; c=40-50; V=51-53; G₁=10-12; G₂=10-13; c'=1.7-2.0; Anterior end to spear guide ring=52 μm; Odontostyle=56-64 μm; Odontophore=38-40 μm; DO=12-15; DN=13-15; RS₁N=57-59; LS₁N=57-60; S₂O=75-80.

Description: Female: Body upon fixation 'C' shaped, tapering towards both the extremities. Cuticle in 2 layers, thickest on tail. Lateral chords about 1/4th of the midbody-width.

Lip region rounded, slightly offset from the rest of body. Amphids stirrup-shaped with slit-like apertures which are nearly 3/5th of labial width and located at the base of lip region. Odontostyle 6-7 labial-widths long, odontophore nearly 2/3rd of the odontostyle length. Fixed guiding ring is at 5-6 labial-widths from the anterior extremity.

Basal bulb of oesophagus 2.4 times of the corresponding body-width and 24% of neck length long. Position of oesophageal gland nuclei and their orifices as given above. Cardia short and conoid. Nerve ring surrounding the anterior slender part of oesophagus at about 2 labial-widths from the base of odontophore. Prerectum 5-6 times of the anal body-width long. Rectum about one anal body-width long.

Genital tract amphidelphic, each sexual branch consisting of a reflexed ovary, a distal narrow and a proximal expanded part of oviduct, and a uterus. Vagina is about 1/3rd of the corresponding body-width long. Vulva is at 49-53% of total body length from anterior extremity.

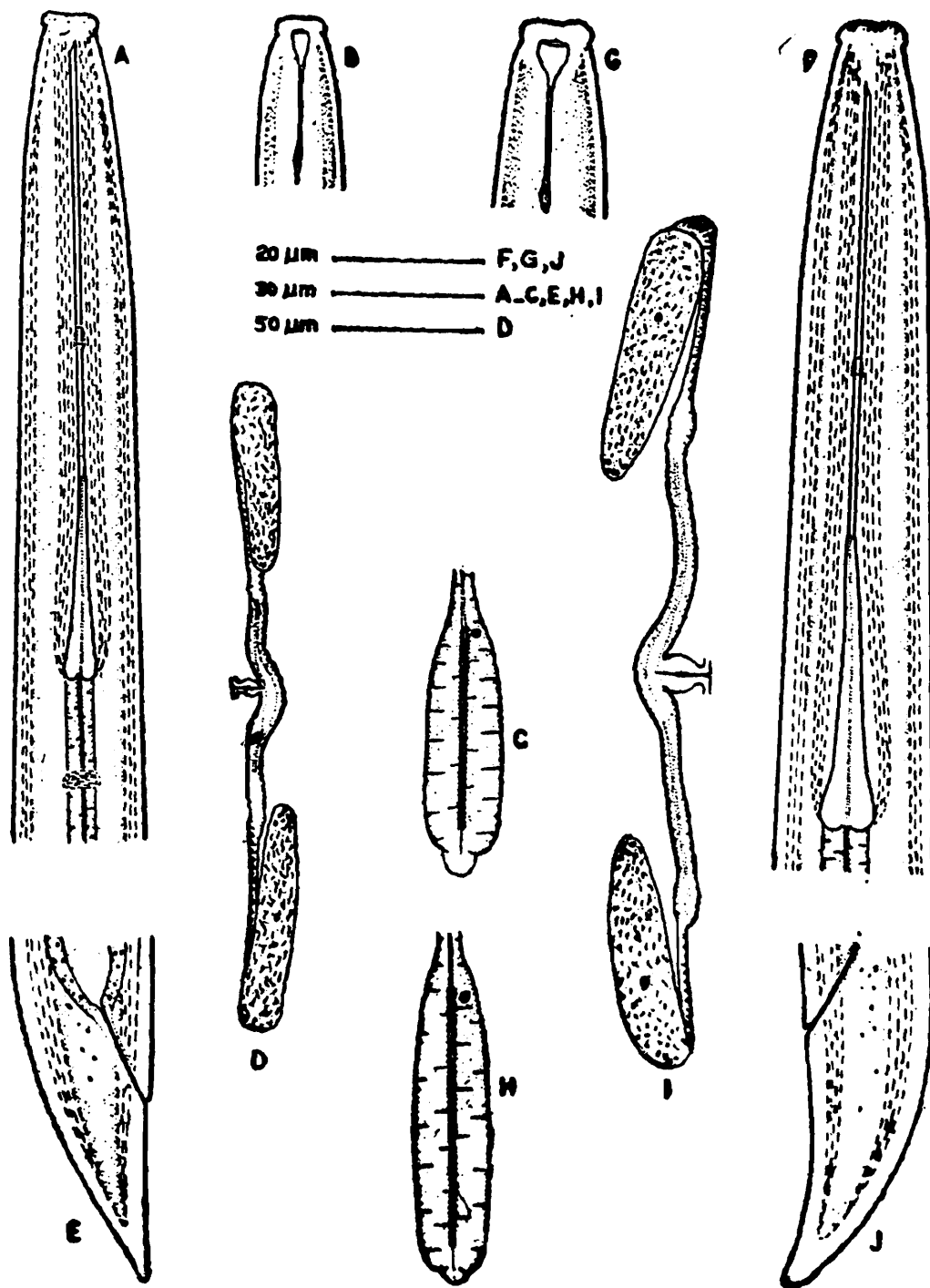
Tail narrow, elongate-conoid, 1.6-2.0 times of the anal body-width long and provided with 2 papillae on each side.

Male: Not found.

Hosts and localities: Soil around roots of i. *Cajanus cajan* from Rajpur, Dehra Dun, U. P. and ii. *Mangifera indica* from Bareilly, U. P.

Remarks: This species is closely related with *X. americanum* Cobb,

1913 from which it differs in being smaller, in having smaller spear and a differently shaped tail ($L=1.6-1.8$ mm; spear= $120-140$ μm ; tail conoid with sharp curvature on dorsal surface in *X. americanum*). This species has so far been reported from India only.



Text-fig. 5.—A-E *Xiphinema neoelongatum* Bajaj & Jairajpuri: (A) Anterior extremity. (B) Lip region. (C) Oesophageal bulb (D) Female genital tract. (E) Female tail. F-J *Xiphinema lambertii* Bajaj & Jairajpuri: (F) Anterior extremity. (G) Lip region. (H) Oesophageal bulb. (I) Female genital tract. (J) Female tail.

6. *Xiphinema neoelongatum* Bajaj & Jairajpuri

(Text-fig. 5, A.—E)

Dimensions: 4♀♀: L=1.4-1.7 mm; a=37-46; b=4.3-6.9; c=40-50; V=54-55; G₁=12-14; G₂=12-14; c'=1.4-1.8; Anterior end to spear guide ring=64-69 μm; Odontostyle=92-96 μm; Odontophore=42-46 μm; DO=12; DN=13; RS₁N=60-63; LS₁N=60-63; S₂O=77-80

Description: Female: Body upon fixation 'C' shaped with tapering extremities. Cuticle in 2 layers, thickest on tail. Fine radial striae clearly visible in the region of neck and on tail. Lateral chords about 1/4th of the midbody-width.

Lip region low, slightly offset from body. Amphids stirrup-shaped with slit-like apertures located at the base of lip region. Odontostyle 8-9 labial-widths long, odontophore nearly one-half of the odontostyle length. Fixed guiding ring is at 7-8 labial-widths from the anterior extremity.

Basal bulb of oesophagus 1.5 times of the corresponding body-width and 17% of neck length long. Position of oesophageal gland nuclei and their orifices as given above. Cardia short and conoid. Nerve ring surrounds the anterior slender part of oesophagus at about 2 labial-widths from the base of odontophore. Prerectum indistinguishable from intestine. Rectum about one anal body-width long.

Genital tract amphidelphic, each sexual branch consisting of a reflexed ovary, distal narrow and proximal expanded parts of oviduct, and a short uterus. Vagina is about 1/3rd of the corresponding body-width long. Vulva is at 55% of total body length from anterior extremity.

Tail short, convex-conoid ending in a subdigitate terminus, 1.4-1.8 times of the anal body-width long and provided with 2 papillae on each side.

Male: Not found.

Host and locality: Soil around roots of *Psidium guajava* from Ambala, Punjab.

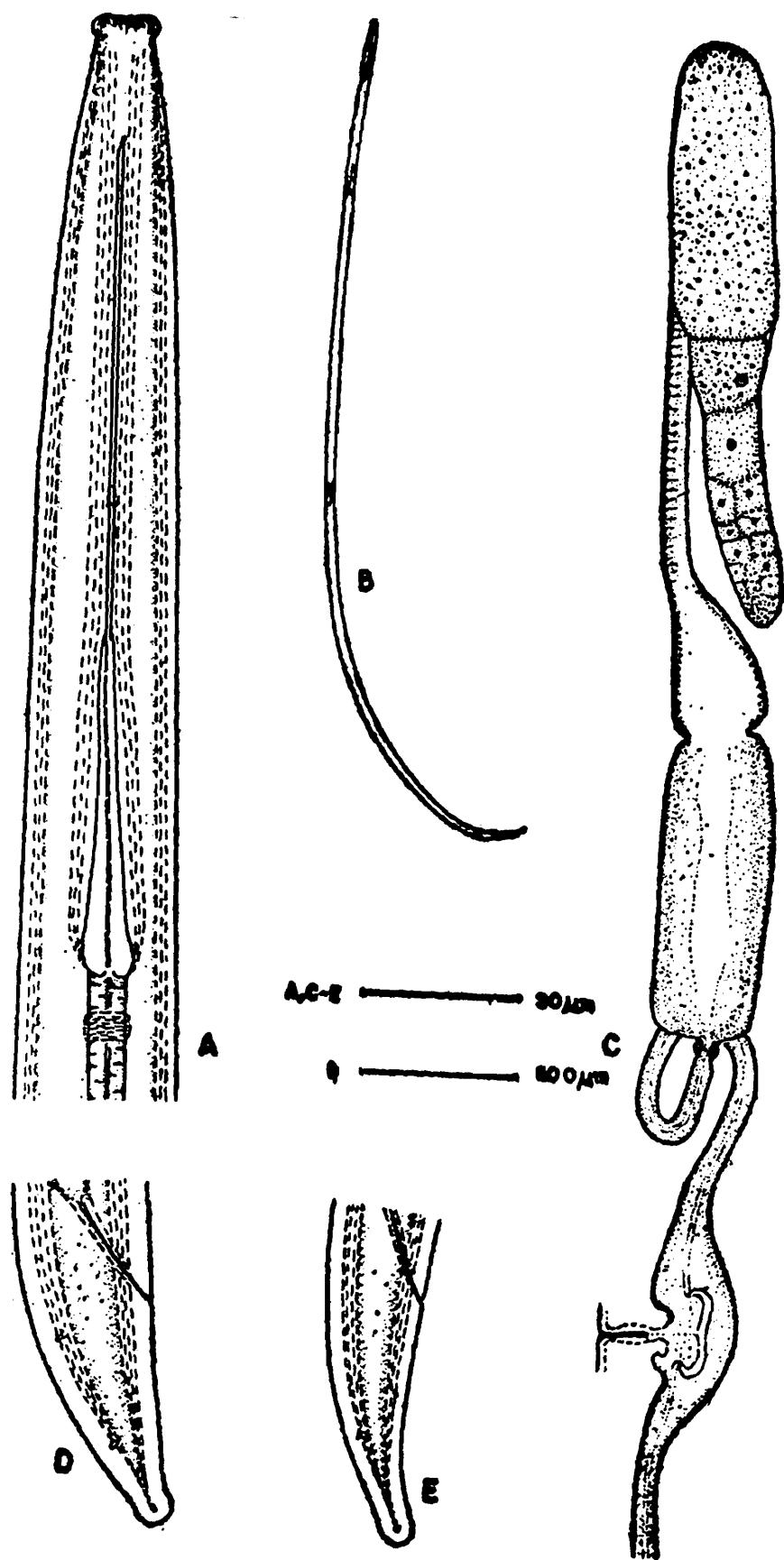
Remarks: This species is closely related with *X. mediterraneum* Martelli & Lamberti, 1967 from which it differs in being more robust, having a differently shaped and less offset lip region; in tail shape; and in lower value of c ratio. This species has not so far been reported from outside India.

7. *Xiphinema luci* sp. n.

(Text-fig. 6)

Dimensions: Paratypes (5♀♀): L=3.03-3.19 mm; a=90-100; b=8.1-9.0; c=76-91; V=49-54; G₁=6-8; G₂=6-8; c'=1.7-2.0; Anterior end to spear guide ring=77-83 μm; Odontostyle=83-86 μm; Odontophore=56-58 μm; DO=7.5-9.0; DN=7.5-10.4; RS₁N=46.5-53.2; S₂O=77.5-85.5; LS₁N=47.0-53.2.

Holotype ♀: $L=3.03$ mm; $a=90$; $b=8.1$; $c=76$; $V=50.5$; $G_1=6$; $G_2=6$; $c'=2.0$; Anterior end to spear guide ring= $77\text{ }\mu\text{m}$; Odontostyle= $86\text{ }\mu\text{m}$; Odontophore= $58\text{ }\mu\text{m}$; $DO=9$; $DN=9$; $RS_1N=52$; $LS_1N=51$; $S_2O=81$



Text-fig. 6.—*Xiphinema luci* sp. n.: (A) Anterior extremity. (B) Entire female (C) Female anterior sexual branch: (D) Female tail. (E) Tail of L_4 .

Description: Female: Body upon fixation 'C' shaped, almost cylindrical with tapering extremities. Cuticle in 2 layers, thickest in the region of tail. Lateral chords about 1/4th of the body-width near middle.

Lip region expanded and offset from the rest of body by a deep constriction. Amphids stirrup-shaped with slit-like apertures which are nearly 3/5th of the labial-width. Odontostyle about 7 labial-widths long, odontophore about 4/7th of the odontostyle length. Fixed guiding ring is at about 7 labial-widths from the oral aperture.

Basal bulb of oesophagus about thrice the corresponding body width and 25% of neck length long. Position of oesophageal gland nuclei and their orifices as given above. Cardia short and conoid. Nerve ring surrounding the anterior slender part of the oesophagus at about one labial-width from base of odontophore. Prerectum indistinguishable from intestine. Rectum about 1.4 times of the anal body-width long.

Genital tract amphidelphic, each sexual branch consisting of a reflexed ovary, distal narrow and proximal expanded parts of the oviduct, an expanded part and a narrow portion of uterus. A distinct sphincter is present between the expanded and narrow parts of uterus. Expanded part of uterus rectangular in shape, measuring $53-58 \times 18-20 \mu\text{m}$. Vagina about one-half of the corresponding body-width long. Vulva at 48-53% of total body length from the anterior extremity.

Tail elongate-conoid with clavate terminus. Inner core of the cuticle extends just up to the tip of the tail and forms a vesicle. It is 1.8-2.0 times of the anal body-width long and provided with 2 papillae on each side.

Male: Not found.

Type host and locality: Soil around roots of *Phaseolus aureus* from Mukhapur, Ajmer, Rajasthan.

Type material: Holotype on slide *Xiphinema luci* sp. n./1, paratypes on slides *X. luci* sp. n./2-4; deposited with the Zoology Department of Aligarh Muslim University.

Differential diagnosis: The new species comes close to *Xiphinema italiae* Meyl, 1953, but differs in the shape of expanded part of uterus position of sphincter muscles, shape of tail and in values of c and c' ratios (in *X. italiae* expanded part of the uterus is rounded, sphincter is present between the oviduct and uterus, tail is more elongate-conoid or conoid-digitate with pointed terminus, inner core of the cuticle does not extend up to the tail tip and also does not form a vesicle, and the values of c and c' ratios are 43 and 3.0 respectively).

This new species is named in honour of Dr. M. Luc, Museum National d'Histoire Naturelle, Laboratoire de Zoologie (Vers), Paris, France.

8. *Xiphinema elongatum* Schuurmans-Stekhoven & Teunissen

(Text-fig. 7, I-L)

1938. *Xiphinema elongatum*: Schuurmans-Stekhoven & Teunissen, *Expl. Natl. Albert.*, 22 : 229.
 1949. *Xiphinema pratensis*: Loos, *J. zool. Soc. India*, 1 : 24.
 1951. *Xiphinema campinense*: Lordello, *Bragantia*, 4 : 313.
 1961. *Xiphinema pratense*: Siddiqi, *Z. Parasitkde*, 20 : 461.
 1963. *Xiphinema elongatum*: Tarjan & Luc, *Nematologica*, 9 : 167.
 1972. *Xiphinema elongatum*: Cohn & Sher, *J. Nematol.*, 4 : 56.
 1972. *Xiphinema elongatum*: Loof & Maas, *Nematologica*, 18 : 109.
 1974. *Xiphinema elongatum*: Heyns, *Phytophylactica*, 6 : 249.

Dimensions: 5♀♀: L=2.05-2.15 mm; a=53-56; b=5.0-5.4; c=40-46; V=43.8-44.6; G₁=10-14; G₂=10-14; c'=2.0; Anterior end to spear guide ring=94-97 µm; Odontostyle=103-105 µm; Odontophore=59-63 µm; DO=12-13; DN=12-13; RS₁N=51-55; LS₁N=51-55; S₂O=77-80.

Description: Female: Body upon fixation only slightly ventrally curved, long and slender with tapering extremities. Cuticle with fine radial striae which are thickest on the tail. Lateral chords about 1/4th of the corresponding body-width.

Lip region rounded, slightly offset. Amphids stirrup-shaped with slit-like apertures which are nearly 3/5th of the labial-width and located at base of lip region. Odontostyle 9-10 labial-widths long; odontophore nearly 1/17th of the odontostyle length. Fixed guiding ring is at 8-9 labial-widths from the oral aperture.

Basal bulb of oesophagus nearly 2.5 times of the corresponding body width and 20% of neck length long. Position of oesophageal gland nuclei and their orifices as given above. Cardia short and conoid. Nerve ring surrounding the anterior slender part of oesophagus at about 2 labial-widths from the base of odontophore. Prerectum distinct in being narrow and in having fewer granules in its cells. Rectum about one anal body-width long.

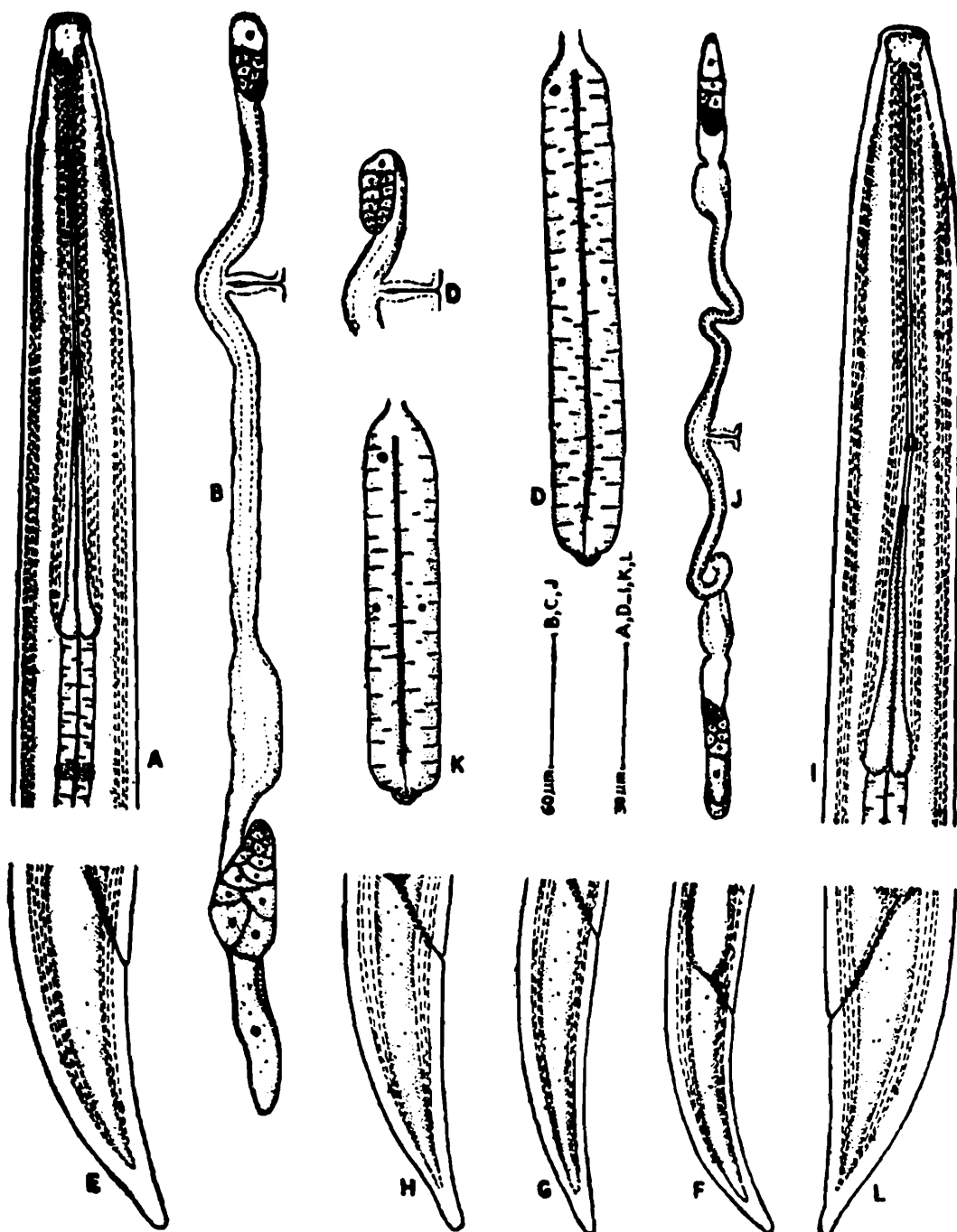
Genital tract amphidelphic, both the sexual branches being equally developed. Each sexual branch consists of a reflexed ovary, distal narrow and a proximal expanded part of oviduct, and a long convoluted uterus which also consists of distal expanded part and proximal narrow portions. The vagina is thick-walled, about one-half of the corresponding body-width. Vulva at 40-44% of total body length from the anterior extremity.

Tail elongate-conoid with subdigitate terminus, 2.0-2.5 times of the anal body-width long and provided with 2-3 papillae on each side,

Male: Not found.

Host and locality: Soil around roots of *Hibiscus rosasinensis* from Sahjanpur, U. P.

Remarks: This species was reported by Siddiqi (1961) from India but was labelled as *X. pratense* Loos, 1949 which was later on syno-



Text-fig. 7.—A-H *Xiphinema orbum* Siddiqi: (A) Anterior extremity (B) Female genital tract. (C) Anterior sexual branch in one of the females. (D) Oesophageal bulb. (E) Female tail. (F-H) Tails of L_2 , L_3 & L_4 respectively. (I-L) *Xiphinema elongatum* Schuurmans Stekhoven & Teunissen: (I) Anterior extremity. (J) Female genital tract. (K) Oesophageal bulb. (L) Female tail.

nymised with *X. elongatum* by Tarjan & Luc (1963). Loof & Maas (1972) have reported this species from Surinam. They observed weakly de-

veloped sclerotized apophyses in the uteri of a female specimen. Heyns (1974) has reported this species from South Africa and has studied its intraspecific variations. However, the South African specimens are longer than those described by Tarjan & Luc, Loof & Maas or Siddiqi. The present specimens from India are very similar to those described by Siddiqi, Tarjan & Luc or Loof & Maas except that the weakly developed sclerotized apophyses observed by Loof & Maas are not present in Indian females of this species as is also the case with the specimens studied by other authors.

Xiphinema elongatum is very closely related to *X. insigne* Loos, 1949 differing only in the position of vulva ($V=30:40$) and in the size of the tail ($c'=5:2.5$).

Xiphinema elongatum is cosmopolitan in distribution. It has been described under the name of *X. pratense* Loos, 1949 and *X. campinense* Lordello, 1951 from different parts of the world.

9. *Xiphinema insigne* Loss

(Text-fig. 8)

1949. *Xiphinema insigne*: Loos, *J. zool. Soc. India*, 1 : 25.
 1959. *Xiphinema indicum*: Siddiqi, *Proc. helminth. Soc. Wash.*, 26 : 152.
 1963. *Xiphinema insigne*: Tarjan & Luc, *Nematologica*, 9 : 163.
 1969. *Xiphinema insigne*: Cohn, *Nematologica*, 15 : 183.
 1971. *Xiphinema insigne*: Saigusa & Yamamoto, *Res. Bull. Pl. Prot. Serv. Japan*, 9 : 27.
 1972. *Xiphinema insigne*: Cohn & Sher, *J. Nematol.*, 4 : 60
 1977. *Xiphinema insigne*: Bajaj & Jairajpuri, *Nematologica*, 23 : 33

Dimensions: 171♀♀: $L=1.9-2.5$ mm; $a=50-70$; $b=5.2-8.1$; $c=15-35$ $V=28-36$; $c'=3.0-8.5$; Anterior end to spear guide ring= $80-110$ μm ; Odontostyle= $80-111$ μm ; Odontophore= $55-64$ μm ;

5♂♂: $L=2.1-2.3$ mm; $a=52-65$; $b=5.3-6.3$; $c=47-54$; $c'=1.4-1.7$; Anterior end to spear guide ring= $87-98$ μm ; Odontostyle= $93-104$ μm ; Odontophore= $51-61$ μm ; Spicule length= $53-58$ μm .

7 L_1 : $L=0.7-0.9$ mm; $a=40-52$; $b=2.9-3.8$; $c=11-14$; $c'=6.2-8.0$. Anterior end to spear guide ring= $33-37$ μm ; Functional odontostyle= $36-45$ μm ; Replacement odontostyle= $55-57$ μm ; Odontophore= $33-35$ μm .

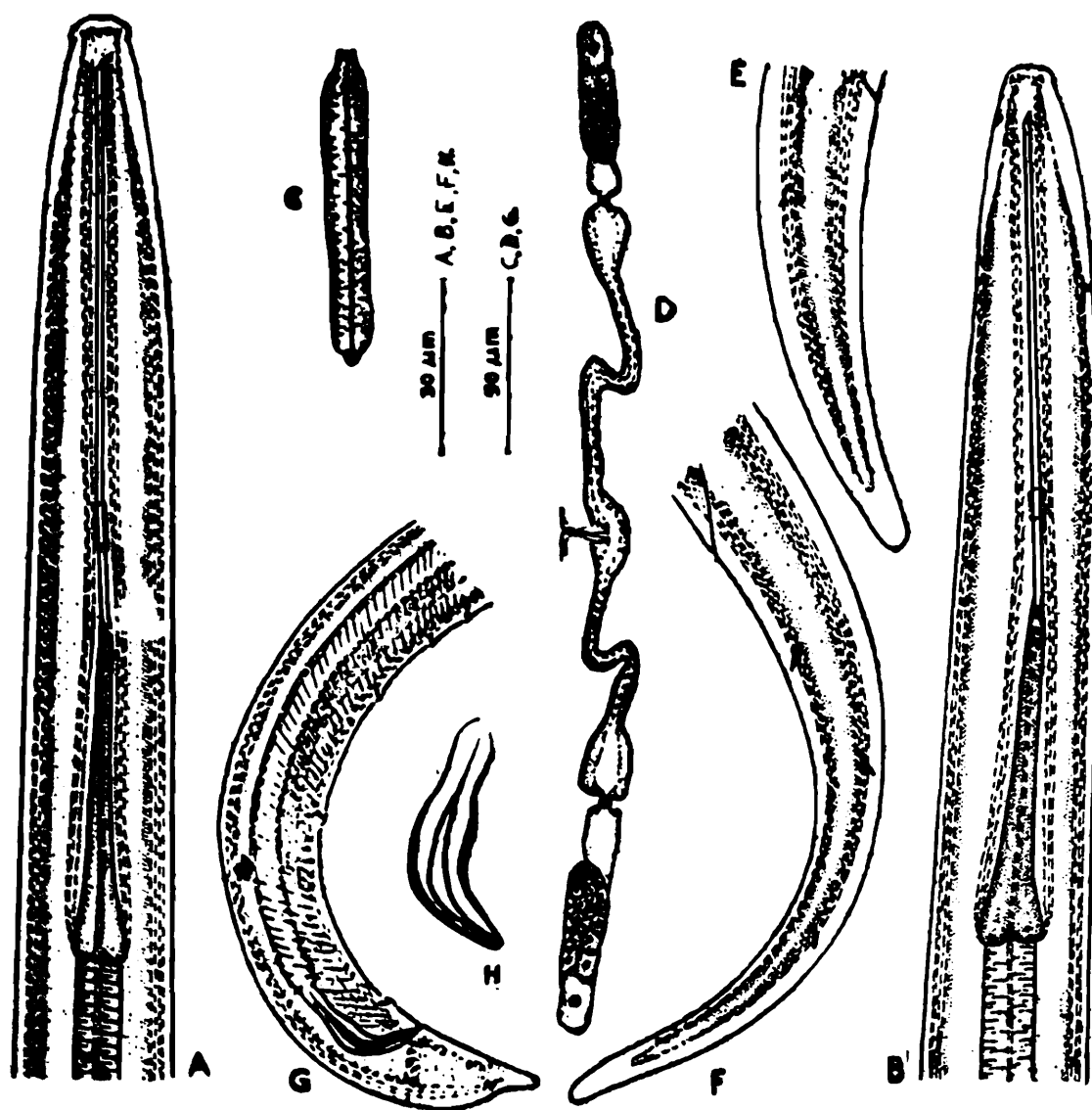
19 L_2 : $L=0.8-1.1$ mm; $a=43-52$; $b=3.3-4.7$; $c=11-15$; $c'=5-8$; Anterior end to spear guide ring= $36-50$ μm ; Functional odontostyle= $50-55$ μm ; Replacement odontostyle= $66-74$ μm ; Odontophore= $36-42$ μm .

