RECORDS

of the

INDIAN MUSEUM

(A JOURNAL OF INDIAN ZOOLOGY)

Vol. 50, 1952

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[*N. B.*—An asterisk (*) preceding a name denotes a new variety or sub-species; a dagger (†) indicates a new species; a double dagger (‡) a new genus or sub-genus; a double asterisk (* *) a new family or sub-family; synonyms are printed in italics.]

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A CHECKLIST OF GENERA OF INDIAN BIRDS.

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Indian Museum, Calcutta.

(Received 12 February 1952)

FOREWORD

Progress in ornithology during the past twenty-five years has been spectacular. Field work, such as done by Koelz and Ripley, has yielded many interesting new discoveries in India, and work in the countries east and west of India has greatly added to our knowledge of south Asiatic birds. Painstaking taxonomic analysis of these new collections by students in India, Great Britain, the United States, Germany, Holland, France, and other countries has shed new light on the systematics and relationships of Indian birds. Also, there has been in ornithological science a rather profound change of systematic concepts during recent decades. As a consequence of this added information and changed concepts, it is unfortunately true that even the " revised edition " of the " Fauna of British India " is now completely out of date, so far as its nomenclature is concerned.

A completely new list of the birds of India is urgently needed. However, the preparation of an up-to-date and reliable list will require the labor of many years. Until then the need for an authoritative list will be met in part by the " Checklist of Genera of Indian Birds " provided by Biswas. This new list of the generic names of Indian birds brings the nomenclature of Indian birds in line with that now employed by progressive workers throughout the world, whether they study Indian birds or the faunas of adjacent areas.

The genus is one of the most important systematic categories. The chief function of the generic name is to express relationships and, as was expressly stated by Linnaeus, to relieve the memory by uniting groups of species. The difficulty with the genus is that although it is based on objective groups, its limits, as well as the ranking of the included groups, are subjective. Authors with different standards of generic values arrive at very different generic arrangements. The adoption of sound standards of generic recognition becomes therefore of vital importance.

In this respect ornithology has had a bad tradition because in the past an arbitrary morphological difference was adopted as generic standard by many authors. The ultimate consequence of this standard was to place virtually every species in a separate genus since nearly every species shows some morphological peculiarities. Unfortunately, Stuart Baker wrote his "Fauna" when this taxonomic philosophy was in its heyday. As a result he placed the 1345 species of Indian birds in 620 genera. The folly of such a virtually uninomial nomenclature is now fully realized, as is the unsoundness of the standard on which it is based: morphological difference. As had been said already by Linnaeus, it is the genus that gives the characters and not the characters that make the genus. In other words, we must look for a natural group of species which together form a genus and then determine the morphological characters that are shared by these species. This is the modern biological approach even though its roots go back to Linnaeus.

The genus is nowadays considered not only a phylogenetic unit, that is an assemblage of species which are related to each other, but also an ecological unit, that is an assemblage of species which jointly occupy a distinctive adaptive zone (major ecological niche). The study of the ecology of genera has as yet only been begun. One of the few detailed analyses is David Lack's study of the ecological differences between the genera of Darwin's Finches. The present list should be very helpful to those who want to undertake similar studies on Indian genera.

Nothing is ever final in science and still further improvements in the arrangement of genera are to be expected. We are now passing in ornithology through a "lumping" period, but it is possible that further researches will show that one or the other of the now lumped genera constitutes a biologically and ecologically well-defined group worthy of generic recognition. The present list forms a sound basis on which further revisionary work can be undertaken.

It is particularly gratifying that this list of Indian birds is the work of an Indian ornithologist. This is but one of the many manifestations of the vigor of Indian science, in general, and of Indian ornithology, in particular. *Vivat, crescat, floreat Ornithologia Indiae.*

Ernst Mayr

Curator of the Whitney-Rothschild Collection
American Museum of Natural History
New York 24, New York.

November 26, 1951.

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Introduction

In the first edition of the 'Fauna of British India, Birds' by Oates (1889, 1890) and by Blanford (1895, 1898) a little over 600 genera were recorded, while in Baker's second edition (1922-1930) this number was raised to 620. In the last two decades our knowledge of Indian ornithology has increased spectacularly. Moreover, the field of taxonomy has developed during the past fifty years to a considerable extent in technique and concept, resulting in the emergence of a new systematics in contrast to the old or orthodox systematics.

According to Mayr (1948), the main trends of developments responsible for this revolutionary change may be grouped as follows: (1) the modification of the Linnean species concept; (2) the recognition of the population as the basic taxonomic unit; and finally, (3) the replacement of the static or morphological species definition by a dynamic or biological one. The static species was simply an aggregate of museum specimens which conformed to certain morphological standard selected by taxonomists; it was not a unit of nature. The biological species, on the other hand, " consists of a group of populations which replace each other geographically or ecologically and of which the neighbouring ones intergrade or interbreed wherever they are in contact or which are potentially capable of doing so in those cases where contact is prevented by geographic or ecological barriers;" this biological species is reproductively isolated from other such groups. As a consequence of this broadening of the species concept, many so-called ' species ' were reduced to the rank of subspecies. As a further consequence there must be compensatory adjustments for genera and other higher categories, or else they lose their importance. It need hardly be emphasized that ' the genus expresses relationship and the species, the differences.' For details elucidating the points mentioned above Huxley (1940, 1942), Mayr (1942, 1948) and Bogert *et al* (1943), among others, may be referred to.

Viewed in this light it becomes evident that many of the genera listed by Baker are superfluous, since they were based on very trifling morphological characters. *Lobivanellus* G. R. Gray, to cite merely one example, differs from *Hoplopterus* Bonaparte only in three specialized characters, *viz.*, the presence of a wattle, the presence of a vestigial hind toe, and the reduction of the wing spur. They are otherwise exceedingly similar in structure, in colour pattern, in habits, etc. They are thus best considered as two species of the same genus and not members of two different genera, the latter treatment certainly obscures their close relationship. " The indiscriminate application of a rigid morphological genus concept.. .is another cause of the large number of superfluous and biologically meaningless genera.. . For maximum utility the genus should not be allowed to encroach upon the next lower category (species), as at present, or upon the next higher (family or subfamily) as in the days of Linnaeus. Although the genus is an abstract concept, the gaps between species are real and unequal, and it is not to be expected that genera will contain the same number of species, or that monotypic genera can be avoided entirely." (*Vide* Amadon, 1943, p. 1).

The above considerations led me to feel that a revision of the genera

of Indian birds in the light of these new principles was desirable, and I first contemplated undertaking this rather arduous task while I was working for the Zoological Survey of India. This cherished project took a concrete shape during the years 1947-1950 when I was a guest worker at the British Museum (Natural History) and the American Museum of Natural History. The major portion of my undertaking was, however, done at the latter institution, and was completed on my return to India. My experience with birds in the field in India and other countries has helped me greatly in a better understanding of the groups.

I have used the word 'India' neither in a strictly geographical nor in any political sense, but merely for the sake of convenience to include Pakistan, India, Nepal, Burma and Ceylon. These same countries were also covered in the 'Fauna of British India' series, and in this respect I have chosen to follow the trail of my illustrious predecessors.

In preparing this paper free use was made of Peters' monumental 'Check-list of Birds of the World' (1931-1951). The various revisional works of Amadon, Deignan, Delacour, Mayr, Meinertzhagen, Ripley, and Vaurie, among others, proved indispensable. For the sequence of the higher categories I have followed Mayr and Amadon (1951), and for the rest, mostly Peters. As a result of these researches only 423 genera have been recognized in the present work as against Baker's 620.

Complete synonymies of the various genera have been purposely avoided as they are available in the standard treatises. Although primarily a checklist of genera, it is thought worthwhile to include under each genus a list of the species that are known to occur in India. Species that are visitors are so indicated after their names. All other species nest in India. An alphabetical index showing the nomenclatorial status of the various generic names that are in use for Indian birds is also appended.

Copies of a draft of the checklist was sent for comments to Dr. Ernst Mayr, Dr. Dean Amadon, Dr. Charles Vaurie, and Captain Jean Delacour of the American Museum of Natural History, New York; Mr. H. G. Deignan of the U. S. National Museum, Washington; Dr. S. Dillon Ripley of the Yale Peabody Museum, New Haven; Mr. James L. Peters* of the Museum of Comparative Zoölogy, Cambridge; Dr. Erwin Stresemann of the Zoologisches Museum, Berlin; Dr. K. H. Voous of the Zoologisch Museum, Amsterdam; Colonel R. Meinertzhagen, London; and Mr. Sálim Ali of the Bombay Natural History Society, Bombay. I record my grateful thanks to all of them for their helpful advice and comments.

Differences of opinion are naturally to be expected among so many ornithologists. On the whole I have tried to follow the majority opinion, but have taken independent decision on some groups, especially on those in which no recent revisions were available. The responsibility for admitting or synonymizing one or the other genus as presented in this work, however, is entirely my own.

*Mr. Peters has since died on April 19,1952.

The extreme courtesy and unfailing assistance received from the authorities of the British Museum (Natural History) and the American Museum of Natural History, particularly from the staff of their ornithological departments, during my stay there, and even up to the present day, are gratefully acknowledged. I am also indebted to Dr. J. L. Bhaduri of the Zoology Department, Calcutta University, and to my colleague, Dr. K. K. Tiwari, for advice and help in different ways. My special debt of gratitude goes, however, to Dr. Ernst Mayr, who has been my inspiring mentor throughout and who has very kindly written the foreword.

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Checklist

Class AVES

Subclass NEORNITHES

Superorder NEOGNATHAE

Order PROCELLARIIFORMES

Family Procellariidae

Subfamily *Procellariinae*

Genus **Daption** Stephens

Species in India—*Daption capensis*[1].

Genus **Puffinus** Brisson

Species in India—*Puffinus leucomelas* (casual visitor), *P. carneipes*[1], *P. pacificus* (casual visitor), *P. tenuirostris*[1] and *P. persicus*.

Subfamily *Hydrobatinae*

Genus **Oceanites** Keyserling and Blasius

Species in India—*Oceanites oceanicus* (casual visitor).

Genus **Fregetta** Bonaparte

Species in India—*Fregetta tropica*[1].

Genus **Oceanodroma** Reichenbach

Species in India—*Oceanodroma homochroa*[1].

Order PODICIPIFORMES

Family Podicipitidae

Genus **Podiceps** Latham

Species in India—*Podiceps ruficollis*, *P. nigricollis* and *P. cristatus*

Order GAVIIFORMES

Family Gaviidae

Genus **Gavia** J. R. Forster

Species in India—*Gavia stellata*[1] and *G. arctica*[1].

[1]Status doubtful ; very rarely recorded from India.

Order PELECANIFORMES

Suborder *PHAËTHONTES*

Family Phaëthontidae

Genus **Phaëthon** Linné

Species in India—*Phaëthon aethereus*[1] (regular visitor), *P. rubricauda* (regular visitor) and *P. lepturus.*

Suborder *FREGATAE*

[Family Fregatidae

Genus **Fregata** Lacépède

Species in India—*Fregata andrewsi* (regular visitor), *F minor*[2] and *F. ariel* (regular visitor).

Suborder *PELECANI*

Superfamily **SULOIDEA**

Family Phalacrocoracidae

Subfamily *Phalacrocoracinae*

Genus **Phalacrocorax** Brisson

Syn. *Haliëtor* Heine

Species in India—*Phalacrocorax carbo, P. fuscicollis* and *P. niger.*

Subfamily *Anhinginae*

Genus **Anhinga** Brisson

Species in India—*Anhinga melanogaster.*

Family Sulidae

Genus **Sula** Brisson

Species in India—*Sula dactylatra* (casual visitor), *S. sula* (regular visitor) and *S. leucogaster*[2].

[1] Includes *indicus.*

[2] Status doubtful; very rarely taken within our limits.

Superfamily **PELECANOIDEA**

Family Pelecanidae

Genus **Pelecanus** Linné

Species in India—*Pelecanus onocrotalus* (regular visitor) and *P. philippensis*[1].

Order FALCONIFORMES

Suborder *FALCONES*

Superfamily **FALCONOIDEA**

Family Accipitridae

Subfamily *Elaninae*

Genus **Elanus** Savigny

Species in India—*Elanus caeruleus.*

Genus **Machaerhamphus** Westerman

Species in India—*Machaerhamphus alcinus.*

Subfamily *Perninae*

Genus **Aviceda** Swainson

Syn. *Baza* Hodgson

Species in India—*Aviceda jerdoni* and *A. leuphotes.*

Genus **Pernis** Cuvier

Species in India—*Pernis apivorus* (regular visitor) and *P. ptilorhyncus.*

Subfamily *Milvinae*

Genus **Milvus** Lacépède

Species in India—*Milvus migrans.*

Genus **Haliastur** Selby

Species in India—*Haliastur indus.*

Subfamily *Accipitrinae*

Genus **Accipiter** Brisson

Syn. *Astur* Lacépède

Species in India—*Accipiter gentilis, A. badius, A. butleri, A. soloënsis* (regular visitor), *A. trivirgatus, A. nisus* and *A. virgatus*[2].

[1]Includes *crispus. Pelecanus roseus* is a synonym of *P. philippensis* [see Chapin and Amadon, *Ostrich,* 21 : 15—18 (1950), and Meinertzhagen, *Ibis,* 93 : 453 (1951)].

[2]Includes *gularis.*

Subfamily *Buteoninae*

Genus **Buteo** Lacépède

Species in India—*Buteo rufinus*, *B. hemilasius*, *B. vulpinus* (regular visitor) and *B. burmanicus* (regular visitor).

Genus **Butastur** Hodgson

Species in India—*Butastur teesa*, *B. indicus* (regular visitor) and *B. liventer*.

Genus **Spizaëtus** Vieillot

Syn. *Limnaëtops* Baker

Species in India—*Spizaëtus nipalensis*, *S. alboniger* and *S. cirrhatus*.

Genus **Hieraaëtus** Kaup

Syn. *Lophotriorchis* Sharpe

Species in India—*Hieraaëtus fasciatus*, *H. pennatus* and *H. kieneri*.

Genus **Aquila** Brisson

Species in India—*Aquila chrysaëtos*, *A. heliaca*, *A. rapax*, *A. nipalensis*, *A. clanga* and *A. pomarina*.

Genus **Ictinaëtus** Blyth

Species in India—*Ictinaëtus malayensis*.

Genus **Haliaeetus** Savigny

Species in India—*Haliaeetus leucogaster*, *H. leucoryphus* and *H. albicilla* (regular visitor).

Genus **Ichthyophaga** Lesson

Species in India—*Ichthyophaga ichthyaetus* and *I. nana*.

Subfamily *Aegypiinae*

Genus **Torgos** Kaup

Syn. *Sarcogyps* Lesson

Species in India—*Torgos calvus*.

Genus **Aegypius** Savigny

Species in India—*Aegypius monachus*.

Genus **Gyps** Savigny

Syn. *Pseudogyps* Sharpe

Species in India—*Gyps fulvus, G. himalayensis, G. indicus* and *G. bengalensis.*

Genus **Neophron** Savigny

Species in India—*Neophron percnopterus.*

Genus **Gypaëtus** Storr

Species in India—*Gypaëtus barbatus.*

Subfamily *CIRCINAE*

Genus **Circus** Lacépède

Species in India—*Circus cyaneus* (regular visitor), *C. macrourus* (regular visitor), *C. pygargus* (regular visitor), C. *melanoleucus* (regular visitor) and *C. aeruginosus*[1] (regular visitor).

Subfamily *CIRCAËTINAE*

Genus **Circaëtus** Vieillot

Species in India—*Circaëtus gallicus.*

Genus **Spilornis** G. R. Gray

Species in India—*Spilornis cheela, S. minimus* and *S. elgini.*

Family FALCONIDAE

Subfamily *POLIHIERACINA*

Genus **Microhierax** Sharpe

Syn. *Neohierax* Swann

Species in India—*Microhierax fringillarius, M. caerulescens, M. melanoleucos* and *M. insignis.*

Subfamily *FALCONINAE*

Genus **Falco** Linné

HIEROFALCO Cuvier, RHYNCHODON Nitzsch, TINNUNCULUS Vieillot, ERYTHROPUS Brehm and CERCHNEIS Boie are subgenera.

Species in India—*Falco rusticolus*[2], *F peregrinus*[3], *F. subbuteo, F. severus, F. columbarius* (regular visitor), *F. chicquera, F. amurensis* (regular visitor), *F. naumanni* (regular visitor) and *F. tinnunculus*

[1]Includes *spilonotus.*
[2]Includes *cherrug* and *jugger.*
[3]Includes *babylonicus.*

Family Pandionidae

Genus **Pandion** Savigny

Species in India—*Pandion haliaetus.*

Order CICONIIFORMES

Suborder *ARDAE*

Family Ardeidae

Subfamily *Ardeinae*

Genus **Ardea** Linné

Species in India—*Ardea sumatrana, A. imperialis, A. goliath* (casual visitor), *A. cinerea* and *A. purpurea.*

Genus **Butorides** Blyth

Species in India—*Butorides striatus.*

Genus **Ardeola** Boie

Species in India—*Ardeola grayi* and *A. bacchus.*

Genus **Bubulcus** Bonaparte

Species in India—*Bubulcus ibis.*

Genus **Egretta** T. Forster

Syn. *Demigretta* Blyth

Species in India—*Egretta alba, E. garzetta, E. gularis*[1], *E. sacra,* and *E. intermedia.*

Genus **Nycticorax** T. Forster

Species in India—*Nycticorax nycticorax.*

Genus **Gorsachius** Bonaparte

Species in India—*Goraschius melanolophus.*

Subfamily *Botaurinae*

Genus **Ixobrychus** Billberg

Species in India—*Ixobrychus minutus, I. sinensis* and *I. cinnamomeus.*

Genus **Dupetor** Heine and Reichenow

Species in India—*Dupetor flavicollis.*

[1]Includes *asha.*

Genus **Botaurus** Stephens

Species in India—*Botaurus stellaris* (regular visitor).

Suborder *CICONIAE*

Family Threskiornithidae

Subfamily *Threskiornithinae*

Genus **Threskiornis** G. R. Gray

Species in India—*Threskiornis melanocephala.*

Genus **Pseudibis** Hodgson

Species in India—*Pseudibis papillosa* and *Ps. davisoni.*

Genus **Plegadis** Kaup

Species in India—*Plegadis falcinellus.*

Subfamily *Plataleinae*

Genus **Platalea** Linné

Species in India—*Platalea leucorodia.*

Family Ciconiidae

Subfamily *Mycteriinae*

Genus **Ibis** Lacépède

Species in India—*Ibis leucocephalus.*

Subfamily *Ciconiinae*

Genus **Anastomus** Bonnaterre

Species in India—*Anastomus oscitans.*

Genus **Ciconia** Brisson

Syn. *Dissoura* Cabanis

Species in India—*Ciconia episcopa, C. ciconia* (regular visitor) and *C. nigra* (regular visitor).

Genus **Xenorhynchus** Bonaparte

Species in India—*Xenorhynchus asiaticus.*

Genus **Leptoptilos** Lesson

Species in India—*Leptoptilos dubius* and *L. javanicus.*

Order PHOENICOPTERIFORMES

Family Phoenicopteridae

Genus **Phoenicopterus** Linné

Syn. *Phoeniconaias* G. R. Gray

Species in India—*Phœnicopterus ruber* and *P. minor* (regular visitor).

Order ANSERIFORMES

Family Anatidae

cf. Delacour and Mayr. *Wilson Bull.*, **57**: 3-55 (1945).

Subfamily *Anserinae*

Genus **Branta** Scopoli

Species in India—*Branta ruficollis* (casual visitor).

Genus **Anser** Brisson

Species in India—*Anser fabalis*[1] (casual visitor), *A. albifrons* (regular visitor), *A. erythropus* (casual visitor), *A. anser* (regular visitor), *A. indicus* and *A. caerulescens* [2,3].

Genus **Cygnus** Bechstein

Species in India—*Cygnus columbianus*[4] (casual visitor), *C. cygnu* (casual visitor) and *C. olor* (casual visitor).

Genus **Dendrocygna** Swainson

Species in India—*Dendrocygna javanica* and *D. bicolor*[5].

Subfamily *Anatinae*

Genus **Tadorna** Fleming

Syn. *Casarca* Bonaparte

Species in India—*Tadorna ferruginea* and *T. tadorna* (regular visitor)

Genus **Anas** Linné

Syn. *Spatula* Boie, *Dafila* Stephens, *Mareca* Stephens, *Querquedula* Stephens, *Nettion* Kaup, *Chaulelesmus* Bonaparte, *Marmaronetta* Reichenbach, *Eunetta* Bonaparte

Species in India—*Anas angustirostris* (regular visitor), *A. acuta* (regular visitor), *A. crecca* (regular visitor), *A. formosa* (casual visitor), *A. falcata* (regular visitor), *A. gibberifrons*[6], *A. poecilorhyncha*, *A. platyrhynchos* (regular visitor), *A. strepera* (regular visitor), *A. penelope* (regular visitor), *A. querquedula* (regular visitor) and *A. clypeata* (regular visitor).

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[1] Includes *neglectus* and *brachyrhynchus*.
[2] Includes *hyperboreus*.
[3] Very rare visitor to our area.
[4] Includes *bewicki* and *jankowskii* (oilm *minor*).
[5] Antedates *Dendrocygna fulva* Gmelin.
[6] Includes *albogularis*.

Genus **Rhodonessa** Reichenbach

Species in India—*Rhodonessa caryophyllacea.*

Genus **Netta** Kaup

Species in India—*Netta rufina* (regular visitor).

Genus **Aythya** Boie

Syn. *Nyroca* Fleming

Species in India—*Aythya ferina* (regular visitor), *A. nyroca*[1], *A. baeri* (regular visitor), *A. fuligula* (regular visitor) and *A. marila* (casual visitor).

Genus **Aix** Boie

Species in India—*Aix galericulata* (casual visitor).