68 L_3 : $L=1.1-1.5$ mm; $a=46-72$; $b=4.2-5.0$; $c=12-18$; $c'=4-9$

Anterior end to spear guide ring=55-66 μm ; Functional odontostyle=60-72 μm ; Replacement odontostyle=77-95 μm ; Odontophore=42-51 μm .

75L₄: L=1 5-1 7 mm; a=49-69; b=4.3-6.0; c=13-36; c'=4-8; Anterior end to spear guide ring=66-83 μm ; Functional odontostyle=75-94 μm ; Replacement odontostyle=90-106 μm ; Odontophore=48-55 μm

Description: Female: Body long and slender with rounded anterior and elongate-conoid posterior extremity. Outer cuticle smooth, inner finely striated. It is thickest in region of vulva and on tail. Lateral chords about 1/4th of the body-width near middle.



Text-fig. 8.—*Xiphinema insigne* Loos: (A & B) Anterior extremities. (C) Oesophageal bulb. (D) Female genital tract. (E & F) Female tails. (G) Male posterior extremity. (H) Spicule.

Lip region almost flat or rounded and slightly offset to well offset. Amphids stirrup-shaped with slit-like apertures which are nearly 3/5th of the labial-width and are located at the base of lip region. Odonto-

style 7.3-10.0 labial-widths long, odontophore nearly 2/3rd of the odontostyle length. Fixed guiding ring is at 7.3-10.0 labial-width from the oral aperture.

Basal bulb of oesophagus 1.7-2.9 times of the corresponding body-width and 20% of the neck length long. Position of oesophageal gland nuclei and their orifices as follows:

DO=7.5-13

RS₁N=53-58

S₂O=80-91

DN=7.5-13

LS₁N=53-59

Cardia short and conoid. Nerve ring surrounding the anterior slender part of the oesophagus at about 2 labial-widths from the base of odontophore. Prerectum 18-25% of total body length and 18-20 times of the anal body-width long. It is distinguishable from the intestine in being narrow and in having fewer granules in its cells. Rectum 1.2-1.5 times of the anal-body-width long.

Genital tract amphidelphic, each sexual branch consisting of a reflexed ovary, distal narrow and proximal expanded parts of oviduct, a distinct sphincter, and an expanded and a convoluted part of uterus. The anterior ovary in most of the specimens is greatly reduced. The vagina about one-half of the corresponding body-width long and opening through a conspicuous vulva at 29-32% of total body length from the anterior extremity.

Tail narrow, conoid to elongate filiform, 3.0-8.5 times of the anal body-width long and provided with 3-4 papillae on each side.

Male: They resemble the females except for stronger curvature at hinder end. Spicules well developed and sharply ventrally curved. Lateral guiding pieces finger-like, 16 μ m long. Supplements consist of an adanal pair and a series of 3-5 ventromedians which are spaced as shown in Text-fig. 8.

Tail conoid, ending in a digitate terminus. It is 1.4-1.7 times of the anal body-width long and provided with 2 papillae on each side.

Juveniles: The various juvenile stages differ from one another in total body length, in length of functional and replacement odontostyles, position of fixed guiding ring from the anterior extremity and in values of c and c' ratios.

For discussion and detailed description of intraspecific variations of this species see Bajaj & Jairajpuri (1977).

10. *Xiphinema orbum* Siddiqi

(Text-fig. 7, A-H)

Dimensions: Bareilly maize population: 5♀♀: L=2.8-3.1 mm; a=72-80; b=7.6-8.0; c=41-45; V=28-30; G₁=1-6; G₂=9-15; c'=2.5-2.8; Anterior end to spear guide ring=75-80 μm; Odontostyle=82-88 μm; Odontophore=57-59 μm; DO=7-11; DN=9-14; RS₁N=52-54; LS₁N=51-55; S₂O=77-80.

4L₃: L=1.1-1.5 mm; a=51-58; b=4.2-5.1; c=50-27; c'=3.3-3.7; Anterior end to spear guide ring=40-48 μm; Functional odontostyle=46-50 μm; Replacement odontostyle=60-66 μm; Odontophore=42 μm; DO=8; DN=10-13; RS₁N=46-50; LS₁N=48-52; S₂O=74-76.

4L₃: L=1.8-2.2 mm; a=63-72; b=8.0-9.0; c=28-30; c'=3.4-3.9; Anterior end to spear guide ring=53-58 μm; Functional odontostyle=57-65 μm; Replacement odontostyle=70-75 μm; Odontophore=46-50 μm; DO=8; DN=11-16; RS₁N=52; LS₁N=51-53; S₂O=76-80.

4L₄: L=2.0-2.4 mm; a=73-83; b=5.6-7.1; c=30-38; c'=2.4-2.7; Anterior end to spear guide ring=62-68 μm; Functional odontostyle=70-77 μm; Replacement odontostyle=82-88 μm; Odontophore=55 μm; DO=9; DN=10-12; RS₁N=52-58; LS₁N=51-54; S₂O=78-83.

Bareilly wild plants population: 5♀♀: L=2.9-3.1 mm; a=75-86; b=7.6-8.0; c=44-47; V=28-29; G₁=3-4; G₂=11-15; c'=2.6-2.8; Anterior end to spear guide ring=77-81 μm; Odontostyle=83-87 μm; Odontophore=58 μm; DO=7-10; DN=10-13; RS₁N=53; LS₁N=53; S₂O=77-80.

Description: Female: Body long and slender with tapering extremities. Cuticle thickest on tail, in 2 layers, outer smooth, inner with fine striae. Lateral chords about 1/4th of the body-width near middle.

Lip region rounded, well offset. Amphids stirrup-shaped with slit-like apertures which are nearly 3/4th of the labial-width and are located just above the base of lip region. Odontostyle 7-8 labial widths long, odontophore nearly 1/1.4 of the odontostyle length. Fixed guiding ring is at 7 labial-widths from the oral aperture.

Basal bulb of oesophagus thrice the corresponding body-width and 20% of neck length long. Position of oesophageal gland nuclei and their orifices as given above. Cardia short and conoid. Nerve ring surrounding the anterior slender part of oesophagus at about 4 labial-widths from the base of odontophore. Prerectum indistinguishable from intestine. Rectum about one anal-body-width long.

Genital tract amphidelphic, but the anterior sexual branch including the ovary is greatly reduced. In one of the present specimens the anterior sexual branch is very short and is represented by an ovary only (Text-fig. 7, C). Each sexual branch consists of a reflexed ovary, distal

narrow and proximal expanded parts of oviduct, and expanded and narrow portions of uterus. The vagina is thick-walled, one-half of the corresponding body-width long. Vulva located at 28-30% of total body length from the anterior extremity.

Tail elongate conoid, 2.5-2.8 times of the anal body-width long and provided with 2 papillae on each side.

Male: Not found.

Juveniles: Various juvenile stages differ from one another in lengths of odontostyles (both functional and replacement), position of fixed guiding ring from the anterior extremity, shape and size of tail and in values of c and c' ratios. Tail is more elongate and narrow in L_2 and L_3 than L_4 which very much resemble the adult tail.

Hosts and localities: Soil around roots of *Zea mays* and wild plants (unidentified) from Rudrapur, Bareilly, U. P.

Remarks: This species was described from India by Siddiqi (1964) from soil around the roots of *Oryza sativa* from Patna, Bihar and has not so far been reported from any other country.

This species is unique among Indian species of *Xiphinema* because of its greatly reduced organs of the anterior sexual branch. Some other species of *Xiphinema* may also have greatly reduced ovary but other structures are normal or may lack anterior sexual branch altogether. This species is also unique in having a very long expanded part of uterus in its posterior sexual branch and its amphidial aperture located slightly anterior to the base of lip region.

11. *Xiphinema basiri* Siddiqi

(Text-figs. 9 & 10)

1959. *Xiphinema basiri*: Siddiqi, *Proc. helminth. Soc. Wash.*, 26 : 156.

1971. *Xiphinema basiri*: Loof & Yassin, *Nematologica*, 16 : 544.

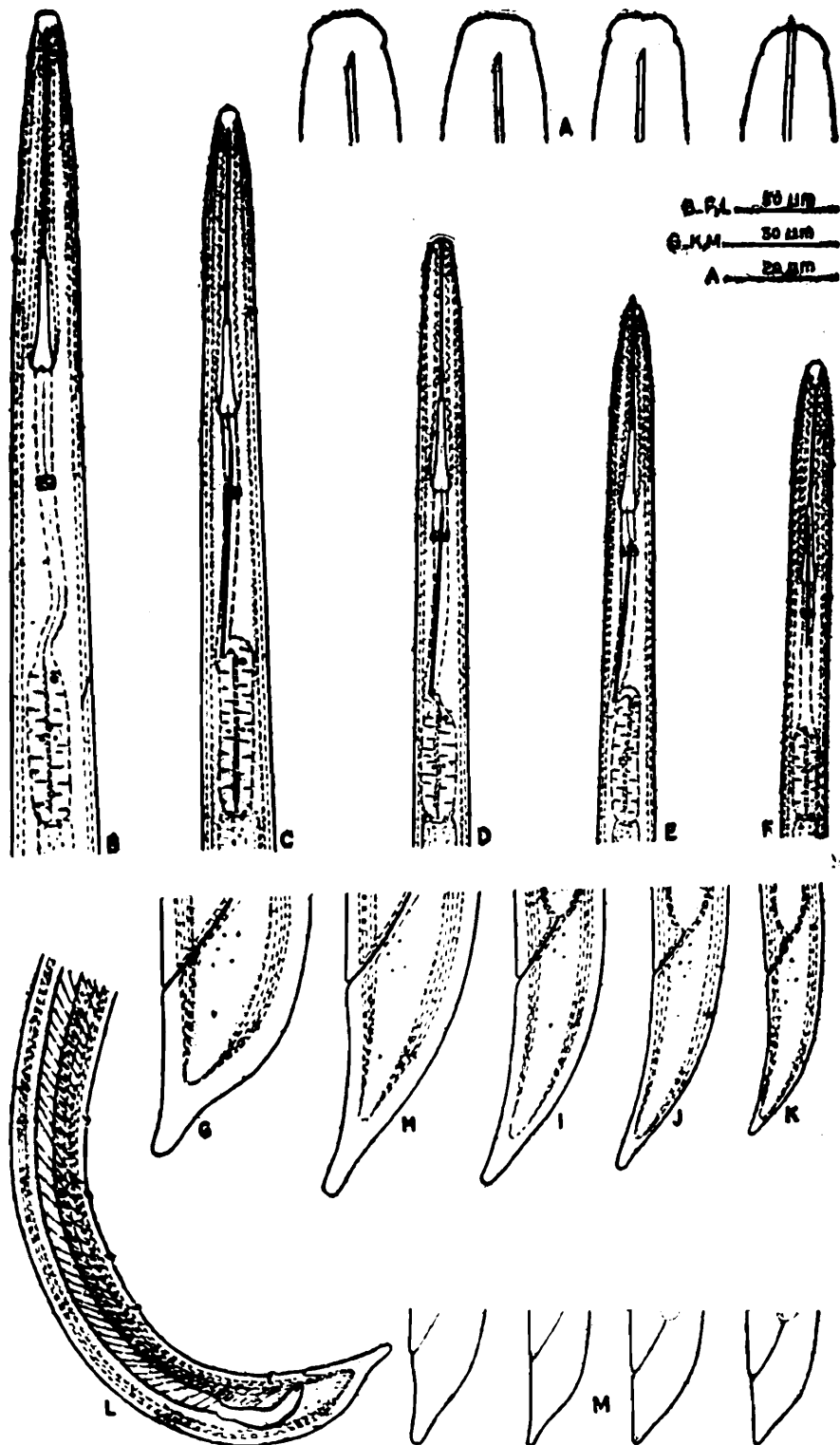
1972. *Xiphinema basiri*: Cohn & Sher, *J. Nematol.*, 4 : 54.

Dimensions: 26♀♀: $L=2.5-3.6$ mm; $a=54-75$; $b=5.8-9.6$; $c=59-95$; $V=48-53$; $G_1=12-16$; $G_2=12-16$; $c'=1.1-1.7$; Anterior end to spear guide ring= $81-113$ μm ; Odontostyle= $103-127$ μm ; Odontophore= $59-70$ μm .

4♂♂: $L=2.8-3.0$ mm; $a=63-72$; $b=6.8-7.3$; $c=87-92$; $c'=1.5$; Anterior end to spear guide ring= $110-115$ μm ; Odontostyle= $117-124$ μm ; Odontophore= $64-67$ μm .

5 L_1 : $L=0.8-0.9$ mm; $a=38-45$; $b=4.8-4.9$; $c=21-22$; $c'=3.1$; Anterior end to spear guide ring= $42-44$ μm ; Functional Odontostyle= $46-48$ μm ; Replacement odontostyle= $60-63$ μm ; Odontophore= 33 μm .

11 L_3 : $L=0.9-1.3$ mm; $a=30-55$; $b=3.7-5.6$; $c=21-30$; $c'=2.4-3.2$; Anterior end to spear guide ring= $48-67$ μm ; Functional odontostyle= $59-66$ μm ; Replacement odontostyle= $70-85$ μm ; Odontophore= $37-44$ μm .



Text-fig. 9.—*Xiphinema basiri* Siddiqi: (A) Lip regions. (B) Oesophageal region of adult. (C-F) Oesophageal regions of L_4 , L_3 , L_2 & L_1 respectively. (G) Female tail. (H-K) Tails of L_4 , L_3 , L_2 ; & L_1 respectively. (L) Male tail. (M) Female tail.

15 L_3 : $L=1.4-2.0$ mm; $a=46-63$; $b=4.7-7.6$; $c=28-38$; $c'=2.1-2.8$; Anterior end to spear guide ring= $53-84$ μm ; Functional odonto-

style=74-84 μm ; Replacement odontostyle=93-103 μm ; Odontophore=41-56 μm .

16 L₄: L=1.8-2.8 mm; a=45-76; b=5.1-7.6; c=40-62; c'=1.6-2.3
Anterior end to spear guide ring=79-96 μm ; Functional odontostyle=92-105 μm ; Replacement odontostyle=107-128 μm ; Odontophore=48-65 μm .

Description: Female: Body long and slender with tapering extremities. Cuticle in 2 layers, thickest in the region of tail peg. Fine radial striae clearly visible on tail. Lateral chords about 1/3rd of the midbody-width.

Lip region rounded, usually slightly offset from the rest of body. Amphidsstirrup-shaped with slit-like apertures which are nearly 3/5th of the labial-width wide and are located at the base of lip region. Odontostyle 8.5-10.0 labial-widths long, odontophore nearly one-half of the odontostyle length. The fixed guiding ring is at 7.0-9.5 labial-widths from the oral aperture.

Basal bulb of the oesophagus 2.5 times of the corresponding body-width and about 25% of neck length long. Positions of various oesophageal gland nuclei and their orifices as follows:

DO = 7.5-12.5
DN = 9.9-13.5

RS₁N = 47-55
LS₁N = 47-55

S₂O = 71-76

Nerve ring surrounding the anterior slender part of the oesophagus at about 2 labial-widths from the base of odontophore. Prerectum 12-17% of total body length and 12-20 times of anal body-width long. It is distinguishable from the intestine in being narrow and in having fewer granules in its cells. Rectum about one anal body-width long.

Genital tract amphidelphic, each sexual branch consisting of a reflexed ovary, distal narrow and proximal expanded parts of oviduct, a distinct sphincter, and expanded and convoluted portions of uterus. Globular pieces usually present in the convoluted part of uterus near its junction with expanded part. These pieces form 'pseudo Z organ'. The vagina about one-half of the corresponding body-width long and opening through conspicuous a vulva at 48-53% of total body-length from the anterior extremity.

Tail conoid-digitate, 1.1-1.7 times of the anal body-width long and provided with 2-3 papillae on each side.

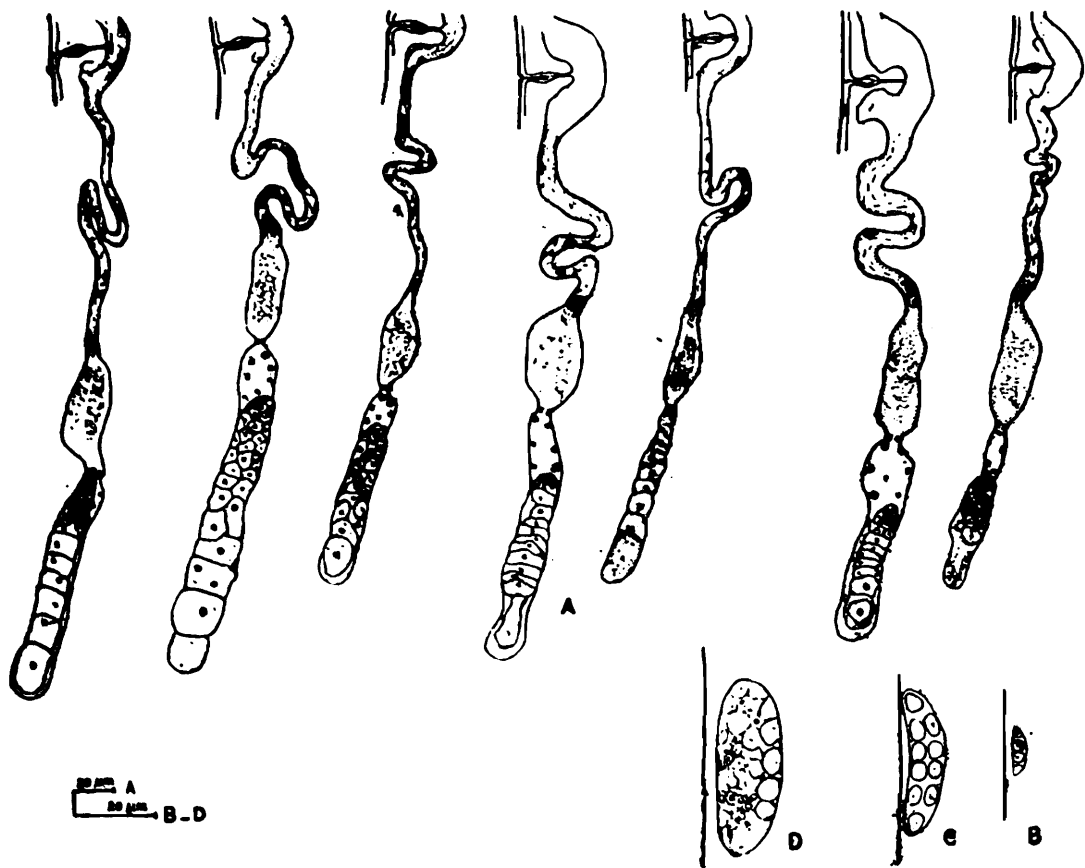
Male: Males resemble the females except for the more curvature at their posterior ends. Spicules well developed, ventrally arcuate and cephalated. Lateral guiding pieces 16 μm long. Supplements consist of an adanal pair and a series of 3-5 ventromedians which are spaced as shown in Text-fig. 9, H.

Tail conoid, ending in a digitate terminus. It is about 1.5 times of the anal body-width long and provided with two papillae on either side.

Juveniles: The various juvenile stages differ from one another in total body length, in lengths of functional and replacement odontostyles, position of fixed guiding ring from the anterior extremity, values of c and c' ratios and tail shape.

Hosts and localities: Soil around roots of *Cirtus limnoia* from Jawahar Park, Aligarh.

Remarks: Siddiqi (1959) described this species from the roots of citrus from Aligarh, India. Yadav & Varma (1967) reported its frequent occurrence in Rajasthan in association with fruit-trees. It is also found in some other countries, e.g., Sudan (Yassin, 1974), Sri Lanka, Mexico, Rhodesia (Cohn & Sher, 1972).



Text-fig.10.—*Xiphinema basiri* Siddiqi: (A) Female posterior sexual branches. (B-D) Genital primordia of L_2 , L_3 & L_4 respectively.

Xiphinema basiri is closely related with *X. coxi* Tarjan, 1964 and *X. ifacolum* Luc, 1961. Cohn & Sher (l.c.) synonymised *X. ifacolum* with *X. basiri* owing to overlapping values of L , a , b , c , V , length of spear and tail shape and in the presence of 'Z' organ. Luc & Dalmasso (1975) rejected this synonymy on the basis of differences in 'Z' organs (*X. ifacolum* has a 'Typical Z organ' while *X. basiri* a 'pseudo Z Organ'), and the structure of the tail tip of the two species (in *X.*

ifacolum the inner surface of the tail tip forms a thin and regular blind canal surrounded apically by a thin muff but in *X. basiri* the tail tip is without a large conical blind canal or any apical muff). *X. bastri* and *X. coxi* differ only in the position of vulva ($V=40-44$ in *X. coxi* and $48-53$ in *X. basiri*) with range showing some overlap in the two species (cf. Cohn & Sher, l.c.). It is quite possible that the two species may be synonyms.

This species causes galling of the root of tomato (cf. Roy, 1974 & Bajaj & Jairajpuri, 1979) and is known to transmit cowpea mosaic virus in Western Nigeria (cf. Caveness *et al.*, 1975).

12. *Xiphinema index* Thorne & Allen

(Text-fig. 11, A-H)

1950. *Xiphinema index*: Thorne & Allen, *Proc. helminth. Soc. Wash.*, 17 : 27.

1961. *Xiphinema index*: Thorne, *Principles of Nematology*: 489.

1973. *Xiphinema index*: Southey, In *The Longidoridae*: 45.

Dimensions: 10♀♀: $L=2.9-3.4$ mm; $a=51-65$; $b=6.9-8.0$; $c=67-88$; $V=38-41$; $G_1=8-13$; $G_2=8-13$; $c'=1.1-1.2$; Anterior end to spear guide ring= $118-121$ μm ; Odontostyle= $123-132$ μm ; Odontophore= $75-81$ μm ; $DO=7-10$; $DN=10-14$; $RS_1N=55-68$; $LS_1N=55-68$; $S_2O=75-85$.

$4L_2$: $L=1.1-1.2$ mm; $a=40-46$; $b=3.9-4.2$; $c=21-27$; c' =Anterior end to spear guide ring= $55-59$ μm ; Functional odontostyle= $62-66$ μm ; Replacement odontostyle= $83-85$ μm ; Odontophore= $46-48$ μm ; $DO=10$; $DN=10$; $RS_1N=47$; $LS_1N=47$; $S_2O=79$.

$1L_3$: $L=1.6$ mm; $a=55$; $b=4.3$; $c=35$; $c'=?$; Anterior end to spear guide ring= 79 μm ; Functional odontostyle= 92 μm ; Replacement odontostyle= 106 μm ; Odontophore= 55 μm ; $DO=11$; $DN=13$; $RS_1N=42$; $LS_1N=48$; $S_2O=80$.

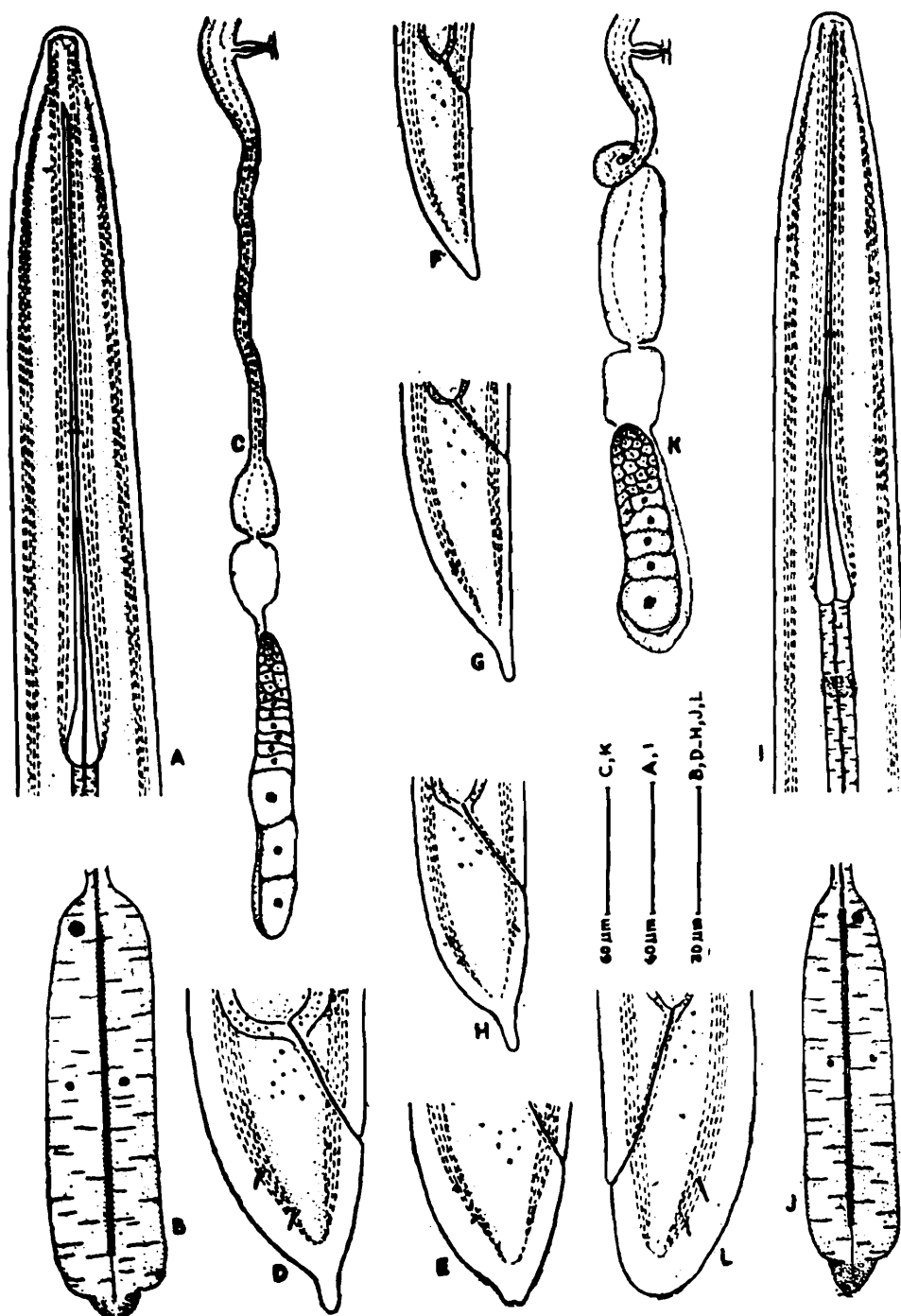
$6L_4$: $L=1.9-2.3$ mm; $a=55-62$; $b=4.6-4.9$; $c=45-48$; $c'=?$ Anterior end to spear guide ring= $90-92$ μm ; Functional odontostyle= $108-110$ μm ; Replacement odontostyle= $128-132$ μm ; Odontophore= $61-65$ μm ; $DO=8-11$; $DN=9-14$; $RS_1N=45-55$; $LS_1N=45-55$; $S_2O=75-84$.

Description: Female: Body long and slender with tapering anterior and rounded posterior extremity. Cuticle in 2 layers, inner one being thicker than the outer. Fine radial striae clearly visible on tail. Lateral chords about $1/4$ th of the body-width near middle.

Lip region rounded, slightly offset. Amphids stirrup-shaped with slit-like apertures which are nearly $3/5$ th of the labial-width and are located at the base of lip region. Odontostyle 8-9 labial-widths long,

odontophore nearly $1/1.6$ th of the odontostyle length. Fixed guiding ring is at 8 labial-widths from the oral aperture.

Basal bulb of oesophagus 2.0-2.5 times of the corresponding body-width and 25% of neck length long. Position of oesophageal gland nuclei and their orifices as given above. Cardia short and conoid. Nerve ring surrounding the anterior slender part of oesophagus at 1-2 labial widths from the base of odontophore. Prerectum about 9 anal body-widths long and is distinguishable from intestine in being narrow and



Text-fig. 11.—A-H *Xiphinema index* Thorne & Allen: (A) Anterior extremity. (B) Oesophageal bulb. (C) Female posterior sexual branch. (D & E) Female tails. (F-H) Tails of L_2 , L_3 & L_4 respectively. I-L *Xiphinema arcum* Khan: (I) Anterior extremity. (J) Oesophageal bulb. (K) Female posterior sexual branch. (L) Female tail.

in having fewer granules in its cells. Rectum about one anal body-width long.

Genital tract amphidelphic, each sexual branch consisting of a reflexed ovary, distal narrow and proximal expanded parts of oviduct, a distinct sphincter followed by distal expanded and proximal convoluted portions of uterus. Vagina about one-half of the corresponding body-width long. Vulva is at 38-41% of total body length from the anterior extremity.

Tail short, dorsally convex, ventrally almost straight or slightly convex with a mammillate peg, about one anal body-width long and provided with 2-3 papillae on each side.

Male: Not found.

Juveniles: The various juvenile stages differ from one another in body lengths, length of odontostyles (both functional and replacement), position of fixed guiding ring from the anterior extremity, value of c and c' ratios and in tail shape. Tail in L_2 is long, in L_3 is less thinner and with a digitate terminus while in L_4 it is short and conoid with a mammillate terminus.

Host and locality: Soil around roots of *Pyrus malus* from Ladakh Road, near university campus, Srinagar, Jammu & Kashmir.

Remarks: This species was first described by Thorne & Allen (1950) from soil around the roots of *Ficus carica* from California, U.S.A., but was later reported from many other parts of the world. Its distribution is closely related to that of its most important host, grapevine. So far it is known to occur in U.S.A., Argentina, Chile, France, Germany, Hungary, Italy, Greece, Turkey, Iran, Iraq, Israel, and North Africa. Mukhopadhyaya & Haque (1974) doubtfully mentioned its occurrence in West Bengal, India and it is here reported for the first time from Jammu & Kashmir, India.

This species is closely related to *X. basilgoodeyi* Coomans, 1964. The two species differ in the position of vulva ($V=38.0-42.5$ in *X. index* and $43.5-52.0$ in *X. basilgoodeyi*).

This species is historically important because it was the first nematode which was demonstrated to act as vector of soil-borne viruses by Hewitt *et al.* (1958) who proved that this species transmits grapevine fanleaf virus. As an ectoparasite it reduces the growth of grapevine and causes darkening of its roots (Cohn & Orion, 1970).

13. *Xiphinema arcum* Khan

(Text-fig. 11, I-L)

Dimensions: 1♀: L=2.2 mm; a=50; b=5.4; c=76; V=35.6; $G_1=9.2$; $G_2=15$; $c'=?$; Anterior end to spear guide ring=90 μm ; Odontostyle=110 μm ; Odontophore=70 μm ; DO=12.5; DN=12.5; $RS_1N=52$; $LS_1N=52$; $S_2O=83$

Description: Female: Body long and slender with tapering anterior end and rounded posterior extremity. Cuticle in 2 layers, thickest in the region of lips and on tail. Fine radial striae clearly visible on tail. Lateral chords about 1/3rd of the body-width near middle.

Lip region rounded, only slightly offset. Amphids stirrup-shaped with slit-like apertures which are nearly one-half of the labial-width and are located at the base of lip region. Odontostyle 9 labial-widths long, odontophore nearly 1/1.5th of the odontostyle length. Fixed guiding ring is at 7.5 labial-widths from the oral aperture.

Basal bulb of the oesophagus twice the corresponding body-width and 20% of neck length long. Position of oesophageal gland nuclei and their orifices as given above. Cardia short and conoid. Nerve ring surrounding the anterior slender part of oesophagus at about 2 labial-widths from the base of odontophore. Prerectum indistinguishable from intestine. Rectum twice the anal body-width long.

Genital tract amphidelphic, anterior sexual branch and anterior ovary shorter than the posterior sexual branch. Each sexual branch consists of a reflexed ovary, distal narrow and proximal expanded parts of oviduct, a distinct sphincter followed by expanded and narrow portions of uterus. Vagina about one-half of the corresponding body-width long. Vulva is at 35% of total body length from the anterior extremity.

Tail short, hemispheroid, about one anal body-width long and provided with 2 papillae on each side.

Male; Not found.

Host and locality: Soil around roots of *Aegle marmelos* from Ranikhet, U.P.

Remarks: Khan (1964) described 'Z' organ in each sexual branch but did not show in the figures. Actually, no 'Z' organ is present in the sexual branches of the holotype that was studied by the present authors. Also, Khan described two pairs of subventral gland nuclei but only one, the first pair is present and the second pair of subventral glands is represented only by their orifices as is typical of all the *Xiphinema* species.

This species is closely related to *Xiphinema hygrophilum* Southey & Luc. 1973 from which it differs in having longer body (L=1.8 mm

in *X. hygrophilum*) and shorter odontostyle (odontostyle=150 μm in *X. hygrophilum*).

This species is so far reported from India only.

14. *Xiphinema ensiculiferum* (Cobb)

(Text-fig. 12, A-D)

1893. *Tylencholaimus ensiculiferus*: Cobb, *Macleay Mem. Vol., Linn. Soc. N. S.W.* : 252.
 1937. *Xiphinema ensiculiferum*: Thorne, *Proc. helminth. Soc. Wash.*, 4 : 14.
 1939. *Xiphinema ensiculiferum*: Thorne, *Capita Zool.* 8 : 111.
 1972. *Xiphinema ensiculiferoides*: Cohn & Sher, *J. Nematol.*, 4 : 50.
 1973. *Xiphinema ensiculiferoides*: Yeates, *N. Z. Jl. Sci.*, 15 : 673.
 1973. *Xiphinema ensiculiferum*: Southey & Luc, *Nematologica*, 19 : 294.

Dimensions: 6♀♀; L=1.6-1.9 mm; a=29-42; b=3.8-4.2; c=66-84; V=30-34; G₂=8-16; c'=0.5-0.8; Anterior end to spear guide ring=116-132 μm ; Odontostyle=138-151 μm ; Odontophore=66-74 μm ; DO=9-15; DN=13-16; RS₁N=47-53; LS₁N=47-53; S₂O=75-81.

Description: Female: Body upon fixation almost straight, cylindrical except for the slight tapering towards lip region. Cuticle in 2 layers, thickest in the tail region. Lateral chords about 1/4th of the body-width near middle.

Lip region flat, continuous with the rest of body. Amphids stirrup-shaped with slit-like apertures which are nearly 3/5th of the labial-width. Odontostyle 10-12 labial-widths long, odontophore about half of the odontostyle length. Fixed guiding ring is at 9-10 labial-widths from the oral aperture.

Basal bulb of oesophagus about 1.5 times of the corresponding body-width and about 15% of neck length long. Position of oesophageal gland nuclei and their orifices as given above. Cardia short and conoid. Nerve ring surrounding the anterior slender part of oesophagus at about one labial-width from the base of odontophore. Prerectum about 7 anal body-widths long and is distinguishable from intestine in having fewer granules in its cells. Rectum about one anal body-width long.

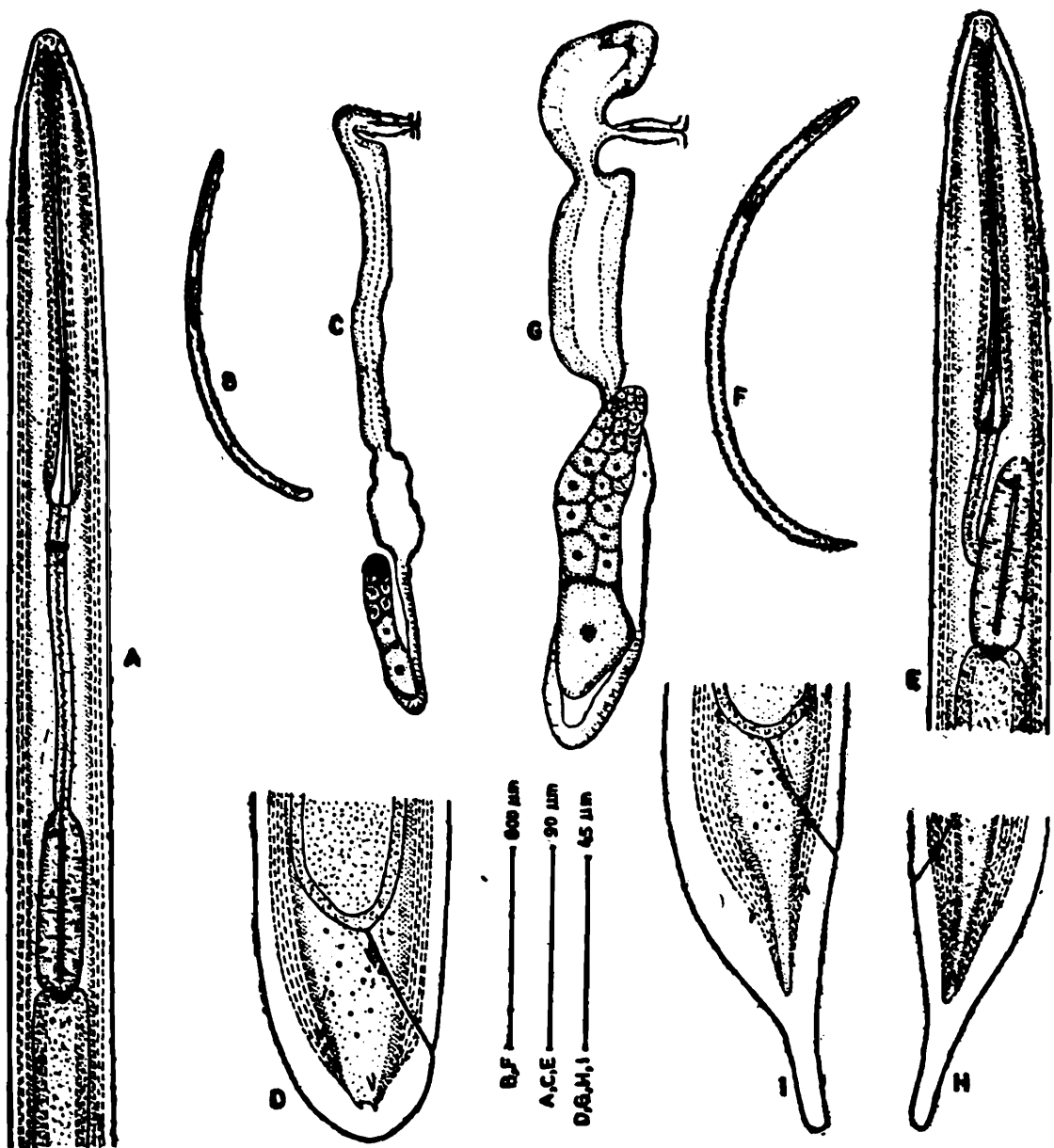
Genital tract mono-opisthodelphic, anterior sexual branch completely absent. Posterior sexual branch consists of a reflexed ovary, distal narrow and proximal expanded parts of oviduct, a distinct sphincter and a uterus. Vagina is less than one-half of the corresponding body-width long. Vulva is at 30-34% of total body length from the anterior extremity.

Tail hemispheroid, 0.5-0.8 times of the anal body-width long and provided with 2 papillae on each side.

Male: Not found.

Host and locality: Soil around roots of *Artocarpus heterophyllus* from Trivandrum, Kerala.

Remarks: This species was first described as *Tylencholaimus ensiculiferus* by Cobb (1893). Thorne (1937) transferred it to *Xiphinema*. Due to the loss of type material there was some uncertainty regarding the degree of reduction of anterior sexual branch as given in the original drawings and description by Cobb. Loos (1949) and Williams (1959) described populations of *Xiphinema* having tail similar to *X. ensiculiferum* and anterior sexual branch reduced to an undifferentiated sac as *X. ensiculiferum*. Luc (1961) redescribed this species from a population collected from Ivory Coast. These specimens possess two sexual branches, both having ovaries, the anterior branch being shorter



Text-fig.12.—A-D *Xiphinema ensiculiferum* (Cobb): (A) Oesophageal region (B) Entire female. (C) Female genital tract. (D) Female tail. E-I *Xiphinema radiculicola* Goodey: (E) Oesophageal region. (F) Entire female. (G) Female genital tract. (H & I) Female tails.

than the posterior one. Cohn & Sher (1972) defined this species as having two complete sexual branches and also proposed a closely related new species *X. ensiculiferoides* based on the specimens collected from Hawaii which have only posterior sexual branch and no trace of an anterior sexual branch. They also synonymised *X. ensiculiferum* apud Loos and *X. ensiculiferum* apud Williams with *X. krugi* Lordello, 1955 which also has a reduced undifferentiated anterior sexual branch. *X. ensiculiferoides* was accepted valid by Yeates (1973) and Roy & Gupta (1974). Southey & Luc (1973) redefined *X. ensiculiferum* on the basis of topotypes and designated a new neotype of this species. Specimens of this population lack anterior sexual branch and so they synonymised *X. ensiculiferoides* with *X. ensiculiferum*. They also proposed two new species, viz., *X. loosi* ($\Rightarrow$ *X. ensiculiferum* apud Loos, 1949 and Williams, 1959) and *X. hygrophilum* ($\Rightarrow$ *X. ensiculiferum* apud Luc, 1961 and Cohn & Sher, 1972). These three species differ from one another in the degree of reduction of anterior sexual branch (completely absent in *X. ensiculiferum*, reduced to undifferentiated sac in *X. loosi*, and though reduced but differentiated and with an ovary in *X. hygrophilum*) and in tail shape (tail completely hemispherical without internal mucro in *X. ensiculiferum* and *X. hygrophilum* and somewhat conoid with an internal mucro in *X. loosi*).

The specimens from India resemble the topotypes described by Southey & Luc (l.c.) differing from it in having smaller spear (total spear length=224-238 μ m in topotypes) and in complete absence of anterior uterine sac (very short uterine sac has been shown in the drawings given by Southey & Luc).

This species has so far been recorded from Fiji (Southey & Luc), Philippines (Cohn & Sher) and New Herbrides (Yeates) and is here reported for the first time from India.

15. *Xiphinema radiculicola* Goodey

(Text-fig. 12, E-I)

- 1936. *Xiphinema radiculicola*: Goodey, *J. Helminth.*, 14 : 69.
- 1939. *Xiphinema radiculicola*: Thorne, *Capita Zool.*, 8 : 109.
- 1949. *Xiphinema radiculicola*: Loos, *J. zool. Soc. India*, 1 : 26.
- 1963. *Xiphinema radiculicola*: Goodey, *Soil and freshwater nematodes*; 447.
- 1971. *Xiphinema australiae*: McLeod & Khair, *Nematologica*, 17 : 58.
- 1971. *Xiphinema radiculicola*: McLeod & Khair, *Nematologica*, 17 : 64.

Dimensions: Jorhat sugar cane population: 5♀♀: L=2.1-2.3 mm; a=38-42; b=8.3-10.2; c=38-42; V=23-24; G₂=10-13; c'=1.4-2.0; Anterior end to spear guide ring=85-90 μ m; Odontostyle=96-101 μ m;

Odontophore=63-66 μm ; **DO**=8-11; **DN**=10-13; **RS₁N**=42; **LS₁N**=42; **S₂O**=78-82.

Manipur population: 10♀♀: **L**=2.0-2.4 mm; **a**=35-46; **b**=7.2-11.2; **c**=36-46; **V**=23-26; **G₂**=8-15; **c'**=1.4-2.0; Anterior end to spear guide ring=84-92 μm ; Odontostyle=96-101 μm ; Odontophore=62-66 μm ; **DO**=8-12; **DN**=9-14; **RS₁N**=40-43; **LS₁N**=41-46; **S₂O**=76-83.

Description: Female: Body slightly ventrally curved with tapering extremities. Cuticle in 2 layers, thickest on tail. Lateral chords about 1/4th of body-width near middle.

Lip region flat, continuous with the rest of body. Amphids stirrup-shaped with slit-like apertures which are nearly 3/5th of the labial-width. Odontostyle 9 labial-widths long, odontophore nearly 1/1.6th of odontostyle length. Fixed guiding ring is at about 8 labial-widths from the oral aperture.

Basal bulb of oesophagus about 1.6 times of the corresponding body-width and 26% of neck length long. Position of oesophageal gland nuclei and their orifices as given above. Cardia short and conoid. Nerve ring surrounding the anterior slender part of oesophagus at about 2 labial-widths from the base of odontophore. Prerectum 15 times of the anal body-width long. Rectum about one anal body-width long.

Genital tract mono-opisthodelphic, anterior sexual branch reduced to a sac-like structure, its length about 1/3rd of the corresponding body-width. In one specimen this sac-like structure is completely missing. Posterior sexual branch consists of a reflexed ovary, distal narrow and proximal expanded parts of oviduct, a sphincter and a uterus. Vagina is thick-walled and may be inclined posteriorly. Vulva is far forward, at 23-26% of total body length from the anterior extremity.

Tail dorsally convex-conoid, ventral surface being almost straight ending in a digitate terminus, 1.5-2.0 times of the anal body-width and provided with 2-3 papillae on each side.

Male: Not found.

Hosts and localities: Soil around roots of *Saccharum officinarum* from Jorhat, Assam, and from around unidentified plants from Manipur.

Remarks: The present specimens from India and those described by Loos (1949) from Sri Lanka are slightly different from the type specimens described by Goodey (1936) from Java, and also from those by McLeod & Khair (1971) from New Wales. The lip region is well offset and the tail is tapering gradually to a conoid terminus with equal dorsal and ventral curvature in the type specimens whereas in our specimens and those described by Loos the lip region is not offset and the tail is more or less straight on the ventral surface with a sharp

curvature on the dorsal side. They are also more robust ($a=52-67$ in type specimens), and have a more anteriorly located vulva ($V=27-30\%$ in type specimens).

Xiphinema radiculicola is closest to *X. monohysterum* Brown, 1968, *X. chambersi* Thorne, 1939 and *X. australiae* McLeod & Khair, 1971. These species differ from one another in the length of body, position of vulva, length of spear and in values of c and c' ratios. However, as indicated by Cohn & Sher (1972) all these biometric characters overlap in different populations of these species and there are no clear-cut differences on the basis of which they can be differentiated. Between *X. australiae* and *X. radiculicola* only the length of spear is slightly different ($199-210\ \mu\text{m}$ in *X. australiae*), but as shown by Cohn & Sher it may vary in *X. radiculicola* from $136-180\ \mu\text{m}$ in syntypes that were studied by them. At the moment it seems best to accept the synonymy of *X. australiae* with *X. radiculicola* as also suggested by Luc & Dalmasso (1975) unless proved otherwise.

This species has already been reported from Java, Australia and Sri Lanka and is here reported for the first time from India.

16. *Xiphinema brasiliense* Lordello

(Text-fig. 13)

1951. *Xiphinema brasiliense*: Lordello, *Bragantia*, 11 : 87.

1962. *Xiphinema itanhaense*: Carvalho, *Archos. Inst. biol. Paulo*, 29 : 223.

1972. *Xiphinema brasiliense*; Cohn & Sher, *J. Nematol.*, 4 : 40.

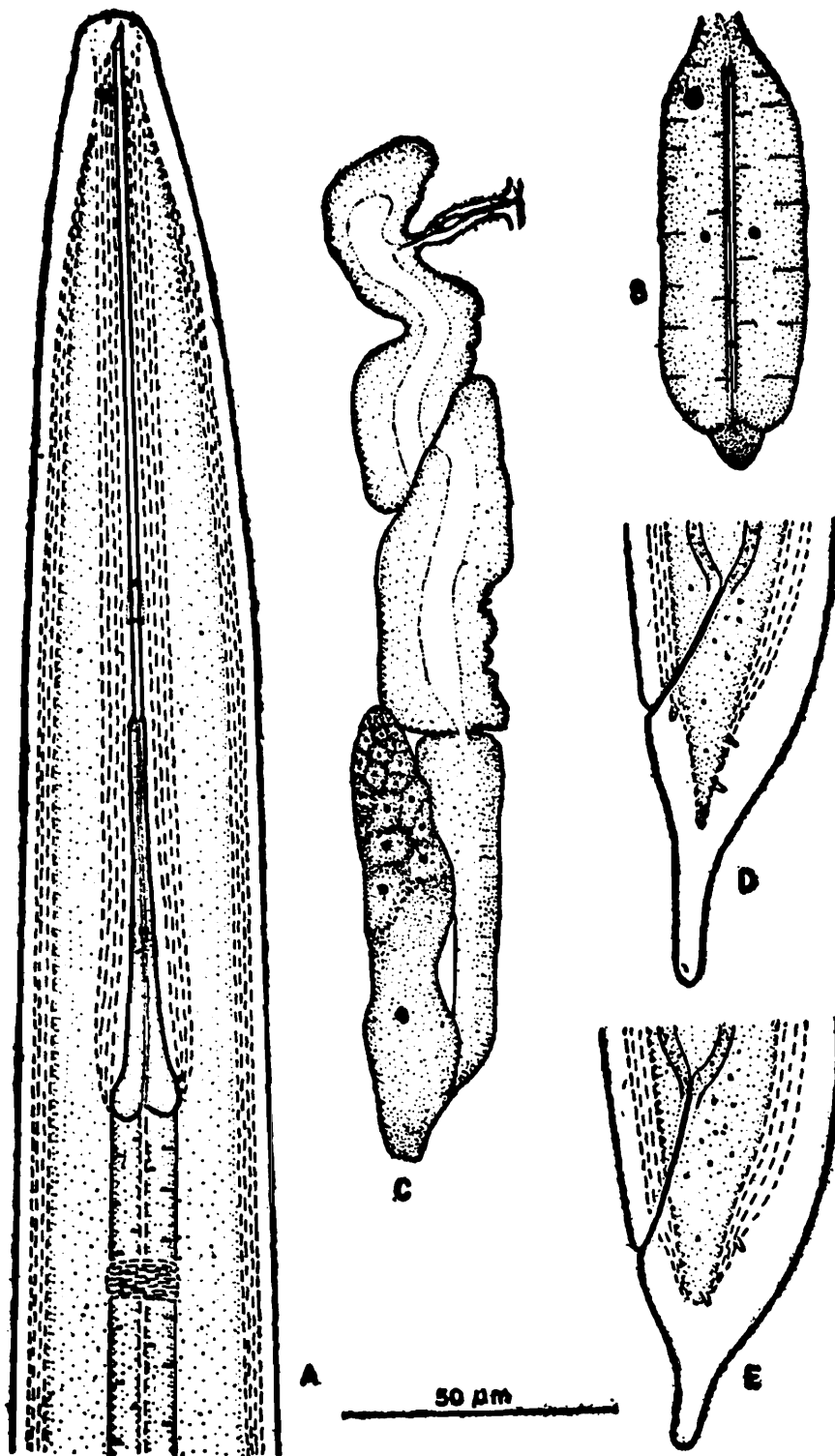
Dimensions: 4♀♀: $L=2.1-2.3\ \text{mm}$; $a=35-42$; $b=5.4-5.8$; $c=45-60$; $V=23.8-25.6$; $G_2=8-18$; $c'=1.2-1.5$; Anterior end to spear guide ring= $106-115\ \mu\text{m}$; Odontostyle= $130-136\ \mu\text{m}$; Odontophore= $68-76\ \mu\text{m}$; $DO=9-11$; $DN=13-16$; $RS_1N=49-50$; $LS_1N=49-50$; $S_2O=74-80$.

Description: Female: Body only slightly ventrally curved upon fixation, cylindrical except for slight tapering towards the extremities. Cuticle in 2 layers, thickest on tail. Lateral chords about 1/4th of the body-width near middle.

Lip region rounded, slightly set off from the rest of body. Amphids stirrup-shaped with slit-like apertures which are nearly 3/5th of the labial-width. Odontostyle 10-12 labial widths long, odontophore 1/1.9 of the odontostyle length. Fixed guiding ring is at about 9 labial-widths from the oral aperture.

Basal bulb of oesophagus about 1.5 times of the corresponding body-width and about 20% of neck length long. Position of oesophageal gland nuclei and their orifices as given above. Nerve ring surrounding

the anterior slender part of oesophagus at about 2 labial-widths from the base of odontophore. Prerectum indistinguishable from the intestine. Rectum about one anal-body width long.



Text-fig.13.—*Xiphinema brasiliense* Lordello: (A) Anterior extremity. (B) Oesophageal bulb. (C) Female genital tract. (D & E) Female tails.

Genital tract mono-opisthodelphic, anterior sexual branch completely absent. Posterior sexual branch consists of a reflexed ovary, distal narrow and proximal expanded parts of oviduct, sphincter and expanded and narrow portions of uterus. Vagina is about one-half of the corresponding body-width long. Vulva is at 24-26% of total body length from anterior extremity.

Tail rounded-digitate with both the dorsal and ventral surfaces convex, about 1.2-1.5 anal body-widths long and provided with 2 papillae on each side.

Male: Not found.

Host and locality: Soil around the roots of tea plants from Darjeeling.

Remarks: This species was first described by Lordello (1951) from around the roots of potato from Brazil. Carvalho (1962) reported a new species, *X. itanhaense* from Brazil which was later synonymised with *X. brasiliense* by Cohn & Sher. (1972).

This species is closely related to *X. radiculicola* Goodey, 1936 from which it differs only in having differently shaped tail (tail with convex ventral surface in *X. brasiliense*, ventral surface straight or concave in *X. radiculicola*).

X. brasiliense has already been reported from Brazil, Guatemala and Sri Lanka and is here reported for the first time from India.

DISTRIBUTION OF *XIPHINEMA* SPECIES IN INDIA

Species of *Xiphinema* are widespread in India which is evident from the fact that these species were found from all the regions of the country that were surveyed in the present study. In 27% of all the samples collected, species of this genus were present. This genus is very common in Jaipur where 75% of the samples yielded three species, viz., *X. americanum*, *X. basiri* and *X. insigne*. This does not agree with the observations of F. A. Khan & A. M. Khan (1972) who failed to collect the species of *Xiphinema* from this district. The genus is on the other hand rare in Jammu, Garhwal, and Pilibhit and was found in only 10% of the samples collected from these places. At other places, it was usual to find it in 20-40% of the samples. The species of this genus are polyphagous and usually attack fruit trees (71%). The flowering plants (9%) and cereals (20%) were also found to harbour *Xiphinema* species.

Xiphinema species differ in their distribution in this country. While some species are widely distributed the others are less frequent and some are restricted to a particular region. *X. insigne* and *X. americanum* are most commonly occurring species present in 37% and 24% of the samples respectively that were positive for *Xiphinema* species. *X. insigne* was collected from soil around the roots of a variety of plants from banks of hot-water sulphur springs, marshy land, foot-hills, hills as well as from the plains. Some of these regions from where *X. insigne* was recorded have temperature below 0°C in winter while in other regions it may rise to 40-45°C during summer. It clearly gives an impression of the temperature tolerance limit of this species. In some

samples its population constituted 90-95% of total nematode fauna. It usually attacks fruit trees (74% in the present study) but is also occasionally found associated with the roots of flowering plants (7%), grasses and other seasonal crops (19%). Although widely distributed elsewhere it is rare in Jammu & Kashmir where only 8% of the samples were positive for this species. However, in Pithoragarh it was the only species of the genus that was found during the survey. There are two distinct morphological forms of this species: *indicum*-form and *insigne*-form (Bajaj & Jairajpuri, 1977). While *insigne*-form is restricted to certain areas of high altitude of India, viz. Rajpur (Dehra Dun), Palampur and Manipur, *indicum*-form is widespread, including in the hills.

Xiphinema americanum is also widespread in India. It was recorded from nearly all the regions that were surveyed except Pithoragarh and was found in the soils collected from marshy places, plains, foot-hills and hills. This species is usually found in heavy populations and occasionally constitutes 95% of total nematode population. It is more common around fruit trees (74%) less around flowering (12%) and seasonal crops and grasses (14%). However, in a soil sample from around roots of ornamental plants at Nishat gardens, Srinagar it occurred in very heavy population. In Western Uttar Pradesh also it is common around the roots of citrus and other fruit trees.

Other species of *americanum*-group that were recorded are *X. brevicolle*, *X. opisthohysterum*, *X. inaequale*, *X. lambertii* and *X. neoamericanum*. Of these, *X. opisthohysterum* and *X. inaequale* are more common in India. *X. opisthohysterum* is also common in soil around the roots of fruit trees in Bareilly, Pilibhit and Nainital districts of Uttar Pradesh and constituted 43%, 50% and 20% respectively of the samples positive for the presence of *Xiphinema* species. This species was not found in any sample collected from other parts except for a single instance when it was present around the roots of citrus at Aligarh. *X. inaequale* was found only from high altitudes around grasses and forest and fruit trees. *X. lambertii* was present in the soil samples collected from Rajpur and Bareilly attacking *Cajanus cajan* and some wild plants. *X. neoelongatum* was collected from soil around the roots of *Psidium guajava* at Ambala (Punjab). *X. brevicolle* was collected from around the roots of grasses from Dalhousie.

The large-sized species like *X. basiri* and *X. index* are less common. They were found in 20 and 9% of the samples positive for *Xiphinema*. *X. basiri* is common in plains and in the samples collected at Jammu, Jaipur, Aligarh, Bareilly, Dehra Dun, Saharanpur, but was absent in the samples from high altitude, e.g., Manipur, Chamba, Dalhousie, Srinagar, Mussorie (Dehra Dun). It usually attacks fruit-trees (77%) and is only seldom found around other plants. *X. index* which is here

reported for the first time from India was found only from soil around roots of apples from Srinagar.

Xiphinema orbum was present in two samples from Bareilly attacking *Zea mays* and wild plants. This species is perhaps restricted in its distribution. *X. luci* was found around the roots of *Phaseolus aureus* from Ajmer, Rajasthan. *X. elongatum* was found in the soil around the roots of flowering plants in Shahjahanpur, U. P.

Three monodelphic species of *Xiphinema*, viz. *X. radiculicola*, *X. ensiculiferum* and *X. brasiliense* have been reported here for the first time from India. *X. radiculicola* is very common in Manipur (27% of the samples positive for *Xiphinema* species) and attacks fruit trees. This species was not found in any other region of the country. *X. ensiculiferum* was collected [from around the roots of *Artocarpus heterophyllus* from Trivandrum only, and *X. brasiliense* from around roots of tea plants from Darjeeling.