Genus **Nettapus** Brandt

Species in India—*Nettapus coromandelianus.*

Genus **Sarkidiornis** Eyton

Species in India—*Sarkidiornis melanotos.*

Genus **Cairina** Fleming

Syn. *Asacornis* Salvadori

Species in India—*Cairina scutulata.*

Genus **Bucephala** Baird

Syn. *Glaucionetta* Stejneger

Species in India—*Bucephala clangula* (regular visitor).

Genus **Mergus** Linné

Syn. *Mergellus* Selby

Species in India—*Mergus albellus* (regular visitor), *M. serrator* (casual visitor) and *M. merganser.*

Genus **Oxyura** Bonaparte

Syn. *Erismatura* Bonaparte

Species in India—*Oxyura leucocephala* (casual visitor).

Order GALLIFORMES

Suborder *GALLI*

Superfamily **CRACOIDEA**

Family MEGAPODIIDAE

[1]Antedates *A. rufa* Mathews and Iredale.

Genus **Megapodius** Gaimard

Species in India—*Megapodius nicobariensis.*

Superfamily **PHASIANOIDEA**

Family Phasianidae

Subfamily *Phasianinae*

Genus **Lerwa** Hodgson

Species in India—*Lerwa lerwa.*

Genus **Ammoperdix** Gould

Species in India—*Ammoperdix griseogularis.*

Genus **Tetraogallus** J. E. Gray

Species in India—*Tetraogallus tibetanus* and *T. himalayensis.*

Genus **Alectoris** Kaup

Species in India—*Alectoris graeca.*

Genus **Francolinus** Stephens

Species in India—*Francolinus francolinus, F. pictus, F. pintadeanus, F. pondicerianus* and *F. gularis.*

Genus **Perdix** Brisson

Species in India—*Perdix hodgsoniae.*

Genus **Rhizothera** G. R. Gray

Species in India—*Rhizothera longirostris.*

Genus **Ophrysia** Bonaparte

Species in India—*Ophrysia superciliosa.*

Genus **Coturnix** Bonnaterre

Syn. *Excalfactoria* Bonaparte

Species in India—*Coturnix coturnix, C. coromandelica* and *C. chinensis.*

Genus **Perdicula** Hodgson

Syn. *Cryptoplectron* Streubel

Species in India—*Perdicula asiatica, P. argoondah, P. erythrorhynchus* and *P. manipurensis.*

Genus **Arborophila** Hodgson

Species in India—*Arborophila torqueola, A. rufogularis, A. atrogularis, A. mandelli* and *A. brunneopectus.*

Genus **Tropicoperdix** Blyth

Species in India—*Tropicoperdix charlotini* and *T chloropus.*

Genus **Caloperdix** Blyth

Species in India—*Caloperdix oculea.*

Genus **Rollulus** Bonnaterre

Species in India—*Rollulus roulroul.*

Genus **Bambusicola** Gould

Species in India—*Bambusicola fytchi.*

Genus **Galloperdix** Blyth

Species in India—*Galloperdix spadicea, G. lunulata* and *G. bicalcarata.*

Genus **Ithaginis** Wagler

Species in India—*Ithaginis cruentus.*

Genus **Tragopan** Cuvier

Syn. *Ceriornis* Swainson

Species in India—*Tragopan melanocephalus, T. satyra, T. blythi* and *T temminckı.*

Genus **Pucrasia** G. R. Gray

Species in India—*Pucrasia macrolopha.*

Genus **Lophophorus** Temminck

Species in India—*Lophophorus impejanus* and *L. sclateri.*

Genus **Gallus** Brisson

Species in India—*Gallus gallus*[1], *G. lafayetti*, and *G. sonnerati.*

Genus **Lophura** Fleming

Syn. *Gennaeus* Wagler

cf. Delacour, *Ibis*, **91** : 188-220 (1949).

Species in India—*Lophura leucomelana*[2], *L. nycthemera, L. ignita*[3] and *L. diardi.*

[1]Includes *bankiva.*

[2]Includes *hamiltoni, melanota, moffitti, lathami* (=*horsfieldi* auct.), *williamsi, swinhoi, lineata* and *crawfurdi.*

[3]Includes *rufa,*

Genus **Crossoptilon** Hodgson

Species in India—*Crossoptilon crossoptilon*[1].

Genus **Catreus** Cabanis

Species in India—*Catreus wallichi.*

Genus **Syrmaticus** Wagler

Species in India—*Syrmaticus humiae.*

Genus **Phasianus** Linné

Species in India—*Phasianus colchicus*[2].

Genus **Chrysolophus** J. E. Gray

Species in India—*Chrysolophus amherstiae.*

Genus **Polyplectron** Temminck

Species in India—*Polyplectron bicalcaratum* and *P. malacensis.*

Genus **Argusianus** Rafinesque

Species in India—*Argusianus argus.*

Genus **Pavo** Linné

Species in India—*Pavo cristatus* and *P. muticus.*

Order CUCULIFORMES

Suborder *CUCULI*

Family Cuculidae

Subfamily *Cuculinae*

Genus **Clamator** Kaup

Species in India—*Clamator coromandus* and *C. jacobinus.*

Genus **Cuculus** Linné

Syn. *Cacomantis* S. Müller, *Hierococcyx* S. Müller, *Penthoceryx* Cabanis and Heine

cf. Delacour, *Zoologica*, **30** : 107 (1945).

Species in India—*Cuculus sparverioïdes, C. varius, C. vagans*[3], *C. fugax, C. micropterus, C. canorus, C. saturatus*[4], *C. poliocephalus, C. sonnerati, C. passerinus* and *C. merulinus.*

[1]Includes *harmani.*
[2]Includes *elegans.*
[3]Antedates *Hierococcyx nanus* Hume,
[4]Antedates *Cuculus optatus* Gould.

Genus **Chrysococcyx** Boie

Syn. *Chalcites* Lesson

Species in India—*Chrysococcyx maculatus* and *C. xanthorhynchus.*

Genus **Surniculus** Lesson

Species in India—*Surniculus lugubris.*

Genus **Eudynamys** Vigors and Horsfield

Species in India—*Eudynamys scolopacea.*

Subfamily *Phaenicophaeinae*

cf. Delacour, *Zoologica,* **30** : 107 (1945).

Genus **Taccocua** Lesson

Syn. *Zanclostomus* Swainson, *Rhopodytes* Cabanis and Heine

Species in India—*Taccocua diardi, T. sumatrana, T. tristis, T. viridirostris, T. leschenaulti* and *T javanica.*

Genus **Phaenicophaeus** Stephens

Syn. *Rhinortha* Vigors, *Rhamphococcyx* Cabanis and Heine

Species in India—*Phaenicophaeus chlorophaeus, P. curvirostris*[1] and *P. pyrrhocephalus.*

Subfamily *Centropodinae*

Genus **Centropus** Illiger

Species in India—*Centropus chlororhynchus, C. andamanensis, C. sinensis* and *C. toulou*[2].

Order GRUIFORMES

Suborder *GRUES*

Superfamily **GRUOIDEA**

Family Gruidae

Subfamily *Gruinae*

Genus **Grus** Pallas

Syn. *Antigone* Reichenbach

Species in India—*Grus grus* (regular visitor), *G. monacha* (? casual visitor), *G. antigone* and *G. leucogeranus* (regular visitor).

[1]Includes *erythrognathus.*

[2]Includes *bengalensis.*

Genus **Anthropoïdes** Vieillot

Species in India—*Anthropoïdes virgo* (regular visitor).

Suborder *HELIORNITHES*

Family Heliornithidae

Genus **Heliopais** Sharpe

Species in India—*Heliopais personata.*

Suborder *OTIDES*

Family Otididae

Genus **Tetrax** T. Forster

Species in India—*Tetrax tetrax* (regular visitor).

Genus **Otis** Linné

Species in India—*Otis tarda* (casual visitor).

Genus **Ardeotis** La Maout

Syn. *Choriotis* G. R. Gray

Species in India—*Ardeotis nigriceps.*

Genus **Chlamydotis** Lesson

Species in India—*Chlamydotis undulata.*

Genus **Eupodotis** Lesson

Syn. *Syphcotides* Lesson, *Houbaropsis* Sharpe

Species in India—*Eupodotis bengalensis* and *E. indica.*

Suborder *RALLAE*

Superfamily **RALLOIDEA**

Family Rallidae

Subfamily *Rallinae*

Genus **Rallus** Linné

Syn. *Hypotaenidia* "Reichenbach" Baker

Rallina G. R. Gray is a subgenus.

Species in India—*Rallus aquaticus* (regular visitor), *R. striatus*, *R. fasciatus*, *R. eurizonoïdes*[1] and *R. canningi.*

[1]Replaces *Rallus superciliaris* Eyton, preoccupied.

Genus **Crex** Bechstein

Species in India—*Crex crex*[1].

Genus **Porzana** Vieillot

Species in India—*Porzana parva* (regular visitor), *P. pusilla*, *P. porzana* (regular visitor), *P. fusca* and *P. bicolor*.

Genus **Amaurornis** Reichenbach

Species in India—*Amaurornis akool* and *A. phoenicurus*.

Genus **Gallicrex** Blyth

Species in India—*Gallicrex cinerea*.

Genus **Gallinula** Brisson

Species in India—*Gallinula chloropus*.

Genus **Porphyrio** Brisson

Species in India—*Porphyrio porphyrio*[2].

Subfamily *Fulicinae*

Genus **Fulica** Linné

Species in India—*Fulica atra*.

Suborder *TURNICES*

Family Turnicidae

Subfamily *Turnicinae*

Genus **Turnix** Bonnaterre

Species in India—*Turnix sylvatica*[3], *T tanki*[4] and *T suscitator*.

Order CHARADRIIFORMES

Suborder *CHARADRII*

Superfamily **JACANOIDEA**

Family Jacanidae

Genus **Hydrophasianus** Wagler

Species in India—*Hydrophasianus chirurgus*.

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[1] Very rarely taken within Indian area.
[2] Includes *poliocephalus*.
[3] Includes *dussumieri*.
[4] *Turnix maculatus* Vieillot is a synonym of *Hemipodius maculosus* Temminck, and is therefore not applicable to this species.

Genus **Metopidius** Wagler

Species in India—*Metopidius indicus.*

Superfamily **DROMADOIDEA**

Family DROMADIDAE

Genus **Dromas** Paykull

Species in India—*Dromas ardeola.*

Superfamily **BURHINOIDEA**

Family BURHINIDAE

Genus **Burhinus** Illiger

Syn. *Esacus* Lesson, *Orthorhamphus* Salvadori

cf. Meinertzhagen, *Ibis*, (11) **6** : 329-356 (1924).

Species in India—*Burhinus oedicnemus*, *B. recurvirostris* and *B. neglectus.*

Superfamily **CHARADROIDEA**

Family HAEMATOPODIDAE

Genus **Haematopus** Linné

Species in India—*Haematopus ostralegus* (regular visitor).

Family CHARADRIIDAE

Subfamily *CHARADRIINAE*

Genus **Chettusia** Bonaparte

Species in India—*Chettusia leucura* (regular visitor) and *C. gregaria* (regular visitor).

Genus **Vanellus** Brisson

Species in India—*Vanellus vanellus* (regular visitor).

Genus **Microsarcops** Sharpe

Species in India—*Microsarcops cinereus* (regular visitor).

Genus **Hoplopterus** Bonaparte

Syn. *Lobivanellus* "Strickl." G. R. Gray

Species in India—*Hoplopterus indicus* and *H. duvaucelii.*

Genus **Lobipluvia** Bonaparte

Species in India—*Lobipluvia malabarica.*

Genus Pluvialis Brisson

Syn. *Squatarola* Cuvier

Species in India—*Pluvialis squatarola* (regular visitor), *P. apricaria* (regular visitor) and *P. dominica* (regular visitor).

Genus **Charadrius** Linné

Syn. *Eupoda* J. F. Brandt, *Leucopolius* Bonaparte, *Cirrepidesmus* Bonaparte

Species in India—*Charadrius hiaticula* (regular visitor), *C. dubius*, *C. alexandrinus*, *C. placidus* (regular visitor), *C. mongolus*, *C. leschenaulti* (regular visitor), *C. asiatica*[1] and *C. veredus*[1].

Subfamily *Scolopacinae*

Genus **Numenius** Brisson

Species in India—*Numenius phaeopus* (regular visitor) and *N. arquata* (regular visitor).

Genus **Limosa** Brisson

Species in India—*Limosa limosa* (regular visitor) and *L. lapponica* (regular visitor).

Genus **Tringa** Linné

Syn. *Glottis* Koch, *Xenus* Kaup, *Pseudototanus* Hume

Species in India—*Tringa erythropus* (regular visitor), *T totanus* (regular visitor), *T. stagnatalis* (regular visitor), *T nebularia* (regular visitor), *T. ochropus* (regular visitor), *T. glareola* (regular visitor), *T. guttifer* (regular visitor) and *T. cinerea* (regular visitor).

Genus **Actitis** Illiger

Species in India—*Actitis hypoleucos* (regular visitor).

Genus **Arenaria** Brisson

Species in India—*Arenaria interpres* (regular visitor).

Genus **Limnodromus** Wied

Species in India—*Limnodromus semipalmatus* (regular visitor).

[1] Status doubtful; very rarely recorded from our area.

Genus **Gallinago** Koch

Syn. *Lymnocryptes* Kaup

Species in India—*Gallinago solitaria, G. nemoricola, G. stenura* (regular visitor), *G. megala* (regular visitor), *G. media* (casual visitor), *G. gallinago* (regular visitor) and *G. minima* (regular visitor).

Genus **Scolopax** Linné

Species in India—*Scolopax rusticola.*

Genus **Calidris** Merrem

Syn. *Erolia* Vieillot, *Crocethia* Billberg

Species in India—*Calidris canutus* (casual visitor), *C. tenuirostris* (regular visitor), *C. albus* (regular visitor), *C. ruficollis* (regular visitor), *C. minutus* (regular visitor), *C. temmincki* (regular visitor), *C. subminutus* (regular visitor), *C. acuminatus* (regular visitor), *C. alpinus* (regular visitor) and *C. testaceus* (regular visitor).

Genus **Eurynorhynchus** Nilsson

Species in India—*Eurynorhynchus pygmeus* (regular visitor).

Genus **Limicola** Koch

Species in India—*Limocola falcinellus* (regular visitor).

Genus **Philomachus** Merrem

Species in India—*Philomachus pugnax* (regular visitor).

Subfamily *Phalaropinae*

Genus **Phalaropus** Brisson

Syn. *Lobipes* Cuvier

Species in India—*Phalaropus fulicarius* (casual visitor) and *P. lobatus* (regular visitor).

Subfamily *Recurvirostrinae*

Genus **Himantopus** Brisson

Species in India—*Himantopus himantopus.*

Genus **Recurvirostra** Linné

Species in India—*Recurvirostra avosetta* (regular visitor).

Subfamily *Ibidorhynchinae*

Genus **Ibidorhyncha** Vigors

Species in India—*Ibidorhyncha struthersi.*

Subfamily *Rostratulinae*

Genus **Rostratula** Vieillot

Species in India—*Rostratula benghalensis.*

Superfamily **GLAREOLOIDEA**

Family GLAREOLIDAE

Subfamily *CURSORIINAE*

Genus **Cursorius** Latham

Species in India—*Cursorius cursor* (regular visitor) and *C. coromandelicus*.

Genus **Rhinoptilus** Strickland

Species in India—*Rhinoptilus bitorquatus*.

Subfamily *GLAREOLINAE*

Genus **Glareola** Brisson

Species in India—*Glareola pratincola*[1] and *G. lactea*.

Suborder *LARI*

Family LARIDAE

Subfamily *STERCORARIINAE*

Genus **Catharacta** Brünnich

Species in India—*Catharacta skua* (casual visitor).

Genus **Stercorarius** Brisson

Species in India—*Stercorarius pomarinus* (casual visitor) and *S. parasiticus* (regular visitor).

Subfamily *LARINAE*

Genus **Larus** Linné

Species in India—*Larus hemprichi*, *L. argentatus*[2] (regular visitor), *L. ichthyaetus* (regular visitor), *L. brunnicephalus*, *L. ridibundus* (regular visitor), *L. geneï* and *L. minutus* (? casual visitor[3]).

Subfamily *STERNINAE*

Genus **Chlidonias** Rafinesque

Species in India—*Chlidonias hybrida*[4] and *C. leucoptera* (regular visitor).

[1] Includes *maldivarum*.
[2] Baker's *L. fuscus taimyrensis* Buturlin is *L. argentatus heuglini* Bree.
[3] Status doubtful. There is a single example from Ladakh in the Koelz collection.
[4] Antedates *Sterna leucopareia* Temminck.

Genus **Gelochelidon** Brehm

Species in India—*Gelochelidon nilotica.*

Genus **Hydroprogne** Kaup

Species in India—*Hydroprogne tschegrava*[1] (regular visitor).

Genus **Sterna** Linné

Syn. *Thalasseus* Boie

Species in India—*Sterna aurantia, S. hirundo* (regular visitor), *S. dougalli, S. repressa, S. sumatrana, S. melanogaster, S. anaethetus, S. fuscata, S. albifrons, S. bergi, S. bengalensis* and *S. sandvicensis* (regular visitor).

Genus **Anoüs** Stephens

Species in India—*Anoüs stolidus* and *A. tenuirostris*[2].

Genus **Gygis** Wagler

Species in India—*Gygis alba* (casual visitor).

Subfamily *Rynchopinae*

Genus **Rynchops** Linné

Species in India—*Rynchops albicollis.*

Order COLUMBIFORMES

Suborder *PTEROCLETES*

Family Pteroclidae

Genus **Syrrhaptes** Illiger

Species in India—*Syrrhaptes tibetanus* and *S. paradoxus*[3].

Genus **Pterocles** Temminck

Species in India—*Pterocles alchatus, Pt. exustus, Pt. senegallus, Pt. orientalis, Pt. coronatus, Pt. lichtensteini* and *Pt. indicus.*

Suborder *COLUMBAE*

Family Columbidae

Subfamily *Treroninae*

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[1] Antedates *Sterna caspia* Pallas.

[2] Includes *minutus.* The three specimens from Indian area referred to *minutus* by Baker [*Faun. Brit. India, Bds.*, **6**: 147 (1929)] need re-examination to ascertain their taxonomic status.

[3] Status doubtful; recorded once within our limits.

Genus **Treron** Vieillot

Syn. *Sphenurus* Swainson, *Sphenocercus* G. R. Gray, *Dendrophassa* Gloger, *Butreron* Bonaparte, *Crocopus* Bonaparte

cf. Biswas, *Bull. Brit. Orn. Cl.*, 70 : 34 (1950).

Species in India—*Treron apicauda, T sphenura, T capellei*[1], *T. curvirostra, T. pompadora, T. fulvicollis, T. vernans, T. bicincta* and *T. phoenicoptera.*

Genus **Ducula** Hodgson

Syn. *Myristicivora* Reichenbach

Species in India—*Ducula aenea, D. badia* and *D. bicolor.*

Subfamily *Columbinae*

Genus **Columba** Linné

Syn. *Alsocomus* Blyth, *Dendrotreron* " Hodgson " Blyth, *Ianthoenas* Reichenbach

Species in India—*Columba leuconota, C. rupestris, C. livia, C. eversmanni* (regular visitor), *C. palumbus, C. arquatrix*[2], *C. elphinstoni, C. torringtoni, C. pulchricollis, C. palumboides* and *C. punicea.*

Genus **Macropygia** Swainson

Species in India—*Macropygia unchall, M. ruficeps* and *M. rufipennis.*

Genus **Streptopelia** Bonaparte

Syn. *Oenopopelia* Blanford

Species in India—*Streptopelia turtur* (regular visitor), *S. orientalis, S. decaocto, S. tranquebarica, S. chinensis* and *S. senegalensis.*

Genus **Geopelia** Swainson

Species in India—*Geopelia striata.*

Genus **Chalcophaps** Gould

Species in India—*Chalcophaps indica.*

Genus **Caloenas** G. R. Gray

Species in India—*Caloenas nicobarica.*

Order PSITTACIFORMES

Family Psittacidae

Subfamily *Psittacinae*

[1] Status doubtful; once recorded from our area.
[2] Includes *hodgsoni.*

Genus **Psittacula** Cuvier

Species in India—*Psittacula eupatria, Ps. krameri, Ps. alexandri, Ps. caniceps, Ps. longicauda*[1], *Ps. intermedia, Ps. cyanocephala, Ps. roseata, Ps. himalayana, Ps. calthorpae* and *Ps. columboides.*

Genus **Psittinus** Blyth

Species in India—*Psittinus cyanurus*[2].

Genus **Loriculus** Blyth

Syn. *Coryllis* Finsch

Species in India—*Loriculus vernalis* and *L. beryllinus.*

Order STRIGIFORMES

Family Strigidae

Subfamily *Striginae*

Genus **Otus** Pennant

Species in India—*Otus sagittatus, O. spilocephalus, O. balli, O. brucei* (? casual visitor), *O. scops*[3] and *O. bakkamoena.*

Genus **Bubo** Duméril

Syn. *Ketupa* Lesson, *Huhua* Hodgson

Species in India—*Bubo bubo, B. nipalensis, B. sumatrana*[4], *B. coromandus, B. zeylonensis, B. flavipes* and *B. ketupu.*

Genus **Nyctea** Stephens

Species in India—*Nyctea scandiaca*[5] (? casual visitor).

Genus **Glaucidium** Boie

Species in India—*Glaucidium brodiei, G. radiatum* and *G. cuculoïdes*[6].

Genus **Ninox** Hodgson

Species in India—*Ninox scutulata*[7] and *N. affinis*

Genus **Athene** Boie

Species in India—*Athene noctua* (casual visitor), *A. brama* and *A. blewetti.*

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[1] Antedates *Palaeornis nicobaricus* Gould.
[2] Antedates *Psittacus incertus* Shaw and Nodder.
[3] Includes *sunia* group.
[4] Replaces *Strix orientalis* Horsfield, preoccupied.
[5] Replaces *Strix nyctea* Linné.
[6] Includes *castanonotum.*
[7] Includes *obscura.*

Genus **Strix** Linné

Species in India—*Strix butleri*[1], *S. seloputo*, *S. ocellata*, *S. leptogrammica*[2] and *S. aluco*[3].

Genus **Asio** Brisson

Species in India—*Asio otus* and *A. flammeus* (regular visitor).

Genus **Aegolius** Kaup

Species in India—*Aegolius funereus*.

Subfamily *TYTONINAE*

Genus **Tyto** Billberg

Species in India—*Tyto alba* and *T capensis*[4].

Genus **Phodilus** St. Hillaire

Species in India—*Phodilus badius*.

Order CAPRIMULGIFORMES

Suborder *CAPRIMULGI*

Family PODARGIDAE

Genus **Batrachostomus** Gould

Species in India—*Batrachostomus moniliger*, *B. hodgsoni*, *B. javensis* and *B. affinis*[5].

Family CAPRIMULGIDAE

Subfamily *CAPRIMULGINAE*

Genus **Eurostopodus** Gould

Syn. *Lycornis* Gould

Species in India—*Eurostopodus macrotis*[6].

Genus **Caprimulgus** Linné

Species in India—*Caprimulgus indicus*, *C. europaeus*, *C. mahrattensis*, *C. macrurus*, *C. asiaticus* and *C. affinis*[7].

[1] Taxonomic status doubtful.
[2] Includes *indranee*.
[3] Includes *nivicola*.
[4] Includes *longimembris*.
[5] Once recorded.
[6] Includes *cerviniceps*.
[7] Includes *monticola*.

Order TROGONIFORMES

Family Trogonidae

Genus **Harpactes** Swainson

Species in India—*Harpactes fasciatus, H. duvauceli, H. oreskios, H. erythrocephalus* and *H. wardi.*

Order CORACIIFORMES

Suborder *CORACII*

Family Coraciidae

Subfamily *Coraciinae*

Genus **Coracias** Linné

Species in India—*Coracias garrulus* and *C. benghalensis.*

Genus **Eurystomus** Vieillot

Species in India—*Eurystomus orientalis.*

Suborder *ALCEDINES*

Superfamily **ALCEDINOIDEA**

Family Alcedinidae

Subfamily *Cerylinae*

Genus **Ceryle** Boie

Species in India—*Ceryle lugubris* and *C. rudis.*

Subfamily *Alcedininae*

Genus **Alcedo** Linné

Species in India—*Alcedo hercules, A. atthis, A. meninting* and *A. euryzona.*

Genus **Ceyx** Lacépède

Species in India—*Ceyx erithacus*[1].

Subfamily *Daceloninae*

Genus **Pelargopsis** Gloger

Syn. *Ramphalcyon* Reichenbach

Species in India—*Pelargopsis amauroptera* and *P. capensis,*

[1] Antedates *Alcedo tridactyla* Pallas.

Genus **Lacedo** Reichenbach

Species in India—*Lacedo pulchella.*

Genus **Halcyon** Swainson

Syn. *Entomothera* Horsfield, *Sauropatis* Cabanis and Heine, *Caridagrus* Cabanis and Heine

Species in India—*Halcyon coromanda, H. smyrnensis, H. pileata, H. chloris* and *H. concreta.*

Suborder *MEROPES*

Family MEROPIDAE

Genus **Merops** Linné

Syn. *Melittophagus* "Boie" Baker

Species in India—*Merops leschenaulti, M. apiaster, M. superciliosus, M. philippinus* and *M. orientalis.*

Genus **Nyctyornis** Jardine and Selby

Syn. *Alcemerops* St. Hillaire

Species in India—*Nyctyornis amicta* and *N. athertoni.*

Suborder *UPUPAE*

Family UPUPIDAE

Subfamily *UPUPINAE*

Genus **Upupa** Linné

Species in India—*Upupa epops.*

Suborder *BUCEROTES*

Family BUCEROTIDAE

Genus **Tockus** Lesson

Syn. *Lophoceros* Ehrenberg

Species in India—*Tockus birostris* and *T. griseus.*

Genus **Berenicornis** Bonaparte

Species in India—*Berenicornis comatus.*

Genus **Ptilolaemus** Ogilvie-Grant

Species in India—*Ptilolaemus tickelli.*

Genus **Anorrhinus** Reichenbach

Species in India—*Anorrhinus galeritus.*

Genus **Aceros** Hodgson

Syn. *Rhyticeros* Reichenbach

Species in India—*Aceros nipalensis, A. undulatus*[1] and *A. narcondami.*

[1] Includes *subruficollis*

Genus **Anthracoceros** Reichenbach

Syn. *Hydrocissa* Bonaparte

Species in India—*Anthracoceros malabaricus* and *A. coronatus.*

Genus **Buceros** Linné

Syn. *Dichoceros* Gloger

Species in India—*Buceros bicornis.*

Genus **Rhinoplax** Gloger

Species in India—*Rhinoplax vigil.*

Order APODIFORMES

Suborder *APODI*

Family Apodidae

Subfamily *Apodina*

Genus **Collocalia** G. R. Gray

Species in India—*Collocalia fuciphaga*[1], *C. brevirostris*[2], *C. inexpectata*, *C. francica*[3] and *C. esculenta*[4].

Genus **Chaetura** Stephens

Syn. *Hirundapus* Hodgson, *Rhaphidura* Oates, *Indicapus* Mathews

Species in India—*Chaetura caudacuta*, *Ch. cochinchinensis*, *Ch. gigantea*, *Ch. leucopygialis* and *Ch. sylvatica.*

Genus **Apus** Scopoli

Syn. *Micropus* Meyer and Wolf

Species in India—*Apus melba*, *A. apus*, *A. pallidus*[5], *A. acuticaudus*, *A. pacificus* and *A. affinis.*

Genus **Cypsiurus** Lesson

Syn. *Tachornis* Gosse

Species in India—*Cypsiurus parvus*[6].

Subfamily *Hemiprocninae*

Genus **Hemiprocne** Nitzsch

Species in India—*Hemiprocne longipennis*[7] and *H. comata.*

[1] *Collocalia innominata* Hume is very probably a subspecies of this species.
[2] Includes *unicolor.*
[3] There seems to be only one record of its occurrence within our area.
[4] Antedates *Collocalia linchi* Horsfield and Moore.
[5] Replaces *Cypselus murinus* Brehm and Brehm, preoccupied.
[6] Includes *batasiensis.*
[7] Includes *coronatus.*

Order PICIFORMES

Suborder *GALBULAE*

Superfamily CAPITONOIDEA

Family Capitonidae

Genus **Megalaima** G. R. Gray

Syn. *Chotorea* Bonaparte, *Cyanops* Bonaparte, *Xantholaema* Bonaparte, *Thereiceryx*, Blanford

cf. Ripley, *Auk*, **62**: 542-563 (1945).

Species in India—*Megalaima virens*, *M. zeylanica*, *M. lineata*, *M. viridis*, *M. mystacophanos*, *M. flavifrons*, *M. franklini*, *M. asiatica*, *M. incognita*, *M. australis* [1,2], *M. rubricapilla*[3] and *M. haemacephala*.

Genus **Calorhamphus** Lesson

Species in India—*Calorhamphus fuliginosus*.

Suborder *PICI*

Family Picidae

Subfamily *Picinae*

Genus **Micropternus** Blyth

Species in India—*Micropternus brachyurus*.

Genus **Picus** Linné

Syn. *Chrysophlegma* Gould, *Callolophus* Salvadori

Species in India—*Picus squamatus*, *P. viridianus*, *P. vittatus*, *P. myrmecophoneus*, *P. canus*, *P. erythropygius*, *P. puniceus*, *P. chlorolophus*, *P. flavinucha*, *P. mentalis* and *P. mineaceus*.

Genus **Dinopium** Rafinesque

Syn. *Brachypternus* Strickland, *Chloropicoides* Malherbe, *Dinopicus* "Rafinesque" Baker

Species in India—*Dinopium benghalense*, *D. shorei*, *D. javense* and *D. rafflesi*.

Genus **Gecinulus** Blyth

Species in India—*Gecinulus grantia* and *G. viridis*.

Genus **Meiglyptes** Swainson

Species in India—*Meiglyptes tristis*[4], *M. jugularis* and *M. tukki*.

[1] Includes *duvauceli*.
[2] *Cyanops robustirostris* Baker is only a juvenal *M. australis*.
[3] Includes *malabarica*.
[4] Includes *grammithorax*.

Genus **Mulleripicus** Bonaparte

Species in India—*Mulleripicus pulverulentus.*

Genus **Dryocopus** Boie

Syn. *Thriponax* Cabanis and Heine

Species in India—*Dryocopus javensis*[1].

Genus **Picoïdes** Lacépède

Syn. *Dendrocopos* Koch, *Dryobates* Boie, *Hypopicus* Bonaparte, *Leiopicus* Bonaparte, *Yungipicus* Bonaparte

cf. Delacour, *Auk*, **68** : 49-51 (1951).

Species in India—*Picoïdes major*[2], *P. assimilis*[3], *P. himalayensis*, *P. darjellensis*, *P. cathpharius*, *P. hyperythrus*, *P. auriceps*, *P. atratus*, *P. macei*[4], *P. mahrattensis*, *P. canicapillus*, *P. nanus* and *P. moluccensis.*

Genus **Hemicircus** Swainson

Species in India—*Hemicircus concretus* and *H. canente.*

Genus **Blythipicus** Bonaparte

Species in India—*Blythipicus pyrrhotis* and *B. rubiginosus.*

Genus **Chrysocolaptes** Blyth

Species in India—*Chrysocolaptes festivus* and *C. lucidus*[5].

Subfamily *PICUMNINAE*

Genus **Picumnus** Temminck

Syn. *Vivia* Hodgson

Species in India—*Picumnus innominatus.*

Genus **Sasia** Hodgson

Species in India—*Sasia ochracea* and *S. abnormis.*

Subfamily *JYNGINE*

Genus **Jynx** Linné

Species in India—*Jynx torquilla* (regular visitor).

Suborder *INDICATORES*

Family INDICATORIDAE

Genus **Indicator** Stephens

Species in India—*Indicator xanthonotus.*

[1] Includes *hodgei.*
[2] Includes *cabanisi.*
[3] Antedates *Picus scindeanus* Horsfield and Moore.
[4] Includes *analis.*
[5] Includes *guttacristatus.*

Order PASSERIFORMES

Suborder *EURYLAIMI*

Family Eurylaimidae

Subfamily *Eurylaiminae*

Genus **Corydon** Lesson

Species in India—*Corydon sumatranus.*

Genus **Cymbirhynchus** Vigors and Horsfield

Species in India—*Cymbirhynchus macrorhynchos*[1].

Genus **Eurylaimus** Horsfield

Species in India—*Eurylaimus javanicus* and *E. ochromalus.*

Genus **Serilophus** Swainson

Species in India—*Serilophus lunatus*[2].

Genus **Psarisomus** Swainson

Species in India—*Psarisomus dalhousiae.*

Subfamily *Calyptomeninae*

Genus **Calyptomena** Raffles

Species in India—*Calyptomena viridis.*

Suborder *TYRANNI*

Superfamily TYRANNOIDEA

Family Pittidae

Genus **Pitta** Vieillot

Syn. *Anthocincla* Blyth

Species in India—*Pitta caerulea, P. nipalensis, P. oatesi, P. brachyura*[3], *P. megarhyncha, P. granatina, P. cucullata, P. cyanea, P. gurneyi* and *P. phayrei.*

Suborder *OSCINES*

Family Alaudidae

cf. Meinertzhagen, *Proc. Zool. Soc. London,* **121** : 81-132 (1951).

Vaurie, *Bull. Amer. Mus. Nat. Hist.,* **97** : 437-526 (1951).

[1] Includes *affinis.*
[2] Includes *rubropygius.*
[3] Includes *moluccensis.*

Genus **Mirafra** Horsfield

Species in India—*Mirafra javanica*[1], *M. assamica* and *M. erythroptera.*

Genus **Eremopterix** Kaup

Species in India—*Eremopterix grisea* and *E. nigriceps*[2].

Genus **Ammomanes** Cabanis

Species in India—*Ammomanes deserti, A. cincturus* and *A. phoenicurus.*

Genus **Alaemon** Keyserling and Blasius

Species in India—*Alaemon alaudipes.*

Genus **Calandrella** Kaup

Syn. *Alaudula* Horsfield and Moore

Species in India—*Calandrella rufescens, C. cinerea*[3], *C. acutirostris* and *C. raytal.*

Genus **Melanocorypha** Boie

Species in India—*Melanocorypha bimaculata, M. calandra* and *M. maxima.*

Genus **Eremophila** Boie

Syn. *Otocoris* Bonaparte

Species in India—*Eremophila alpestris*[4].

Genus **Galerida** Boie

Species in India—*Galerida cristata, G. malabarica* and *G. deva.*

Genus **Alauda** Linné

Species in India—*Alauda arvensis* and *A. gulgula.*

Family HIRUNDINIDAE

cf. Mayr and Bond, *Ibis*, 85 : 334-343 (1943).

Subfamily *HIRUNDININAE*

Genus **Riparia** T. Forster

Species in India—*Riparia riparia* and *R. paludicola.*

Genus **Hirundo** Linné

Syn. *Ptynoprogne* Reichenbach, *Krimnochelidon* Walden

Species in India—*Hirundo rupestris, H. obsoleta* (? regular visitor), *H. concolor, H. tahitica*[5], *H. rustica, H. smithi, H. fluvicola, H. daurica* and *H. striolata.*

[1] Includes *cantillans* group.
[2] Includes *albifrons.*
[3] Includes *brachydactyla* group.
[4] Includes *penicillata* group.
[5] Antedates *Hirundo javanica* Sparrman.

Genus **Delichon** Horsfield and Moore

Species in India—*Delichon urbica*[1] and *D. nipalensis.*

Family Pycnonotidae

cf. Delacour, *Zoologica*, **28**: 17-28 (1943).

Genus **Spizixos** Blyth

Species in India—*Spizixos canifrons.*

Genus **Pycnonotus** Boie

Syn. *Molpastes* Hume

Euptilosus G. R. Gray, Microtarsus Eyton, Brachypodius Blyth [syn. *Microtarsus* "Eyton" Baker], Rubigula Blyth [syn. *Pycnonotus* "Kuhl" Baker (part), *Squamatornis* Baker], Otocompsa Cabanis, Alcurus Blyth, Hemitarsus Bonaparte and Loidorusa Cabanis [syn. *Pycnonotus* "Kuhl" Baker (part), *Kelaartia* Jerdon, *Xanthixus* Oates] are subgenera.

Species in India—*Pycnonotus eutilosus, P. atriceps*[2], *P. poiocephalus, P. dispar*[3], *P. melanicterus, P. cyaniventris, P. jocosus, P. xanthorrhous, P. leucotis, P. leucogenys, P. cafer, P. aurigaster, P. striatus, P. zeylanicus, P. finlaysoni, P. xantholaemus, P. penicillatus, P. flavescens, P. goiavier, P. luteolus, P. plumosus, P. blanfordi, P. simplex* and *P. erythrophthalmos.*

Genus **Criniger** Temminck

Syn. *Alophoixus* Oates

Species in India—*Criniger flaveolus, C. tephrogenys, C. ochraceus* and *C. phaeocephalus.*

Genus **Microscelis** G. R. Gray

Syn. *Cerasophila* Bingham

Tricholestes Salvadori and Iole Blyth are subgenera.

Species in India—*Microscelis criniger, M. charlottae*[4], *M. viridescens, M. nicobariensis, M. ictericus, M. virescens*[5], *M. flavalus, M. madagascariensis*[6] and *M. thompsoni.*

Family Irenidae

Subfamily *Aegithininae*

Genus **Aegithina** Vieillot

Syn. *Aëthorhynchus* Sundevall

Species in India—*Aegithina viridissima, Ae. tiphia, Ae. nigrolutea* and *Ae. lafresnayi.*

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[1] Includes *cashmeriensis.*

[2] *Pycnonotus cinereoventris* (Blyth) is only a colour phase of *P. atriceps.*

[3] Includes *flaviventris* group.

[4] Replaces *Iole olivacea* Blyth [see Deignan, *Proc. Biol. Soc. Washington*, **61**: 8 (1948)].

[5] Includes *malaccensis* and *macclellandi.*

[6] Includes *psaroides* and *leucocephalus.*

Genus **Chloropsis** Jardine and Selby

Species in India—*Chloropsis cyanopogon, C. sonnerati, C. jerdoni, C. cochinchinensis, C. hardwickei* and *C. aurifrons.*

Subfamily *Ireninae*

Genus **Irena** Horsfield

Species in India—*Irena puella.*

Family Campephagidae

Genus **Hemipus** Hodgson

Species in India—*Hemipus picatus* and *H. hirundinaceus*[1].

Genus **Tephrodornis** Swainson

Species in India—*Tephrodornis gularis* and *T. pondicerianus.*

Genus **Coracina** Vieillot

Syn. *Graucalus* Cuvier, *Volvocivora* Hodgson, *Lalage* "Boie" Baker

cf. Ripely, *Auk*, **58**: 381-395 (1941).

Species in India—*Coracina novaeholladiae*[2], *C. melaschistos, C. fimbriata* and *C. melanoptera*[3].

Genus **Pericrocotus** Boie

Species in India—*Pericrocotus flammeus, P. brevirostris, P. ethologus, P. solaris* and *P. roseus.*

Family Muscicapidae

Subfamily *Muscicapinae*

Genus **Terpsiphone** Gloger

Syn. *Tchitrea* Lesson

Species in India—*Terpsiphone paradisi.*

Genus **Hypothymis** Boie

Species in India—*Hypothymis azurea.*

Genus **Philentoma** Eyton

Species in India—*Philentoma velata* and *P. pyrrhoptera.*

Genus **Ficedula**[4] Brisson

Syn. *Siphia* Hodgson, *Muscicapula* Blyth (part), *Ochromela* Blyth, *Anthipes* Blyth

Species in India—*Ficedula parva, F. strophiata, F. monileger, F. hyperythra, F hodgsoni, F. nigrorufa, F. westermanni, F. superciliaris, F. tricolor* and *F. sapphira.*

[1] Status doubtful [see Ticehurst, *Ibis*, (14) **4**: 726-727 (1940)].

[2] Includes *macei.*

[3] Includes *sykesi.*

[4] Limits of this genus have been based on Vaurie, *Bull. Amer. Mus Nat. Hist.* (in press).

Genus **Niltava**[1] Hodgson

Syn. *Muscicapula* Blyth (part),
Muscicapella Bianchi, *Olcyornis* Baker

Species in India—*Niltava grandis, N. macgrigoriae, N. sundara, N. vivida, N. concreta, N. pallipes, N. poliogenys, N. unicolor, N. rubeculoïdes, N banyumas*[2], *N tickelliae* and *N hodgsoni.*

Genus **Muscicapa**[1] Brisson

Syn. *Hemichelidon* Hodgson, *Alseonax* Cabanis,
Eumyias Cabanis

Species in India—*Muscicapa striata, M. sibirica, M. latirostris, M. muttui, M. ruficauda, M. ferruginea, M. sordida, M. thalassina* and *M. albicaudata.*

Genus **Culicicapa** Swinhoe

Species in India—*Culicicapa ceylonensis.*

Genus **Rhinomyias** Sharpe

Species in India—*Rhinomyias olivacea* and *R. brunneata* (regular visitor).

Genus **Pachycephala** Vigors

Syn. *Muscitrea* Blyth

Species in India—*Pachycephala griseola.*

Genus **Rhipidura** Vigors and Horsfield

Syn. *Leucocirca* Swainson, *Chelidorhynx* Blyth

Species in India—*Rhipidura hypoxantha, R. albicollis, R. aureola, R. pectoralis* and *R. javanica.*

Subfamily *Timaliinae*

cf. Delacour, *L'Oiseau*, **16** : 7-32 (1946).

Genus **Pellorneum** Swainson

Species in India—*Pellorneum ruficeps, P. palustre, P. fuscicapillum, P. nigrocapitatum* and *P. albiventer.*

Genus **Malacocincla** Blyth

Syn. *Erythrocichla* Sharpe, *Aethostoma* Sharpe

Species in India—*Malacocincla tickelli, M. rostrata, M. bicolor, M. sepiaria* and *M. abbotti.*

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[1] Limits of these genera have been based on Vaurie, *Bull. Amer. Mus. Nat. Hist.* (in press.)

[2] Includes *whitei* and *magnirostris.*

Genus **Malacopteron** Eyton

Syn. *Ophrydornis* Büttikofer

Species in India—*Malacopteron magnum* and *M. magnirostre.*

Genus **Pomatorhinus** Horsfield

Species in India—*Pomatorhinus montanus*[1], *P. ruficollis, P. erythrogenys, P. hypoleucos, P. ferruginosus* and *P. ochraceiceps.*

Genus **Xiphirhynchus** Blyth

Syn. *Xiphorhamphus* Blyth

Species in India—*Xiphirhynchus superciliaris.*

Genus **Rimator** Blyth

Species in India—*Rimator malacoptilus.*

Genus **Turdinus** Blyth

Syn. *Gypsophila* Oates

Species in India—*Turdinus crispifrons, T. brevicaudatus* and *T epilepidotus*[2]

Genus **Pnoepyga** Hodgson

Species in India—*Pnoepyga albiventer* and *Pn. pusilla.*

Genus **Spelaeornis** David and Oustalet

Syn. *Elachura* Oates

cf. Ripley, *Auk,* **67** : 390-391 (1950).

Species in India—*Spelaeornis formosa, S. haplonota*[3] , *S. troglodytoïdes* [4], *S. caudata*[5] and *S. longicaudata.*

Genus **Sphenocichla** Godwin-Austen and Walden

Species in India—*Sphenocichla humei*[6].