SUMMARY

In the present work an account is given of the morphology and systematics of *Xiphinema* species. The validity of the groups/subgenera proposed by Dalmasso (1969), Cohn & Sher (1972), Southey (1973) and Roy & Gupta (1974) has been discussed and the species of this genus have been re-arranged in 5 groups, viz. *americanum*-group, *elongatum*-group, *chambersi*-group, *rotundatum*-group, and *radiculicola*-group. The descriptions of all the species of *Xiphinema* so far recorded from India based on the type material and or fresh material collected from different parts of this country (mainly from Uttar Pradesh, Himachal Pradesh, Rajasthan, Jammu & Kashmir, Arunachal Pradesh, etc.) during the last several years have been provided and their distribution given. The description of each species is followed by a detailed discussion on its relationships, geographical distribution, economic importance, etc. In all, the following 15 known species were recorded: *X. americanum* Cobb, 1913, *X. brevicolle* Lordello & Da Costa, 1961, *X. opisthohysterum* Siddiqi, 1961, *X. inaequale* Khan & Ahmad, 1975, *X. elongatum* Schuurmans-Stekhoven & Teunissen, 1938, *X. lambertii* Bajaj & Jairajpuri, 1976, *X. neoelongatum* Bajaj & Jairajpuri, 1976, *X. insigne* Loos, 1949, *X. orbum* Siddiqi, 1964, *X. basiri* Siddiqi, 1959, *X. index* Thorne & Allen, 1950, *X. acrum* Khan, 1964, *X. ensiculiferum* Cobb, 1893) Thorne, 1937, *X. radiculicola* Goodey, 1936 and *X. brasiliense* Lordello, 1951. While *X. index* was previously recorded in West Bengal doubtfully (Mukhopadhyaya & Haque, 1974), *X. ensiculiferum*, *X. radiculicola* and *X. brasiliense* are first records of monodelphic species from India. The males of *X. opisthohysterum* and *X. inaequale* have monorchic and triorchic gonads respectively. In addition to the already

known species, *X. luci*, a new species was also found during the course of investigations. This new species is described in detail along with its diagnostic characters and relationships.

The synonymy of *X. australiae* McLeod & Khair, 1971 with *X. radicicola* and *X. neoamericanum* Saxena *et al.*, 1973 with *X. americanum* is proposed.

X. insigne, *X. americanum* and *X. basiri* are the widespread species in this country, while *X. ensiculiferum*, *X. arcum*, *X. luci*, *X. brasiliense* and *X. neoelongatum* are very much restricted in their distribution. The other species are also fairly distributed.

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ON THE COLEOPTEROUS SUBFAMILY LANGURIINAE FROM INDIA

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Arrow (1925) was the first author who revised the Indian Languriidae and divided the family into two subfamilies Languriinae and Cladoxeninae. Subsequent workers followed the classification of Arrow (1925). Crowson (1955) added two subfamilies Pharaxonothinae and Setariolinae to it. Sengupta and Crowson (1969, 1971) transferred several genera from the families Cryptophagidae and Erotylidae to Languriidae and introduced a modified classification of the family Languriidae, which is as follows:—

Family	LANGURIIDAE Wiedemann
Subfamily	LANGURIINAE Arrow
Tribe	Languriini (=Languriinae Arrow)
Tribe	Cladoxenini (=Cladoxeninae Arrow)
Tribe	Thallisellini Sengupta
Subfamily	LOBERINAE Bruce
Tribe	Loberonothini Sengupta and Crowson
Tribe	Pharaxonothini Sengupta and Crowson
Tribe	Loberini Sengupta
Subfamily	TORAMINAE Sengupta
Subfamily	SETARIOLINAE Crowson
Subfamily	CRYPTOPHILINAE Casey
Tribe	Cryptophilini Casey
Tribe	Xenoscelinini Sengupta and Crowson

In the present study only subfamily Languriinae have been dealt with. Since Arrow (1925), no body has dealt with seriously on Languriidae from India. Recently, Sengupta and Mukherjee (in press) described a new genus and a species of Languriidae from West Bengal. The present study is based on the collections made by various survey parties from the Department of Zoological Survey of India during the period from 1917 to 1975. The chief collectors were S. Kemp (Assam, 1917), S. L. Hora (Darjeeling, 1930), H. S. Pruthi (Uttar Pradesh, 1933), B. S. Lamba (Uttar Pradesh, 1958), A. G. K. Menon (Sikkim, 1959), K. C. Jayaram (Arunachal Pradesh, 1961), B. Nath (Andhra Pradesh,

1962), A. N. T. Joseph (Arunachal Pradesh, 1966), S. K. Tandon (Arunachal Pradesh, 1969), T. Sengupta (Darjeeling, 1971; Tamil Nadu and Karnataka, 1971 : North East India Survey, 1974 and North Western India Survey, 1975), P. K. Maiti (Darjeeling, 1973) and J. K. Jonathan (Darjeeling, 1974).

The collection comprises 24 species in 7 genera. Of these nineteen species are recorded for the first time from different states of India.

LIST OF SPECIES

Tribe Languriini

1. *Macromelea longicornis* (Wiedemann)
2. *Pachylanguria elongata* (Fowler)
3. *P. variiventris* (Kraatz)
4. *P. tumidicollis* (Kraatz)
5. *P. cuprea* Arrow
6. *Pentelanguria elateroides* Crotch
7. *Doubledaya atripennis* Arrow
8. *D. schenklingi* (Fowler)
9. *D. severini* Fowler
10. *Anadastus laticornis* Arrow
11. *A. flavimanus* Arrow
12. *A. dohertyi* Arrow
13. *A. capitatus* Gorham
14. *A. ochreipennis* Fowler
15. *A. filiformis* (Fowler)
16. *A. densus* Arrow
17. *A. bifasciatus* Motschulsky
18. *A. nigriventris* (Motschulsky)
19. *Caenolanguria assamensis* (Fowler)
20. *C. andamanica* Arrow
21. *C. birmanica* (Harold)
22. *Languriiphasma laeta* Arrow
23. *L. discoidalis* (Fowler)

Tribe Cladoxenini

24. *Paracladoxena bipustulata* Fowler

Tribe Languriini

1. *Macromelea longicornis* (Wiedemann)

1823. *Languria longicornis* Wiedemann, Zool. Mag., ii, 1 : 48.

1925. *Macromelea longicornis* : Arrow, Fauna Brit. India, *Clavicornia* : ~~Eg-~~
tylidae, Languriidae and Endomychidae, London : 251.

Material : Andhra Pradesh : 13 ex., Nagarjunkonda, Guntur Dist., 7. IX. 1962, B. Nath Coll.

Remarks : So far, this species was reported from Tamil Nadu, and Karnataka, and also from Sri Lanka. Now it is being reported for the first time from Andhra Pradesh.

The monotypic genus *Macromelea* is confined to South India and Sri Lanka. This genus can be easily distinguished by the following characters. General appearance narrowly elongate with slender antennae and legs. Dorsal surface of head and prothorax red, and elytra blue-black and shiny. Male is larger than female, joint 3 of antenna distinctly larger than joint 4, club 3-jointed and poorly developed, elytral epipleura well defined and extended upto the apex, eyes coarsely faceted; length 14 to 25 mm.

2. *Pachylanguria elongata* (Fowler)

1801. *Trogosita elongata* Fowler, *Syst. Eleuth.* 1 : 152

1925. *Pachylanguria elongata* : Arrow, *Fauna Brit. India, Clavicornia : Erotylidae, Languriidae and Endomychidae*, London : 173.

Material : Arunachal Pradesh : 1 ex., Hapali, Subansiri Div., 15. V. 1966; 1 ex., Kimin, Subansiri Div., 9. V. 1966; 1 ex., Kameng Div., 3. V. 1966; 1 ex., Dejoo, Subansiri Div., 10. III. 1966, all A. N. T Joseph Coll.; 1 ex., Namsai, Chowkham Road, 16. III. 1969, S. K. Tandon Coll.; 1 ex., Salari, Kameng, 22. VI. 1961; 1 ex., Naphra, Kameng, 6. VI. 1961, all K. C. Jayaram Coll.; Sikkim : 1 ex., Sirbaton, 31. II. 1959, A. G. K. Menon Coll.; 1 ex., Gangtok, 5. V. 1962, S. Ali Coll.; Uttar Pradesh : 1 ex., Mussorie, VII. 1933, H. S. Pruthi Coll.; 1 ex., Barasu, Garhwal Dist., 6. V. 1958; 1 ex., Akhrot Koti, Garhwal Dist., 17. V. 1958, all B. S. Lamba Coll.; West Bengal : 1 ex., Rangpu, Darjeeling Dist., 28. V. 1974, J. K. Jonathan Coll.

Remarks : So far, this species was recorded from Sikkim, and Assam, and also from Bangladesh, Burma, Malay Peninsula, Sumatra, Java, and Borneo. Now it is being reported for the first time from Uttar Pradesh and Arunachal Pradesh.

General appearance elongate, narrowed posteriorly, legs and antennae rather short, antennal club well developed and 4-jointed. Elytra usually metallic blue, sometimes green or coppery, pronotum brownish to blackish brown, head and antenna blackish, ventral surface reddish except ventrite 5, which is blackish; length 12-17 mm.

3. *Pachylanguria variiventris* (Kraatz)

1899. *Tetralanguria variiventris* Kraatz, *Dtsch. ent. Z.* : 348.

1925. *Pachylanguria variiventris* : Arrow, *Fauna Brit. India Clavicornia : Erotylidae, Languriidae and Endomychidae*, London : 174.

Material : Sikkim : 2 ex., Lachung, 6. VIII. 1959, A. G. K. Menon Coll.; West Bengal : 2 ex., Pashok, Darjeeling Dist., 3. VI. 1930, S. L. Hora Coll.

Remarks : So far, this species was recorded from West Bengal and Meghalaya, and also from Burma, Cheba and Tonkin. Now it is being reported for the first time from Sikkim.

This is a distinct species and can be easily separated from other species by its general appearance being rather large, robust, slightly narrowed posteriorly, legs moderately long, antennae short, club 4-jointed and abrupt. Pronotum with a dark median stripe and with a pair of spots on lateral sides, elytra metallic blue or green, head and antenna blackish; length 20 mm.

4. *Pachylanguria tumidicollis* (Kraatz)

1899. *Tetralanguria tumidicollis* Kraatz, *Dtsch. ent. Z.*, : 349.

1925. *Pachylanguria tumidicollis* : Arrow, *Fauna Brit. India, Clavicornia : Erotylidae, Languriidae and Endomychidae*, London : 173.

Material : Arunachal Pradesh : 1 ex., Pamir, Subansiri Division, 17. V. 1966, A. N. T. Joseph Coll.

Remarks : So far, this species was recorded from Meghalaya, and also from Bangladesh. Now it is being reported for the first time from Arunachal Pradesh.

General appearance large, narrowed posteriorly, apex of elytra truncated, prothorax quadrate, antennae short, stout, club 4-jointed and compact. Elytra, antennae and legs black, pronotum reddish and head blackish ; length 20 mm.

5. *Pachylanguria cuprea* Arrow

1925. *Pachylanguria cuprea* Arrow, *Fauna Brit. India, Clavicornia : Erotylidae, Languriidae and Endomychidae*, London : 176.

Material : Assam : 1 ex., Above Tura, Garo Hills, .IX. 1917 Mrs. Kemp Coll.

Remarks : So far, this species was recorded from Uttar Pradesh. Manipur and Sikkim, and also from Burma. Now it is being reported for the first time from Assam.

General appearance slender, elongate and tapering in front and behind, prothorax narrowed in front, elytra posteriorly narrowed and

its apex truncate-serrate, antennae and legs moderately slender, antennae short, club 4-jointed and compact. Head, prothorax and elytra black with bluish tinge both dorsally and ventrally, antennae and legs black; length 15 mm.

6. *Pentelanguria elateroides* Crotch

1876. *Pentelanguria elateroides* Crotch, *Cist. Ent.*, 1 : 380.

1925. *Pentelanguria elateroides* : Arrow, *Fauna Brit. India, Clavicornia : Erotylidae, Languriidae and Endomychidae*, London : 179.

Material : Sikkim : 1 ex., Lochen, 9. VI. 1959; 1 ex., Pechrek, 2. IV 1959, all A.G.K. Menon Coll.

Remarks : So far, this species is recorded from Darjeeling District of West Bengal and Sikkim.

General appearance slender, elongate and tapering in front and behind, antennae stout, club 4-jointed and compact, elytra produced behind. Elytra, pronotum and head black with metallic tinge, legs and antennae black and abdomen red; length 18—20 mm.

7. *Doubledaya atripennis* Arrow

1925. *Doubledaya atripennis* Arrow, *Fauna Brit. India, Clavicornia : Erotylidae, Languriidae and Endomychidae*, London : 189.

Material : Arunachal Pradesh : 1 ex., 'Pamir, Subansiri Division, 18.V.1966, A.N.T. Joseph Coll.

Remarks : So far, this species was recorded from West Bengal, Assam and Meghalaya. Now it is being reported for the first time from Arunachal Pradesh.

General appearance moderately large, prothorax quadrate, antennae short, club 4-jointed and compact, head and prothorax punctured, elytral puncturation arranged in rows, elytral extremities truncate. Elytra blackish-brown, head and pronotum chocolate brown, antennae and legs brown, and abdomen black; length 10 mm.

8. *Doubledaya schenklingi* (Fowler)

1908. *Callilanguria schenklingi* Fowler, Wytsman's *Gen. Insect.*, *Languriinae*, 78 : 21.

1925. *Doubledaya schenklingi* : Arrow, *Fauna Brit. India, Clavicornia : Erotylidae, Languriidae and Endomychidae*, London : 199.

Material : Sikkim : 1 ex., Toong, 10. V. 1962, S. Ali Coll.

Remarks : So far, it was re-ordered from Nilgiri Hills. Now it is being reported for the first time from Sikkim.

General appearance elongate, slender and parallel-sided, antennae slender, club 4-jointed and loose, elytra moderately punctured, elytra produced behind and its apex truncate-serrate, prothorax convex and sparsely punctured. Head and pronotum red both dorsally and ventrally, elytra bluish black with metallic tinge, antennae and legs brownish; length 15 mm.

9. *Doubledaya severini* Fowler

1893. *Doubledaya severini* Fowler, *Ann. Soc. ent. Belg.*, 37 : 74

1925. *Doubledaya severini* : Arrow, *Fauna Brit. India, Clavicornia : Erotylidae, Languriidae and Endomychidae*, London : 190.

Remarks : So far, this species is only recorded from Sikkim. General appearance slender, elongate and tapering towards the apex of elytra, vertex of head and prothorax smooth and impunctate, elytra truncated at apex and puncturation arranged in rows, antennae short, club 4-jointed, head and pronotum red both dorsally and ventrally, elytra blue, legs and antennae brown, abdomen red but sternite 5 blackish; length 12 mm.

10. *Anadastus laticornis* Arrow

1925. *Anadastus laticornis* Arrow, *Fauna Brit. India, Clavicornia : Erotylidae, Languriidae and Endomychidae*, London : 232

Material : Assam : 1 ex., Above Tura, Garo Hills, 15.VII.—30. VIII. 1917, S. Kemp Coll.; West Bengal : 1 ex., Singla, Darjeeling Dist., III. 1973, P. K. Maiti Coll; 1 ex., Pashok, Darjeeling Dist., VI. 1916, L. C. Hartless Coll.

Remarks : So far, this species was recorded from Sri Lanka. Now it is being reported for the first time from India.

General appearance small, elongate, and parallel-sided head and prothorax finely and minutely punctured, elytral puncturation arranged in rows and elytral apex truncate, eyes large and finely faceted, antennae slender, club 4-jointed and broad, sternite 5 finely pubescent, femora lines on sternite 1 absent. Head and pronotum red both dorsally and ventrally, elytra brown chocolate, antennae and legs blackish brown and abdomen black; length 3.5 - 5 mm.

11. *Anadastus flavimanus* Arrow

1925. *Anadastus flavimanus* Arrow, *Fauna Brit. India, Clavicornia : Erotylidae, Languriidae and Endomychidae*, London : 225.

Material : Assam : 1 ex., Above Tura, Garo Hills, 15.VII. & 30. VIII. 1917, S. Kemp Coll.; West Bengal : 1 ex., 1 km. West of Reyang, Darjeeling, 30. III. 1973, P. K. Maiti Coll.

Remarks : So far, this species was recorded from Meghalaya and also from Burma. Now it is being reported for the first time from Assam and West Bengal.

General appearance small, elongate, parallel-sided, head and prothorax sparsely punctured, antennae slender, club 4 jointed and loose. Head and pronotum red both dorsally and ventrally, elytra blackish brown, legs and antennae brown, antennal club black and abdomen reddish brown; length 5-7 mm.

12. *Anadastus dohertyi* Arrow

1925. *Anadastus dohertyi* Arrow, *Fauna Brit. India, Clavicornia : Erotylidae, Languriidae and Endomychidae*, London : 216.

Material : West Bengal : 6 ex., Singla, Darjeeling Dist., 18.IV. 1973, P.K. Maiti Coll.

Remarks : So far, this species was recorded from Assam. Now it is being reported for the first time from Darjeeling Dist., West-Bengal.

General appearance small, elongate and parallel-sided, punctuation on head fine and dense, prothorax transverse, convex and impunctate, elytral extremities truncate, legs and antennae slender, club 5-jointed and loose, eyes finely faceted, metasternum sparsely punctured and a pair of parallel femoral lines on sternite 1 present. Head and pronotum red both dorsally and ventrally, elytra, legs, antennae and metasternum black, and abdomen red; length 4—5.5 mm.

13. *Anadastus capitatus* Gorham

1896. *Anadastus capitatus* Gorham *Ann. Mus. Civ. stor. nat. Genova*, 36 : 272.

1925. *Anadastus capitatus* ; Arrow, *Fauna Brit. India, Clavicornia : Erotylidae, Languriidae and Endomychidae*, London : 213.

Material : Assam : 1 ex., Above Tura, Garo Hills, 15.VII. & 30. VIII. 1917, S. Kemp Coll.

Remarks : So far, this species was recorded from Burma. Now it is being reported for the first time from India.

General appearance slender, elongate and parallel-sided, vertex of head and prothorax finely punctured, prothorax convex and transverse, eyes finely faceted, elytral extremities separately rounded, antennae slender, club 4-jointed and compact, and sternite 1 with a pair of parallel femoral lines. Head and pronotum red both dorsally

and ventrally, elytra brownish black, antennae and legs black, abdomen red, and metasternum black; length 4.5 mm.

14. *Anadastus ochreipennis* (Fowler)

1890. *Languria ochreipennis* Fowler, *Ent. mon.* 26 : 107.

1925. *Anadastus ochreipennis* : Arrow, *Fauna Brit. India, Clavicornia : Erotylidae, Languriidae and Endomychidae*, London : 233.

Material : Tamil Nadu; 2 ex., Tope, Foot of Palni Hills, 1922, S. Kemp Coll.; Arunachal Pradesh : 1 ex., Rupa, Kameng, 2. IV. 1961, K. C. Jayaram Coll.

Remarks : So far, this species was recorded from Assam, and also from Malay Peninsula, Philippine Island. Now it is being reported for the first time from Tamil Nadu and Arunachal Pradesh.

General appearance slender, elongate and parallel-sided, head coarsely punctured, prothorax quadrate and convex, elytral apex truncate, antennae and legs slender, club 4-jointed and loose, eyes finely faceted and sternites 4 and 5 pubescent. Head and pronotum red both dorsally and ventrally, elytra blackish brown, antennae and legs brownish, antennal club black, and abdomen brown; length 5.5 mm.

15. *Anadastus filiformis* (Fowler)

1801. *Trogosita filiformis* Fowler, *Syst. Eleuth.*, 1 : 152

1925. *Anadastus filiformis* ; Arrow, *Fauna Brit. India, Clavicornia : Erotylidae, Languriidae and Endomychidae*, London : 217.

Material : Arunachal Pradesh : 1 ex., Pamir Subansiri Division, 17 V 1966, A.N.T Joseph Coll., West Bengal : 1 ex, Darjeeling, 28.III. 1973, P. K. Maiti Coll.

Remarks : So far, this species was recorded from Burma, Siam, Tonkin, S. China, Philippine Islands, Java and Borneo. Now it is being reported for the first time from India.

General appearance slender, elongate and parallel-sided, elytra tapering posteriorly, elytral extremities truncate, antennae slender, club 4-jointed and compact, eyes finely faceted, stennite 5 pubescent, sternite 1 with a pair of parallel femoral lines. Head, pronotum and elytra reddish brown, apex of elytra, antennae, legs, metasternum and abdomen black; length 5.5-7 mm.

16. *Anadastus densus* Arrow

1925. *Anadastus densus* Arrow, *Fauna Brit. India, Clavicornia : Erotylidae, Languriidae and Endomychidae*, London : 223.

Material : Arunachal Pradesh : 1 ex., Pamir, Subansiri Div., 7 V. 1966, *A.N.T. Joseph* Coll.; West Bengal : 1 ex., Tista Bazar, Darjeeling Dist., 18. IV.1971, *T. Sengupta* Coll.

Remarks : So far, this species was recorded from South India. Now it is being reported for the first time from West Bengal and Arunachal Pradesh.

General appearance large and elongate, elytral intervals closely situated antennae short and slender, club 4 jointed and compact, eyes finely faceted, scutellum triangular with pointed apex, apex of elytra truncated, legs slender, sternite 1 with a pair of parallel femoral lines. Head and pronotum red both dorsally and ventrally, elytra deep blue black, antennae, legs, prosternum, mesosternum, metasternum and abdomen black; length 7 mm.

17. *Anadastus bifasciatus* (Motschulsky)

1860. *Languria bifasciata* Mostchulsky, *Schrenk's Reison im Amrul.*, 2 : 241.

1925. *Anadastus bifasciatus* ; Arrow, *Fauna Brit. India, Clavicornia : Erotylidae, Languriidae and Endomychidae*, London : 230.

Material : Tamil Nadu : 13 ex., Oote., Bot. Gardens, 3.XII. 1971, *T. Sengupta* Coll.

Remarks : So far, this species is recorded from Uttar Pradesh, West-Bengal, South India, and also from Sri Lanka, Thailand and South China.

General appearance small, slender, elongate and parallel-sided, head and pronotum coarsely punctured, front margin of prothorax boardened, elytral extremities separately rounded, antennae short, club 4- jointed and compact, legs short, prosternum, metasternum and abdomen coarsely punctured. Head brown, pronotum yellowish, elytra with a median transverse yellowish orange band and legs with trochanters, apex of femora and basal part of tibiae brownish; length 5-6.5 mm.

18. *Anadastus nigriventris* (Motschulsky)

1860. *Languria nigriventris* Mostchulsky *Schrenk's Reisen im Amrul.*, 2 : 241.

1925. *Anadastus nigriventris* : Arrow, *Fauna Brit. India Clavicornia : Erotylidae, Languriidae and Endomycidae*, London : 224.

Material : West Bengal : 1 ex., Darjeeling, 9.VI.1973, *P. K. Maiti* Coll.

Remarks : So far, this species was recorded from Sri Lanka. Now it is being reported for the first time from India.

General appearance slender, parallel-sided, small, elytra tapering posteriorly, head and prothorax sparsely punctured, prothorax convex and transverse, elytral extremities truncated, eyes moderately large and finely faceted antennae slender, club 4-jointed and loose, abdominal sternite 1 with a pair of parallel femoral lines. Head and pronotum red both dorsally and ventrally, elytra brownish chocolate, antennae and legs brown, abdomen and metasternum brownish red; length 5.5 mm.

19. *Caenolanguria assamensis* (Fowler)

1886. *Languria assamensis* Fowler *Trans. ent. Soc. Lond.*, : 24.

1925. *Caenolanguria assamensis* : Arrow, *Fauna Brit. India, Clavicornia : Erotylidae, Languriidae and Endomychidae*, London : 240.

Material : Uttar Pradesh : 1 ex., Kumaon Hills, 16. V. 1930.

Remarks : So far, this species was recorded from Assam, and also from Burma. Now it is being reported for the first time from Uttar-Pradesh.

General appearance elongate and parallel-sided, large, head and pronotum finely and sparsely punctured, prothorax transverse and convex, antennae short and slender, club 4-jointed and compact, eyes coarsely faceted, abdomen, metasternum and prosternum distinctly punctured. Head and pronotum red both dorsally and ventrally, elytra deep chocolate brown, antennae, legs, abdomen, metasternum and prosternum black; length 9 mm.

20. *Caenolanguria andamanica* Arrow

1925. *Caenolanguria andamanica* Arrow, *Fauna Brit. India, Clavicornia Erotylidae, Languriidae and Endomychidae*, London : 236.

Material : Andaman Islands : 2 ex.

Remarks : So far this species is recorded from Andaman Islands.

General appearance elongate, large, head finely punctured, prothorax convex and narrowed in front, elytra coarsely punctured and interstices with fine and minute punctures, antennae short and slender, club 4-jointed and compact, eyes coarsely faceted, legs slender, abdominal sternite 1 with a pair of divergent femoral lines. Head and pronotum red, elytra chocolate brown, antennal club and legs brown, prosternum, metasternum and abdomen black; length 8.5 mm.

21. *Caenolanguria birmanica* (Harold)

1879. *Languria birmanica* Harold *Mitt. Munch. ent. ver.*, 3 : 74.

1925. *Caenolanguria birmanica* : Arrow, *Fauna Brit. India, Clavicornia : Erotylidae, Languriidae and Endomychidae*, London : 241.

Material : West Bengal : 1 ex., Darjeeling, 6.IV.1973, P. K. Maiti Coll.

Remarks : So far, this species is recorded from Uttar Pradesh, Bikkim, West Bengal, and also from Burma.

General appearance moderately elongate, parallel-sided and moderately large, head finely and sparsely punctured, eyes coarsely faceted, pronotum transverse, convex and impunctate, apex of elytra separately rounded, antennae slender, club 4- joined and loose, and metasternum sparsely punctured. Head and pronotum red, elytra blue black, antennae, legs abdomen, metasternum and mesosternum black; length 7 mm.

22. *Languriophasma laeta* Arrow

1925. *Languriophasma laeta* Arrow, *Fauna Brit. India, Clavicornia Erotylidae, Languriidae and Endomychidae*, London : 204

Material : Arunachal Pradesh : 2 ex., Deopani, 6.III. 1969, S. K. Tandon Coll.

Remarks : This species is recorded from almost all over India.

General appearance elongate, parallel-sided and large, head coarsely punctured, eyes finely faceted, antennae slender, club 4- jointed, short and compact, pronotum transverse and coarsely punctured, apex of elytra separately rounded, scutellum triangular and pointed at the apex, abdomen, metasternum and mesosternum coarsely punctured, and elytral epipleura rather indistinct towards apex. Head and pronotum red both dorsally and ventrally, antennae black, elytra chocolate brown, abdomen, metasternum and mesosternum red; length 8-9 mm.

23. *Languriophasma discoidalis* (Fowler)

1908. *Caenolanguria discoidalis* Fowler *Wytsman's Gen. Insect., Languriinae* : 17.

1925. *Languriophasma discoidalis* : Arrow, *Fauna Brit. India, Clavicornia Erotylidae, Languriidae and Endomychidae*, London : 205.

Material : Arunachal Pradesh : 1 ex., Kameng, 4.VI. 1961, K. C. Jayaram Coll.

Remarks : So far, this species was recorded from Tamil Nadu and Karna taka. Now it is being recorded for the first time from Arunachal Pradesh.

General appearance slender, elongate and parallel-sided, head coarsely punctured, eyes finely faceted, antennae short and slender, club 4 jointed and compact, pronotum quadrate and distinctly punctured, elytral apex separately rounded, legs short, abdomen, metasternum and mesosternum distinctly punctured. Head and pronotum red both dorsally and ventrally, antennal club, elytra, legs, abdomen, metasternum and mesosternum black; length 6.5 mm.

Tribe Cladoxenini

1. *Paracladoxena bipustulata* Fowler

1886. *Paracladoxena bipustulata* Fowler, *Trans. ent. Soc. Lond.*, : 311

1925. *Paracladoxena bipustulata* : Arrow, *Fauna Brit. India, Clavicornia ; Erotylidae, Languriidae and Endomychidae*, London : 263.

Material : Karnataka : 1 ex., Bangalore, 10.XII.1971, *T Sengupta* Coll.

Remarks : So far, this species was recorded from Sri Lanka. Now it is being reported for the first time from India

General appearance rather short, elytra and prothorax narrowed in front and behind, head and pronotum distinctly punctured, antennae slender and rather long, club 3-jointed, eyes moderately coarsely faceted, elytra rather short, smooth and shiny, apex of elytra separately rounded, legs slender, and abdomen distinctly punctured. Head, pronotum and elytra dark reddish brown, posterior one-third of elytra with a transverse pale marking; length 4.5 mm.

SUMMARY

Twenty four species of family Languriidae (Languriinae) are reported in this paper from different parts of India. Seventeen of these species constitute new records from different states of India.

ACKNOWLEDGEMENTS

This research was carried out in the Coleoptera Section, Zoological Survey of India. We are grateful to Director, Zoological Survey of India for Laboratory facilities. We would like to thank the staff of Coleoptera Section of the Zoological Survey of India, particularly Mr C. R. Basu and Mr. A. R. Bhaumik for various assistance.