Genus **Stachyris** Blyth

Syn. *Cyanoderma* Salvadori, *Stachyridopsis* Sharpe, *Thringorhina* Oates

Species in India—*Stachyris rufifrons, S. ruficeps, S. pyrrhops, S. chrysaea, S. striata*[7], *S. nigriceps, S. oglei* and *S. erythroptera.*

Genus **Dumetia** Blyth

Species in India—*Dumetia hyperythra*[8] .

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[1] Includes *schisticeps, horsfieldi, olivaceus* and *nuchalis* groups.
[2] Includes *roberti* group.
[3] Taxonomic status doubtful [see Ticehurst, *Ibis,* (14) **3** : 349 (1939)].
[4] Includes *sherriffi* and *souliei.*
[5] Includes *chocolatinus, badeigularis* (?), *sinlumensis, kauriensis, reptatus* and *oatesi.*
[6] Includes *roberti.*
[7] Includes *guttata.*
[8] Includes *albogularis.*

Genus **Rhopocichla** Oates

Species in India—*Rhopocichla atriceps.*

Genus **Macronus** Jardine and Selby

Syn. *Mixornis* Blyth

Species in India—*Macronus gularis.*

Genus **Timalia** Horsfield

Species in India—*Timalia pileata.*

Genus **Chrysomma** Blyth

Species in India—*Chrysomma sinense* and *C. altirostre.*

Genus **Panurus** Koch

Species in India—*Panurus biarmicus*[1].

Genus **Paradoxornis** Gould

Syn. *Suthora* Hodgson, *Conostoma* Hodgson, *Psittiparus* Hellmayr, *Neosuthora* Hellmayr

Species in India—*Paradoxornis aemodium, P. unicolor, P. webbiana, P. fulvifrons, P. poliotis, P. nipalensis, P. verreauxi, P. dravidiana, P. atrosuperciliaris, P. ruficeps, P. gularis* and *P. flavirostris*[2].

Genus **Turdoides** Cretzschmar

Syn. *Argya* Lesson, *Acanthoptila* Blyth

Species in India—*Turdoides nipalensis, T. caudata, T. earlei, T. gularis, T. longirostris, T malcolmi, T subrufa, T. rufescens, T somervillei* and *T. striata.*

Genus **Babax** David

Species in India—*Babax lanceolatus* and *B. waddelli.*

Genus **Garrulax** Lesson

Syn. *Ianthocincla* Gould, *Trochalopteron* Blyth, *Grammatoptila* Reichenbach, *Stactocichla* Sharpe, *Dryonastes* Sharpe

Species in India—*Garrulax cinereifrons, G. albogularis, G. moniliger, G. pectoralis, G. striatus, G. leucolophus, G. strepitans, G. chinensis, G. nuchalis, G. galbanus, G. gularis*[3], *G. variegatus, G. cineraceus, G. rufogularis, G. ocellatus, G. caerulatus, G. ruficollis, G. merulinus, G. sannio, G. cachinnans*[4], *G. lineatus, G. virgatus, G. austeni, G. squamatus, G. subunicolor, G. affinis, G. erythrocephalus* and *G. milnei.*

Genus **Liocichla** Swinhoe

Species in India—*Liocichla phoenicea* and *L. ripponi.*

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[1] Status doubtful, recorded once only.
[2] Includes *guttaticollis.*
[3] Includes *delesserti.*
[4] Includes *jerdoni.*

Genus **Leiothrix** Swainson

Syn. *Mesia* Hodgson

Species in India—*Leiothrix argentauris* and *L. lutea.*

Genus **Myzornis** Blyth

Species in India—*Myzornis pyrrhoura.*

Genus **Cutia** Hodgson

Species in India—*Cutia nipalensis.*

Genus **Pteruthius** Swainson

Syn. *Hilarocichla* Oates

Species in India—*Pteruthius rufiventer, Pt. erythropterus*[1], *Pt. xanthochloris, Pt. melanotis* and *Pt. aenobarbus.*

Genus **Gampsorhynchus** Blyth

Species in India—*Gampsorhynchus rufulus.*

Genus **Actinodura** Gould

Syn. *Sibia* Hodgson

Species in India—*Actinodura egertoni* [2] and *A. nipalensis.*

Genus **Minla** Hodgson

Syn. *Siva* Hodgson, *Staphida* Swinhoe

Species in India—*Minla ignotincta, M. strigula, M. cyanouroptera* and *M. castaniceps*[3].

Genus **Yuhina** Hodgson

Syn. *Erpornis* Hodgson, *Ixulus* Hodgson

Species in India—*Yuhina humilis, Y. bakeri, Y. flavicollis, Y. gularis, Y. diademata, Y. occipitalis, Y nigrimentum* and *Y. zantholeuca.*

Genus **Alcippe** Blyth

Syn. *Schoeniparus* Hume, *Fulvetta* David and Oustalet, *Lioparus* Oates, *Pseudominla* Oates

Species in India—*Alcippe chrysotis, A. cinerea, A. castaneiceps, A. vinipectus, A. cinereiceps*[4], *A. dubia, A. poiocephala* and *A. nipalensis.*

Genus **Heterophasia** Blyth

Syn. *Leioptila* " Blyth " Baker

Species in India—*Heterophasia annectans, H. capistrata*[5], *H. melanoleuca, H. pulchella* and *H. picaoïdes.*

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[1] Includes *aeralatus.*
[2] Includes *ramsayi* group.
[3] Includes *striatus* group.
[4] Includes *manipurensis.*
[5] Includes *gracilis* and *castanoptera* groups.

Subfamily *Sylviinae*

Genus **Tesia** Hodgson

Species in India—*Tesia cyaniventer* and *T. olivea.*

Genus **Oligura** Hodgson

Syn. *Chlorotesia* Delacour

cf. Deignan, *Postilla*, no. 7, p. 4 (1951).

Species in India—*Oligura castaneocoronata.*

Genus **Cettia** Bonaparte

Urosphena Swinhoe and Horeites Hodgson [syn. *Horornis* Hodgson, *Neornis* Blyth, *Homochlamys* Salvadori] are subgenera.

cf. Delacour, *Ibis*, **84**: 509-519; **85**: 27-31 (1942-43).

Species in India[1]—*Cettia squameiceps* (regular visitor), *C. pallidipes*, *C. diphone*[2] (casual visitor), *C. fortipes*[3], *C. major*, *C. flavolivacea*, *C. acanthizoides*, *C. brunnifrons* and *C. cetti* (regular visitor).

Genus **Bradypterus** Swainson

Syn. *Dumeticola* Blyth

Tribura Hodgson [syn. *Elaphrornis* Legge] is a subgenus.

cf. Delacour, *Ibis*, **85**: 31-40 (1943).

Species in India—*Bradypterus thoracicus*, *B. major*, *B. taczanowskius* (regular visitor), *B. luteoventris* and *B. palliseri.*

Genus **Hippolais** Balderstein

Species in India[4]—*Hippolais caligata*[5], *H. scita* (regular visitor) and *H. languida.*

Genus **Sylvia** Scopoli

Species in India—*Sylvia nana*, *S. althaea*, *S. curruca*, *S. hortensis* and *S. communis* (regular visitor).

Genus **Graminicola** Jerdon

Species in India—*Graminicola bengalensis.*

Genus **Megalurus** Horsfield

Species in India—*Megalurus palustris.*

Genus **Phragamaticola** Jerdon

Species in India—*Phragamaticola aëdon* (regular visitor).

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[1] *Neornis albiventer* Godwin-Austen, generally included in the Indian avifauna, is an imaginary species, being the same as *Pellorneum albiventer* (Timaliinae).

[2] Includes *canturians.*

[3] Includes *pallidus.*

[4] Baker's [*Faun. Brit. India, Bds.*, 2: 443 (1924)] inclusion of *Hippolais pallida* in the Indian avifauna is based on a very doubtful record. The validity of *Hippolais obsoleta*, generally included in the Indian list, is questionable.

[5] Includes *rama.*

Genus **Schoenicola** Blyth

Species in India—*Schoenicola platyura.*

Genus **Chaetornis** G. R. Gray

Species in India—*Chaetornis striatus.*

Genus **Lusciniola** G. R. Gray

Species in India—*Lusciniola melanopogon.*

Genus **Locustella** Kaup

Species in India—*Locustella certhiola* (regular visitor), *L. lanceolata* (regular visitor) and *L. naevia.*

Genus **Acrocephalus** Naumann

Species in India—*Acrocephalus dumetorum, A. agricola*[1], *A. orinus, A. stentoreus*[2] and *A. arundinaceus* (regular visitor).

Genus **Phylloscopus** Boie

Syn. *Acanthopneuste* Blasius, *Herbivocula* Swinhoe

cf. Ticehurst, *Syst. Rev.* Phylloscopus, 193 pp. (1938).

Species in India—*Phylloscopus collybita, P. neglectus, P. tytleri, P. affinis, P. griseolus, P. fuligiventer, P. fuscatus* (regular visitor), *P. armandi* (regular visitor), *P. schwarzi* (regular visitor), *P. pulcher, P. inornatus, P. subviridis, P. proregulus, P. maculipennis, P. borealis* (regular visitor), *P. magnirostris, P. trochiloides, P. tenellipes*(regular visitor), *P. occipitalis, P. coronatus* (regular visitor), *P. reguloides, P. davisoni* and *P. cantator.*

Genus **Regulus** Cuvier

Species in India—*Regulus regulus.*

Genus **Leptopoecile** Severtzov

Species in India—*Leptopoecile sophiae.*

Genus **Seicercus** Swainson

Species in India—*Seicercus burkei, S. castaniceps, S. affinis, S. poliogenys* and *S. xanthoschistos.*

Genus **Abroscopus** Baker

Species in India—*Abroscopus superciliaris, A. albogularis, A. schisticeps* and *A. flavogularis*[3].

Genus **Tickellia** Blyth

Species in India—*Tickellia hodgsoni.*

[1] Includes *concinens* group.
[2] Includes *bistrigiceps.*
[3] Validity of this species is doubtful [see also Ticehurst, *Ibis,* (14) **5**: 178 (1941)].

Genus **Orthotomus** Horsfield

Syn. *Phyllergates* Sharpe

Species in India—*Orthotomus coronatus*, *O. sutorius*, *O. atrogularis* and *O. ruficeps*.

Genus **Prinia** Horsfield

Syn. *Suya* Hodgson, *Franklinia* Jerdon, *Laticilla* Blyth, *Scotocerca* Sundevall

cf. Deignan, *Smithson. Misc. Coll.*, **103** (3) : 1 (1942).

Species in India—*Prinia socialis*, *P. inornata*, *P. sylvatica*, *P. hodgsoni*, *P. rufescens*, *P. polychroa*[1], *P. gracilis*, *P. superciliaris*, *P. cinereocapilla*, *P. buchanani*, *P. flaviventris*, *P. atrogularis*, *P. burnesi*[2] and *P. inquieta*.

Genus **Cisticola** Kaup

Species in India—*Cisticola exilis* and *C. juncidis*.

Subfamily *Turdinae*

Genus **Luscinia** T. Forster

Syn. *Larvivora* Hodgson

Species in India—*Luscinia megarhyncha* (casual visitor), *L. brunnea*[3] and *L. cyane* (regular visitor).

Genus **Erithacus** Cuvier

Syn. *Cyanosylvia* Brehm, *Calliope* Gould, *Muscisylvia* Hodgson, *Tarsiger* Hodgson, *Myiomela* G. R. Gray, *Ianthia* Blyth

Species in India—*Erithacus chrysaeus*, *E. hyperythrus*, *E. indicus*, *E. cyanurus*, *E. leucura*, *E. svecicus* (regular visitor), *E. cyaneculus*, *E. calliope* (regular visitor) and *E. pectoralis*[4].

Genus **Grandala** Hodgson

Species in India—*Grandala coelicolor*.

Genus **Hodgsonius** Bonaparte

Species in India—*Hodgsonius phoenicuroïdes*.

Genus **Erythropygia** Smith

Syn. *Agrobates* Swainson

Species in India—*Erythropygia galactotes* (? regular visitor).

Genus **Phoenicurus** T. Forster

Syn. *Chaimarrornis* Hodgson, *Adelura* Bonaparte, *Rhyacornis* Blanford

Species in India—*Phoenicurus ochruros*, *P. erythronotus* (regular visitor), *P. hodgsoni* (regular visitor), *P. frontalis*, *P. schisticeps*, *P.*

[1] Includes *criniger* group.
[2] Includes *cinerascens*.
[3] Includes *wickhami*.
[4] Includes *tschebaiewi*.

fuliginosus, *P. caeruleocephalus*, *P. auroreus* (regular visitor), *P. erythrogaster* and *P. leucocephalus*.

Genus **Copsychus** Wagler

Syn. *Kittacincla* Gould

Species in India—*Copsychus saularis* and *C. macrourus*.

Genus **Saxicoloides** Lesson

Species in India—*Saxicoloides fulicata*.

Genus **Cinclidium** Blyth

Syn. *Callene* Blyth

Species in India—*Cinclidium frontale*.

Genus **Turdus** Linné

Syn. *Arceuthornis* Kaup, *Geokichla* S. Müller

Species in India—*Turdus albocinctus*, *T feae*, *T viscivorus*, *T ruficollis* [1], *T. musicus* [2], *T. obscurus* (regular visitor), *T pilaris* (regular visitor), *T. unicolor*, *T rubrocanus*, *T. dissimilis*, *T sibirica* (regular visitor), *T. kessleri* [3], *T boulboul*, *T merula*, *T eunomus* (regular visitor), *T. wardi* and *T. citrinus*.

Genus **Zoothera** Vigors

Syn. *Oreocincla* Gould

Species in India—*Zoothera marginata*, *Z. monticola*, *Z. spiloptera*, *Z. dauma* [4], *Z. dixoni* and *Z. molissima*.

Genus **Monticola** Boie

Species in India—*Monticola solitarius* [5], *M. saxatilis* (regular visitor and *M. gularis* [6].

Genus **Oenanthe** Vieillot

Species in India—*Oenanthe isabellina*, *Oe. deserti*, *Oe. xanthopryma* (regular visitor), *Oe. oenanthe*, *Oe. finschi*, *Oe. leucomela*, *Oe. monacha*, *Oe. picata* [7] and *Oe. alboniger*.

Genus **Cercomela** Bonaparte

Species in India—*Cercomela fusca*.

Genus **Saxicola** Bechstein

Syn. *Rhodophila* Jerdon

Species in India—*Saxicola macrorhyncha*, *S. insignis*, *S. ferrea*, *S. melanoleuca*, *S. caprata*, *S. torquata* and *S. leucura*.

---

[1] Includes *atrogularis*.
[2] Occurrence in India doubtful.
[3] Status doubtful, once recorded from India.
[4] Includes *aurea*.
[5] Includes *rufiventris*.
[6] Includes *cinclorhyncha*.
[7] '*Oenanthe capistrata*' and '*Oe. opistholeuca*' are colour phases of *Oenanthe picata*.

Genus **Brachypteryx** Horsfield

Syn. *Heteroxenicus* Sharpe

Species in India—*Brachypteryx stellatus, B. hyperythrus, B. major, B. montana*[1] and *B. leucophrys*[2].

Genus **Myiophoneus** Temminck

Syn. *Arrenga* Lesson

cf. Delacour, *Auk*, **59** : 246-264 (1942).

Species in India—*Myiophoneus blighi, M. caeruleus* and *M. horsfieldi.*

Genus **Cochoa** Hodgson

Species in India—*Cochoa viridis*[3] and *C. purpurea.*

Genus **Enicurus** Temminck

Syn. *Hydrocichla* Sharpe, *Microcichla* Sharpe

Species in India—*Enicurus maculatus, E. leschenaulti*[4], *E. scouleri, E. immaculatus, E. schistaceus* and *E. ruficapilla.*

Subfamily *Troglodytinae*

Genus **Troglodytes** Vieillot

Species in India—*Troglodytes troglodytes.*

Subfamily *Cinclinae*

Genus **Cinclus** Borkhausen

Species in India—*Cinclus cinclus* and *C. pallasi.*

Family Prunellidae

Genus **Prunella** Vieillot

Syn. *Laiscopus* Gloger

Species in India—*Prunella collaris, P. himalayana, P. strophiata, P. rubeculoïdes, P. atrogularis, P. fulvescens* and *P. immaculata.*

Family Motacillidae

Genus **Anthus** Bechstein

Syn. *Oreocorys* Sharpe

Species in India—*Anthus hodgsoni, A. trivialis, A. pratensis, A. similis, A. campestris, A. nilghiriensis, A. novaeseelandiae*[5], *A. rufogularis, A. sylvana, A. roseata* and *A. spilonetta.*

---

[1] Includes *cruralis* and *sinensis.*

[2] Includes *nipalensis.*

[3] *Cochoa rothschildi* Baker is only a colour phase of *C. viridis.*

[4] Includes *frontalis.*

[5] Includes *rufulus* and *richardi* groups.

Genus **Motacilla** Linné

Syn. *Dendronanthus* Blyth

Species in India.—*Motacilla flava*[1], *M. citreola, M. cinerea, M. maderaspatensis, M. alba* and *M. indica.*

Family Laniidae

Subfamily *Lanniinae*

Genus **Lanius** Linné

Species in India—*Lanius tigrinus, L. excubitor, L. colluroides, L. vittatus, L. collurio* (regular visitor). *L. tephronotus, L. schach*[2], *L. cristatus* and *L. senator*[3].

Family Artamidae

Genus **Artamus** Vieillot

Species in India—*Artamus fuscus.*

Family Bombycillidae

Subfamily *Hypncoliinae*

Genus **Hypocolius** Bonaparte

cf. Dealcour and Amadon, *Ibis,* **91** : 427-429 (1949).

Species in India—*Hypocolius ampelinus* (casual visitor).

Subfamily *Bombycillinae*

Genus **Bombycilla** Vieillot

Species in India—*Bombycilla garrulus* (casual visitor).

Family Certhiidae

Genus **Certhia** Linné

Species in India—*Certhia familiaris, C. stoliczkae, C. himalayana* and *C. discolor.*

Family Sittidae

Subfamily *Salpornina*e

Genus **Salpornis** G. R. Gray

Species in India—*Salpornis spilonotus.*

[1]Includes *feldegg.*

[2]Includes *tricolor* (olim *nigriceps*) group.

[3]Occurrence in India doubtful.

Genus **Tichodroma** Illiger

Species in India—*Tichodroma muraria.*

Subfamily *Sittinae*

Genus **Sitta** Linné

Species in India—*Sitta europaea*[1], *S. magna, S. leucopsis, S. himalayensis, S. victoriae, S. frontalis, S. formosa* and *S. tephronota.*

Family Paridae

Subfamily *Parinae*

Genus **Parus** Linné

Syn. *Lophophanes* Kaup, *Machlolophus* Cabanis.

Species in India—*Parus ater, P. nuchalis, P. cyanus, P. palustris*[2], *P. major, P. monticola, P. xanthogenys*[3], *P. rubidiventris*[4], *P. melanolophus* and *P. dichrous.*

Genus **Melanochlora** Lesson

Species in India—*Melanochlora sultanea.*

Genus **Sylviparus** Burton

Species in India—*Sylviparus modestus.*

Subfamily *Aegithalinae*

Genus **Aegithalos** Hermann

Syn. *Aegithaliscus* Cabanis.

Species in India—*Aegithalos iouschistos, Ae. niveogularis, Ae. concinnus, Ae. bonvaloti* and *Ae. leucogenys.*

Subfamily *Remizinae*

Genus **Remiz** Jarocki

Species in India—*Remiz pendulinus*[5] (casual visitor).

Genus **Cephalopyrus** Bonaparte

Species in India—*Cephalopyrus flammiceps.*

Family Dicaeidae

cf. Mayr and Amadon, *Amer. Mus. Novit.*, no. 1360, pp. 1-32 (1947).

[1]Includes *castanea* group and *cashmiriensis.*
[2]Occurrence in India doubtful.
[3]Includes *spilonotus* group.
[4]Includes *rufonuchalis* group.
[5]Includes *coronatus.*

Genus **Anaimos** Reichenbach

Species in India—*Anaimos maculatus* and *A. percussus*[1].

Genus **Dicaeum** Cuvier

Syn. *Pachyglossa* Blyth, *Piprisoma* Blyth, *Acmonorhynchus* Oates

Species in India—*Dicaeum agile, D. chrysorrheum, D. melanoxanthum, D. vincens, D. trigonostigma, D. erythrorhynchos, D. concolor, D. cruentatum* and *D. ignipectus.*

Family NECTARINIIDAE

cf. Delacour, ***Zoologica*, 29** : 17-38 (1944).

Genus **Anthreptes** Swainson

Syn. *Chalcoparia* Cabanis

Species in India—*Anthreptes simplex, A. malacensis, A. rhodolaema* and *A. singalensis.*

Genus **Nectarinia** Illiger

Syn. *Cinnyris* Cuvier

CYANOMITRA Reichenbach and LEPTOCOMA Cabanis [syn. *Chalcostetha* Cabanis] are subgenera.

Species in India—*Nectarinia hypogrammica, N. zeylonica, N minima, N. sperata*[2], *N. chalcostetha, N lotenia, N. jugularis*[3] and *N. asiatica.*

Genus **Aethopyga** Cabanis

Species in India—*Aethopyga gouldiae*[4], *Ae. nipalensis, Ae. saturata*[5], *Ae. siparaja* and *Ae. ignicauda.*

Genus **Arachnothera** Temminck

Species in India—*Arachnothera longirostris, A. chrysogenys, A. affinis* and *A. magna.*

Family ZOSTEROPIDAE

Genus **Zosterops** Vigors and Horsfield

Species in India—*Zosterops japonica*[6], *Z. palpebrosa*[7], *Z. siamensis* and *Z. ceylonensis.*

Family FRINGILLIDAE

Subfamily *EMBERIZINAE*

[1]Includes *ignicapillus.*
[2]Includes *brasiliana.*
[3]Includes *pectoralis* and *flamaxillaris* groups.
[4]Includes *dabryi.*
[5]Includes *sanguinipectus* group.
[6]Includes *simplex* group.
[7]Includes *aureiventris* group.

Genus **Emberiza** Linné

Species in India[1]—*Emberiza schoeniclus, E. striolata, E. pusilla, E. fucta, E. cia* [2], *E. buchanani, E. hortulana, E. stewarti, E. spodocephala, E. aureola, E. rutilla, E. brunniceps, E. melanocephala, E. leucocephala* and *E. calandra.*

Genus **Melophus** Swainson

Species in India—*Melophus lathami.*

Subfamily *Fringillinae*

Genus **Fringilla** Linné

Species in India—*Fringilla coelebs* (casual visitor).

Subfamily *Carduelinae*

Genus **Serinus** Brisson

Syn. *Metoponia* Bonaparte

Species in India—*Serinus pusillus.*

Genus **Carduelis** Brisson

Syn. *Acanthis* Borkhausen, *Spinus* Koch, *Chrysomitris* Boie, *Hypacanthis* Cabanis

Species in India—*Carduelis spinoïdes, C. carduelis*[3], *C. flavirostris, C. cannabina* and *C. thibetana.*

Genus **Callacanthis** Bonaparte

Species in India—*Callacanthis burtoni.*

Genus **Leucosticte** Swainson

Syn. *Fringalauda* Hodgson

Species in India—*Leucosticte nemoricola* and *L. brandti.*

Genus **Rhodopechys** Cabanis

Syn. *Bucanetes* Cabanis, *Rhodospiza* Sharpe

Species in India[4]—*Rhodopechys mongolica, R. githaginea* and *R. obsoleta.*

Genus **Erythrina** Brehm

Syn. *Carpodacus* Kaup, *Procarduelis* Blyth, *Propasser* Hodgson, *Pyrrhospiza* Blyth

Species in India—*Erythrina erythrina, E. rubescens, E. nipalensis, E. vinacea, E. rhodochrous, E. rhodochlamys, E. verreauxi, E. rhodopepla,*

[1]Baker's [*Faun. Brit. India, Bds.*, **3** : 219 (1926)] inclusion of *Emberiza citrinella* in the Indian list is without any authentic basis.

[2]*Emberiza godlewskii* Taczanowski, which is here included as a subspecies of *E. cia*, may ultimately prove to be a separate species.

[3]Includes *caniceps* group.

[4]There is no actual record of the occurrence of *Rhodopechys sanguinea* in India, although it is included in the Indian list by Baker [*Faun. Brit. India, Bds.*, **3**: 144-145 (1926)].

E. edwardsi, *E. pulcherrima*, *E. thura*, *E. rubicilla*[1], *E. rubicilloides* and *E. punicea*.

Genus **Propyrrhula** Hodgson

Species in India—*Propyrrhula subhimachala*.

Genus **Loxia** Linné

Species in India—*Loxia curvirostra*.

Genus **Pyrrhoplectes** Hodgson

Species in India—*Pyrrhoplectes epauletta*.

Genus **Haematospiza** Blyth

Species in India—*Haematospiza sipahi*.

Genus **Pyrrhula** Brisson

Species in India—*Pyrrhula aurantiaca*, *P. erythrocephala*, *P. erythaea* and *P. nipalensis*.

Genus **Mycerobas** Cabanis

Syn. *Perissospiza* Oberholser

Species in India—*Mycerobas caneipes*, *M. melanozanthos* and *M. icteroïdes*.

Genus **Coccothraustes** Brisson

Species in India—*Coccothraustes coccothraustes*.

Family Ploceidae

Subfamily *Passerinae*

Genus **Petronia** Kaup

Syn. *Gymnoris* Blyth

cf. Vaurie, *Amer. Mus. Novit.*, no. 1406, p. 2 (1949).

Species in India—*Petronia petronia* and *P. xanthocollis*.

Genus **Passer** Brisson

Species in India—*Passer domesticus*, *P. hispaniolensis*, *P. montanus*, *P. rutilans*, *P. pyrrhonotus* and *P. flaveolus*.

Genus **Montifringilla** Brehm

Species in India[2]—*Montifringilla adamsi*, *M. taczanowskii*, *M. ruficollis* and *M. blanfordi*.

[1]Includes *severtzovi*.

[2]Baker's [*Faun. Brit. India, Bds.*, 3 : 186-187 (1926)] inclusion of *Montifringilla nivalis* in the Indian list is based on a probable sight record from Safed Koh.

Subfamily *Ploceinae*

Genus **Ploceus** Cuvier

Syn. *Ploceëlla* Hume

Species in India—*Ploceus philippinus*[1], *P. manyar*, *P. megarhynchus*, *P. benghalensis* and *P. hypoxanthus*.

Subfamily *Estrildinae*

cf. Delacour, *Zoologica*, **28** : 69-86 (1943).

Genus **Estrilda** Swainson

Amandava Blyth [syn. *Stictospiza* Sharpe] is a subgenus.

Species in India—*Estrilda amandava*[2] and *E. formosa*.

Genus **Erythrura** Swainson

Species in India—*Erythrura prasina*.

Genus **Lonchura** Sykes

Syn. *Uroloncha* Cabanis

Euodice Bonaparte and Munia Hodgson are subgenera.

Species in India—*Lonchura malabarica*, *L. striata*, *L. leucogastra*, *L. kelaarti*[3], *L. punctulata* and *L. malacca*[4].

Family Sturnidae

cf. Amadon, *Amer. Mus. Novit.*, no. 1247, pp. 1-16 (1943).

Subfamily *Sturninae*

Genus **Saroglossa** Blyth

Species in India—*Saroglossa spiloptera*.

Genus **Aplonis** Gould

Syn. *Lamprocorax* Bonaparte

Species in India—*Aplonis panayensis*.

Genus **Sturnus** Linné

Syn. *Pastor* Temminck, *Gracupica* Lesson, *Sturnia* Lesson, *Sturnopastor* Blyth *Temenuchus* Cabanis, *Sturnornis* Legge, *Spodiopsar* Sharpe, *Agropsar* Oates

Species in India—*Sturnus malabaricus*, *S. senex*, *S. pagodarum*, *S. sturninus* (regular visitor), *S. roseus* (regular visitor), *S. vulgaris*,

[1] *Ploceus atrigula* (=*passerinus*) represents the intermediate populations of the eastern subhimalayas.

[2] Includes *flavidiventris*.

[3] Includes *jerdoni*.

[4] Includes *atricapilla* group.

S. cineraceus (casual visitor), *S. contra*, *S. nigricollis*, *S. burmanicus*[1] and *S. sinensis*[2] (regular visitor).

Genus **Acridotheres** Vieillot

Syn. *Aethiopsar* Oates

Species in India—*Acridotheres tristis*, *A. ginginianus*, *A. fuscus*[3], *A. cristatellus* (regular visitor) and *A. albocinctus*.

Genus **Mino** Lesson

Syn. *Ampeliceps* Blyth

Species in India—*Mino coronatus*.

Genus **Gracula** Linné

Species in India—*Gracula religiosa* and *G. ptilogenys*.

Family Oriolidae

Genus **Oriolus** Linné

Species in India—*Oriolus oriolus*, *O. chinensis*, *O. xanthornus*, *O. xanthonotus* and *O. trailli*.

Family Dicruridae

cf. Vaurie, *Bull. Amer. Mus. Nat. Hist.*, **93** : 205-342 (1949).

Genus **Dicrurus** Vieillot

Syn. *Chibia* Hodgson, *Bhringa* Hodgson, *Chaptia* Hodgson, *Dissemurus* Gloger, *Dissemuroides* Hume, *Dissemurulus* Oates

Species in India—*Dicrurus macrocerus*, *D. leucophaeus*[4], *D. caerulescens*, *D. annectens*, *D. aeneus*, *D. remifer*, *D. hottentottus*, *D. andamanensis* and *D. paradiseus*[5].

Family Corvidae

cf. Amadon, *Amer. Mus. Novit.*, no. 1251, pp. 1-21 (1944).

Genus **Platylophus** Swainson

Species in India—*Platylophus galericulatus*.

Genus **Garrulus** Brisson

Species in India—*Garrulus glandarius*[6] and *G. lanceolatus*.

---

[1]Includes *leucocephalus*.
[2]Replaces *Sturnus buffonianus* Lesson, for *Oriolus sinensis* Gmelin is not preoccupied by *O. chinensis* Linné.
[3]Includes *grandis* and *mahrattensis*.
[4]Includes *leucogenys*.
[5]Includes *lophorinus*.
[6]Includes *bispecularis* and *leucotis* groups.

Genus **Kitta** Temminck

Syn. *Cissa* Boie, *Urocissa* Cabanis

Species in India—*Kitta chinensis*, *K. ornata*, *K. flavirostris* and *K. erythrorhyncha*.

Genus **Pica** Brisson

Species in India—*Pica pica*.

Genus **Crypsirina** Vieillot

Syn. *Dendrocitta* Gould

Species in India—*Crypsirina vagabunda*, *C. frontalis*, *C. leucogaster*, *C. formosae*, *C. bayleyi*, *C. temia* and *C. cucullata*.

Genus **Platysmurus** Reichenbach

Syn. *Glenargus* Cabanis

Species in India—*Platysmurus leucopterus*.

Genus **Podoces** Fischer

Species in India—*Podoces humilis*.

Genus **Nucifraga** Brisson

Species in India—*Nucifraga caryocatactes*[1].

Genus **Pyrrhocorax** Tunstall

Species in India—*Pyrrhocorax graculus* and *P. pyrrhocorax*.

Genus **Corvus** Linné

Species in India—*Corvus splendens*, *C. frugilegus*, *C. monedula*, *C. macrorhynchus*, *C. corone*[2] and *C. corax*.

---

[1]Includes *multipunctata*.
[2]Includes *cornix* group.

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Graucalus Cuvier, 39
Grus Pallas, 20
Gygis Wagler, 27
Gymnoris Blyth, 53
Gypaëtus Storr, 12
Gyps Savigny, 12
Gypsophila Oates, 41

Haematopus Linné, 23
Haematornis Vigors, preoccupied.
Haematospiza Blyth, 53
Halcyon Swainson, 32
Haliaeetus Savigny, 11
Haliastur Selby, 10
Haliëtor Heine, 9
Harpactes Swainson, 31
Heliopais Sharpe, 21
Hemichelidon Hodgson, 40
Hemicircus Swainson, 35
Hemiprocne Nitzsch, 33
Hemipus Hodgson, 39
Hemitarsus Bonaparte, 38
Herbivocula Swinhoe, 45

Heterophasia Blyth, 43
Heteroxenicus Sharpe, 48
Hieraaëtus Kaup, 11
Hierococcyx S. Müller, 19
Hierofalco Cuvier, 12
Hilarocichla Oates, 43
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Hippolais Balderstein, 44
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Hypocolius Bonaparte, 49
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Phoenicopterus Linné, 15
Phoenicurus T. Forster, 46
Phragamaticola Jerdon, 44
Phyllergates Sharpe, 46
Phylloscopus Boie, 45
Pica Brisson, 56
Picoïdes Lacépède, 35
Picumnus Temminck, 35
Picus Linné, 34
Piprisoma Blyth, 51
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Platysmurus Reichenbach, 56
Plegadis Kaup, 14
Ploceëlla Hume, 54
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Pluvialis Brisson, 24
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Pomatorhinus Horsfield, 41
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Pseudototanus Hume, 24
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Psittinus Blyth, 29
Psittiparus Hellmayr, 42
Pterocles Temminck, 27
Pteruthius Swainson, 43
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Rhinoplax Gloger, 33
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Rhinortha Vigors, 20
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Rhizothera G. R. Gray, 17
Rhodonessa Reichenbach, 16
Rhodopechys Cabanis, 52
Rhodophila Jerdon, 47
Rhodospiza Sharpe, 52
Rhopocichla Oates, 42
Rhopodytes Cabanis and Heine, 20
Rhyacornis Blanford, 46
Rhynchodon Nitzsch, 12
Rhyticeros Reichenbach, 32
Rimator Blyth, 41
Riparia T. Forster, 37
Rollulus Bonnaterre, 18
Rostratula Vieillot, 25
Rubigula Blyth, 38
Rynchops Linné, 27

Salpornis G. R. Gray, 49
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Sarkidiornis Eyton, 16
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Sauropatis Cabanis and Heine, 32
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Saxicoloides Lesson, 47
Schoenicola Blyth, 45
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Siphia Hodgson, 39
Sitta Linné, 50
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Sphenocichla Godwin-Austen and Walden, 41
Sphenurus Swainson, 28
Spilornis G. R. Gray, 12
Spinus Koch, 52
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Spodiopsar Sharpe, 54
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Stactocichla Sharpe, 42
Staphida Swinhoe, 43
Stercorarius Brisson, 26
Sterna Linné, 27

STUDIES ON PARASITES OF INDIAN FISHES, I, PROTOZOA MYXOSPORIDIA TOGETHER WITH A CHECK LIST OF PARASITIC PROTOZOA DESCRIBED FROM INDIAN FISHES.[1]

By

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(Plate I.)

In the course of investigations on parasitic incidence in Indian fresh and brackish-water food fishes, 15 species, with a new genus of Myxosporidians, were observed. These are described below. A check list of the myxosporidia and other parasitic protozoa so far described from Indian fishes is also given including those recorded by Southwell (1915), Southwell and Prashad (1918), Halwani (1930), Ray (1933), Setna and Bana (1935), deMello and Vales (1936), Chakravarty (1939, 1943), Ganapati (1941), Setna (1942) and Chakravarty and Basu (1948).

The fishes were obtained from various ponds and from market samples. Occasional collections made from the river Hoogly and Chilka lake were also examined. The parasites were studied fresh and with the vital stains Methylene Blue (0·5 per cent.) and Neutral Red (0·5 per cent.). For permanent preparations smears were fixed with Bouin's fluid (aquous), methyl alcohol, or by heating slightly over the spirit lamp. They were stained with Delafield's haematoxylin and eosine, or Heidenhain's iron-alum haematoxylin. Satisfactory results were generally obtained. Five per cent. potassium hydroxide solution was used to extrude the polar filament.

The following table shows the incidence of infection found during the investigations.

TABLE I.

Host.	Number examined.	Number infected.	Parasite.	Habitat.
1. *Barbus sarana* (Ham.).	3	3	*Myxobolus branchhialis* sp. nov.	Gills.
2. *Barbus ticto* (Ham.).	15	1	*Myxobolus barbi*, sp. nov.	Skin.

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Table I—*contd.*

Host.	Number examined.	Number infected.	Parasite.	Habitat.
3. *Cirrhina mrigala* (fingerlings). (Ham.).	100	40	*Chloromyxum mrigalae*, sp. nov.	Gall bladder.
,, ,,	100	50	*Myxobolus indicum*, sp. nov.	Muscles, skin, Liver.
,, ,,	190	67	*Myxobolus sphericum*, sp. nov.	Scales.
4. *Cirrhina reba* (Ham.).	4	1	*Thelohanellus mrigalae*, sp. nov.	Skin on the head.
,, ,,	40	12	*Chloromyxum mrigalae*, sp. nov.	Gall bladder.
5. *Chela bacaila* (Ham.).	50	1	*Thelohanellus gangeticus* sp. nov.	Muscles.
6. *Labeo calbasu* (Ham).	14	1	*Thelohanellus calbasui* sp. nov.	Scales.
7. *Lates calcarifer* (Bl.).	20	6	*Henneguya latesi*, sp. nov.	Gills and mouth cavity.
8. *Ophicephalus gachua* (Ham.).	8	3	*Unicauda ophicephali* sp. nov.	Gills.
9. *Odontamblyopus* (Ham.) *rubicandus.*	50	15	*Neohenneguya tetraradiata* gen. et. sp. nov.	Gills.
10. *Strongylura strongylura* (v. Hass).	2	2	*Kudoa chilkaensis* sp. nov.	Muscles.
11. *Therapon jarbua* (Forsk.).	4	1	*Sphaeromyxa theraponi*, sp. nov.	Gall bladder.
12. *Xenentodon cancila* (Ham.).	1	1	*Chloromyxum* sp. nov.	,,

Chloromyxum mrigalae, sp. nov.

During the months of September and October 1950 the gall bladder of *Cirrhina reba* and *C. mrigala* obtained from the Research Station tank No. 2 were found to be infected with a new species of *Chloromyxum*. The size of infected specimens of *C. reba* observed ranged from 4 to 8 cms. and those of *C. mrigala* from 5 to 7 cms. The scales and the muscles of these fishes also carried a heavy infection of *Myxobolus sphericum* sp. nov. and *M. indicum* sp. nov. respectively (See pages 68 and 69). The guts of the infected fishes, which were comparatively weak and emaciated, were found to be empty.

Trophozoite.—The young trophozoite (6·3μ in diameter) is circular and has a few refringent granules in its endoplasm. The ectoplasm is hyaline and the endoplasm is vacuolated. The trophozoite moves with the help of the blunt pseudopodia. The mature trophozoite (19·8-23μ in diameter) is more or less globular in shape and has 8-12 spores in various stages of development.

The spore.—It is spherical with thin and smooth shell valves. The sutural line is distinct and slightly curved. The four polar capsules which are spherical, are equal in size and each opens out by a small duct. In the front view all the capsules are not seen in the same plane, but one of them is slightly below the other three. The sporoplasm fills nearly half of the extra-capsular cavity. There is only one sporoplasm nucleus which is situated in the centre of the spore.

Measurements of the spore.—Diameter 9—10μ. Diameter of the polar capsule 2·7-3·6μ.

Chloromyxum sp. The gall bladder of one specimen of *Xenentodon cancila* (11·9 cms. long) obtained from the Belghuria fish farm pond 'C' on 4th October 1950 carried a mild infection of *Chloromyxum* sp. Unfortunately permanent preparations could not be made, but the observations made on the fresh spores are as follows. The spore is spherical, 7·2 μ in diameter, the shell being smooth and the sutural line slightly raised. The polar capsules are spherical and 2·7μ in diameter.

Remarks.—There are at present, including the above two additions, 49 species of *chloromyxum* besides the two species *C. diploxys* (Gurley) and *chloromyxum* sp. Awerinzew (listed by Kudo in 1933). The last two species do not appear to deserve recognition because *C. diploxys* has two polar capsules situated at two poles (which is not a generic character for *chloromyxum*) and is recorded from an insect, while the spore of *Chloromyxum* sp. Awarinzew has not been described so far.

Meglitsch (1937) recorded *Chloromyxum* sp. from the gall bladders of *Aplodinotus grunniens, Helioperca incisor* and *Ictiobus babalus.* In 1947 he listed the species of *Chloromyxum* as follows to supplement the earlier list of Kudo (1933).

50. *C.* sp. Meglitsch 1937 } Not *C. opladeli nar C. thompsoni.*
51. *C.* sp. *Meglitsch*, 1937 }
52. *C. gibbosum* Herrick, 1941.
53. *C. opladeli* Meglitsh, 1942% *C.* sp. Meglitsch 1937.
54. *C. thompsoni* Meglitsch 1942=*C.* sp. Meglitsch 1937.

It is not clear on what basis he retained the two species numbered 50 and 51, as no description of *Chloromyxum* species was given by him in 1937 In the absence of any description, these two species can not be recognised.

For facilitating the future work these 49 species of *Chloromyxum* are divided into the following four groups based on the characters of the shell valves. It may be stated that due to non-availability of literature detailed information could not be gathered for eleven of these species and hence they could not be grouped.

Group I.

Shell striated without posterior cilia.

C. protei	*C. truttae*	*C. cristatum*
C. dubium	*C. thymalli*	*C. koi*
C. misgurni	*C. fujitai*	*C. granulosam*
C. trijugum	*C. catostomi*	*C. wardi*
C. salvelini	*C. giganteum*	*C. quadriforme.*
C. opladeli	*C. sphaericum*	*C. parasiluri*
C. cyprini	*C. sphyrnae*	

Group II.

Shell striated with posterior cilia.

C. leydigi	*C. ovatum*	*C. oviforme*
C. pristiophori	*C. scyliorhinum*	

Group III.

Shell smooth with posterior cilia.

C. caudatum	*C. magnum*

Group IV.

Shell smooth without posterior cilia.

C. fluviatile	*C. mucronatum*	*C. chitosens.*
C. levigatum	*C. mrigalae*	*Chloromyxum* sp.

Species about which no information could be obtained are :—

C. incertum, *C.* sp. of Zandt, *C. bora*, *C. legeri*, *C.* sp. of Touraine, *C. oncorrhynchi*, *C. tanakai* *C. barbi*, *C. esocinum* and *C. rutili.*

Thus it will be seen that *Chloromyxum mrigalae* sp. nov. and *Chloromyxum* sp. belong to the group IV, but they differ from all the described species in the shape and size of the spores. In *C. chitosenese* Fujita (1923) the polar capsules are unequal, in *C. levigatum* Jameson (1931) the spore is somewhat oval and the polar capsules are long and narrow while in *C. mucronatum* Gurley (1893) the spore is sub-globular and mucronate anteriorly. In *C. fluviatile* Thelohan, the spore is spherical with a well marked ridge, and the polar capsule is slightly pyriform. In *C. mrigalae* sp. nov. and *Chloromyxum* sp. described here the spores are smooth. The polar capsules are spherical and the sutural ridges are absent. *C. mrigalae* and *Chloromyxum* sp. differ in the size of the spores. The other species of *Chloromyxum* described from India is *C. amphipnoui* Ray, 1933 from the gall bladder of *Amphipnous cuchia* and *Heteropneustes fossilis.* The spore of this species is circular in front view and ovoidal in side view. The shell valve is thin and striated and the dimensions as given by Chakravarty are, length and breadth 8·24—10·3μ ; polar capsule 4·1—5·2×3·1-4μ.

Kudoa chilkaensis, sp. nov.

On 11th May 1951 two specimens of *Strongylura strongylura* (36·5 and 42·0 cms. in length) were obtained from Chilka lake at Balugaon. On examination these fishes were found to be infected with small cysts (0·6-0·8m.m. in diameter). These cysts were attached to muscles and the peritoneum in the oesophageal region. They were referable to a new species of myxosporida *viz., Kudoa chilkaensis* sp. nov.