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ISOLATION OF *VIBRIO PARAHAEMOLYTICUS* FROM *MUSCA DOMESTICA VICINA* AND *CHRYSOMYIA MEGACEPHALA* IN CALCUTTA

By

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(With 1 Table)

INTRODUCTION

Sporadic non-seasonal cases of gastroenteritis due to *Vibrio parahaemolyticus* infection occur in Calcutta throughout the year, involving poor socioeconomic group of non-vegetarian and strict vegetarian habits. In an attempt to search the reservoir of this infection, isolates of few fresh non-marine animals were examined and *V. parahaemolyticus* was demonstrated in the following fishes: *Caridina rajadhar* (chingri), *Amblybharigondon mola* (mourolla), *Bardus ticto* (punti), *Glossogobbius guiris* (bele) and *Apocryptes lanceolatus* (goole). Out of 100 samples of pond water around the slum areas in Calcutta, positive isolation of *V. parahaemolyticus* biotype I was detected in 35. However, attempts to isolate *V. parahaemolyticus* biotypes from 50 normal human stools, 258 faecal samples of crow and 250 stools of dog yielded no positive result (Chatterjee, 1974). *V. parahaemolyticus* was also isolated in about 30% marine sample, i.e., Hooghly river water and marine shrimps in Calcutta (Chatterjee *et al.*, 1973).

In the city of Calcutta house flies and other related flies abound. Do they play any role as the reservoir of this bacterium? An attempt was made to isolate *V. parahaemolyticus* biotype I from the whole body washings and viscera of the flies collected from fish stalls and sweet shops of Calcutta.

MATERIALS AND METHODS

Samples of flies were collected once in a week in sterile test tubes, separately from fish markets and sweet shops situated in the heart of Calcutta city. Different fish and sweet shops in the same locality were selected each time.

As soon as the collection was brought to the laboratory, the tubes containing the flies were kept in ice for 20 minutes so as to anaesthetize them for dissection. Five flies each from fish and sweet shop were selected at random for dissection.

Prior to dissection, each fly was dropped in a labelled sterile test tube having 10 ml. of alkaline peptone water containing 3% NaCl (P 9.2), with the help of a sterile forceps. Each tube was then shaken thoroughly, so as to wash the fly externally and kept as such for 10 minutes. Internal viscera of each fly was then dissected on a sterile slide using sterile forceps and needles. Internal organs so dissected were then drained into another labelled tube (label corresponding to its washing) containing 10 ml. of peptone solution.

The washings of individual flies and internal viscera so collected were then bacteriologically investigated for isolation of *V. parahaemolyticus* biotype I according to the method of Chatterjee (1974).

Table 1.—Isolation of *Vibro parahaemolyticus* from *Musca domestica vicina* and *Chrysomya megacephala*.

Site	<i>Musca domestica vicina</i>						<i>Chrysomya megacephala</i>					
	Washings			Viscera			Washings			Viscera		
	No.	Positive	%	No.	Positive	%	No.	Positive	%	No.	Positive	%
Fish stalls (10)	44	2	4.54	41	8	19.51	6	—	—	4	2	50
Sweet shops (10)	45	3	6.66	40	10	25.00	5	—	—	5	—	—
TOTAL (20)	89	5	5.61	81	18	22.22	11	—	—	9	2	22.22

RESULTS AND DISCUSSION

From 10 different fish stalls, 44 house flies (*Musca domestica vicina*) and 6 blue bottle flies (*Chrysomya megacephala*) were captured. Similarly from 10 sweet shops 45 house flies (*M. d. vicina*) and 5 blue bottle flies (*C. megacephala*) were brought to the laboratory (Table 1).

Out of altogether 89 *M. d. vicina*, *V. parahaemolyticus* was isolated from the surface washings of 5 specimens (5.61%) of which 2 (4.54%) were collected from the fish stalls and 3 (6.66%) from the sweet shops.

Out of 81 viscera of *M. d. vicina* examined, *V. parahaemolyticus* was present in 18 (22.22%), 8 (19.51%) from fish stalls and 10 (25%) from sweet shops.

External washings of 11 *C. megacephala* caught from both kinds of shops did not yield any positive result.

Out of 9 viscera of *C. megacephala* studied, *V. parahaemolyticus* was isolated from 2 specimens (22.22%), obtained from fish stalls.

It was observed that the flies of both species were attracted to fish and sweetmeat, but the number of *M. d. vicina* was much greater than that of *C. megacephala* in both types of shops.

Potentially pathogenic *V. parahaemolyticus* biotype I was present in both the species of flies.

From the whole-body washings of the flies the rate of isolation was comparatively low and isolation was only positive in *M.d. vicina*.

Examination of the viscera of those flies revealed interesting results. The rate of isolation of *V. parahaemolyticus* from the viscera (22.22%) was higher than that of the washings (5.61%) in both the species of flies. However from the viscera of *C. megacephala* caught from sweet shops no *V. parahaemolyticus* was isolated upto now.

The results indicate that the organisms get suitable environment in the viscera of the flies to survive.

This study reveals that house flies and other related flies play a role as reservoir of *V. parahaemolyticus* in Calcutta. No other reference has been quoted in the literature to the occurrence of *V. parahaemolyticus* in flies.

The rate of infection of the viscera of both species of flies is alarming, indicating a thorough study of the epidemiology of parahaemolyticus gastroenteritis in Calcutta through the year.

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SUMMARY

Potentially pathogenic *Vibrio parahaemolyticus* was isolated from *Musca domestica vicina* and *Chrysomya megacephala* flies from the fish stalls and sweet shops in Calcutta.

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NOTES ON TWO SPECIES OF *ECHINASTER* MÜLLER AND TROSCHEL (ECHINODERMATA: ASTEROIDEA) FROM THE INDIAN OCEAN

By

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(With 1 Plate and 3 Tables)

INTRODUCTION

While studying the unnamed asteroids of the Zoological Survey of India, the authors came across some specimens of the genus *Echinaster* Müller and Troschel, collected from several localities in the Indian Ocean. On examination these were found to belong to two species, *E. purpureus* (Gray) and *E. luzonicus* (Gray). Both the species together with a third, *E. varicolor* H. L. Clark, have been distinguished from one another by the shape of the arms, appearance of the subambulacral area and capability for autotomy. However, the present material also includes some specimens showing intermediate characters, thereby suggesting their probable conspecificity. The present paper discusses variations observed along with the taxonomic status of these species and also includes some new distributional records.

SYSTEMATIC ACCOUNT

CLASS : ASTEROIDEA

ORDER : SPINULOSIDA

FAMILY : ECHINASTERIDAE

1. *Echinaster purpureus* (Gray)

(Plate I, Figs. 1-3)

1840. *Othilia purpurea* Gray, *Ann. Mag. nat. Hist.*, (i) 6 : 282.
1910. *Echinaster eridanella* : Koehler, *Echinoderma of the Indian Museum*, Part VI : 174.
1915. *Echinaster eridanella* : H. L. Clark, *Spolia zeylan.*, 10 : 89.
1926. *Echinaster purpureus* : Mortensen, *Trans. zool. Soc. Lond.*, 28 : 121.

Table 1. *Echinaster purpureus*

(All specimens have five arms and one madreporite)

Sl. No.	Locality	Reg. No.	R(mm.)	r (mm.)	br(mm.)	R/r	R/br	Remarks
1.	Suez Canal	E 696/1	70	8.5	10.0	8.2	7.0	Arms equal. Subambulacral area bare.
2.	Mauritius	E 404/1	45	7.5	7.5	6.0	6.0	Arms equal. Subambulacral spines continuous at the base of three arms, discontinuous in the remaining two arms.
3.	"	"	45	7.5	8.0	6.0	5.6	Four arms equal, fifth 33 mm. long. Subambulacral spines discontinuous in two arms, continuous on one side and discontinuous on the other side of third arm and absent in the remaining two arms. ¹
4.	Okha	E 699/1	95	10.0	10.5	9.5	9.0	Arms subequal R=75—95 mm. Subambulacral spines continuous.
5.	"	E 697/1	95	8.5	11.0	11.2	8.6	Arms equal. Subambulacral spines continuous.
6.	Beyt Island	E 698/1	140	13.5	13.5	10.4	10.4	" " " " "

1969. *Echinaster purpureus* : James, *Bull. Cent. mar. Fish. Res. Inst.*, 7: 54.

1971. *Echinaster purpureus* : Clark and Rowe, *Monograph of Shallow-water Indo-West Pacific Echinoderms*, : 73.

Material : (i) 1 ex. Suez Canal (Received from R. B. Seymour Sewell on 8.i.1917) Z.S.I. Reg. No. E 696/1. (ii) 2 exs. Mauritius (*Berlin Mus. Exch.*) Z.S.I. Reg. No. E 404/1. (iii) 1 ex. Three miles SE of Okha Port, Gulf of Kutch, 22.i.19 2. Z.S.I. Reg. No. E 697/1. (iv) 1 ex. Beyt Island, near Okha, Gulf of Kutch, 31.xii. 1954. T. D. Soota, Coll. Z.S.I. Reg. No. E 698/1. (v) 1 ex. Okha, Gulf of Kutch, 12.iii.1966. V. C. Agrawal, Coll. Z.S.I. Reg. No. E 699/1.

Description (Table 1) :

R=45—140 mm.; R/r = 6.0—11.2; R/br=5.6-10.4.

Arms five, long, cylindrical and subequal in length. Madreporite single. Abactinal surface reticular with short blunt spines. Furrow spines stout, round or slightly spatulate, often united by thick skin giving a serrate appearance. Subambulacral area generally bare, sometimes with a continuous or discontinuous series of short spines.

Remarks : The specimens show different degrees of variation in the compactness of the abactinal reticulum as well as in the occurrence of subambulacral spines. Thus the abactinal reticulum is wide in the single specimen from the Suez Canal and relatively compact in those from other localities. The variations in the subambulacral spines are presented in table 1.

Distribution: Red Sea, East coast of Africa, Islands of the western Indian Ocean, Gulf of Kutch and Bay of Bengal.

Generally a shallow-water species, though Bell (1909) reported it from 504 m. at Desroches in the western Indian Ocean which however needs confirmation.

The species is recorded here for the first time from the Gulf of Kutch.

2. *Echinaster luzonicus* (Gray)

(Plate I, Figs. 4—9)

1840. *Othilia luzonica* Gray, *Ann. Mag. nat. Hist.*, (i) 6 : 282.

1919. ?*Othilia purpurea* : Fisher, *U. S. Nat. Mus. Bull.*, 100 (III) : 432. Non: *Othilia purpurea* Gray, 1840.

1921. *Echinaster luzonicus* : H. L. Clark, *Pap. Dep. mar. biol. Carnegie Instn.*, 10 : 98.

1969. *Echinaster luzonicus* : James, *Bull. Cent. mar. Fish. Res. Inst.*, 7 : 54.

1971. *Echinaster luzonicus* : Clark and Rowe, *Monograph of Shallow-water Indo-West Pacific Echinoderms*, : 72.

1974. *Echinaster luzonicus* : Marsh, *Micronesica*, 10 : 93.

Table 2. *Echinaster luzonicus*

(The specimen (Sl. No. 12) has four madreporites; the remainder have only two.)

Sl.No.	Locality	Reg. No.	No. of Arms.	R(mm.)	r (mm.)	br(mm.)	R/r	R/br	Remarks
1.	Horsburgh Atoll	E 700/1	6	50	5.5	7.0	9.1	7.1	One arm 50 mm., others 10-30 mm. Subambulacral series continuous.
2.	Beyt Island	E 701/1	6	120	14.0	14.0	8.6	8.6	Arms subequal. Subambulacral area bare or with discontinuous series of spines at the base and continuous only towards the tip.
3.	Andaman Sea	E 702/1	7	85	11.0	10.5	7.7	8.1	Arms unequal, R=40—85 mm. for six arms, the seventh broken at the base. Subambulacral area bare, interrupted here and there by a few spines.
4.	Camorta Island	E 703/1	5	60	8.0	8.5	7.6	7.1	One arm 60 mm., others 14-45 mm. Subambulacral series continuous.
5.	"	"	5	65	8.0	9.0	8.1	7.2	Two arms 65 mm., others 11-23 mm. Subambulacral series continuous.
	"	"	5	75	11.0	12.0	6.8	6.3	One arm 75 mm., two arms 65 mm. remaining 35 and 45 mm. respectively Subambulacral series continuous.

7.	"		6	32	7.0	7.0	4.6	4.6	Arms unequal, R=19-32 mm. Subambulacral series continuous.
8.	"	"	6	35	8.5	7.5	4.1	4.7	Four arms 30-35 mm., remaining 15 mm. Subambulacral series continuous.
9.	"	"	6	45	10.0	9.0	4.5	5.0	One arm 45 mm., remaining 30-35 mm. Subambulacral series continuous.
10.	"	"	6	55	9.0	8.0	6.1	6.9	One arm 40 mm., remaining 55 mm. Subambulacral series continuous.
11.	"	"	6	65	10.0	10.0	6.5	6.5	Two arms 60 and 65 mm., respectively, remaining 20-34 mm. Subambulacral series continuous.
12.	"	"	7	55	10.0	9.0	5.5	6.1	Two arms 55 mm., three arms 45 mm., remaining two arms 30 and 35 mm. respectively. Subambulacral series continuous.

Material : (i) 1 ex. Stn. 649. Boulder zone of marginal reef, Horburgh Atoll, Maldivé Is., 22.X.1923, *R.I.M.S. 'Investigator'*, Coll. Z.S.I. Reg. No. E 700/1. (ii) 1 ex. Beyt Island, near Okha, Gulf of Kutch, 31.xii. 1954, *T. D. Soota*, Coll. Z.S.I. Reg. No. E 701/1. (iii) 1 ex. Stn. 222. Andaman Sea, $13^{\circ} 27' N$ $93^{\circ} 14' 30'' E$, 729 m., 21.xii. 1896, *R.I.M.S. 'Investigator'*, Coll. Z.S.I. Reg. No. E 702/1. (iv) 9 exs. Camorta, Nicobar Is., 9.x. 1972, *K. Reddiah*, Coll. Z.S.I. Reg. No. E 703/1.

Description (Table 2) :

$R=32-120$ mm.; $R/r=4.1-9.1$; $R/br = 4.68-6$.

Arms five to seven, often unequal in length. Madreporites two to four. Abactinal reticulum generally compact with often slender spines. Furrow spines long, sometimes united by thick skin. Subambulacral spines generally distinct from the actinal spines and in a continuous row.

Remarks : These specimens also show different degrees of variation in the compactness of the abactinal reticulum as well as in the occurrence of subambulacral spines. Thus the abactinal reticulum is compact in the specimens from Camorta Island and more open in those from the other localities. The variations in the subambulacral spines are presented in table 2.

This species is known to reproduce by autotomy and regeneration and the arms are unequal in all the specimens except the one from Beyt Island, in which they are subequal. The specimen from the Maldivé Is. is a 'comet' form with one arm 50 mm. long and five regenerating arms 10-30 mm. long. It is interesting to note that some of the madreporites in the specimens from Camorta Island are irregular in shape and extend to the sides of the disc along the interradii (Fig. 8) or to the base of the adjacent arms.

Fisher (1919) considered *E. luzonicus* as conspecific with *E. purpureus*. From the geographical occurrence and description, most of his specimens of *Othilia purpurea* appear to belong to *E. luzonicus*. There were also in his collections a few five-rayed specimens with equal arms and single madreporite which may as well belong to *E. purpureus*.

Distribution : Maldivé Is., Gulf of Kutch, Bay of Bengal, East Indies, China Sea, Japan, Australia and Islands of South Pacific.

Generally a shallow-water species. However, the present material includes a specimen from 729 m. in the Andaman Sea.

The species is recorded here for the first time from the Maldivé Is., Gulf of Kutch and the Andaman and Nicobar Is.

DISCUSSION

The three Indo-West Pacific representatives of the asteroid genus *Echinaster*, *E. purpureus* (Gray), *E. luzonicus* (Gray) and *E. varicolor* H. L. Clark, are distinguished from one another by the shape of the arms and occurrence of subambulacral spines. A perusal of the available literature reveals not only that these characters show a very wide range of variation, but there is also limited correlation between some of the morphological variations and geographical distribution, resulting in confusion regarding the identification and distribution of these species.

Gray (1840) described *E. purpureus* as 'purplish (i.e. when preserved) and with rays three times as long as the width of the body' ($R=6r$) and *E. luzonicus* as 'reddish brown and with five or six rays, four times as long as the width of the body' ($R=8r$). It appears that Brown (1910), Clark (1915) and Fisher (1919) considered them to be conspecific.

Later, Clark (1921) separated these two species and subsequently (1938) described a third, *E. varicolor*, from Australia, distinguishing them from one another, chiefly by the shape of the arms as determined by R/r and R/br ratios and the occurrence of the subambulacral spines. However, the observations of A. M. Clark (in Clark and Rowe 1971) and of the present authors (Table 3) show that these ratios are variable and the ranges of variation overlap.

Though A. M. Clark used the occurrence of the subambulacral spines in distinguishing these species, she nevertheless noticed their variability. In our material also, they vary in the specimens of both species, collected from the same or nearby locality and even in different arms of the same specimen. Thus, in all the specimens of *E. purpureus* from the Gulf of Kutch (Fig. 3) the subambulacral spines are in a continuous series¹ in one of the two from Mauritius they are continuous in three arms and discontinuous in the remaining two, and in the other they are continuous in two arms, continuous on one side and discontinuous on the other side in one arm and totally absent in the remaining two arms and finally in the specimen from the Suez Canal they are totally absent.

Regarding *E. luzonicus*, in the specimen from the Gulf of Kutch (Fig. 6) the subambulacral spines are either totally absent or are in a discontinuous series proximally and in a continuous series only distally; in those from the Maldivé Is. and Andaman Sea (Figs. 4, 7) they are

¹ Recently one of us (D.R.K.S.) examined two specimens of *E. purpureus* collected from the Gulf of Kutch and present in sir P. P. Institute of Science, Bhavanagar. These show five subequal arms, single madreporite and continuous series of conspicuous subambulacral spines.

Table 3. Comparison of published and observed variations in three nominal species of *Echinaster* Müller and Troschel

Sl. No.	Character	<i>E. Purpureus</i>	<i>E. luzonicus</i>	<i>E. varicolor</i>	Present material
1.	Arms	Five, equal or subequal with stout base and tapering tip	Five or more, unequal, cylindrical	Same as in <i>E. purpureus</i>	<i>E. purpureus</i> with cylindrical arms. <i>E. luzonicus</i> with subequal arms and arms with stout base and tapering tip.
2.	R/r	6-7 (H. L. Clark, 1921) 5.6-9.6 (Mean 7.3) (A.M.Clark, 1971)	7-10.5 (H. L. Clark, 1921) 5.6-9.5 (Mean 6.8) (A.M.Clark, 1971)	8-10 (H.L.Clark, 1938) 5.8, 6.4, 7.3 (A.M.Clark, 1971)	<i>E. purpureus</i> 6-11.2 (Mean 8.6). <i>E. luzonicus</i> 4.1-9.1 (Mean 6.6).
3.	R/br	5.5-6.5 (H.L.Clark, 1921) 4.8-8.6 (Mean 6.3) (A.M.Clark, 1971)	7-10.5 (H.L.Clark, 1921) 5.6-8.4 (Mean 6.8) (A.M.Clark, 1971)	6-8.5 (H.L.Clark, 1938)	<i>E. purpureus</i> 5.6-10.4 (Mean 7.8). <i>E. luzonicus</i> 4.6-8.6 (Mean 6.5).
4.	br-r	br greater than r	br equal to or less than r	br greater than r	<i>E. purpureus</i> with br equal to r. <i>E. luzonicus</i> with br greater than r.
5.	Subambulacral area	Bare or with discontinuous series of spines	Continuous series of spines	Spines continuous only at the base of arms	<i>E. purpureus</i> with continuous series of spines. <i>E. luzonicus</i> with bare subambulacral area or discontinuous series of spines

either totally lacking or are scattered and very discontinuous and finally in all the specimens from Camorta Island they are distinctly arranged in a continuous row (Fig. 9)²

Further, A. M. Clark observed that the abactinal reticulum was more compact in *E. luzonicus* than in the other two species. However, we find that it is compact only in the specimens from Camorta Island (Fig. 8) while it is somewhat wide in those from the remaining localities (Fig. 5) thus resembling the specimens of *E. purpureus* (Fig. 2).

While *E. luzonicus* is autotomous with five or more unequal arms, *E. purpureus* and *E. varicolor* consistently have only five equal or subequal arms. But it is not always possible to distinguish the autotomous specimens as in the case of Fisher's (1919) six-rayed specimens with a single madreporite, from the Sulu Archipelago and our six-rayed specimen with subequal arms and two madreporites, from Beyt Island (Table 2, No. 2) and the five-rayed specimen with one shorter arm, from Mauritius. (Table 1, No. 3) Moreover, Clark (1921) included specimens with five equal arms and a single madreporite under *E. luzonicus* and later (1938) erected *E. varicolor* for similar specimens with the subambulacral series continuous only at the base of the arms. But A. M. Clark who compared specimens, including a paratype of *E. varicolor* and two syntypes of *E. purpureus*, did not find significant differences among them.

In view of the extent of variation found, it appears that all three nominal species may be conspecific. From a comparative study (Table 3), it appears likely that *E. varicolor* is conspecific with *E. purpureus*. There is also a strong indication that *E. luzonicus* too may be conspecific with *E. purpureus*. However, nothing definite can be stated until their reproductive behaviour and the probable influence of ecological factors on the morphological variations are studied (see Achituv, 1969; Thayer, 1975).

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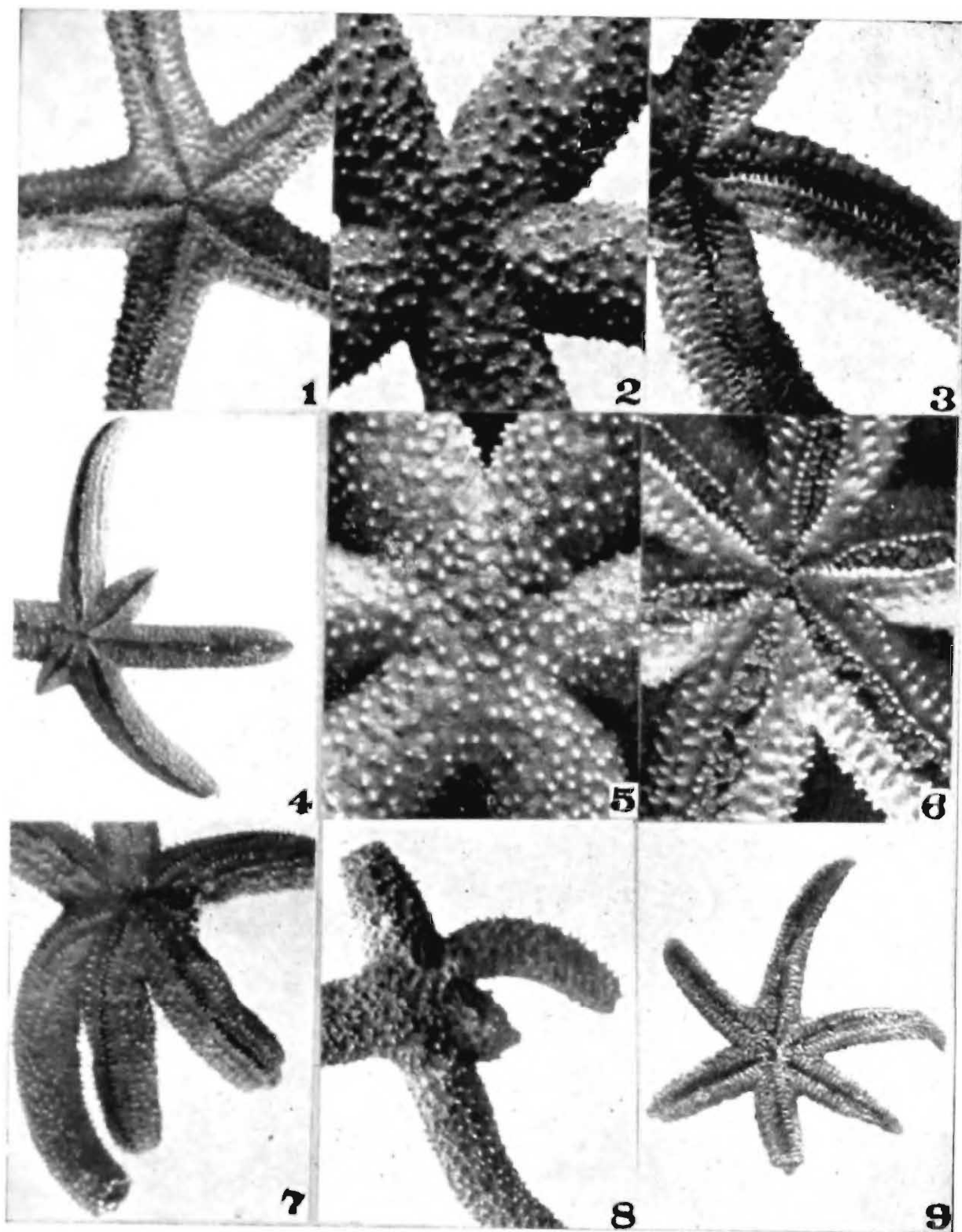
² We also examined, five more specimens of *E. luzonicus* from Camorta Island, collected by Dr. K. Reddiah and party on 8-10-1972. Four of these specimens show six unequal arms while the fifth shows four such and a fifth broken at the base. In all the five specimens the subambulacral area is bare.

SUMMARY

Two species of the asteroid genus *Echinaster* M. & T., *E. purpureus* (Gray) and *E. luzonicus* (Gray) are reported, both of which are recorded for the first time from the Gulf of Kutch, in addition, *E. luzonicus* from the Maldives, Andaman and Nicobar Islands. Variations observed in the present material throw some doubt on the validity of *E. luzonicus* and *E. varicolor* H. L. Clark, as distinct from *E. purpureus*. Their taxonomic status is discussed in the light of observed variations.

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Figs. 1—3. *Echinaster purpureus*. 1. Actinal view; Mauritius (Table 1, No. 2); 2. Abactinal view; Okha (Table 1, No. 5); 3. Actinal view of the same.

Figs. 4—9. *Echinaster luzonicus*. 4. Actinal view; Maldive Is. (Table 2, No. 1); 5. Abactinal view; Beyt Island (Table 2, No. 2); 6. Actinal view of the same; 7. Actinal view; Andaman Sea (Table 2, No. 3); 8. Abactinal view; Camorta Island (Table 2, No. 5); 9. Actinal view; Camorta Island (Table 2, No. 9).

PSOCOPTERA OF CALCUTTA AND ENVIRONS (WEST BENGAL: INDIA)

By

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INTRODUCTION

The Psocid fauna of India did not receive much attention because of their minute size and little economic importance, excepting a few damaging books and stored cereal products. A few individual may occasionally disseminate plant diseases by feeding pathogenic fungi and leaving viable spores in faeces deposited elsewhere (New, 1971).

Seventy nine species belonging to thirteen families of Psocoptera were recorded earlier by Enderlein (1903), Banks (1914), Navas (1934), Pearman (1942), Menon (1938 & 1942), Datta (1963, 1965, 1966 and 1969, a, b, c, d.) Thornton and Wong (1966, 1968) Lee and Thornton (1967) and Behura and Dash (1968). Out of this twenty five species were known from West Bengal. Twelve species viz., *Psococerastis taprobanes* (Hagen) *Liposcelis paetus* Pearman, *Ectopsocus ramburi* Datta, *Ectopsocus bangalensis* Datta, *Pseudocaecilius fletcheri* Datta, *Psococerastis asiaticā* Datta, *Tapinella fasciata* Thornton and Wong, *Peritroctes bengalensis* Thornton and Wong, *Peripsocus sclerotus* Thornton and Wong *Ectopsocus cinctus* Thornton and Wong, *Hemipsocus ornatus* Datta, and *Lichenomima indica* Datta, were recorded from Calcutta and its environs.

The present paper deals with seventeen species of Psocoptera representing fourteen genera and eleven families collected from Calcutta and its surrounding four districts viz. 24 Parganas, Howrah, Hooghly and Barasat. Two families and seven species among these, are new to India.

SYSTEMATIC ACCOUNT

Family PSOCATROPIDAE

1. *Psocatropos* (= *Granthakita*) *cuttackae* (Behura & Dash)

1968. *Granthakita Cuttackae* Behura and Dash, *Prak Utk. Univ. J. (Sc.)* 5: (2) : 47-51.

Material : 2 ♂ ♂, 3 ♀ ♀; Ballygunge, South Calcutta, 15. vii. 1975; ex. book; body length (in alcohol) : 1.2 mm. (♂) 1.3 mm. (♀).

Remarks : The veins of the wings are variable; venation vary even in the two wings of the same individual. They are common in the dwelling houses throughout the year (Behura and Dash, 1968).

Distribution : INDIA : Cuttack; Orissa and Calcutta (first record).

Family LIPOSCOLIDAE

2. *Liposcelis transvaalensis* (Enderlein)

1909. *Troctes transvaalensis* Enderlein, *Stett. ent. ztsg.*, 70 : 272.

1967. *Liposcelis transvaalensis* (Enderlein). Smithers, *Austr. Zool.*, 14, Pt. I : 28.

Material : 4 ♀ ♀ (apterous forms); Jabakusum House, Central Calcutta, 10. viii, 1975, ex. book; body length (in alcohol): 1.2 mm.

Remarks : The specific identification was confirmed with characteristics as recorded by Enderlein (1909).

Distribution : INDIA : Bombay; Maharashtra and Calcutta [first record]. SOUTH AFRICA (Transvaal).

Family PACHYTROCTIDAE

3. *Tapinella formosana* Enderlein

1908. *Tapinella formosana* Enderlein, *Zool. Anz.*, 33 : 774.

1967. *Tapinella formosana* Enderlein. Smithers, *Austr. Zool.*, 14, Pt. I : 28.

Material : 1 ♀ (alate form), Botanical garden, Sibpur, Howrah 7. ix. 1974; ex. leaf litter; body length (in alcohol): 1.3 mm.

Distribution : INDIA : Bombay; Maharashtra and Sibpur; West Bengal [first record]. FORMOSA.

4. *Tapinella fasciata* Thornton & Wong

1966. *Tapinella fasciata* Thornton and Wong, *Trans. R. ent. soc. Lond.*, 118 (1) : 1-4.

Material 3 ♂ ♂, 7 ♀ ♀ (alate forms), Batanagar, 24-Parganas; 28. ii. 1976; ex. dry banana leaves; body length (in alcohol) : 1.2 mm. (♂); 1.3 mm. (♀).

Remarks : The dominating character in the specimens are the lateral stripes running down the body which are found in the nymphs also.

Distribution : INDIA : Calcutta, Batanagar [second record]; West Bengal.

5. *Pachytroctes (Psacadium) georgi* (Menon)

1938. *Psacadium georgi* Menon, *Proc. Ind. Acad. Sci. (B)* 8 (4) : 280-283.

1967. *Pachytroctes (Psacadium) georgi* (Menon). Smithers, *Austr. Zool.*, 14, Pt. I : 30.

Material : 2 ♀ ♀ (apterous forms), Botanical garden, Sibpur, Howrah, 17. i. 1975; ex. leaf litter; body length (in alcohol) : 1.5 mm.

Remarks : The antennae of the specimens are very long and thin in relation to body.

Distribution : INDIA : Bombay; Maharashtra and Sibpur; West Bengal (first record).

6. *Peritroctes bengalensis* Thornton & Wong

1966. *Peritroctes bengalensis* Thornton and Wong, *Trans. R. ent. Soc. Lond.* 118, Pt. I : 4.

Material : 1 ♀ (apterous form), Barasaat, 24-Parganas, 27. viii. 1975; ex. dry leaf litter; body length (in alcohol): 1 mm.

Remarks : The antennae of the specimen are longer than the sub-globular abdomen.

Distribution : INDIA : Calcutta, Barasaat [second record]; West Bengal:

Family CAECILIIDAE

7. *Caecilius muggenburgi* Enderlein

1903. *Caecilius muggenburgi* Enderlein, *Ann. Hist. nat. Mus. Hung.*, 1 : 269.

1967. *Caecilius muggenburgi* Enderlein. Smithers, *Austr. Zool.*, 14, Pt. I : 44.

Material : 1 ♀, Tollygunge, South Calcutta, 10. x. 1975; ex. semidry bush; body length (in alcohol); 1.4 mm.

Distribution : INDIA (first record). SINGAPORE, JAVA, PHILIPPINES and FORMOSA.

Family AMPHIPSOCIDAE

8. *Dasypsocus solox* (Enderlein)

1903. *Kolbea solox* Enderlein, *Ann. Hist. nat. Mus. Hung.*, 1 : 278.

1967. *Dasypsocus solox* (Enderlein). Smithers, *Austr. Zool.*, 14, Pt. 1 : 57.

Material : 1 ♀, Sheoraphuli, Hooghly, 24. x. 1975; ex. dry banana leaf; body length (in alcohol) : 2.5 mm.

Distribution : INDIA (first record). SINGAPORE.

Family LACHESILLIDAE

9. *Lachesilla pedicularia* (Linne)

1746. *Hemerobius flavicans* Linne, *Faun. suecica*, 223.

1919. *Lachesilla Pedicularia* (Linne). Enderlein, *Cat. Coll. S-L*, 3 : 16.

Material : 1 ♂, 3 ♀♀, Baruipur, 24-Parganas, 25. xi. 1975; ex. dry date leaves; body length (in alcohol): 1.4 mm. (♂); 1.5 mm. (♀).

Distribution : INDIA [first record]. NEPAL, EAST AFRICA, EUROPE, NORTH AMERICA, ARGENTINA and JAPAN.

Family PERIPSOCIDAE

10. *Ectopsocus bengalensis* Datta

1965. *Ectopsocus bengalensis* Datta, *J. Beng. nat. Hist. Soc.*, 34 (1) : 58-60.

Material : 1 ♂, 1 ♀, in vicinity of Rabindra Sarobar, South Calcutta, 18. ix. 1975; ex. dry foliage; body length 1.5 mm. (♂); 1.9 mm. (♀).

Distribution : INDIA: Barrackpore and Calcutta [second record]; West Bengal.

11. *Ectopsocus cinctus* Thornton

1962. *Ectopsocus cinctus* Thornton, *Trans. R. ent. Soc. Lond.*, 114 : 305.

1967. *Ectopsocus cinctus* Thornton : Smithers, *Austr. Zool.*, 14, Pt. I : 65.

Material : 3 ♀ ♀, from table-top, JabaKusum House, Central Calcutta, 24.ix.1975; body length (in alcohol) : 1 mm. - 1.3 mm.

Remarks : The specimens are generally found on dry leaves. The material studied are collected from table-top.

Distribution : INDIA : Calcutta [second record]. HONG KONG, VIETNAM and MALAYSIA.

12. *Peripsocus sclerotus* Thornton & Wong

1966. *Peripsocus sclerotus* Thornton and Wong, *Trans. R. ent. Soc. Lond.*, 118, Pt. I : 16-18.

Material : 1 ♀, in vicinity of Rabindra Sarobar, South Calcutta, 21. viii. 1975; ex. dry foliage; body length (in alcohol) : 1.5 mm.

Distribution : INDIA : Calcutta (second record).

13. *Peripsocus anoplus* Thornton & Wong

1968. *Peripsocus anoplus* Thornton and Wong, *Pacif. Ins. Monogr.*, 19 : 33-34.

Material : 2 ♂ ♂, 3 ♀ ♀, Dankuni, Hooghly, 22.i.1976. ex. dry date-leaves; body-length (in alcohol) : 1.9 mm. (♂); 2 mm. (♀).

Distribution : INDIA (first record). MALAYSIA.

Family HEMIPSOCIDAE

14. *Hemipsocus chloroticus* (Hagen)

1858. *Psocus chloroticus* Hagen, *Verh. zool. bot. Ges. Wein*, 8 : 474.

1967. *Hemipsocus chloroticus* (Hagen). *Smithers, Austr. Zool.*, 14, Pt. I : 72.

Material : 3 ♂ ♂, Sheoraphuli, Hooghly, 24. x. 1975.; ex. dry banana-leaves; body length (in alcohol) : 2.3mm. -2.9 mm.

Distribution : INDIA [first record]. CEYLON, SINGAPORE, SUMATRA, JAVA, SARAWAK, PHILIPPINES, FORMOSA and JAPAN.

Family PSEUDOCAECILIIDAE

15. *Pseudocaecilius citricola* (Ashmead)

1903. *Pseudocaecilius elutus* Enderlein, *Ann. hist. nat. Mus. Hung.*, 1 : 261.

1976. *Pseudocaecilius citricola* (Ashmead). *Turner, Sys. Ent.*, 1 : 212.

Material : 2 ♀ ♀, Botanical garden, Sibpur, Howrah, 19.xi.1974; ex. green vegetation; body length (in alcohol) : 1.8 mm.

Distribution : INDIA : Sibpur; West Bengal [second record]. JAVA, SINGAPORE, MADAGASCAR, SOUTH AFRICA, MOSAMBIQUE, CONGO, PORTO RICA, NORTH AMERICA.

Family ARCHIPSOCIDAE

16. *Archipsocus recens* Enderlein

1903, *Archipsocus recens* Enderlein, *Ann. Hist. Nat. Mus. Hung.* 1 : 286: Fig. 1 : Pl. viii.

Material : 2 ♀ ♀ (micropterous forms), in vicinity of Rabindra Sarobar, 4 vii. 1974; ex. bark; body length (in alcohol) : 1.5 mm.

Remarks : The figure and the key attributes directly and tallys with *Archipsocus recens*, recorded by Enderlein (1903) from Singapore. Its specific status is further confirmed as it agrees, without any deviation to the supplementation made by Badonnel (1966 : 409).

Distribution : INDIA [first record]. SINGAPORE and INDONESIA

Family PSOCIDAE

17. *Trichadenotecnum apertum* Thornton

1961. *Trichadenotecnum apertum* Thornton, *Trans. R. ent. Soc. Lond.*, 113 : 7

1976. *Trichadenotecnum apertum* : Ray and Srivastava *Newsl. zool. Surv. India*, 2 (1) : 26.

Material : 1 ♀, Botanical garden, Sibpur, Howrah, 19.xi.1974, ex. dry leaves; body length (in alcohol) : 2.3 mm.

Distribution : INDIA [first record]. HONG KONG.

SUMMARY

This paper deals with seventeen species of Psocoptera from Calcutta and Environs; of these seven are new records to India; viz, *Caecilius muggenburgi* Enderlein, *Dasypsocus solox* (Enderlein), *Lachesilla pedicularia* (Linne), *Peripsocus anoplus* Thornton and Wong, *Hemipsocus Chloroticus* (Hagen), *Archipsocus recens* Enderlein and *Trichadenotecnum apertum* Thornton.

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ANIMAL REMAINS FROM LUMBINI (NEPAL)

By

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(With 1 Plate and 1 Table)

INTRODUCTION

This report deals with the collection of animal remains from Lumbini, the birth place of Lord Buddha in Nepal excavated during the field season of 1970-1971 by the Department of Archaeology, Government of Nepal.

The following species are represented in this collection : A carp, *Lissemys punctata* (Bonnaterre), *Chitra indica* (Gray), *Sus scrofa cristatus* Wagner, *Bos indicus* Linn., *Bubalus bubalis* Linn., *Capra hircus aegagrus* Gmelin, *Ovis aries dolichura* Duerst, *Axis axis* Erxleben and *Equus caballus* Linn.

In almost all cases the animal remains from Lumbini are very fragile and fragmentary in nature. The organic materials of the bones have disappeared to a great extent and they are impregnated with inorganic material. Even the long bones such as humerus, radius, femur, tibia and canal bones consist of fragments only and hence are unsuitable for measurement etc.

The majority of the remains are domestic animals, the most prominent being those of Zebu or domestic humped cattle of India. The limited number of remains of the Indian buffalo indicate that probably the then human inhabitants did not maintain these animals in such large herds as humped cattle. The remains of goat and sheep are very small in number and that of the domestic pig are fairly represented. Amongst the remains, the presence of a single 1st phalanx of true horse is of great significance, showing that the horse was very useful animal in the daily life of the then inhabitants.

Amongst the wild animals, only the spotted deer (*Axis axis*) is represented.

Of the reptilian remains recorded are those of the common Soft-shelled Box Turtle (*Lissemys punctata*), the Soft-shelled River Turtle (*Chitra indica*) and a single vertebra of a snake.

These Lumbini remains resemble in their species those of Mohenjodaro (Sewell & Guha, 1931), Harappa (Prashad, 1936), Hastinapura (Nath 1955), Maski (Nath, 1957), Saranath (Nath, 1958), Rangpur (Nath, 1963), Nagda (Nath, 1966), Rupar (Nath, 1968) and Brahmigiri, (Nath, 1968).

SYSTEMATIC ACCOUNT OF THE ANIMAL REMAINS

Class PISCES

Order TELEOSTEI

A Carp

One dorsal spine and one abdominal vertebra of a fish. Locus : H₂₀-H₂₁, QD₁; Stratum : (6); Depth : 6' 9"; Reg. No. 2; Date : 18-2-72.

The dorsal spine and the vertebra appear to belong to some species of Carp. Not identifiable even generically, as the distinctive features are not well marked.

Class REPTILIA

Order CHELONIA

Family TRIONYCHIDAE

Lissemys punctata (Bonnaterre)

(Pl. I, Figs. 1 & 1A)

(Common Soft-shelled Box Turtle)

One fragment of plastron, Locus : H₂₀-J₂₀; Stratum : (3); Depth : 1' 6"; Reg. No. 1; Date : 29-12-70.

In pattern and vermiculations this fragment corresponds to those of Harappa (Prashad, 1936, p. 14), Mohenjodaro (Sewell & Guha, 1931, p. 663), Hastinapura (Nath, 1955, p. 108) and a Sarnath (Nath, 1958, p. 168) and belong to adult individual.

Chitra indica (Gray) (Pl. I, Fig. 2)

(Soft-shelled River Turtle)

One fragment of plastron. Locus : H₂₀-J₂₀, QD₄; Stratum : (7); 3' 2"; Date : 31-12-70.

The fragment of the plastron resembles in pattern and vermiculations those of Mohenjodaro (Sewell & Guha, 1931, p. 663), Harappa

(Prashad, 1936, p. 14), Hastinapura (Nath, 1955, p. 108), and Rupar (Nath, 1968, p. 72).

Order OPHIDIA

An abdominal vertebra of a snake. Locus : T₁₃-T₁₄, QD₁; Depth : 7'; Stratum : (11); Reg. No. 4; Date : 2-2-71.

Not identifiable, as distinctive features are not well marked. The zygosphene, a wedge-like process on the anterior side of the neural arch, and the zyganttrum, a depression on the posterior surface of the neural arch, are well marked in it.

Class MAMMALIA

Order ARTIODACTYLA

Family SUIDAE

Sus scrofa cristatus Wagner (Pl. 1, Figs. 3, 3A)

(Indian Domestic Pig)

1. Distal fragment of humerus without distal condyles having supinator ridge. Locus : H₂₀-QD₂; Stratum : (5); Depth : 2' 5"; Reg. No. 1; Date : 31-12-70.

2. Distal fragment of the left humerus without epiphysis. Locus : K₂₀-J₂₀, QD₃; Stratum : (6); Depth : 3' 6"; Reg. No. 1; Date : 17-1-71.

3. Fragment of the left horizontal ramus of lower mandible with 3rd premolar and 1st & erupting molar of an young one. Locus : H₂₀-J₂₀, D₂; Stratum : (10); Depth : 6' 8"; Reg. No. 10; Date : 12-2-71.

4. Fragment of a proximal shaft of right tibia without proximal epiphysis of an young one. Locus : H₂₀-J₂₀, D₂; Stratum : (10); Depth : 6' 8"; Reg. No. 10; Date : 12-2-71.

5. Left upper 2nd molar. Locus : H₂₀-J₂₀; Stratum : (7); Depth : 5' 5"; Reg. No. 7; Date : 7-1-71.

6. Left upper 4th premolar. Locus : T₁₃-T₁₄, QD₁; Stratum : (5); Depth : 2' 3"; Reg. No. 9; Date : 11-2-71.

7. Fragment of the shaft of humerus without proximal and distal extremities. Locus : H₂₀-H₂₀, QD₁; Stratum : (6); Depth : 5' 1"; Reg. No. 1; Date : 17-2-71.

8. Distal fragment of humerus. Locus : H₂₁-Q₂, QD₂; Stratum : (5); Depth : 3'; Reg. No. 1; Date : 31-1-71.

9. Fragment of a shaft of femur. Locus : T₁₃-T₁₄, QD₁; Stratum : (11); Depth : 7' 3"; Reg. No. 7; Date : 5-2-71.

10. Fragment of the shaft of radius. Locus : H₂₀-J₂₀, QD₂; Stratum : (5); Reg. No. 15; Date : 19-1-71.

11. Upper canine tooth. Locus : T₁₃-T₁₃; Stratum : (7); Depth : 7' 10"; Date : 15-1-71.

These remains are mostly fragmentary in nature. It is difficult, therefore, to be certain about the size of this species. All bones are mostly of young individuals and thereby showing that the people practiced fullfledged domestication of this animal.

The remains of the domestic pig have been recorded from Harappa (Prashad, 1936, p. 54), Mohenjodaro (Sewell & Guha, 1931, pp. 660-661), Rupar (Nath, 1968, p. 103), Hastinapura (Nath, 1955, pp. 118-119), Rangpur (Nath, 1963, pp. 157-158) and Nagda (Nath, 1966, p. 183).

Family BOVIDAE

Bos indicus Linn. (Pl. 1, figs. 5, 5A, 5B)

(The Zebu or Domestic Humped cattle of India)

1. 1st phalanx of forefoot. Locus : K₂₀-J₂₀, QD₃; Stratum : (6); Depth : 3' 6"; Date : 11-1-71.
2. One fragment of proximal part of 3rd and 4th metatarsal. Locus : T₁₃-T₁₄, QD₁; Stratum : (11) Depth : 7' Reg. No. 4; Date : 2-2-71.
3. Slightly broken distally left lower molar tooth. Locus : T₁₃-T₁₄, QD₁; Stratum : (6); Depth : 4' 3"; Reg. No. 10.
4. Distal fragment of 3rd & 4th metatarsal. Locus : T₁₃-T₁₄, QD₁; Stratum : (4); Depth : 3' 5"; Reg. No. 11; Date : 11-2-71.
5. Body of a vertebra. Locus : T₁₃-T₁₄, QD₁; Stratum : (4); Depth : 3' 5" Reg. No. 11; Date : 11-2-71.
6. Fragment of a blade of scapula. Locus : T₁₂-T₁₃, QD₁; Stratum : (3); Depth : 1' 8"; Reg. No. 10; Date : 6-1-71.
7. Fragments of horizontal ramus of lower mandible. Locus : H₂₀-J₂₀, QD₁; Stratum : (10); Depth : 6' 8"; Reg. No. 10; Date : 12-2-71.
8. Fragment of a rib. Locus : H₂₀-J₂₀, QD₂; Stratum : (10); Depth : 6' 8"; Reg. No. 10; Date : 12-2-71.
9. Fragmentary piece of a cervical vertebra. Locus : T₁₂-T₁₃, Q₄; Stratum : unstratified; Depth : 7' 7"; Reg. No. 9; Date : 28-1-71.
10. Proximal fragmentary portion of a scapula with a portion of glenoid cavity. Locus : T₁₂-T₁₃; Q₄; Stratum : unstratified; Depth : 7' 7"; Reg. No. 9; Date : 28-1-71.
11. Fragmentary piece of a cervical vertebra with process of spine. Locus : T₁₂-T₁₃, QD₄; Stratum : (5); Depth : 2' 8"; Reg. No. 4; Date : 4-1-71.
12. Fragment of astragalus. Locus : H₂₀-J₂₀, QD₂; Stratum : (3); Depth : 1' 6"; Reg. No. 1; Date : 29-12-70.
13. Body of a lumbar vertebra. Locus : H₂₀-J₂₀, QD₄; Stratum : (5); Depth : 6' 7"; Date : 6-1-71.
14. Eroded left scaphocuboid bone. Locus : H₂₀-J₂₀, QD₄; Stratum : (5); Depth : 6' 7"; Date : 6-1-71.

15. Fragment of a bone. Locus : T_{13} - T_{14} , QD_1 ; Stratum : (11); Depth : 7'3"; Date : 5-2-71.
16. 3rd phalanx of forelimb. Locus : H_{20} - H_{21} , QD_1 ; Stratum : (6); Depth : 5' 1"; Date : 17-2-71.
17. Proximal fragmentary bone of a radius. Locus : H_{20} - H_{21} , QD_1 ; Stratum : (6); Depth : 5'1" Date : 17-2-71.
18. Proximal eroded 1st phalanx. Locus : H_{20} - J_{20} , Q_4 ; Stratum : (7); Depth : 3'2"; Reg. No. 2; Date : 31-12-70.
19. 1st phalanx (Broken proximally and distally) of fore-limb. Locus : H_{20} -SE; Stratum : (2); Reg. No. 3; Date : 29-12-70.
20. Distal fragmentary piece of the humerus (medial condyle). Locus : H_{21} - Q_3 ; Stratum : (5); Depth : 3'; Reg. No. 1; Date : 31-1-71.
21. Eroded 3rd phalanx of fore-foot. Locus : T_{13} - T_{14} , QD_1 ; Stratum : (11); Depth : 7'-8' 6"; Reg. No. 6; Date : 3-2-71.
22. A fragmentary rib. Locus : T_{13} - T_{14} , QD_1 ; Stratum : (11); Depth : 7'-8' 6"; Reg. No. 6; Date : 3-2-71.
23. Proximal fragment of tibia. Locus : T_{13} - T_{14} , QD_1 ; Stratum : (11); Depth : 7'-8' 6"; Reg. No. 6; Date : 3-2-71.
24. Fragment of horizontal ramus of lower jaw. Locus : T_{13} - T_{14} , QD_1 ; Stratum (11); Depth : 7'-8' 6"; Reg. No. 6; Date : 3-2-71.
25. Fragment of a rib. Locus : H_{20} - J_{20} , QD_2 ; Stratum : (5); Date : 19-1-71.
26. Fragmentary piece of humerus. Locus : T_{13} - T_{14} , QD_1 ; Stratum : (9); Depth : 6'5"; Date : 28-1-71.
27. Fragment of a left astragalus. Locus : T_{13} - T_{14} , QD_1 ; Stratum : (3); Date : 12-2-71.
28. Fragment of a shaft of radius. Locus : H_{20} - J_{20} , QD_2 ; Stratum : (3); Depth : 1'6"; Reg. No. 6; Date : 2-1-71.
29. Body of a lumbar vertebra. Locus : H_{20} - J_{20} , QD_4 ; Stratum : (5); Depth : 6'7"; Date : 6-1-71.
30. Eroded left scaphocuboid of the pes. Locus : H_{20} - J_{20} , QD_4 ; Stratum : (5); Depth : 6'7"; Date : 6-1-71.
31. 1st phalanx of right pes. Locus : T_{12} - T_{13} , Q_{14} ; Stratum : (11); Depth : 5'6"; Date : 13-1-71.
32. One piece of distal end fragment of 3rd & 4th metatarsal. Locus : T_{12} - T_{13} Q_{14} ; Stratum : (11); Depth : 5'6"; Date : 13-1-71.
33. Fragment of the vertical ramus of left mandible with broken coronoid process. Locus : T_{12} - T_{13} , Q_{14} ; Stratum : (11); Depth : 5'6"; Date : 13-1-71.
34. Fragment of a sacral bone. Locus : T_{12} - T_{13} , Q_{14} ; Stratum : (11); Depth : 5'6"; Date : 13-1-71.
35. Fragment of horizontal ramus of left mandible. Locus : H_{20} - J_{20} , QD_2 ; Stratum : (10); Depth : 6'; Reg. No. 12; Date : 11-2-71.
36. Rib (fragment). Locus : T_{12} - T_{13} , QD_4 ; Stratum : (8); Date : 11-1-71.

37. Horizontal ramus of mandible c tooth (fragment). Locus : T_{12} - T_{13} , QD_4 ; Stratum : (8); Date : 11-1-71.
38. Two Ribs (fragments). Locus : T_{12} - T_{13} , QD_4 ; Stratum : (9); Depth : 6'6" Date : 19-1-71.
39. Five pieces of rib (fragments). Locus : H_{20} - J_{20} , QD_4 ; Stratum : (5); Date : 6-1-71.
40. 3rd & 4th metacarpal (fragment). Locus : H_{20} - QD_2 ; Stratum : (5); Depth : 2'5"; Date : 13-12-70.
41. Body of lumber vertebra. Locus : T_{12} - T_{13} ; Stratum : (7); Depth : 7'10"; Date : 15-1-71.
42. Third broken phalanx. Locus : K_{20} - L_{20} , QD_3 ; Stratum : (6); Depth : 3'6"; Date : 11-1-71.

The remains of humped cattle of India, listed above, including the long bones are very fragmentary. The great frequency with which the remains of *Bos indicus* have been met with indicates that the inhabitants probably used to maintain large herds of this animal. In a number of cases the remains are those of the young ones which indicate that the people practised full-fledged domestication of the humped cattle of India.

The few teeth available resemble closely those from Harappa, Mohenjodaro, Hastinapura, Maski, Rupar and Brahmagiri and also the recent specimens of *Bos indicus* in the collection of the Zoological Survey of India.

These remains closely resemble the smaller humped, short-horned variety found from Mohenjodaro (Sewell & Guha, 1931, p. 654), Hastinapura (Nath, 1955, pp. 110-114), Maski (Nath, 1957, pp. 122-125), Rupar (Nath, 1968, pp. 80-95), Brahmagiri (Nath, 1968, pp. 69-72).

From the structural resemblance between the skeletal remains excavated at Lumbini and those of the modern domestic humped cattle of India present in the collection of the Zoological Survey of India, it is evidently clear that Lumbini remains are alike those of the domesticated cattle now found in India.

Bubalus bubalis Linn. (Pl. 1, Figs. 6, 6A)

(The Domestic Buffalo)

1. Fragment of the shaft of humerus. Locus : H_{20} - J_{20} , QD_2 ; Stratum : (7); Depth : 5'5"; Reg. No. 7; Date : 7-1-71.
2. Fragment of the distal part of right humerus. Locus : H_{20} - J_{20} ; Stratum : (7); Depth : 5'5"; Reg. No. 7; Date : 7-1-71.

3. Fragment of a rib of thoracic region. Locus : H₂₀-H₂₁; Stratum : (6); Depth : 7'; Date : 5-3-71.
4. Fragment of a rib of lumber region. Locus : H₂₀-H₂₁; Stratum : (6); Depth : 7'; Date : 5-3-71.
5. 1st phalanx of right manus. Locus : H₂₀-J₂₀; Stratum : (7); Depth : 3'2"; Date : 31-12-70.
6. 2nd broken phalanx of fore-foot. Locus : K₂₀-L₂₀, QD₃; Stratum : (6); Depth : 3'6"; Date - 11-1-71.
7. A broken talus. Locus : H₂₀-J₂₀, QD₄; Stratum : (7); Depth : 3'2"; Date : 31-12-70.

The find of a smaller number of fragments of the bones of *Bubalus bubalis* indicates that the inhabitants probably did not maintain large herds of this animal as compared with the *Bos indicus* Linn.

These remains show very close structural resemblance with those of the specimens of modern domestic buffaloes present in the collection of the Zoological Survey of India. Thus the remains of the domestic buffalo are closely akin to the modern domesticated race of buffalo. They are similar to those of Mohenjodaro (Sewell & Guha, 1931, p. 659), Harappa (Prasad, 1936, pp. 32-37), Hastinapura (Nath, 1955, p. 115) and Rupar (Nath, 1968, pp. 97-98).

Subfamily CAPRINAE

Capra hircus aegagrus Gmelin

(The Domestic Goat)

1. One fragment of the shaft of femur. Locus : H₂₀-J₂₀, QD₂; Stratum : (10); Depth : 6'8"; Date : 12-2-72.
2. One fragment of radius. Locus : T₁₂-T₁₃, QD₂; Stratum : (5); Depth : 2'8"; Date : 9-1-71.
3. Fragment of the body of lumber vertebra. Locus : T₁₂-T₁₃, QD₄; Stratum : (6); Date : 10-2-71.
4. Fragmentary piece of femur. Locus : T₁₃-T₁₄, QD₁; Stratum : (9); Depth : 6'3"; Reg. No. 5; Date : 2-2-71.
5. Right lower second molar. Locus : T₁₃-T₁₄, QD₁; Stratum : (5); Depth : 2'3"; Reg. No. 9; Date : 11-2-71.
6. Fragmentary shaft of femur of an young one. Locus : T₁₃-T₁₄, QD₁; Stratum : (5); Depth : 2'3"; Reg. No. 9; Date : 11-2-71.
7. Fragment of a pelvic bone with acetabulum. Locus : T₁₃-T₁₄; Stratum : (5); Reg. No. 3; Date : 31-1-71.
8. A fragment of the horn-core. Locus : T₁₃-T₁₄, QD₁; Stratum : (11); Depth : 7'; Reg. No. 4; Date : 2-2-71.
9. Fragment of a body of lumber vertebra. Locus : T₁₃-T₁₃, QD₄; Stratum : (6); Date : 10-2-71.

10. Fragment of a skull. Locus : H₂₀-J₂₀, QD₂; Stratum : (5); Depth : 2'10"; Date : 18-1-71.

These remains are very fragmentary. The few available teeth do not show any specialized features and generally resemble those of the recent domestic goat.

These fragments resemble those of the goat from Harappa (Prashad, 1936, pp. 47-48), Hastinapura (Nath, 1955, p. 117), Maski (Nath, 1957, pp. 127-128) and Rupar (Nath, 1968, pp. 99-100).

Ovis aries dolichura Duerst

(The Domestic Sheep)

1. Left upper 1st molar. Locus : T₁₃-T₁₄, QD₁; Stratum : (11); Depth : 7'8' 6"; Reg. No. 6; Date : 3-2-71.

2. Fragment of the shaft of radius. Locus : T₁₃-T₁₄, QD; Stratum : (11); Depth : 7'-8' 6"; Reg. No. 6; Date : 3-2-71.

The two fragments generally resemble those of the recent specimens of domestic sheep in the collection of the Zoological Survey of India. These fragments from the Lumbini excavations resemble those of the remains of the domestic sheep from Harappa, Hastinapura, Maski and Rupar.