The smear preparations only showed the mature spores and not the vegetative forms.

The spore.—In the front view the posterior region of the spore is convex and the anterior end is attenuated. The lateral sides of the anterior half are slightly straight. In the anterior view the spore is rectangular in shape with rounded ends. The shell valves are four in number and are thin and smooth. On fixation they get distorted very easily. The sutural line is indistinct and in some spores does not seem to be complete in the anterior view. The nuclei of the shell valve cells are round and situated at the four corners. The four polar capsules are long, pyriform and convergent. Their anterior ends slightly project out of the shell valve as seen in *K. funduli* (Hahn). The polar capsules are straight as in *K. funduli* and not curved as in the *K. clupeidae* (Hahn). The nucleus of the polar capsule cell is situated at the posterior margin of the polar capsule. The sporoplasm is granular and fills most of the extra capsular cavity. Only one nucleus is seen situated in the centre of the sporoplasm.

Measurements of the spore.—Length, 5·5μ ; breadth 7·2μ ; thickness 5·8μ ; polar capsule 3·5×1·0—1·5μ ; length of the polar filament 10·0μ.

Remarks.—This species resembles *K. clupeidae* in the size of the spore but the polar capsules are of different sizes in the two species. In the shape of the spore it resembles *K. funduli* but in the latter species the spore is more oval as compared to that of *K. chilkaensis.* Meglitsch (1948) has listed the points of difference between *K. funduli* and *K. clupeidae.* The present form differs from both of them in the points listed above.

Meglitsch (1947) created the new genus *Kudoa* for those forms of Chloromyxidae which are histozoic and with the spores quadrate or stellate in shape in the anterior view. He transferred eight species of *Chloromyxum* to the new genus *Kudoa.* The present species is the ninth one and the first to be described from India. The other species are described from North and South America, South Africa, Australia and Europe.

Myxobolus branchialis, sp. nov.

(pl.I, figs. 6—7.)

Three specimens of *Barbus sarana* (11·3-14·8 cms. in length) bought from the local market on 10th November, 1949 had small white cysts on their gill filaments, which were brought to my notice by Mr. A David of this Station. On examination, the cysts were found to contain a new species of *Myxobolus* described here as *Myxobolus branchialis* sp. nov.

The trophozoite.—It is circular and contains only one spore. The protoplasm is finely granular and is surrounded by a thin layer of ectoplasm.

The spore.—It is more or less oval in front view and fusiform in side view. The shell valves are smooth, symmetrical and moderately thick. The sutural ridge is prominent. The two polar capsules are convergent, unequal, and oval in shape with the anterior end slightly pointed. The polar filaments are also unequal. The nucleus of polar capsule cell is oval and is situated near the posterior end of the polar capsule. The sporoplasm fills most of the extra capsular cavity and has one nucleus in the centre. The iodinophilous vacuole is oval and posterolateral in position.

Measurements of the spore.—Length, 6·4-7μ; breadth, 4·5-5μ; thickness, 3·2-4·0μ; polar capsule, 3·5×1·5μ and 1·5×1·0μ; length of the polar filament, 24·0-27·2μ, and 12·0-14·5μ, iodinophilous vacuole 1·7×2·3μ.

Size of the cyst 0·27-0·45mm. Diameter of the trophozoite 13·5μ.

Remarks.—This species resembles *M. inaequalis*, *M. musculi*, *M. aureatus*, *M. mrigali* and *M. calbasui* in having unequal polar capsules and the absence of the inter capsular ridge, but it differs from them in the dimensions and shape of the spore and the relative size of the ploar capsules.

Myxobolus indicum, sp. nov.

(pl.I, figs. 8—9.)

The muscles, liver and the intestinal wall of over 50 per cent. of specimens of *Cirrhina mrigala* obtained from the Research Station tank number 2 in September, 1950 were found to be heavily infected with small cysts (0·5-0·7mm. in diameter) of a species of *Myxobolus*. At first this was identified as *M. calbasui* Chakravarty (1939) but detailed examination showed it to be a different species of *Myxobolus* and is described here as *M. indicum* sp. nov.

These fishes were also heavily infected on the under side of their scales with *Myxobolus sphaericum* sp. nov. (see page 69).

The smears of the cysts showed only the mature spores suggesting that the infection was fairly advanced. The spore is oval in front view and lenticular in side view. The shell valves are moderately thick, symmetrical and smooth. The polar capsules are unequal and divergent. The longer one is pyriform and the smaller one is more or less spherical. The posterior ends of the polar capsules are at differ levels and not at the same level as in *M. calbasui*. The sporoplasm is granular and fills most of the extra capsular space. One sporoplasm nucleus is present in the centre of the spore. The iodinophilous vacuole varies from round to oval in shape and is situated near the posterior end.

Measurements of the spore.—Length, 9·5-10·8μ; breadth, 7·5-8·2μ thickness 5·5μ; polar capsules, 2·7-3·6×1·8μ and 1·8×1·0μ; diameter of the iodinophilous vacuole 2·5μ.

Remarks.—The other species of *Myxobolus* described from the muscles of *mrigala* is *M. calbasui*. Inspite of the same host and the habitat the two species differ in the shape and size of the spore and the polar capsules. The anterior end is pointed in *M. calbasui* but is round in *M. indicum*. The shell is thicker in *M. calbasui* as compared to the present species. This species resembles *M. mrigalae* Chakravarty (1939) in the size of the spore but the triangular thickenings on the sutural ridge in *M. mrigalae* are absent in *M. indicum*.

Myxobolus sphericum, sp. nov.

(pl.I, figs. 10—11.)

The inner side of the scales of over 65 per cent of the specimens of *Cirrhina mrigala* obtained from the Research Station tank number 2 in September 1950 were heavily infected with the cysts of a new species of *Myxobolus* described here as *M. sphericum* sp. nov. The size of the infected fish ranged between 4·8-8·7 cms. The largest number of cysts present on a fish (5·4 cms.) was sixty. The infected scales were raised along their posterior margin and in some cases the scales had fallen off. The infection was all over the body but absent on the head. The infected scales were thinner and devoid of chromatophores but not perforated like scales of *C. mrigala* infected with *M. mrigalae* as reported by Chakravarty (1939). Only mature spores were present in the cysts.

The spore.—It is oval in front view and lenticular in side view. The anterior end is wider than the posterior end, unlike in many other species where the greatest width is in the middle of the spore. The shell valves are moderately thick, smooth and symmetrical. The sutural ridge is prominent and has four thickenings along its posterior margin but the sutural line is not clear. The polar capsules are spherical, equal and convergent. They open outside by small ducts. A small triangular intercapsular ridge is present between the openings of the two capsules. The nucleus of the polar capsule cell is small, elliptical and is situated near the posterior end of the capsule. The iodinophilous vacuole is prominent and oval in shape. The sporoplasm is granular. The sporoplasm nucleus is situated anterior to the vacuole.

Measurements of the spore.—Length, 9-9·5μ ; breadth, 7·2μ ; thickness 5·0-5·5μ ; polar capsule 2·8-3·6μ in diameter; iodinophilous vacuole 2·0-2·7μ in diameter.

Remarks.—In the shape of the spore this species resembles *M. elongatus* Fujita (1924) but the two species differ in the size of the spores, shape of the polar capsules as also the habitate. A ' rim ' is present in the posterior region upto the polar capsule in *M. elongatus* which is absent in *M. sphericum*. The other species of *Myxobolus* described from the scales of *C. mrigala* is *M. mrigalae* but it differs from the present new species in the absence of the inter-capsular ridge and in the shape and size of the spore. The polar capsules are unequal in *M. mrigalae* but they are equal in *M. sphericum*.

Myxobolus barbi, sp. nov.

(pl.I, figs. 12—13.)

Small white cysts were present on the skin of one out of 15 specimens of *Barbus ticto* obtained from tank 'F' at the Belghuria fish farm in June 1950. The cysts, whitish in colour, were covered by thin fibrous tissue. Only mature spores were present in the cysts.

The spore.—It is perfectly oval in front view and lenticular in side and anterior view. The shell valves are thick. The sutural ridge is prominent but the sutural line is indistinct. The polar capsules are pyriform, equal and convergent and their ducts open out close together. A small inter-capsular ridge is present between the openings of the polar capsules. The sporoplasm fills most of the extra-capsular cavity. The iodinophilous vacuole is round. The capsulogenous nuclei are very small and situated near the posterior end of the capsule. One abnormal spore had a small prolongation on one side near the posterior end. The size of this spore was similar to that of the normal spore.

Measurements of the spore.—Length, 12·6-13·5μ; breadth, 9·0μ, thickness 5·5-6·3μ polar capsules 3·6-4·5μ×2·7μ. Thickness of the shell 0·8μ.

Remarks.—In the shape of the spore this species resembles *M. gigas* Auerbach but differs from it in the size of the spore and character of the sutural ridge. In size the new species resembles *M. catostomi* Fantham *et al.* (1939) but the two species differ in the character of the sutural ridge. The sutural ridge of *M. catostomi* has folds, where as, it is smooth in *M. barbi.* sp. nov.

There are at present 112 species of Myxobolus of which only ten are described from India. These species of *Myxobolus* can be divided into the following four groups based on the characters of the spores and the polar capsules.

Group I.

Polar capsules equal, with Inter-capsular ridge.

M. mulleri	*M. pfeifferi*	*M. exiguus*
M. obesus	*M. cycloides*	*M. gigas*
M. scardinii	*M. bramae*	*M. cyprinicola*
M. balleri	*M. squamae*	*M. pleuronectidae*
M. discrepans	*M. notropis*	*M. catostomi*
M. elongatus	*M. squamosus*	*M. sphericum*
M. barbi		

Group II.

POLAR CAPSULES EQUAL, INTER-CAPSULAR RIDGE NOT PRESENT.

M. ellipsoides	*M. oviformis*	*M. lintoni*
M. globosus	*M. transovalis*	*M. anurus*
M. sp. Gurley 1894	*M. cyprini*	*M. neurobius*
M. aeglefini	*M. physophilus*	*M. chondrophilus*
M. macrocapsularis	*M. sandrac*	*M. cordis.*
M. sp. Wagner	*M. permagnus*	*M. rotundus*
M. minutus	*M. minutus*	*M. magnus*
M. carassii	*M. funduli*	*M. nodularis*
M. hylae	*M. miyairii*	*M. koi*
M. orbiculatus	*M. mesentericus*	*M. cunhai*
M. pygocentris	*M. noguchii*	*M. stokesi*
M. peocilichthidis	*M. dentium*	*M. percae*
M. rhinichthidis	*M. couesii*	*M. hyborhynchi*
M. subcircularis	*M. nemachili*	*M. subepithelialis*
M. osburni	*M. conspicuus*	*M. granäis*
M. associatus	*M. teres*	*M. ovatus*
M. angustus	*M. vastas*	*M. gravidus*
M. compressus	*M. mutabilis*	*M. mutabilis*
M. nodosus	*M. obliquus*	*M. bellus*
M. lutzi	*M. intestinalis*	*M. congesticius*
M. transovalis	*M. capsulatus*	*M. moxostomi*
M. bengalensis	*M. clarii*	*M. catlae.*

Group III.

POLAR CAPSULES UNEQUAL INTER-CAPSULAR RIDGE NOT PRESENT

M. inaequalis	*M. musculi*	*M. aurealus*
M. ovoidalis	*M. destruent*	*M. calbasui*
M. mrigali	*M. branchialis*	*M. indicus.*
M. uniporus		

Group IV,

POLAR CAPSULES UNEQUAL INTER-CAPSULAR RIDGE PRESENT.

M. dispar.

No detailed information could be obtained due to the non-availability of literature on the following species :

M. guyenoti, *M. kudoi*, *M. gibbosus* *M. bilineatum*, *M. variabilis*, *M. hungaricus* *M. heterocapsulatus*, *M. lobatus*, *M. kubanicum* and *M. kostiri.*

Information for the following species is incomplete and it has not been possible to classify them in any of the above groups.

M. sp. Gurley, *M.* sp. Gurley, *M.* sp. Lebzelter, *M.*, sp. Miyairi, *M. sphaeralis*, *M.* sp. Southwell, M. sp. Splenodre, *M.* sp. Kudo.

The species under the above groups can further be divided into sub-groups on the basis of the characters of the shell valves and the sutural ridge.

TABLE II.

Measurements in microns of the spores of Myxobolus *species described from India.*

	Length.	Breadth.	Thickness.	Polar capsule.
M. clarii Chakravarty (1943)	11·3-12·4	10·3	6·18	6·18×3·09 equal.
M. catlae Chakravarty (1943)	14·5-16·5	6·18	5·15	10·3-12·36× 2·06-3·1 equal.
M. calbasui Chakravarty (1939)	12·45-15	8·2-10	6·18	6·18×4·12 and 4·12—3·09 unequal.
M. mrigalae Chakravarty (1939).	7·2-8·4	7·2-8·4	6·18	5·15×3·09 and 3·09 ×2·06 unequal.
M. bengalensis Chakravarty and Basu (1948).	8·56-9·36	6·42-6·8	4·28	4·28-5·8×2·5-3·2 equal
M. nodularis Southwell and Prashad (1918).	9	7·2	—	3·4 long equal.
M. branchialis sp. nov.	6·4-7	4·5-5	3·2-4	3·5×1·5 and 1·4×1 unequal.
M. barbi sp. nov.	12·6-13·5	9	6·3	3·6-4·5×2·7 equal.
M. indicum sp. nov	9·5-10·8	7·5-8·5	5·5	2·7-3·6×1·8 and 1·8 ×1·2 unequal.
M. sphericum sp. nov.	9—9·5	7·2	5·5-5	Diameter 2·8-3·6 equal.

Henneguya latesi, sp. nov.

(pl.I, figs. 14-15.)

The gills and the wall of the mouth cavity of *Lates calcarifer*, were infected with small cysts of Myxosporidia. The infected fishes (20·4—48 cms. long) were apparently healthy and the protozoan infection did not seem to harm the fishes to any appreciable extent. The only other Myxosporidian described from *L. calcarifer* is *Leptotheca latesi* Chackravarty, (1943) from the gall bladder. The fishes were obtained from the Chilka Lake and the local market.

The cysts contained only mature spores and no vegetative stages were observed.

The spore.—In the front view it is pyriform and pointed posteriorly the anterior end being broad and more or less flattened. In the sutural

view the spore is fusiform. The shell valves are thin and symmetrical. Posteriorly there are two very thin prolongations, which are fused for some distance from the base. The polar capsules are pyriform and slightly convergent. The polar filament is seen coiled within them but could not be extruded on the application of 5 per cent. KOH solution. The nuclei of the polar capsule cells are elliptical and situated near the posterior margin of the polar capsule. The sporoplasm is granular and fills most of the extra-capsular cavity. The iodinophilous vacuole is situated near the posterior end, in front of which one or two sporoplasm nuclei can be seen.

Measurements of the spore.—Length (excluding the posterior prolongation) 9·0—10·8 μ ; breadth, 6·3—8·2 μ ; thickness, 5·4 μ ; polar capsule, 3·6×2 μ ; length of the posterior prolongations, 17·2—25·4 μ ; diameter of the iodinophilous vacuole, 1·5 μ ; ratio of the length of the spore to the length of the posterior prolongation nearly 1 : 2.

Remarks.—In the size of the spore this species resembles *H.zschokkei* (length 10 μ and breadth 7 μ) and *H.salmonis* (length 10—11·6 μ and breadth 5—7·7 μ) but differs from them in the length of the posterior prolongation and size of the polar capsules. It resembles *H.otolithi* and *H.nigris* in the shape of the spore but differs from them in the size of the spore and the posterior prolongations.

So far only three species of *Henneguya* have been described from Indian fishes.

TABLE III.

Measurements in microns of the spore of Henneguya *species described from India.*

	Total length (including the tail).	Length.	Breadth.	Thickness.	Polar capsule.	Posterior prolongation.
H. ophicephali, Chakravarty (1939).	41·5—52·5	..	6·8—7·21	4·12	6·18—9·27 ×2·06—3 and 5·15—8·24×2·06—3	20—32
H. otolithi Ganapati (1941).	..	10—12	6—8·5	4·5	3·4×2—2·5	35—40
H. latesi sp. nov.	26·2—35·5	9—10·8	6·3—7·2	5·4	3·6×2	17·2—25·4

At present 56 species are included under *Henneguya*. It has not been possible to divide these species into groups as has been done for other genera in this paper. More information about spore character of various species is required before any grouping can be successfully attempted.

Unicauda ophicephali, sp. nov.

The gills of *Ophiocephalus gachua* obtained from the local market in September 1948 and July 1949 were found to be infected with white

spherical cysts 1—1·5 mm. in diameter. The highest number of the cysts present in one fish (13·7 cms. long) was five. The fishes were apparently in good health.

The cysts had only the mature spores and no young trophozoites were seen.

The spore.—It is long, conical and tapering posteriorly and round anteriorly. The shell valves are thick and smooth, and the sutural line and the sutural ridge are prominent and straight. The nuclei of the shell valve cells are elliptical and situated near the middle of the spore. The caudal prolongation is long, thick and tapering posteriorly. The polar capsules are pyriform, convergent and slightly unequal. The nuclei of the polar capsule cells are oval and situated near the inner margin of the polar capsule. The sporoplasm is granular and fills most of the extra-capsular cavity. One or two sporoplasm nuclei are present anterior to the iodinophilous vacuole.

Measurements of the spore.—Length, 19·8—26·4 μ; breadth, 5·4—7.2 μ; thickness, 4·5—5 μ; length of the polar capsules, 7·2—8·1 μ, and 5·5—7·2 μ respectively; breadth of the polar capsule, 2—3 μ; length of the caudal prolongation 20·5—23·8 μ; diameter of the iodinophilous vacuole 0·8 μ.

Remarks.—This species resembles *U. oviperda* (Cohn) in the shape of the spore, but in the latter species the posterior prolongation is shorter. The length of the spore is similar in *U. ophicephali* and *U. acerinae* (Schroeder) of Nemeczek (1911) but the form of the spore differs in these two species.

Chakravarty (1939) described *Henneguya ophicephali* from the gills and muscles of *Ophiocephalus punctatus* and therein he described two types of spores. "In the spores obtained from the gills, the tail was found bifurcated and devaricated (Pl. 9 Fig. 25 and Pl. 10 Fig. 26) while in those from the muscles the bifurcations are approximated (Pl. 10 Fig. 29—30)" (Chakravarty 1939, p. 175). In 1944 Davis divided the genus *Henneguya* in three genera *Henneguya, Unicauda* and *Myxobilatus.* The form described by Chakravarty from the muscles comes under *Unicauda.* The species described herein from the gills of *O. gachua* is similar to that described by Chakravarty (1939) from the muscles, so *Hennguya ophicephali* Chakravarty becomes synonym (in part) of *U. ophicephali* sp. nov.

Davis (1944) has listed ten species under *Unicauda.* But the review of the literature shows that the following species can also be transferred to *Unicauda. Henneguya acerinae* (Schroeder) described by Nemeczek in 1911 and by Jirovec (1942) have one posterior prolongation only. The measurements of the spore given by these two authors are very much similar. It is proposed that this species be transferred to *Unicauda* as *U. nemeczeki* nom. nov. *H. oviperda* (Cohn), and *H. limatula* Maglitsch, (1937) are also transferred to *Unicauda* because the spores have single caudal prolongation.

At present there are 14 species of *Unicauda* which can be divided into the following three groups :

GROUP I.

POSTERIOR PROLONGATION NEARLY AS LONG AS THE MAIN BODY OF THE SPORE.

U. strongylura and *U. ophicephali.*

GROUP II.

POSTERIOR PROLONGATION SHORTER THAN THE MAIN BODY OF THE SPORE.

U. oviperida, U. crassii and *U. fontinalis.*

GROUP III.

POSTERIOR PROLONGATION LONGER THAN THE MAIN BODY OF THE SPORE.

U. clavicauda, U. crassicauda, U. monura, U. brachura, U. spatulata, U. limatula U. nemeczeki, U. plasmodia and *U. macrura.*

Neahenneguya tetraradiata, gen. *et.* sp. nov.

The gills of 15 out of 50 *Odontamblyopus rubicundus* obtained from the river Hooghly on 1st February 1950 were found to be infected with small cysts (diameter 0·5 mm.), which could be easily removed. There was no pathological effect on the gills to any appreciable extent. On close examination the cysts were found to belong to a new genus and species of myxosporidia designated as *Neohenneguya tetraradiata.* gen. *et* sp. nov.

The trophozoite.—The young trophozoite is irregular in shape and has one developing spore in it. The protoplasm is not properly differenciated into the ecto and endo-plasm.

The spore.—It is fusiform with two long thin prolongations at either end. The prolongations are equal in length. The shell valves are thin, smooth and slightly unequal in size. The sutural line is thin and the sutural ridge is not distinct. The polar capsules are spherical and tendem in position in the front view. They are situated a little posterior to the anterior end of the spore. The openings of the capsules are in different directions. The anterior capsule opens on the front side and posterior capsule opens on the sutural side. The polar filament is long and thin. The iodinophilous vacuole is situated near the end, opposite to the polar capsule end. The sporoplasm between the polar capsule and the vacuole is granular and has one or two nuclei. The polar capsule cell nucleus is not seen.

Measurements of the spore.—Length (excluding the prolongations), 16·2—21·6 μ ; breadth and thickness 5·4 μ ; diameter of the polar capsule 2—2·7 μ ; diameter of the iodinophilous vacuole 1·5—2·5 μ ; length of the prolongations 63—72 μ.

The present form belongs to the family Myxobolidae as it possesses the iodinophilous vacuole and two polar capsules. The caudal prolongations indicate its affinity to *Henneguya* Thelohan but the presence of the prolongations at the anterior end also, and the opening of the polar capsules at the sides instead of at the anterior end show that it is different from this genus. The aforesaid characters justify the creation of a new genus for the reception of the present form. The generic diagnosis is given below.