Family CERVIDAE

Axis axis Erxleben (Pl. 1, Fig. 4)

(The Chital or Spotted Deer)

1. One proximal fragment of 3rd & 4th metatarsal. Locus : K₂₀-J₂₀, QD; Stratum : (6); Depth : 3'6"; Reg. No. 1; Date : 17-1-71.

This solitary find shows the presence of chital at Lumbini.

Remains of chital have also been recorded from Prabhas (Nath, 1967, p. 66) and from Brahmagiri (Nath, 1968, p. 75).

Order PERISSODACTYLA

Family EQUIDAE

Equus caballus Linn. (Pl. 1, Figs. 7, 7A)

1. One 1st phalanx of the fore-foot proximally broken. Locus : H₂₀-J₂₀, QD₂; Stratum : (6); Depth : 2'10"; Reg. No. 8; Date : 9-1-71.

This solitary find shows that the inhabitants were acquainted with the horse at Lumbini. It resembles in size and shape the modern horse, *Equus caballus* of India (See Table 1).

Table 1.—Measurements (in mm.) of the 1st phalanx of fore-foot of the horse.

1st phalanx of the fore-foot	Lumbini	Rupar (RPR 2-7)	Harappa	Modern specimen (in the Zoological Survey of India)
1. Saggital length	86	87	79	81
2. Greatest breadth of the proximal end	—	56	52	52
3. Minimum breadth of diaphysis	33	32	33	32
4. Greatest distal breadth of bone	46	48	45	44
5. Greatest breadth of distal articular surface	43	45	42	42

Remains of the horse *Equus caballus* have been recorded from Mohenjodaro (Sewell & Guha, 1931, p. 653), Harappa (Nath, 1962, pp. 1-14), Hastinapura (Nath, 1955, p. 109) and Rupar (Nath, 1968, p. 80).

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SUMMARY

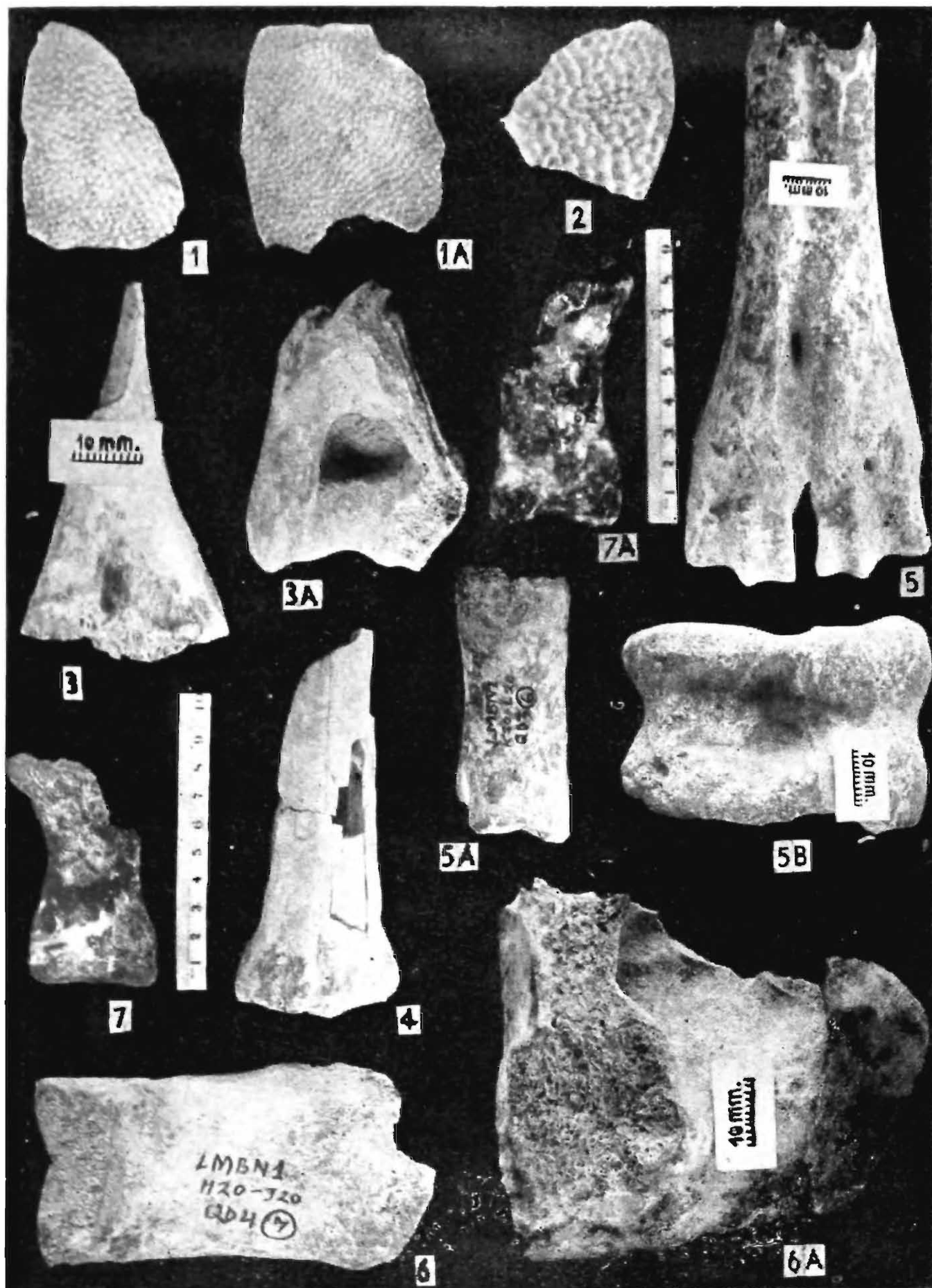
This report is based on the collection of animal remains excavated by the Department of Archaeology, Government of Nepal during the field season of 1970-1971 from Lumbini, Nepal. Altogether eleven species is represented. Amongst them, the domesticated animals are as follows:—*Bos indicus* Linn., *Bubalus bubalis* Linn., *Capra hircus aegagrus* Erxl., *Ovis aries dolichura* Duerst, *Equus cabalus* Linn. and *Sus scrofa cristatus* Wagner.

Amongst the wild animals, only the spotted deer, *Axis axis* Erxl. is represented. The reptilian fauna is represented by *Lissemys punctata* (Bonnaterre), *Chitra indica* (Gray) and snake.

A few bones of *Bos Indicus* Linn. bear definite chopping marks thereby showing that the inhabitants probably used this animal as food.

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Explanation for Plate IX

Lissemys punctata (Bonneterre)

Fig. 1. & 1A.—Fragment of plastron.

Chitra indica (Gray)

Fig. 2. —Fragment of plastron.

Sus scrofa cristatus Wagner

Fig. 3. —Distal fragment of the left humerus without epiphysis.

Fig. 3A —Distal fragment of humerus.

Axis axis Erxleben

Fig. 4 —Proximal fragment of 3rd & 4th metatarsal.

Bos indicus Linn.

Fig. 5. —Proximal fragment of 3rd & 4th metatarsal.

Fig. 5A. —First phalanx.

Fig. 5B. —Fragment of left astagalus.

Bubalus babulis Linn.

Fig. 6. —1st phalanx of right manus without mark.

Fig. 6A. —Fragment of the distal part of humerus.

Equus caballus Linn.

Fig. 7. —Volar view of 1st phalanx.

Fig. 7A. —Dorsal view of 1st phalanx.

STUDIES ON THE LIFE HISTORY OF INDIAN DRAGONFLIES, *PSEUDAGRION RUBRICEPS* SELYS (COENAGRIONIDAE : ODONATA)

By

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(With 3 Text-figures and 2 Tables)

INTRODUCTION

Studies on the larval stages and life history of Indian Odonata are very meagre. Efforts made so far have generally been directed towards the study of adults only. To have a better understanding of the biology of Indian species in particular and tropical in general the author has begun a study of the life history of Indian dragonflies from various aquatic habitats. In the present paper life history of *Pseudagrion rubriceps* Selys, a species widely distributed in Oriental Regions, is described. No detailed account of the biology and larval stages of Indian species of genus *Pseudagrion* Selys are available, though brief notes on the subject are to be found by Laidlaw (1915, 1916), Fraser (1924) and Lieftinck (1934). Recently Kumar (1973) has made taxonomic descriptions of the last instar larvae of *P. rubriceps* Selys and *P. laidlawi* Fraser.

Within Indian limits *P. rubriceps* Selys is widely distributed in plains and submontane areas, W. Bengal and U. P. In western Himalaya it is recorded from Corbett National Park, Dehra Dun, Pauri, Tehri, Nainital, Almora (U. P.), Bilaspur, Hamirpur and Sirmaur (H. P.).

MATERIAL AND TECHNIQUES

Studies on the life history in the laboratory were started on 9.vi. 1976 by collecting eggs laid in vegetation by a ovipositing female in tandem at a perennial pond at vill. Gorakhpur, Dehra Dun. In the laboratory vegetation with eggs was kept submerged in water in a glass vessel. Hatching started on 22.vi.76 and completed on 25.vi.76. Study on larval development was begun on 23.vi.76 by starting rearing of 6 larvae in 2nd instar. All the 6 larvae emerged into imagos from 27.

TABLE 1.—Breeding Record (1976) of 6 larvae of *Pseudagrion rubriceps* Selys

Eggs collected on 9. VI. 1976.

Eggs hatched on 22. VI. 76 - 24. VI. 76.

INSTAR	Larva	I	Larva	II	Larva	III	Larva	IV	Larva V		Larva VI	
	Date of entry	dura- tion (in days)	Dt. of entry	Dura- tion (in days)	Dt. of entry	Dura- tion (in days)	Dt. of entry	Dur- ation (in days)	Dt. of entry	Dura- tion (in days)	Dt. of entry	Dura- tion (in days)
2nd	23. VI. 76	2	23. VI. 76	2	23. VI. 76	3	23. VI. 76	3	23. VI. 76	2	23. VI. 76	3
3rd	25. VI. 76	3	25. VI. 76	5	26. VI. 76	3	26. VI. 76	4	25. VI. 76	4	26. VI. 76	3
4th	28. VI. 76	5	30. VI. 76	3	29. VI. 76	2	30. VI. 76	1	1. VII. 76	2	29. VI. 76	4
5th	3. VII. 76	3	3. VII. 76	2	1 VII. 76	4	1 VII. 76	4	1. VII. 76	2	3. VII. 76	2
6th	6. VII. 76	5	5. VII. 76	5	5. VII. 76	2	5. VII. 76	4	3. VII. 76	6	5. VII. 76	4
7th	11. VII. 76	4	10. VII. 76	6	7. VII. 76	4	9. VII. 76	4	9. VII. 76	4	9. VII. 76	5
8th	15. VII. 76	6	16. VII. 76	6	11. VII. 76	6	13. VII. 76	6	13. VII. 76	6	14. VII. 76	6
9th	21. VII. 76	4	22. VII. 76	4	17. VII. 76	7	19. VII. 76	4	19. VII. 76	4	20. VII. 76	5
10th	25. VII. 76	6	26. VII. 76	6	24. VII. 76	4	23. VII. 76	4	23. VII. 76	5	25. VII. 76	5
Emergence	31. VII. 76		1. VIII. 76		28. VII. 76		27. VII. 76		28. VII. 76		30. VII. 76	
Total number of days (from oviposition to emergence)		52		53		49		48		49		51

vii.76 to 31.vii.76 after passing through 10 instars, thus taking 50-54 days respectively from oviposition to emergence. Breeding record of the larvae reared in the laboratory is tabulated in table 1. In early instars larvae were fed on *Paramaecium* and *Cyclops* and later on mosquito larvae.

Studies on various instars are based on laboratory reared material. Regular sampling from various aquatic habitats and field studies were carried out, in the years 1975-76, in order to study the seasonal regulation of the species.

The terminology used for the labium is that of Corbet (1953), for tibial comb and tarsi that of Mac Neill (1967), and for the anal appendages those of Snodgrass (1954) and Mac Neill (1960).

OVIPOSITION AND EGGS

Oviposition is endophytic and occurs in tandem. The pair flies lazily amidst the vegetation at the banks of water bodies. Egg may be laid above water level or in submerged vegetation. The pair moves from one twig to another while ovipositing. Eggs are laid in oblique transverse rows in cortex of twigs or at the lower surface of leaves.

Eggs are elongated and some what cylindrical (measuring 0.96-1.02 mm.), with narrow anterior pole (Text-fig. 1A). When freshly laid yellowish, soon become darker.

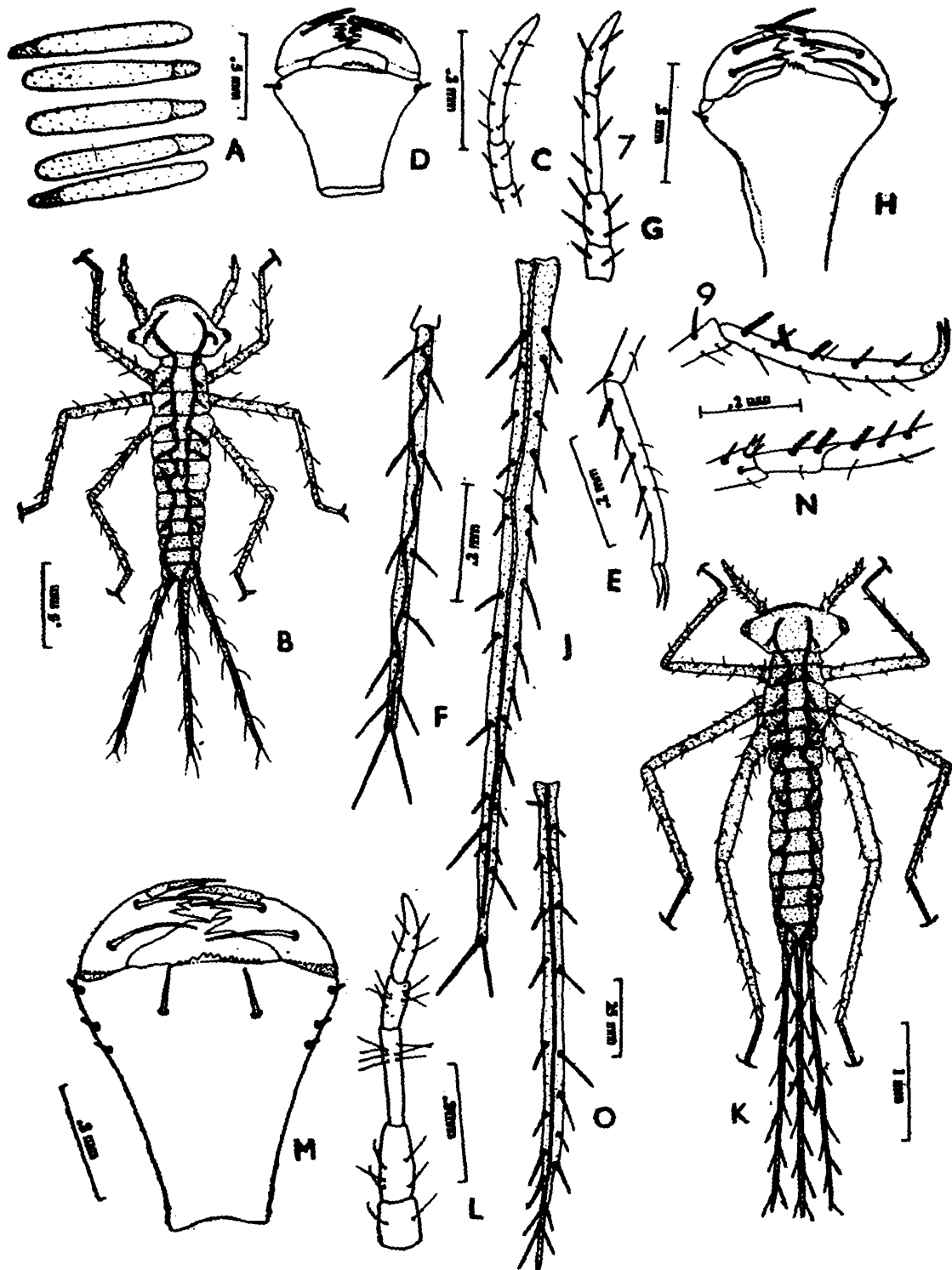
LARVAL STAGES

1st Instar or Prolarva: Hatching takes place through the rupture end of the egg and is of very short duration. Head somewhat squarish, abdomen elongated, narrowing posteriorly; legs folded ventrally over the abdomen; caudal lamellae thin, elongated.

2nd Instar (Text-fig. 1, B-F) : Elongated and slim in appearance with almost transparent body; tracheae distinctly visible in abdominal region (Fig. 1B); *Antennae* (Fig. 1C) 3-segmented, sparsely beset with setae; *labium* (Fig. 1D) small, flat, squarish; premental setae absent, a lateral spiniform seta present near the base of palpus, distal margin of prementum straight but with a few mesial crenations; palpal setae 1+1, distal margin of palpus formed into a number of crenulations; *tarsi* (Fig. 1E) single-segmented, beset with few spiniform setae; *Caudal lamellae* thin, ribbon-like long processes, almost transparent with a distinct undulating trachea traversing its full length (Fig. 1F). Length 2.2 mm.

3rd Instar (Text-fig. 1, G-J) : Larvae increasing in size with paired tracheae distinct in thoracic and abdominal region. *Antennae* (Fig. 1G) 4-segmented, the flagellar segment having divided into two; on

labium (Fig. 1H) premental setae still absent, crenations at distal margin of prementum beset with a claviform seta each; palpal setae 2+2, last one added at base, distal margin of palpus still deeply crenulated; *tarsi* single-segmented, beset with a few pectinate setae (Fig. 1I); *caudal*



Text-fig. 1.—(A-O) Life history of *P. rubriceps* Selys: (A) The eggs; (B-F) 2nd Instar (B. larva, C. antenna, D. labium, E. tibial comb and tarsi, F. epiproct); (G-J) 3rd Instar (G. antenna, H. labium, I. tibial comb and tarsi, J. epiproct); (K-O) 4th Instar (K. larva, L. antenna, M. labium, N. tibial comb and tarsi, O. epiproct).

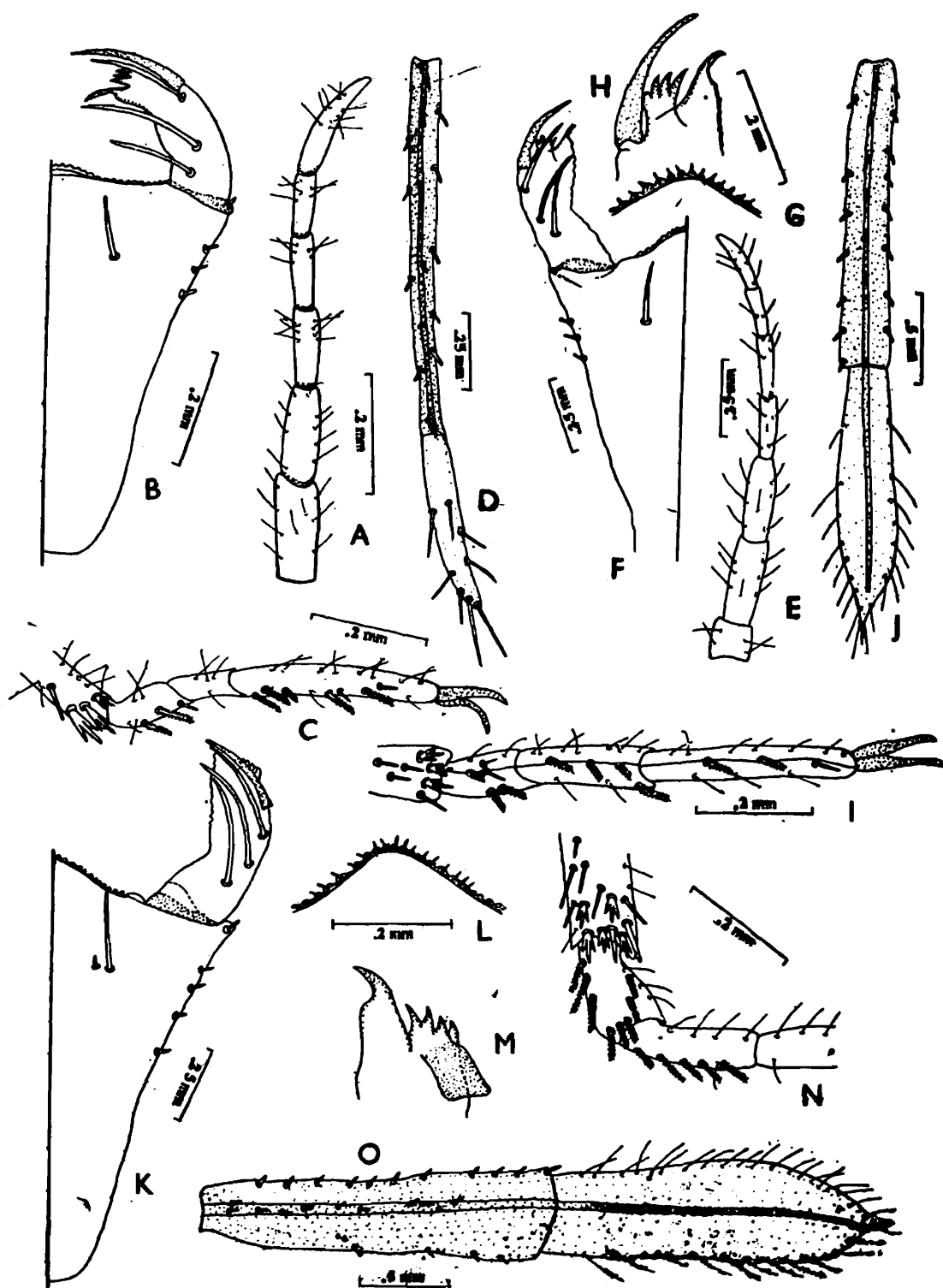
lamellae (Fig. 1J) increase in size, uniformly beset with long setae laterally, a median trachea traverses through its length. Length 4.5 mm.

4th Instar (Text-fig. 1, K-O): Larvae with caudal lamellae almost as long as body. *Antenna* (Fig. 1L) 5-segmented, 1st flagellar segment having divided into two, uniformly beset with setae; *labium* (Fig. 1M) still flat and squarish, premental setae 1+1, crenations at distal margin of prementum increasing in number; palpal setae 2+2, distal margin of palpus starts forming an outer and inner lobe; movable hook medium-sized; *tarsi* (Fig. 1N) 2-segmented, the distal one largest, tibial comb comprises a single tridentate seta; *tarsi* beset with pectinate setae; *caudal lamellae* (Fig. 1,O) becoming broader with short blunt setae proximally, narrowing distally. Length 6 mm.

5th Instar (Text-fig. 2,A-D) : Caudal lamellae shorter than body. *Antennae* (Fig. 2A) 6- Segmented, basal flageller segment again having divided into two; *labium* (Fig.2B) premental setae 1+1, laterally beset with a few spiniform setae; palpal setae 3+3, last seta added in inter-polar position; distal margin of palpus formed into two distinct lobes, the outer comprising 5-6 teeth, the inner forming a hook; *tarsi* 3-segmented, beset with a few pectinate setae; tibial comb comprise sa few tridentate setae (Fig. 2C). *Caudal lamellae* (Fig. 2D) now differentiated into ante-and post-nodal regions, antenodal region narrower with densely arranged rows of short spiniform setae, while the postnodal region has a few widely placed, long simple setae. Length 8.7 mm.

6th Instar (Text-fig. 2, E-J) : *Antenna* (Fig. 2E) 7- segmented, basal flagellar segment again dividing into two. *Labium* (Fig. 2F) becoming a bit elongated and narrower; premental setae 1+1, distal margin of prementum now having well formed crenations, each beset with a seta (Fig. 2G) palpal setae 3+3; outer lobe at distal margin of palpus with 4 teeth while the inner forms a curved end hook (Fig. 2H); *tarsi* 3-segmented beset with pectinate and spiniform setae, *tibial comb* comprises a number of tridentate setae (Fig. 2I); wing buds appear as rudiments and cover 1st abdominal segment. Female gonapophyses appear as triangular paired structures mid-ventrally on 9th abdominal segment; *caudal lamellae* with postnodal region becoming foliaceous and broader distally, antenodal region longer than postnodal (Fig. 2J). Length 10.4 mm.

7th Instar (Text-fig. 2 K-O) : *Antenna* 7-segmented, uniformly beset with setae. Premental setae $1_1 + 1^1$, setulae added mesally; number of lateral spiniform setae increasing, a few spiniform setae present mid-apically; palpal setae 3+3 (Figs. 2 K-M) : *tarsi* 3-segmented, tibial comb comprises a number of irregularly arranged tridentate setae, *tarsi* beset with paired row of pectinate setae (Fig. 2N); wing buds



Text-fig. 2.—(A-O) Life history of *P. rubriceps* Selys: (A-D) 5th Instar (A. antenna, B. labium, C. tibial comb and tarsi, D. epiproct); (E-J) 6th Instar (E. antenna, F. labium, G. enlarged view distal margin of prementum, H. enlarged view distal margin of palpus, I. tibial comb and tarsi, J. epiproct); (K-O) 7th Instar (K. labium, L. enlarged view distal margin of prementum, M. enlarged view distal margin of palpus, N. tibial comb and tarsi, O. epiproct).

increasing in size and extend up to middle of 2nd abdominal segment. Female gonapophyses further increasing in size, paired processes extend up to anterior side of 9th segment; *caudal lamellae* have acquired the

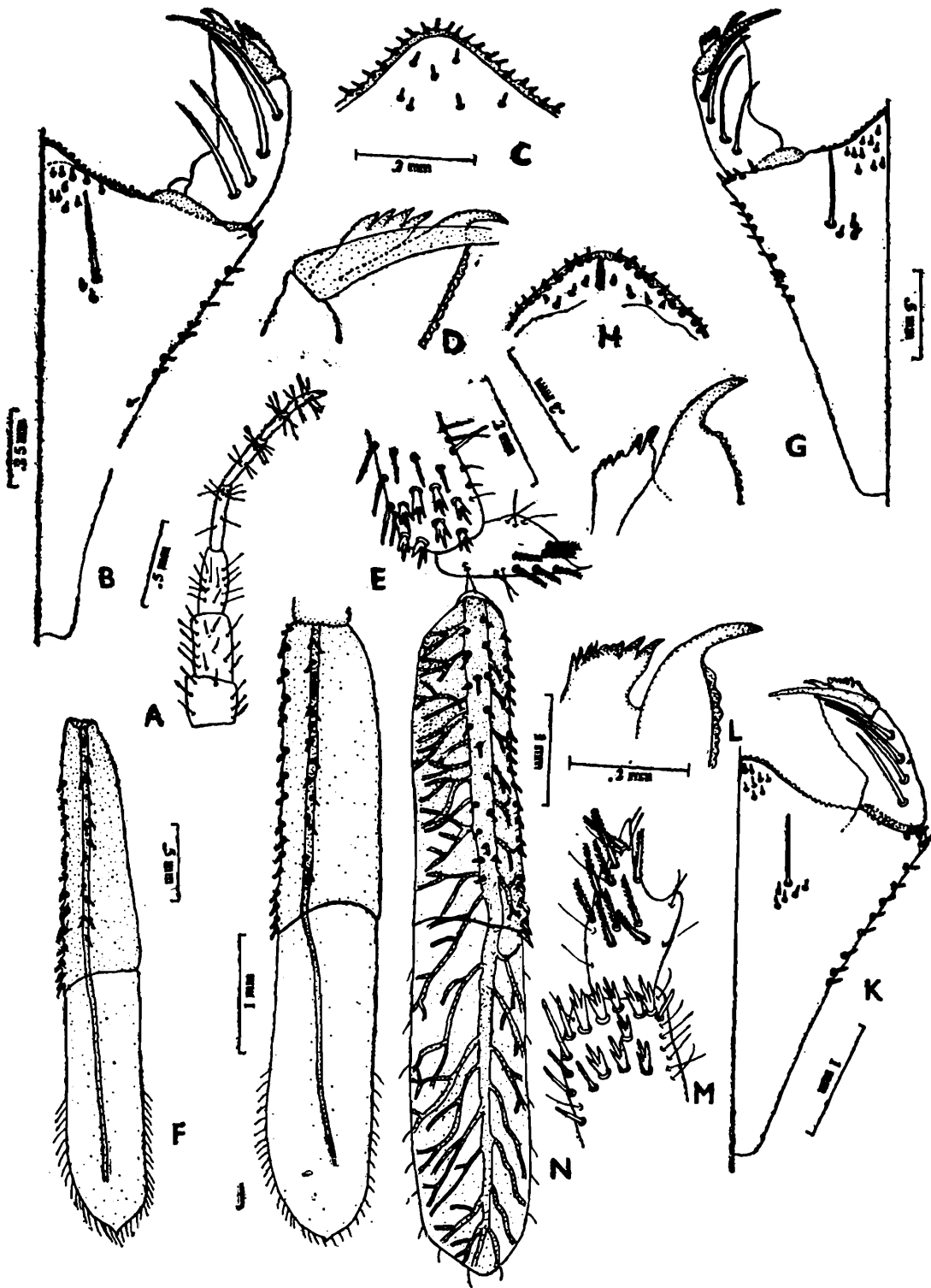
characteristic shape of the genus *Pseudagrion*, ante-and postnodal regions of almost same size, a median trachea distinct through whole length of lamella, antenodal region beset with rows of densely arranged spiniform setae; postnodal region bearing a few fine lateral setae, apex napiform (Fig. 2, O). Length 13. 1 mm.