Neohenneguya nov. gen. Myxobolidae in which the spore is fusiform with two equal prolongations at each of its anterior and posterior end. The polar capsules are spherical with their openings in different directions. Histozoic, on the gill of estuarine fish. Type species: *N. tetraradiata* sp. nov.

Thelohanellus mrigalae, sp. nov.

Out of four *Cirrhina mrigala* fingerlings (3—4 cms. long) obtained from the fry market one had three cysts (0·75 mm. in diameter) on its head, two between the eyes and one near the snout. The infected fish was kept under observation for 12 days along with others in the laboratory aquarium but no additional specimen was observed to be infected. Smears of the cysts showed only the spores.

The spore.—In the front view the spore is oval with the lateral sides more or less parallel, and a slight knob like projection at the anterior end. In the sutural view the spore is pyriform. The shell-valves are thick, symmetrical and smooth. The sutural line is prominent. The polar capsule is oval and occupies nearly half of the spore cavity. The polar capsule cell is elliptical and situated just posterior to the polar capsule. The sporoplasm fills nearly the whole of the extra-capsular cavity. It has only one nucleus, behind which the iodinophilous vacuole is situated.

Measurements of the spore.—Length, 10·8—12 μ; breadth, 6·3—7·2 μ; thickness, 4·5—5·4 μ; polar capsule, 5·4—7·2 μ×3·6—5·0 μ.

Remarks.—In size it resembles the spore of *T. oculileucisci* but differs from it in shape. The shape of the spore is somewhat like that of *T. catlae* Chakravarty and Basu (1948) but differs from it in the size of the spore and shape of the polar capsule.

Thelohanellus calbausi, sp. nov.

One *Labeo calbasu* (18·6 cms.) obtained from Sheoraphulli market in February 1949 had two white cysts (1·5 and 2 mm. in diameter) on the scales on the lateral sides of the fish. At the place of attachment of the cyst the scale was perforated. In *mrigala* also the scale becomes perforated when infected by *Myxobolus mrigalae* Chakravarty. When the smears of the cysts were prepared, only the mature spores were seen.

The spore.—It is more or less oval, the anterior end is less broad than the posterior end. In the side view it is pyriform. The shell is thin smooth and the sutural valves are equal. The sutural line is distinct

but there is no sutural ridge. The polar capsule is oval with the anterior end drawn into a small duct. The capsulogenous cell nucleus is elliptical and is situated near the posterior end. The sporoplasm is granular and has two big round nuclei in the middle of the spore. The nuclei of the shell valve cells are also seen along the lateral margin in the region of the polar capsule.

Measurements of the spore.—Length 9—10·8 μ ; breadth 7·2 μ ; thickness 5·5 μ ; polar capsule 5·4×3·4 μ diameter of the sporoplasm nucleus 1·2 μ.

Remarks.—This species resembles *T. mrigalae* sp. nov. in the size but differs from it in the shape of the spore. In shape of the spore it resembles *T. seni* Southwell and Prashad (1918) except that the spore of the latter species has a thickened sutural ridge.

Thelohanellus gangeticus. sp. nov.

During the course of studies of the spawning grounds of the carps in the Ganges river near Nimtita one small specimen of *Chela bacaila* (4·6 cms. long) was obtained which showed a tumorous growth on the body in its pectoral region. This specimen was kindly handed over to me by Sri S. J. Karamchandani of this Station for study. Other specimens examined at the Research Station from the local ponds were free from the infection.

A piece of this tumour was examined under the microscope which showed many spores of *Thelohanellus*, described here as *T. gangeticus* sp. nov.

No vegetative stages of the parasite were seen in the smear preparation. The spore is elongated and thin and the two lateral sides nearly straight. The posterior end is slightly flattened with rounded ends. The anterior end is truncated, and from the side the spore appears pyriform. A sutural ridge is present but the sutural line is not clear. The polar capsule is pyriform with a thin neck. The sporoplasm fills nearly half of the extra-capsular cavity. The iodinophilous vacuole is small and varies in position. In some spores it is in the centre of the spore whereas in others it is near the posterior end. There is only one sporoplasm nucleus and the protoplasm around it is dense. Some spores are arched at the anterior end in the front view, but in other respects they are simlar to the typical spores described above.

Measurements of the spore.—Length, 16·2—17·5 μ ; breadth 5·4 μ ; thickness 3·5 μ ; size of the polar capsule 7·2×2·5 μ.

Remarks.—This species resembles *T. pyriformis* in the shape and the length of the spore to a certain extent, but the two species differ in the breadth of the spore. The present species is characteristic in having its posterior end slightly flattened and not round or oval as in other species.

So far 15 species of *Thelohanellus* have been described. Of these six species are from India. Eleven species have the length of the spore more than 15 μ except the four—*T. seni*, *T. oculileucisci*, *T. mrigalae*, and *T. calbasui* in which the spore length is between 10—15 μ.

TABLE IV.

Measurements in microns of the spore of Thelohanellus *species described from India.*

	Length.	Breadth.	Thickness.	Polar capsule.
T. seni, (Southwell and Prashad 1918).	12·48—14·94	8·56	..	6·42×4·0
T. rohitae (Southwell and Prashad 1918).	30—33	10—13	..	16·2×7—8·24
T. catlae (Chakravarty and Basu 1948.)	19·26—21·4	10·7—12·4	12·48	10·71—13·9× 9·63—11·77
T. mrigalaei sp. nov. .	10·8—12	6·3—7·2	4·5	5·4—7·2× 3·6—5
T. calbasui sp. nov. .	10·5—11	6·3	3·6	5·4×3·6
T. gangeticus sp. nov. .	16·2—17	5·4	2·7—3	7·2×2·5

Sphaerymyxa pultai, sp. nov.

Twelve out of 50 specimens of *Odontamblyopus rubicundus* caught from the river Hooghly near the Research Station showed infection in the gall bladder by a new species of *Sphaeromyxa* which is described here as *S. pultai* sp. nov. The fishes were obtained during the months of October and December, 1950 and March 1951. No appreciable difference was noticed in the seasonal intensity of the infection. The bile in all the infected fishes was viscous and whitish in colour.

Vegetative stage.—The young trophozoite is circular (4·5 μ in diameter) with two big circular nuclei (1·8 μ in diameter). The protoplasm is clear and hyaline. The mature trophozoite is mono or di-sporous. The endoplasm is vacoulated surrounded by a thin layer of ectoplasm. The monosporous form measures 12·6—13·9 μ and the di-sporous trophozoite measures 19—27·3 μ. There are 6—8 nuclei in the mature trophozoite.

The spore.—It is long with truncate ends. The two sides are slightly curved in the front and the sutural views. The shell is thin and smooth. The sutural line is more or less parallel to the long axis of the spore. There is no sutural ridge. The polar capsules are long, pyriform and with truncate ends. The nucleus of the polar capsule cell is round and situated just behind the polar capsule. The sporoplasm is granular and does not fill the whole of the extra-capsular cavity. Two round sporoplasm nuclei are situated in the middle of the spore.

Measurements of the spore.—Length, 28·8—30·0 μ; breadth and thickness 5—5·5; diameter of the sporoplasm nucleus 1—1·3 μ.

Remarks.—This species resembles *S. gibbonsia* Noble in the size of the spore, but the spore in the latter species is more arched in the front view. In the shape of the spore *S. pultai* sp. nov. resembles *S. balbianii*

Thelohan, but in the latter species the shell valve is striated and also the size of the spores in the two species are different. In *S. ovale* the spore is oval in shape and smaller in size than the present species.

Sphaeromyxa theraponi, sp. nov.

One out of 4 specimens of *Therapon jarbua* obtained from Port Canning on 4th December 1950, showed an infection in the gall bladder by a new species of *Sphaeromyxa* which is described here as *S. theraponi* sp. nov. The bile was slightly viscous and the colour of the bile was yellowish. The intensity of infection was not very heavy. Only mature spores were found.

The spore.—It is arched in the front view, one side being more arched than the other. Some spores, abnormal in shape are deeply arched and appear 'V' shaped. In the sutural view the spore is more or less 'S' shaped and the two polar capsules open in different directions. The shell valve is thin and smooth. The sutural line is 'S' shaped, thin and distinct. The sutural ridge is absent. The polar capsules are small and pyriform, with truncate ends. The sporoplasm fills most of the extra-capsular cavity.

Measurements of the spore.—Length (distance between the ends of the two polar capsules in the front view) 19·8 μ; breadth and thickness 5·4 μ; polar capsules 7·2 × 2·7 μ.

Remarks.—This species has its spore arched in the front view and sutural line is 'S' shaped. In this character it resembles *S. incurvata*, *S. hellandi*, *S. exneri* and *S. reinhardti* but it differs from them in the size of the spore.

There are 15 species of *Sphaeromyxa* described so far. On the basis of the shape of the spore these are divided into the following four groups:

GROUP I.	GROUP II.
SHELL STRIATED.	SHELL SMOOTH, SPORE ELONGATED IN FRONT VIEW.
S. balbianii *S. curvaula*	*S. ovale*, *S. arcuata*, *S. paltai*, and *S. longa* *S. gasterostei*.
GROUP III.	**GROUP IV.**
SHELL SMOOTH, SPORE CURVED IN FRONT VIEW AND THE SUTURAL LINE 'S' SHAPED.	SHELL SMOOTH, SPORE CURVED IN THE FRONT VIEW, AND THE SUTURAL LINE STRAIGHT.
S. incurvata, *S. hellandi*, *S. exneri*, *S. reinhardti*, and *S. theraponi*.	*S. sabrazesi*, *S. lateralis* and *S. gibbonsia*.

The two new species of *Sphearomyxa* described here are the only ones so far recorded from India. They can easily be distinguished from others by the shape and size of the spore.

Check List of Parasitic Protozoa Described from Indian Fishes.

SPOROZOA.

TELOSPORIDIA.

COCCIDIA

Eimeriidae.

Eimeria

E. harpodoni, Setna & Bana, 1935	*Harpodon nehereus.*
E. southwelli Halwani, 1930	*Aetobatis narinari.*
Eimeria sp. Setna & Bana, 1935	*Trichurus savala.*
Eimeria sp. Setna & Bana, 1935	*Plotosus cannius.*
Eimeria sp. Setna & Bana, 1935	*Sillago sihama.*

Haemogregerinide.

Haemogregarina

H. thyrsoideae deMello & Vales, 1936	*Thyrsoidea macrurus.*
Haemogregarina sp. Plinner, 1914	*Colisa fasciatus.*

CNIDOSPORIDIA.

Myxosporidia Butschli, 1881.

Unipolaria Tripathi, 1948.

CERATOMYXOIDEA Tripathi, 1948.

Ceratomyxidae Doflein, 1899.

Ceratomyxa Thelohan, 1892.

C. hilsae Chakravarty, 1939	*Hilsa ilisha.*
C. gobioidesi Chakravarty, 1939	*Odontamblyopus rubicundus.* *Colisa fasciatus.*
C. scatophagi Chakravarty, 1943	*Scatophagus argus.*

Leptotheca Thelohan, 1895.

L. latesi Chakravarty, 1943	*Lates calcarifer.*
L. macronesi Chakravarty, 1943	*Mystus gulio.*
Sphaerospora sp. Southwell & Prashad, 1918	*Barilius barna.*

Chloromyxidae Thelohan, 1892.

Chloromyxum Mingazzini, 1890.

C. amphipnoui Ray, 1933	*Amphipnous cuchia.* *Heteropneustes fossilis.* *Amblypharyngodon mola.*
C. mrigalae sp. nov	*Cirrhina mrigala, C. reba.*
Chloromyxum sp.	*Xenentodon cancila.*

Kudoa Meglitsch, 1947.

K. chilkaensis sp. nov.	*Strongylura strongylure.*

MYXOBOLOIDEA Tripathi, 1948.

Myxobolidae Thelohan, 1892.

Myxobolus Butschli, 1882.

M. bengalensis Chakravarty & Basu, 1948	*Catla catla.*
M. branchialis sp. nov.	*Barbus sarana.*
M. barbi sp. nov.	*Brabus ticto.*
M. calbasui Chakravarty, 1939	*Labeo calbasu, L. rohita, Cirrhina mrigala.*
M. clarii Chakravarty, 1943	*Clarius batrachus.*
M. catlae Chakravarty, 1943	*Catla catla, Labeo rohita* and *Cirrhina mrigala.*

M. indicum sp. nov.	*Cirrhina mrigala.*
M. mrigalae Chakravarty, 1939	*Cirrhina mrigala.*
M. nodularis Southwell & Prashad, 1918	*Rasbora daniconius.*
M. sphericum sp. nov.	*Cirrhina mrigala.*
Henneguya Thelahan, 1892.	
H. latesi sp. nov. .	*Lates calcarifer.*
H. ophicephali Chakravarty, 1939	*Ophicephalus punctatus.*
H. otolithi Ganapati, 1941 .	*Otolithus ruber, O. maculatus.*
Unicauda Davis, 1944.	
U. ophicephali sp. nov.	*Ophicephalus gachua. O. punctatus.*
Neohenneguya gen. nov.	
N. tetraradiata sp. nov.	*Odontamblyopus rubicundus.*
THELOHANELLIDAE Tripathi, 1948.	
Thelohanellus Kudo, 1933.	
T. calbasui sp. nov.	*Labeo calbasu.*
T. catlae Chakravarty & Basu, 1948 . .	*Catla catla.*
T. gangeticus sp. nov. . .	*Chela bacaila.*
T. mrigalae sp. nov. . . .	*Cirrhina mrigala.*
T. rohitae (Southwell & Prashad, 1918) . .	*Labeo rohita.*
T. seni (Southwell & Prashad, 1918) .	*Catla catla.* *Labeo rohita.*
Bipolaria Tripathi, 1948.	
MYXIDIIDAE Thelohan, 1892.	
Myxidium Butschli, 1882.	
M. heteropneustesi Chakravarty, 1943	*Heteropneustes fossilis.*
M. leiberkuhni Butschli, 1881	*Anabas testudineus.*
M. procerum var. *calcariferi* Chakravarty, 1943 .	*Lates calcarifer.*
M. glossogobi Chakravarty, 1939 . .	*Glossogobius giuris.*
Sphaeromyxa Thelohan, 1892.	
S. pultai sp. nov.	*Odontamblyopus rubicundus.*
S. theraponi sp. nov.	*Therapon jarbua.*
Zschokkella Auerbach, 1910	
Z. fossilae Chakravarty, 1943 . .	*Heteropneustes fossilis.*
Z. ilishae Chakravarty, 1943 . . .	*Hilsa ilisha.*

Note.—Setna (1942) has given a list of 18 species of Elasmobranch fishes which are infected by Myxosporidian parasites and in order to complete this list the table given by Setna is queted below.

Host	Number of species from each host	Genus	Seat of infection
1. *Carcharinus pleurotaenia*	1	*Ceratomyxa*	Gall bladder
2. *Cestraction blochii* . .	2	*Ceratomyxa* *Chloromyxum*	do.
3. *Cestracion zygaena* . .	3	*Ceratomyxa* *Ceratomyxa* *Chloromyxum*	do.

Host	Number of species from each host	Genus	Seat of infection
4. *Chiloscyllium griseum*	1	*Chloromyxum*	Gall bladder
5. *Carcharinus menisorrah* .	2	*Ceratomyxa* *Ceratomyxa*	do.
6. *Carcharinus limbatus* .	5	*Leptotheca* *Chloromyxum* *Ceratomyxa* *Ceratomyxa*	do.
7. *Hemigaleus balfouri* .	3	*Ceratomyxa* *Ceratomyxa* *Chloromyxum*	do.
8. *Pristis cuspidatus* . .	2	*Chloromyxum* *Ceratomyxa*	do.
9. *Rhynchobatus djeddensis* .	2	*Chloromyxum* *Ceratomyxa*	do.
10. *Scoliodon sorrakowah* .	3	*Chloromyxum* *Ceratomyxa* *Leptotheca*	do. Kidney
11. *Scoliodon* sp. . .	2	*Chloromyxum* *Ceratomyxa*	Gall bladder
12. *Scoliodon walbeehmi* .	3	*Ceratomyxa* *Ceratomyxa* *Chloromyxum*	do.
13. *Scoliodon palasorrah* .	2	*Ceratomyxa* *Chloromyxum*	do.
14. *Carcharinus bleekeri* .	3	*Ceratomyxa* *Ceratomyxa* *Chloromyxum*	do.
15. *Hypoprion macloti* . .	2	*Ceratomyxa* *Ceratomyxa*	do.
16. *Carcharinus melanopterus*	2	*Ceratomyxa* *Chloromyxum*	do.
17. *Trygon bleekeri* . .	1	*Chloromyxum*	do.
18. *Rhynoptera javanica* .	1	*Chloromyxum*	do.

ALPHABETICAL LIST OF THE HOSTS.

1. *Aetobatis narinari* (Euphrasen) . . . Myliobatidae.
   Emeria Southwelli (Intestine)
2. *Amblypharyngodon mola* (Ham). . . . . Cyprinidae.
   Chloromyxum amphipnoui (Gall bladder)
3. *Amphipnous cuchia* (Ham.) . . . Amphipnoidae.
   Chloromyxum amphipnoui (Gall bladder)

4. *Anabas testudineus* (Bl.) . . . Anabantidae.
   Myxidium leiberkuhni (Gall bladder)

5. *Barbus* (*Puntius*) *sarana* (Ham.) . Cyprinidae.
   Myxobolus branchialis (Gills)

6. *Barbus* (*Puntius*) *ticto* (Ham.) . . . . Cyprinidae.
   Myxobolus barbi (Skin)

7. *Barilius barna* (Ham.) . . . . Cyprinidae.
   Sphaerospora sp. (Under the scale)

8. *Catla catla* (Ham.) . . Cyprinidae.
   Myxobolus catlae (Gills)
   M. bengalensis (Gills)
   Thelohanellus catlae (Gills)
   T. seni (Gills)

9. *Chela bacaila* (Ham.) . Cyprinidae.
   Thelohanellus gangeticus (Skin and muscles)

10. *Cirrhina mrigala* (Ham.) . . Cyprinidae.
    Chloromuxum mrigalae (Gall bladder)
    Myxobolus calbasui (Gills)
    M. catlae (Gills)
    M. indicum (Muscles)
    M. mrigalae (Scales)
    M. Sphericum (Scales)

11. *Cirrhina reba* (Ham.) . . . . . Cyprinidae.
    Chloromyxum mrigalae (Gall bladder)

12. *Clarias batrachus* (L.) . . . . . Clariidae.
    Myxobolus clarii (Gall bladder, liver, ovary (Bl. schn.) testis, and fat bodies)

13. *Coilia fasciatus* (Bl. Schn.) . . . . Osphronemidae.
    Haemogregarina sp. (Blood)

14. *Glossogobius giuris* (Ham.) . . . Gobiidae.
    Myxidium glossogobi (Gall bladder)

15. *Harpodon nehereus* (Ham.) . Synodidae.
    Eimeria harpodoni (Intestine)

16. *Heteropneustes fossilis* (Bl.) . . . . Heteropneustidae.
    Chloromyxum amphipnoui (Gall bladder)
    Myxidium heteropneustesi (Gall bladder)
    Zschokkella fossilae (Gall bladder)

17. *Hilsa ilisha* (Ham.) . . . . . Clupeidae.
    Ceratomyxa hilsae (Gall bladder)
    Zschookkella ilishae (Gall bladder)

18. *Labeo calbasu* (Ham.) . . . . . Cyprinidae.
    Myxobolus calbasui (Gall bladder)
    Thelohanellus calbasui (Skin)

19. *Labeo rohita* (Ham.) . . . Cyprinidae.
    Myxobolus calbasui (Gall bladder)
    Myxobolus catlae (Gills)
    Thelohanellus rohitae (Gills)
    T. Seni (Median & caudal fin)

20. *Lates calcarifer* (Bl.) . . . . Percidae.
    Leptotheca latesi (Gall bladder)
    Myxidium procerum var *calcariferi* (Gall bladder)
    Henneyguya latesi (Gills and skin)

21. *Mystus gulio* (Ham.) . . . . . Bagridae.
    Leptotheca macronesi (Gall bladder)

22. *Ophicephalus gachua* (Ham.) . . . . . Ophicephalidae.
Unicauda ophicephali (Gills)

23. *Ophicephalus punctatus* (Bl.) . . . . . Ophicephalidae.
Henneguya ophicephali (Gills)
Unicauda ophicephali (Muscles)

24. *Otolithus maculatus* (Kuhl. & Hass.) and

25. *Otolithus rubber* (Bl. Schn.) . . . Scieanidae.
Henneguya otolithi (Heart)

26. *Odontamblyopus rubicundus* (Ham.) . . . Gobiidae.
Ceratomyxa gobioidesi (Gall bladder)
Neohenneguya tetraradiata (Gills)
Sphaeromyxa pultai (Gall bladder)

27. *Plotosus canius* (Ham.) . . Plotossidae.
Eimeria sp. (Intestine)

Rasbora daniconius (Ham.) . . . . . Cyprinidae.
Myxobolus nodularis (Muscles)

29. *Scatophagus argus* (Bl.) . . . . . Percidae.
Ceratomyxa scatophagi (Gall bladder)

30. *Sillago sihama* (Forsk.) . . Trachinidae.
Eimeria sp. (Intestine)

31. *Strongylura strongylura* (v. Hass.) . . . . Scombresocedae.
Kudoa chilkaensis (Muscle)

32. *Therapon jarbua* (Forsk.) . . . . . Percidae.
Sphaeromyxa theraponi (Gall bladder)

33. *Thyrsoidea macrurus* (Blkr.) . . . . Muraenidae.
Haemogregarina thyrsoideae (Blood)

34. *Xenentodon cancila* (Ham.) . . . . Scombresocidae.
Chloromyxum sp. (Gall bladder)

So far only 39 species of Myxosporidia are described from 29 species of Indian fishes excluding the list of 18 species of Elasmobranch fishes given by Setna in 1942. Of these 29 species, 11 species are from Cyprinidae, which are mostly cultured in ponds specially in Bengal. Among the Clupeids, myxosporidia have been described only from one species *i.e.*, *Hilsa ilisha*. It may be added here that our knowledge of the incidence of myxosporidian infection in riverine and marine fishes is very poor. Again, in the case of recorded species there is a vast field for the study of systematics, geographical and seasonal distribution of the parasites and their effect on the hosts, so that their full significance in relation to fish and fishery may be elucidated.