8th Instar (Text-fig. 3, A-F) : Larvae have acquired the characteristic *Pseudagrion* appearance. *Colour*-yellowish green with dark brown markings dorsally, lamellae slightly darker in antenodal region.

Antennae (Fig. 3A) : 7-segmented, densely beset with setae; **labium** (Figs. 3, B-D) - premental setae 1_2+2^1 , Mid-apical spiniform setae on prementum further increasing in number; palpal setae $4+4$, last seta being added at base, movable hook long, narrow outer lobe at distal margin of palpus with 4 teeth, narrow at base, inner lobe larger, pointed and curved, hook-like at apex (Fig. 3-D); number of setae on tibial and tarsi increasing further (Fig. 3E), paired female gonapophyses extend up to 10th abdominal segment; hind wing buds extend as far as end of 2nd abdominal segment; **caudal lamellae** further increasing in size with apex of postnodal half becoming rounded, a row of spiniform setae present on median tracheae in antenodal region (Fig. 3F). Length 16.5 mm.

9th Instar (Text-fig. 3, G-J): Larvae further increasing in length and becoming darker. Premental setae 1_3+_31 , a row of lateral and a few spiniform setae present near the base of palpus (Fig. 3 G), palpal setae $4+4$; tibial comb comprises a number of densely arranged tridentate setae, tarsi with paired rows of pectinate setae; paired female gonapophyses extend as far as 10th segment; **caudal lamellae** (Fig. 3J) of almost uniform width, ante-and postnodal regions of same size, apex of postnodal region almost rounded. Length 19.2 mm.

10th or last Instar (Text-fig. 3, K-N) : Yellowish-green to yellowish-brown, mottled with brown dorsally. Premental setae 1_5+_51 , spiniform setae also present mid-apically on prementum, and also a row laterally, palpal setae $4+4$, distal end of palpus distinct in two lobes (Fig. 3L), movable hook about two-third of the palpus. **Tibial comb** (Fig. 3M): comprises a large number of tridentate setae; tarsi beset with pectinate setae. **Caudal lamellae** (Fig. 3N) flat, duplex with almost rounded apex: ante nodal region darker than postnodal region and is beset with spiniform setae. The thick median trachea traverse all along the length of caudal lamellae, from it branch off a number of lateral oblique secondary and tertiary tracheae; length-epiproct 4.62 mm, paraprocts 5.37 mm. Total length 21.5 mm.



Text-fig. 3.—(A-N) Life history of *P. rubricaps* Selys. (A-F) 8th Instar (A. antenna, B. labium, C. enlarged view distal margin prementum, D. enlarged view distal margin palpus, E. tibial comb and tarsi, F. epiproct); (G-J) 9th Instar (G. labium, H. enlarged view distal margin of prementum, I. enlarged view distal margin of palpus, J. epiproct); (K-N) 10th Instar (K. labium, L. enlarged view distal margin of palpus, M. tibial comb and tarsi, N. epiproct).

BIOLOGY

P. rubriceps Selys is another multivoltine species occurring at Dehra Dun. Adults are common on the wing almost throughout the

year around temporary and perennial ponds and at slow running marshy streams in thick jungles of submontane tracks. Adults generally confine themselves around aquatic biotopes and fly low amidst the vegetation.

Seasonal regulation of *P. rubriceps* is almost identical to that of *Ceragrion coromandelianum* (Fab.) (Kumar, in press) and a small number of other multivoltine species occurring at Dehra Dun. Larvae are found in temporary and perennial ponds, slow running marshy streams and sometimes amidst shallower water of rivers in plain areas of the valley.

Larval development is rapid and with slight overlapping of broods the species is able to complete at least 3 larval generations in a year. The summer larval broods (i.e., March-April to May-June and June-July to August-September) are completed rapidly in about 2 months time each (cf. the breeding record presented in this paper, table 1), thus the first batch of adult emergence in a year occurs in March-April from perennial ponds, oviposition takes place soon after and the 2nd batch of emergence occurs in June-July. A number of ephemeral monsoon ponds are formed during this period as a result of S. W monsoons and these too are now used for oviposition and development of one larval generation. The 2nd larval brood is again completed rapidly like the preceding summer brood and the 3rd batch of adults emerge in September-October. Adults remain on the wing for a while and shortly oviposit either in perennial ponds or in slow running marshy streams. However, with the advent of winter the larval development is slowed down and is completed in about 5-6 months (cf. Kumar, in press), the emergence occurs in following March-April thus completing 3 larval generations in a year at Dehra Dun.

ACKNOWLEDGEMENTS

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SUMMARY

Life history of *Pseudagrion rubriceps* Selys has been studied in the field and the laboratory. Specimens were reared from egg to adult. The principal changes in external morphology in different instars and the characters which are helpful in distinguishing various instars are described in detail. The seasonal regulation of the species has also been studied in the field.

TABLE 2.—Summary of larval changes in *Pseudagrion rubriceps* Selys

Instar	1	2	3	4	5	6	7	8	9	10
Antennal Segments		3	4	5	6	7	7	7	7	7
Premental Setae	—	—	1+1	1+1	1+1	1+1	1+1	1+1	1+1	1+1
Palpal Setae		1 & 1	2 & 2	2 & 2	3 & 3	3 & 3	3 & 3	4 & 4	4 & 4	4 & 4
Tarsal segments	Pro-larva	1	1	2	3	3	3	3	3	3
Abdominal Segments covered with Wing buds	—	—	—	—	$\frac{1}{2}$	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$	4
Female gonapophyses		—	—	—	—	r	i	i	i	i
Body length (in mm) including the caudal lamellae		2.2	4.5	6.9	8.7	10.4	13.1	16.5	19.2	21.5

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AMPHIBIAN FAUNA OF KHASI HILLS, MEGHALAYA

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INTRODUCTION

Owing to the high rainfall and humidity one should expect a rich Amphibian fauna in Khasi Hills and our study has fully justified this. In all, we have examined 862 specimens of both adults and juveniles which yielded 20 species.

There are a few recent accounts of Amphibia from Khasi Hills. Roonwal and Kripalani (1961) have described *Philautus cherrapunjiae* from Cherrapunji. Yazdani and Chanda (1971) have described *Ansonia meghalayana* from the same area. Collection and study of more examples of this species have enabled Pillai and Yazdani (1973) to erect a new genus *Bufoides* to accommodate it. Pillai and Chanda (1973) described another new species from Shillong, viz. *Philautus shillongensis*. They have also described two new frogs, *Rana danieli* and *Rana mawphlangensis* both from Khasi Hills (Pillai and Chanda, 1977).

The material on which this report is based has been accumulating in the Eastern Regional Station of the Zoological Survey of India, Shillong for a period of 14 years from 1959 to 1973. We have not included all the collection data as is customary in a taxonomic paper of this kind but relevant details are given at the appropriate places. Colour pattern is given for most species and notes wherever necessary. References wherein full description of the species is given are indicated under each species. Keys for genera and species dealt with are also given.

In addition to these 20 species, atleast five more species—records of Amphibia are available in literature from Khasi Hills and which are not represented in our material. These are *Amolops formosus* (Günther, 1875), *Rana kuhli* Dum. & Bibr., 1841, *Rana leptoglossa*

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(Cope, 1868), *Rana assamensis* Sclater, 1892 and *Rhacophorus nigropalmatus* Boulenger, 1895. Including these, the total number of species known from Khasi Hills goes upto 25. The prevailing climatological conditions are so congenial to their life that the list presented here does not appear to exhaust its wealth of Amphibian fauna. More intensive surveys are likely to increase the number of species further.

The commonest forms as judged from the number of specimens and diversity of localities are *Rana limnocharis*, *Bufo melanostictus* and *Rana cyanophlyctis* which together constitute about 90% of the bulk of the material. While *B. melanostictus* is stable and exhibits little variation within the species, the other two species of *Rana* exhibit intra-specific variations. The colour pattern in *R. limnocharis* presents considerable diversity particularly with reference to the vertebral line which may be totally non-existent or very conspicuously broad. In *R. cyanophlyctis*, on the other hand, such variations embrace more characters like body profile, tuberculation, glandular fold, tympanum etc.

Out of the many localities in Khasi Hills which yielded Amphibian material, two viz. Cherrapunji and Mawphlang deserve special mention. Both these places have yielded six species each presumably because of little disturbance from human agencies. Cherrapunji with its very high rainfall has hills and plateau strewn with large boulders and temporary pools which provide ideal habitat for concealment and breeding. A virgin forest sheltered by hills and cut up with streams provides ideal ecological conditions in Mawphlang for a rich Amphibian fauna. Both these localities are sure to yield more species.

The colour given for the species is that in the preserved state.

The authors are thankful to the Director, Zoological Survey of India, for providing opportunity to undertake this work.

LIST OF AMPHIBIANS FROM KHASI HILLS

The following families, genera and species (Gorham, 1974) are represented in the material studied.

Class AMPHIBIA

Order ANURA

Family PELOBATIDAE

Genus (1) *Megophrys* Kuhl & V. Hass

1. *Megophrys monticola* Kuhl. & V. Hass

Genus (2) *Leptobrachium* Tschudi2. *Leptobrachium hasselti* Tschudi

Family HYLIDAE

Genus (3) *Hyla* Laurenti3. *Hyla annectens* (Jerdon)

Family BUFONIDAE

Genus (4) *Bufo* Laurenti4. *Bufo melanostictus* Schneider5. *Bufo himálayanus* GüntherGenus (5) *Bufoides* Pillai & Yazdani6. *Bufoides meghalayana* (Yazdani and Chanda)

Family RANIDAE

Genus (6) *Amolops* Cope7. *Amolops afghanus* (Günther)Genus (7) *Rana* Linnaeus8. *Rana limnocharis* Wiegmann9. *Rana cyanophlyctis* Schneider10. *Rana alticola* Boulenger11. *Rana danieli* Pillai & Chanda12. *Rana mawphlangensis* Pillai & Chanda13. *Rana laticeps* Boulenger14. *Rana gerbillus* Annandale15. *Rana livida* (Blyth)

Family RHACOPHORIDAE

Genus (8) *Philautus* Gistel16. *Philautus cherrapunjiae* Roonwal and Kripalani17. *Philautus shillongensis* Pillai and Chanda18. *Philautus andersoni* (Ahl)Genus (9) *Rhacophorus* Kuhl19. *Rhacophorus leucomystax* (Kuhl)20. *Rhacophorus reinwardtii* (Sch gel)

SYSTEMATIC ACCOUNT

1. *Megalophrys monticola* Kuhl. & V. Hass., 1822

1882. *Megalophrys montana*: Boulenger, *Cat. Batr. Sal. Brit. Mus.* : 442.

1923. *Megalophrys montana*: V. Kampen, *Amph. Indo-Austr. Arch.* : 8.

A single example of this Pelobatid toad is available in the collection, obtained from Shillong Peak, the highest point in the Khasi Hills with an altitude of 1960 metres.

Skin of upper parts smooth, granulate in front of and behind tympanum, with a few warty tubercles on flank; upper eyelid with a raised margin and an angular process about its middle. Upper parts brown, head dark grey. Lower parts with brown blotches. A white tubercle on each side of breast.

Our specimen which measures 48 mm from tip of snout to vent is a male.

2. *Leptobrachium hasselti* Tschudi, 1838

1882. *Leptobrachium hasselti*: Boulenger, *Cat. Batr. Sal. Brit. Mus.* : 441.

1923. *Megalophrys hasselti*: V. Kampen, *Amph. Indo-Austr. Arch.* : 13.

We have a single example of a large-headed and frail-limbed specimen which agrees well with the descriptions of the species.

Mid-dorsal skin smooth with whitish tubercles laterally. Ashy-grey above with symmetrical brown and black patterns and spots. A triangular patch with its base touching the two upper eyelids. Black canthal and temporal streak, the latter encircling the brownish tympanum. Flanks with rows of black spots, limbs barred. Belly white, throat faintly mottled, the pre-humeral part darker. A distinct fatty hump above vent.

The specimen measures 37 mm from tip to vent and is a male. It was taken from Burhalang near Nongpoh (alt. 650) on 26-6-1965.

3. *Hyla annectans* (Jerdon, 1890)

1882. *Hyla annectans* Boulenger, *Cat. Batr. Sal. Brit. Mus.* : 382.

1890. *Hyla annectans* Boulenger, *Fauna Brit. India* : 509.

Four specimens, three from Mawphlang (27-6-63 and 9-12-64) and one from Urman (19-2-70) are being referred to *Hyla annectans*.

Upper parts slate-coloured a brownish streak from nostril to front of eye; a black lateral streak upto groin, ending often in two or three black spots with interconnections. Hind parts of thighs (sometimes

front also) with conspicuous black spots on white or yellowish background. Hind margin of tibia similarly marked in some.

The largest example measures 41 mm from tip of snout to vent.

4. *Bufo melanostictus* Schneider, 1799

1882. *Bufo melanostictus*: Boulenger, *Cat. Batr. Sal. Brit. Mus.* : 306.

● 1923. *Bufo melanostictus*: V. Kampen, *Amph. Indo-Austr. Arch.* : 80.

92 adults and 166 juveniles are available from the following localities:— Barapani, Bishnupur, Lawsohtun, Mawblang, Motinagar, Maidan Laban, Polo ground, Risa Colony, Sericulture garden, Upper Shillong, Umshing, Umran, Shillong Peak and Old Barapani Road.

5. *Bufo himalayanus* Günther, 1864

1882. *Bufo sikkimensis* Boulenger, *Cat. Batr. Sal. Brit. Mus.* : 305.

To this species we refer a single example of a small toad collected from Mawphlang on 14-8-1973 and measuring 35 mm from tip of snout to vent.

Dorsally black and brown, head more brownish than black; a faint vertebral line from hind end forwards upto middle of dorsum. Belly and throat yellowish with conspicuous black spots, often confluent giving an irregular "wormy" pattern. Beset with pointed tubercles on the dorsal part of body and limbs. Parotoids and some of the larger tubercles with a tinge of red. Coarsely granulated ventrally.

6. *Bufoides meghalayana* (Yazdani & Chanda, 1971)

1971. *Ansonia meghalayana* Yazdani & Chanda, *J. Assam Sci. Soc.*, 14 (1): 76.

1973. *Bufoides meghalayana* Pillai & Yazdani, *J. zool. Soc.* 25 : 65.

17 examples of this rock toad are available from Cherrapunji collected from cavities in rocks while breeding.

7. *Amolops afghanus* (Günther, 1858)

1882. *Rana afghana* Boulenger, *Cat. Batr. Sal. Brit. Mus.* : 60.

1920. *Rana latopalmata* Boulenger, *Rec. Indian. Mus.*, 20 : 217.

We have no hesitation in referring a single example of frog collected from Nongkrem Hill, Shillong on 20-1-1969 to *Amolops afghanus*.

Skin smooth dorsally but strongly warty on sides. Dark olive above, spotted and marbled with black and grey.

The specimen is a male measuring 62 mm. from snout to vent.

8. *Rana limnocharis* Wiegmann, 1835

1920. *Rana limnocharis*: Boulenger, *Rec. Indian, Mus* : 28.

1973. *Rana limnocharis*: V. Kampen, *Amph. Indo-Austr. Arch.* : 167

290 adults and 54 juveniles collected all the year round from 25 localities agree well with *Rana limnocharis* forma *typica*.

The colouration is variable. Ground colour ranges from light brown to black. The two limbs of the V-shaped mark connecting the orbits are often transversely across. Mid-dorsal white line present or absent. When present it may be very thin and faint or broad and conspicuous. Similar white lines have been seen to run along the thighs and in a few right upto the heel.

The largest example is a female of head and body 52 mm from Shillong Peak. The collection localities are:—Barapani, Cherrapunji, Decame, Lailad, Laitker, Laityigew, Lalchand Basti, Mawblank, Mawmluh, Mawpat, Mawphlang, Mawroh, Myllem, Nongkrem, Polo, Pynthermukrah, Risa Colony, Sericulture garden, Shella, Umroi, Umshing, Umtynger, Umphrynai, Upper Shillong, Weiloi.

9. *Rana cyanophlyctis* Schneider, 1799.

1882. *Rana cyanophlyctis*: Boulenger, *Cat. Batr. Sal. Brit. Mus.* : 17.

1920. *Rana cyanophlyctis*: Boulenger, *Rec. Indian Mus.* : 12.

We have examined 179 examples of this species. Majority of specimens agree with the descriptions of this species except a few, the most notable being 5 specimens collected from Upper Shillong on 6-11-1962 and 3 specimens from Shella on 20-7-1973. The variations exhibited by these 8 examples are as under. The profile of the waist is not in conformity with the rest in being more "toad-like", the width of the body being greatest at its junction with the thighs. In typical *cyanophlyctis* this part is narrower than the rest of the trunk. The eyes protrude more and the eyelids are more superior than lateral owing to a less broad upper eyelid and broader lower eyelid. In the majority of examples we have examined the slits are lateral and the lower lids narrow with the result that the slits are fully visible in side profile. On the other hand, in examples from Upper Shillong and Shella the slits are partly or not visible at all from sides. The supra-tympanic fold is not distinct and at best appears as a whitish band or a row of white spots while in typical forms it is a distinctly elevated glandular fold. The tympanum in the eight examples is also smaller being about half the diameter of orbit. The skin of upper parts is smooth without granulations or the characteristic warts tipped with minute asperites. When the limb is folded at right angles to the body the heels definitely overlap while in typical examples the heels

do not meet or they just meet but not overlap. It is tempting to describe these eight specimens under a new taxon but we refrain from doing so because the genus *Rana* shows considerable range of variations and it will not be desirable to erect a new species or subspecies without detailed morphometric studies on populations from wider areas.

We, therefore, include them under *Rana cyanophlyctis* without assigning them a separate status.

The material of *R. cyanophlyctis* has been collected from Burnihat, Barapani, Bishnupur, Lalchand Basti, Mawroh, Mawlai, Motinagar, Myllem, Nonglayer, Oakland (Botanical garden), Polo, Pynthermukrah, Shella, Shillong Peak, Umran, Umsning, Umtham, Umtynger, Upper Shillong.

10. *Rana alticola* Boulenger, 1882.

1912. *Rana alticola*. Annandale, *Rec. Indian Mus.* : 8.

1920. *Rana alticola*: Boulenger *Rec. Indian Mus.* : 166.

Rana alticola is represented in our material by a single example from Cherrapunji measuring 47 mm from snout to vent, donated by Shri J. H. Bourne.

The dorso-lateral folds appear to be more widely separated than is usual for the species ($4\frac{1}{2}$ times in total length as against 6 to $6\frac{1}{2}$ times). Colour lost due to long preservation. Pale brownish above, not spotted. Folds edged with brown. Lower parts pale.

Adults of this species are extremely rare compared to the tadpoles which are abundant and common.

11. *Rana danieli* Pillai & Chanda

1977. *Rana danieli* Pillai and Chanda, *J. Bombay nat. Hist. Soc.*, 74.

Two species from Mawphlang (60 mm, & 40 mm) and one from Nongkrem (61 mm) belong to the above species.

12. *Rana mawphlangensis* Pillai & Chanda

1977. *Rana mawphlangensis* Pillai & Chanda, *J. Bombay nat. Hist. Soc.*, 74.

A single example of a female (90 mm) collected from Mawphlang is available.

13. *Rana laticeps* Boulenger, 1882.

1882. *Rana laticeps*, Boulenger *Cat. Batr. Sal. Brit. Mus* : 20.

1920. *Rana laticeps*, Boulenger *Rec. Indian Mus.* : 67.

Three small frogs measuring 36 mm, 31 mm & 27 mm collected from Mawphlang on 7-5-1969 undoubtedly belong to *Rana laticeps*.

Skin above brown or grey, marbled with dark. Dark-bordered warts and tubercles present, sometimes arranged in longitudinal rows. A white strip below the supratympanic fold. A dark bar connects the eyes, a faint inverted V-mark at the level of forelimbs. Outer part of arms with a pair of whitish tubercles. Lower parts smooth, white except throat which has brown irregular patches ending abruptly at shoulder level.

All three are females.

14. *Rana gerbillus* Annandale, 1912

1912. *Rana gerbillus* Annandale, *Rec. Indian Mus.* : 10.

1920. *Rana gerbillus*: Boulenger, *Rec. Indian Mus.* : 207.

To this species we assign a small specimen (23 mm) collected from a stream at Mawblang near Cherrapunji on 7-1-1970. One of us (R. S. P.) has collected several larger examples of this species from the Siang District (Abor Hills), Arunachal Pradesh wherefrom this species was originally described by Annandale (1912). The present example, though juvenile, resembles the Abor Hill specimens very well.

Rana gerbillus is known hitherto from Abor Hills and Darjeeling only and its occurrence in Khasi Hills constitutes a new record.

15. *Rana livida* (Biyth, 1855)

1890. *Rana livida* Boulenger, *Fauna Brit. India* : 462.

1920. *Rana livida*: Boulenger, *Rec. Indian Mus.* : 214.

Four examples (two large and two small) of this species are available in the collections.

Back uniform bluish-grey or slate-coloured with or without a row of large spots which become progressively smaller towards the interorbital region. The spots are absent in the two smaller specimens where the background colour itself is very dark. Sides sepia brown, tympanum with circular whitish rim. Limbs brownish with conspicuous white marbling. Lower parts white except in male where throat and chest are light brown and belly and thighs granulate. This male (47 mm) is more deeply coloured, with a black patch on the front part of the arm. Pad on thumb much larger than that on female of about the same size (45 mm).

The four examples were collected from Chandmari, Shillong on 7-6-1967 and measure 88, 75, 47 and 45 mm. The last but one is a male.

16. *Philautus cherrapunjiae* Roonwal & Kripalani, 1961

1961. *Philautus cherrapunjiae* Roonwal & Kripalani, *Rec. Indian Mus.* : 325.

This species was erected by Roonwal and Kripalani (1961) on the basis of recently metamorphosed young ones from Cherrapunji. In spite of our best efforts we failed to collect the adult of this species which is still unknown. But we have collected a young frog from Mawblang, near Cherrapunji on 29-9-1970. This example (figured in Pillai and Chanda, 1973) measures 16.4 mm from tip of snout to vent and is slightly larger in size and more advanced than any of the material which the original authors had.

17. *Philautus shillongensis* Pillai and Chanda, 1973

1973. *Philautus shillongensis* Pillai and Chanda, *Proc. Indian Acad. Sci.* 78 (1) : 30.

8 examples of this small-sized species are available in the collections, all from Malki forest, Shillong. Grey to black, a dark band connecting the eyelids; a 'V' shaped lightmark; pale ventrally.

The largest example is 20 mm from tip of snout to vent and smallest 10 mm. The frogs were collected in the cold months of January and February and were hibernating in caked earth.

18. *Philautus andersoni* (Ahl, 1927)

1882. *Ixalus tuberculatus* Boulenger, *Cat. Batr. Sal. Brit. Mus.* : 104.

24 specimens collected from three localities in Shillong (Nongthymmai, Motinagar & Malki forest) are being identified as *Philautus andersoni*, originally described from Kakhyen Hills. This species has subsequently been collected from Abor Hills (Siang District) by Annandale (1912).

Like the previous one, *Philautus andersoni* also is small in size, the largest example in the collection being 18 mm from snout to vent. Dorsal side and flanks light grey to dark, beset with tubercles and warts with white tips; belly and thighs strongly granulate with whitish blotches. An X-shaped large mark joining the eyes to groins is present in all with varying degrees of intensity; dark bar connecting eyes. One example has the entire upper side black while in two others the median dorsal parts is white separating the 'X' mark. Limbs with transverse bars.

19. *Rhacophorus leucomystax* (Kuhl, 1829)

1882. *Rhacophorus maculatus* Boulenger *Cat. Batr. Sal. Brit. Mus.* : 83.
 1912. *Rhacophorus maculatus himalayensis* Annandale, *Rec. Indian Mus.* 8 : 14.
 1923. *Rhacophorus leucomystax* V. Kampen, *Amph. Indo-Austr. Arch.* : 246.

Three examples of tree frogs available in the collection, all from Shillong, are identified as *Rhacophorus leucomystax*, better known in literature as *R. maculatus*.

Upper parts grey, brown or darkish; sometimes spotted with irregular blotches; a canthal and temporal black streak often edged with white on upper side; white spots on flank and hind part of thigh; limbs with transverse bars. Ventrally white or yellow; belly and thigh granulate.

The largest example in the collection measures 57 mm and the smallest 33 mm in head and body.

Another four examples of the species showing a different and distinctive colour pattern are being referred to the var. *quadrilineata* (Boie). Two larger examples are brownish above while the other two are pale. Four dark longitudinal bands are present in all the upper side of head and body in varying degrees of clarity. These bands, in the preserved condition, appear paler in comparison to the dark canthal supratemporal streaks.

The localities and size of these examples are as follows:—Fruit Garden (54 mm), Insectory building compound (50 mm), Maidan Laban (46 mm) and Umran (37 mm).

20. *Rhacophorus reinwardtii* (Schlegel, 1837)

1890. *Rhacophorus bimaculatus* Boulenger, *Fauna Brit. India* : 472.
 1852. *Rhacophorus bimaculatus* Boulenger *Cat. Batr. Sal. Brit. Mus.* : 90.

This species is represented in the collection by three examples, one from a tree at Pynursla, the second from Mawblang and a small example from Cherrapunji. The first example was leafy green at the time of collection. In spirit the dorsal surface is pinkish and the ventral side immaculate. Behind the arm on flank the characteristic large black spots are very prominent. The number of spots is variable. The Pynursla specimen which is largest (55 mm from snout to vent) has two large spots on the right and three smaller ones on the left side. The example from Mawblang has two spots each on both sides while the Cherrapunji specimen has only one spot on each side. The anterior spot when present is larger than those behind. Skin on upper side smooth, belly and thighs white and beautifully granulated.

KEY TO THE GENERA OF AMPHIBIA (ANURA) OCCURRING IN KHASI HILLS
(Those with single species are indicated in paranthesis).

1. Intercalary ossicle between two distal phalanges present		.2
— Intercalary ossicle absent		.3
2. Vomerine teeth present	<i>Rhacophorus</i>	
— Vomerine teeth absent	<i>Philautus</i>	
3. Vomerine teeth present		.4
— Vomerine teeth absent	..	7
4. Disc on fingers much larger than tympanum	<i>.Amolops (afghanus)</i>	
— Disc on fingers if present, small, never larger than tympanum*	..	.5
5. Pupil horizontal		.6
— Pupil vertical	<i>.Megophrys (monticola)</i>	
6. Fingers free, tongue deeply notched and bifid	..	<i>Rana</i>
— Fingers webbed at base, tongue only slightly nicked	<i>.Hyla (annectens)</i>	
7. Skin of upper parts warty	..	.8
— Skin of upper parts not warty	<i>.Leptobrachium (hasselti)</i>	
8. Parotoid glands present		<i>Bufo</i>
— Parotoid glands absent	<i>.Bufoides (meghalayana)</i>	

KEY TO SPECIES OF AMPHIBIA (ANURA) OCCURRING IN KHASI HILLS
(Those with two or more species under each genus).

A. Genus *Bufo*

Head with distinct bony ridges, tympanum distinct		<i>melanostictus</i>
Cranial ridges indistinct, tympanum hidden	..	<i>himalayanus</i>

B. Genus *Rana*

1. Discs of toe-tips, if present, without groove		.2
— Discs of toe-tips with a crescentic or horse-shoe-shaped circum—marginal groove		.6
2. A distinct dorso-lateral glandular fold present from behind eye to vent		<i>danieli</i>
— Dorso-lateral folds absent		.3

3. Tympanum very distinct	..	.4.
-. Tympanum indistinct	...	. <i>laticeps</i>
4. Outer metatarsal tubercle present		. <i>limnocharis</i>
-. Outer metatarsal tubercle absent		.5
5. Inner metatarsal tubercle prominent, pointed and digitiform	...	. <i>cyanophlyctis</i>
-. Inner metatarsal tubercle moderate, not digitiform		. <i>mawphlangensis</i>
6. Dorso-lateral glandular fold absent	.	. <i>livida</i>
-. A distinct dorso-lateral fold from above tympanum to hip		. 7
7. Fingers with large discs, that of third as large as tympanum		. <i>gerbills</i>
-. Fingers with small discs		. <i>alticola</i>

C. Genus *Philautus*

1. Skin of dorsum devoid of tubercles and warts		2
-. Skin of dorsum beset with tubercles and warts		. <i>tuberculatus</i>
2. Toes three-fourth webbed		. <i>cherrapunjiae</i>
-. Toes free	.. .	. <i>shillongensis</i>

D. Genus *Rhacophorus*

Fingers webbed to discs, one to three conspicuous black spots on axilla

. .. *reinwardtii*

Fingers with rudimentary webbing, no spots on axilla

. *leucomystax*

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