SUMMARY.

Fifteen new species and one new genus of Myxosporidian parasites are described from fresh-water and estuarine fishes of India.

A check list of the Protozoan parasites from Indian fishes is also given.

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(2) The references printed in the bold type refer to Indian species.

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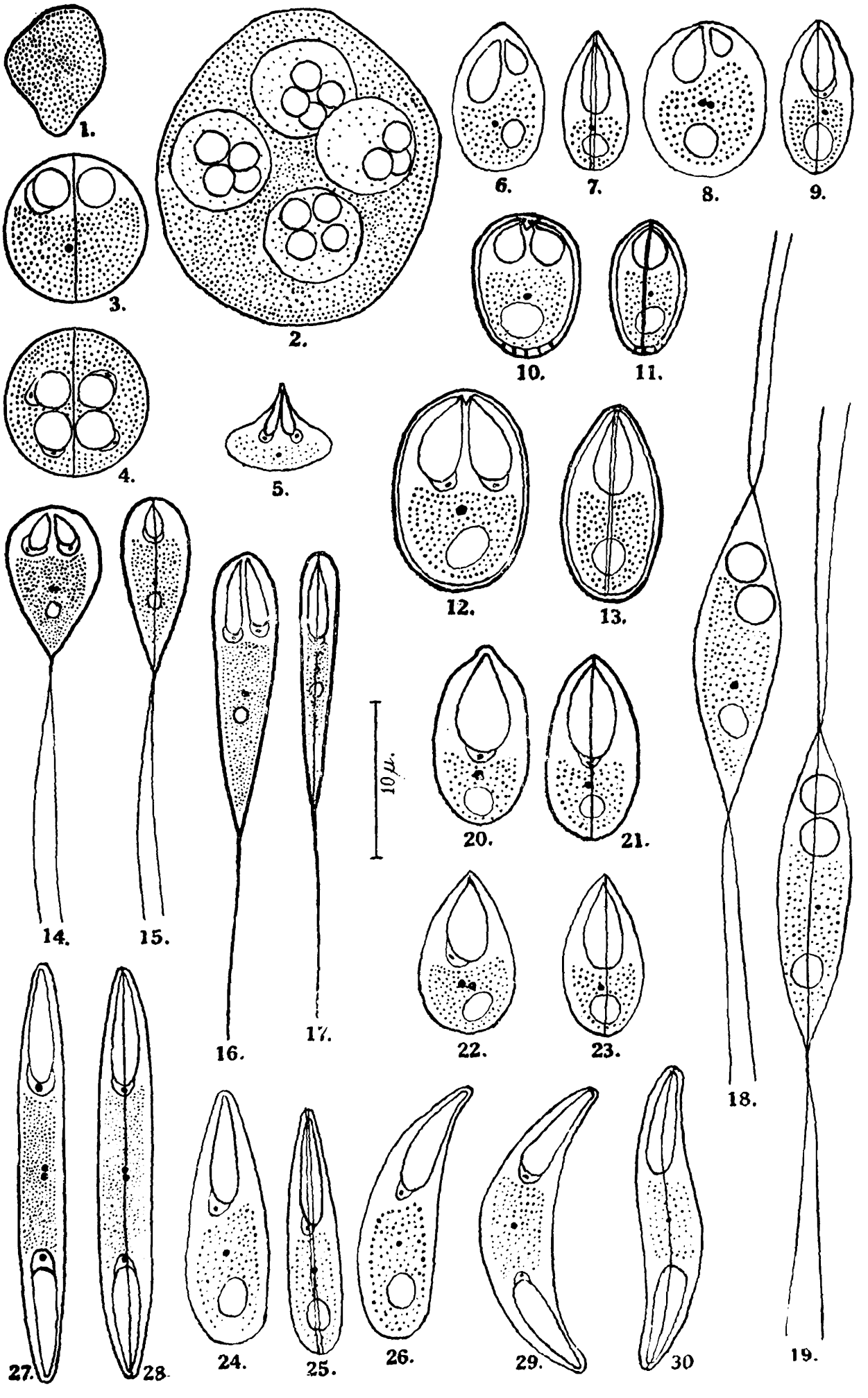

PARASITES OF INDIAN FISHES.

STUDIES IN ORIENTAL BIBIONIDAE: NEW SPECIES OF *PLECIA* AND *PENTHETRIA* AND A REVISION OF THE *PLECIA IMPOSTOR* COMPLEX. (BIBIONIDAE: DIPTERA)*.

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The paper deals in large part with a study of the complex of species which are related to *Plecia impostor* Brunetti. The study was begun in 1943 when the writer collected, in North India, three different species which fit the original description of *impostor*. Since that time a number of other species have been studied which cannot be distinguished from the original description of *impostor*. Through the kind co-operation of Dr. S. L. Hora and Dr. R. N. Mathur, the writer has been able to study the type and one male paratopotype of *P. impostor* and it has thus been possible to definitely establish the identity of this species.

The impostor complex

This group of species is distinguished from other oriental *Plecia* by the brown to black discoloration on the anterior portion of the mesonotum. The remainder of the mesonotum is orange to rufous and the pleura are largely brown to black. The presence of dark coloring on the front of the mesonotum is useful only in separating the males, the females often have the entire mesonotum rufous. The antennae of the males are nine segmented in all of the known oriental species, excepting *dilatata* Brunetti which has twelve segments in the antennae. This latter species very probably fits in a distinct group because of other characters which it possesses but since no other close relatives are known it is treated here in the *impostor* complex. The male genitalia of the species in this complex

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exhibit no particular affinities which definitely separate them into a group. In all of the species studied the posterior lateral margins of the ninth sternum are, however, rather strongly lobate.

Key to the *impostor* complex of *Plecia* known from the orient. (based upon males)

1. Hind tibiae parallel sided, not swollen ; hind tarsi not incrassate Antennae nine segmented, apical segment small and inconspicuous....2

Hind tibiae distinctly dilated on apical halves ; hind tarsi incrassate. Antennae twelve segmented, the apical segment much narrower and longer than the penultimate. (Simla, India). . .... .*dilatata* Brunetti

2. The posterior lateral margins of the ninth sternum extend well beyond the apices of the claspers, usually the lobes are about two times longer than the claspers (fig. *1b*.). 4

The claspers extend as far as, or well beyond the apices of the ninth sternum (fig. 4*b*) 3

3. The claspers about as wide as long, nearly quadrate in shape and extend only as far as the apices of the ninth sternum (fig. 4*b*). Ninth tergum not forcipate (fig. 4*a*). (Upper Assam, India).... .*intercedens* sp. nov.

Claspers at least two times longer than wide and pointed at apices ; the posterior lateral margins of the sternum not strongly lobate and reach scarcely half way to the apices of claspers. Ninth tergum strongly forcipate, the lateral lobes slender and well developed. (Malabar Coast S. W. India) .. .. .*malabarana* Hardy

4. Posterior lateral margins of ninth sternum strongly forcipate, the lobes about two times longer than the remainder of the sternum. At its narrowest point (opposite the bases of the claspers) the ninth sternum is about equal in length to the extended claspers. (Assam).... ... .*pullata rubicunda* var. nov.

Not as above, the posterior lateral lobes not as long as the remainder of the sternum and the sternum, at its narrowest point two or more times longer than the claspers.. 5

5. Claspers club-shaped and with an irregular basal lobe (fig. 3*b*). Posterior median margin of ninth sternum with a large projection which has a " V " shaped concavity at its apex. Ninth tergum as in figure 3*a*. (Northern India). .*impostor* Brunetti.

Not as above.. 6

6. Claspers terminating in a sharp beak-like point on their inner apices, (fig. *6b*), see (Hardy, 1949). The median process on the hind margin of the ninth sternum two times wider than one of the claspers and terminates in a slight point. (Kumaon, India). .. . . . .*tecta* Hardy.

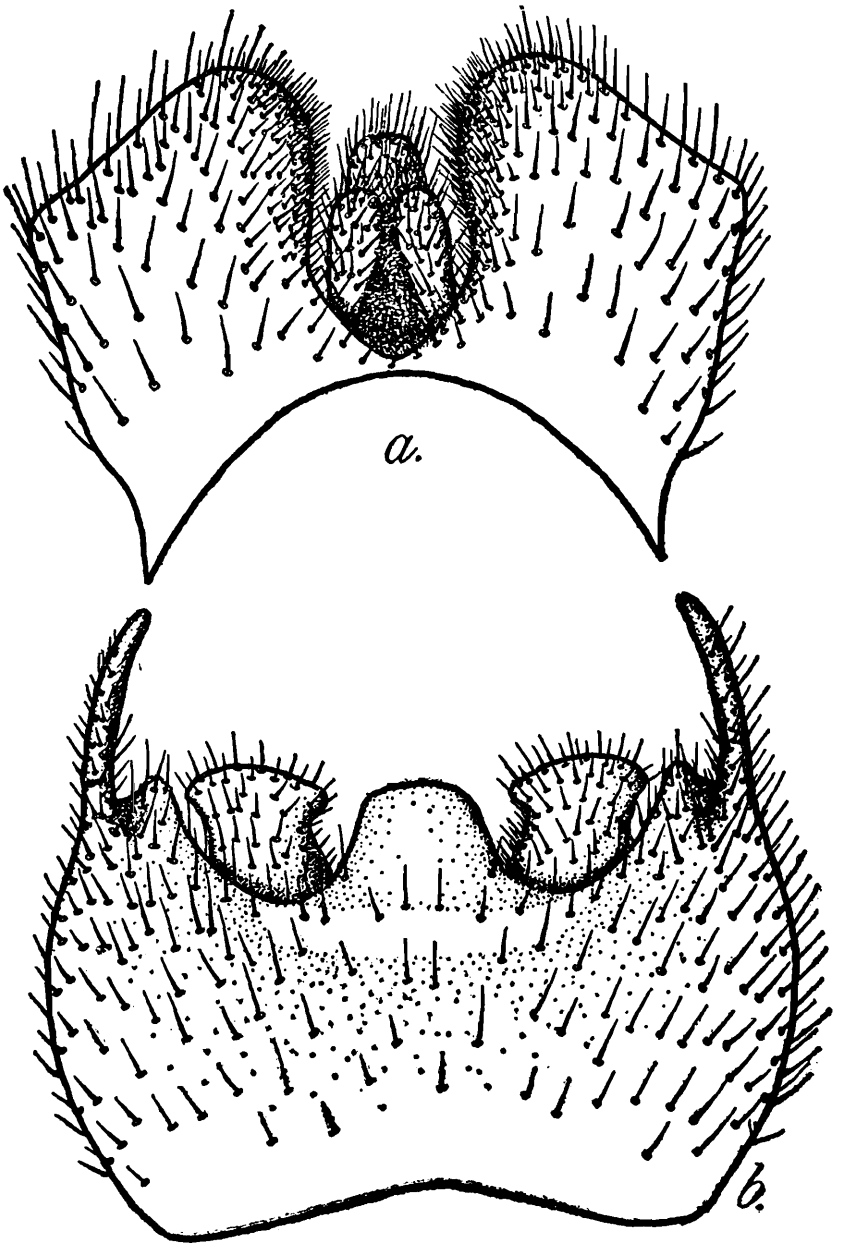
Not as above ; the median process on the sternum rounded at its apex and about as broad as a clasper. 7

7. Posterior lateral margins of ninth tergum strongly tapered to acute points (fig. 5*a*). (Kumaon and Assam, India). .*neglecta* sp. nov.

Posterior lateral margins rounded, not at all narrowed (fig. *1a*). (South-western India) . . ..*decepta* sp. nov.

Plecia decepta, sp. nov.

This species is closely related to *Plecia neglecta* sp. nov., it is distinguished by the differences in the male genital structures. The ninth tergum is very differently developed than in *neglecta*. The tergum is nearly divided into two plates by the deep concavity of the hind margin; a definite sclerotized bridge, however, joins the two side pieces. The posterior lateral margins are very broadly rounded (fig. 1*a*) and not extended into a slender lobe as in *neglecta* (fig. 5*a*). From a ventral view the genitalia are very similar in the two species, except for portions



TEXT-FIG. 1.—*Plecia decepta*, sp. nov.
a. ninth tergum of male; *b*. male genitalia, ventral view.

of the tergum which are visible from below. The posterior lateral margins of the sternum are extended into long slender arms in both species, these appear to be slightly more elongate in *decepta* than in *neglecta* as shown in the figures 1*b* and 5*b*. The claspers and the other characteristics of the sternum are very much alike in both species.

In other details this species fits the description of *P. impostor* Brunetti and *neglecta* sp. nov.

Length: body, 4·0 mm.; wings, 4·7 mm.

Female: The dorsum of the thorax is almost entirely rufous. The anterior margin of the mesonotum and the humeral ridges are just slightly discolored with brown. One female at hand, which was collected at the same time as a male at Coimbatore, has three rather broad brown to black longitudinal stripes extending part way down the dorsum. These stripes are separated by the mesonotal furrows. This is obviously an aberrant specimen and is not being designated as a paratype. The pleura of the typical *decepta* females are chiefly rufous and not extensively brown or black.

Length: body, 4·0—4·8 mm.; wings, 4·7—5·3 mm.

Holotype male, allotype female: Mormugao, Goa, India (J. C. Bridwell), seven paratypes, two females and five males from the following localities: same as type; near Poona, Purandhat, India, Circa 3,500 ft., October 17, 1927 (Col. E. P. Jewell—B. M. 1925-50), and Coimbatore, South India, December 9, 1947 (P. Susai Nathan).

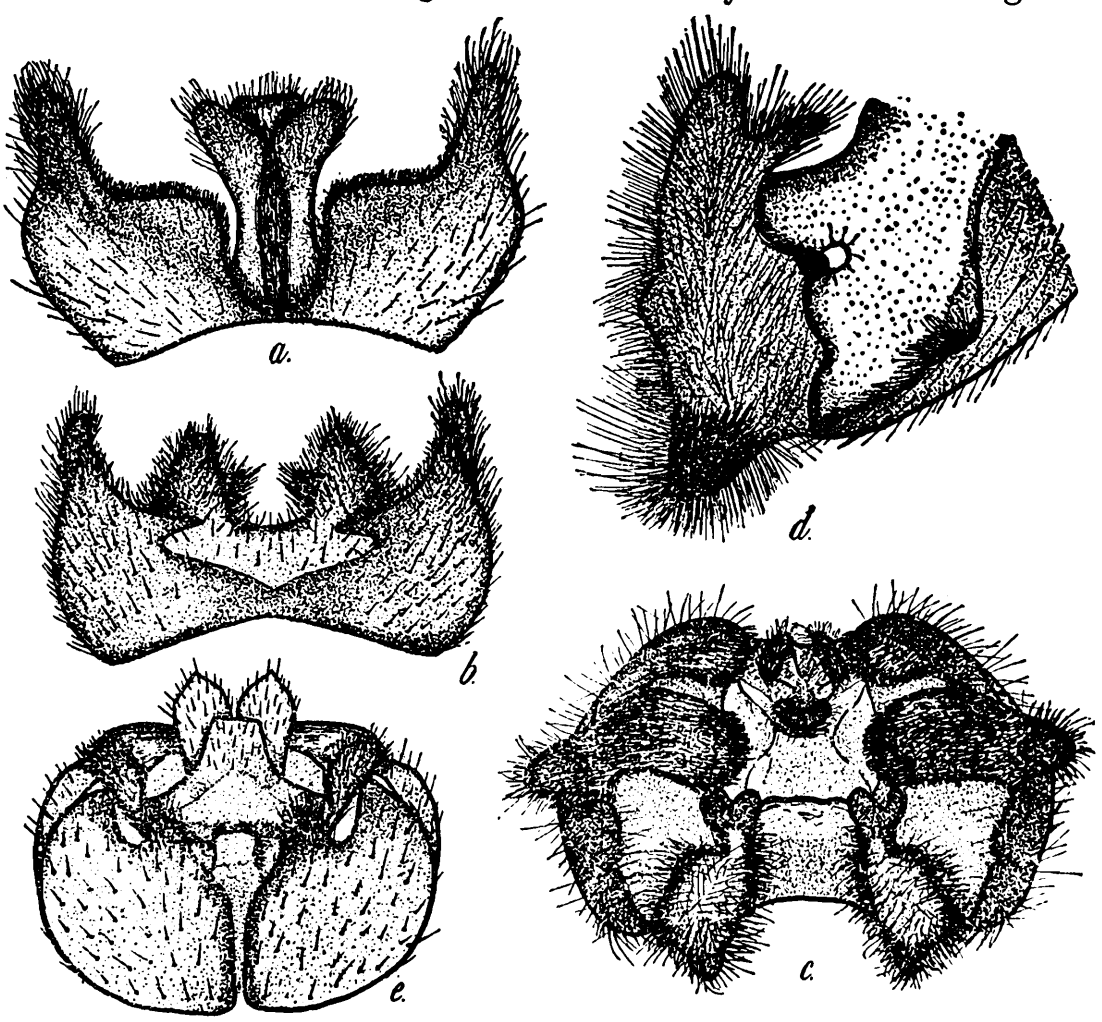
Holotype, allotype and two paratypes returned to the United States National Museum; two paratypes are in the British Museum (Natural History); two are in the B. P. Bishop Museum, Honolulu, T. H., and one is at the University of Hawaii.

Plecia gressitti, sp. nov.

This species belongs to the group of *Plecia* which have the top portion of the thorax rufous and the remainder of the body brown to black in colour. It is related to *P. pullata* Hardy from India and is distinguished from this and all the other known species by the male genitalia. The development of the clasping structures, ninth sternum and ninth tergum, as shown in the figures, is very different from that of the related forms.

Male: *Head*: Antennae nine segmented, and predominantly brown to black in colour; the scape and pedicel are tinged with rufous. The antennal segments are distinctly separated and not compact. The apical segment is globose in shape and almost equal in length to the penultimate segment. The rostrum folds tightly against the face and is not conspicuous. *Thorax:* Mesonotum and scutellum entirely rufous, remainder of thorax and the halteres black, tinged with brown. Thorax chiefly bare, with an inconspicuous patch of fine black hairs on the upper portions of the sternopleura and on the humeri and with some scattered brownish hairs along the mesonotal furrows. *Legs*: All black and densely covered with rather long black hair. The femora are moderately swollen on their apical portions. The tibiae and tarsi are not at all swollen, their sides are straight or nearly so. The hind metatarsi are seven to eight times longer than wide. *Wings*: Dark smoky brown fumose; the stigmata are just slightly darker brown than the remainder of the wing membrane. Vein R_3 straight, forming an angle of about 75° with R_{4+5}. The section of vein M_{1+2} from the r-m crossvein to the furcation is almost two times longer than the r-m crossvein. Vein Cu_1 is bent downward at its apex but the cubital cell is not strongly narrowed. *Abdomen*: Entirely black, densely covered with dark colored hairs.

Genitalia: The ninth sternum is about two times wider than long and is cleft about half its length on the hind margin. The lobes of the posterior lateral margins are acutely pointed but do not extend to the apices of the lateral lobes of the tergum (fig. 2*b*). The claspers are very conspicuous and densely black pilose. From a direct ventral view each clasper has a large obtuse lobe which extends beyond the apices of the lateral lobes of the sternum. There is also a small lobe developed on the inner side of each clasper near the lower edge (fig. 2*b*). The claspers appear to be fused with the median margin of the ninth sternum on their inner bases. From an end view, or when the genitalia are tilted back, the claspers are seen to extend back into the genital chamber beyond the inner edge of the



TEXT-FIG. 2.—*P. gressitti*, sp. nov.
a. male genitalia, dorsal; *b.* genitalia, ventral; *c.* genitalia, end view; *d.* right clasper of male; *e.* female genitalia, ventral.

sternum. The inner portion of each clasper is bilobed at its apex. The outer lobe is sharp pointed (fig. 2*d*). The claspers do not appear to be movable and the inner developments appear to act as supporting structures around the aedeagus. The ninth tergum is cleft almost to its base, it has a broad 'U' shaped concavity in the middle of the hind margin. The posterior lateral margins of the tergum are produced into rather slender lobes, subacute at apices (fig. 2*a*).

Length: body, 6·0 mm.; wings, 6·3 mm.

Female: Similar in most details to the male, the pleura are, however, usually distinctly tinged with rufous. In some female specimens the sternopleura are largely rufous with just brownish discolorations over the

remainder of the pleura. The antennae are eleven segmented, all the joints are very distinct except for the last two which are closely joined. The apical segment is small and nipple-like. The front possesses a rather strong tubercle in the middle just behind the antennae and has a moderately developed carina down the center. The ocellar tubercle is well developed and the compound eyes are sparsely covered with short pile. *Female genitalia* : The ninth tergum is three or more times wider than long and is semimembranous in the anterior median portion with a narrow sclerotized bridge along the posterior margin. The posterior lateral margins are developed into moderately long densely pilose lobes. The cerci are longer than wide and slightly pointed at apices. On the inner side each lateral margin of the tergum is developed into a flattened ridge which extends to the egg laying orifice. The eighth sternum is completely divided into two plates. Each is just slightly wider than long and is developed into a short obtuse lobe on its inner posterior margin (fig. 2*e*).

Length: body, 6·5—7·0 mm.; wings, 8·0—8·5 mm.

Holotype male and allotype female: Kwangtang, South China. Koon-Yam-Kok, on river between Wai-Chow and Ho-Yun, April 6, 1940 (L. Gressitt and F. K. To). Eight paratypes, three males and five females: six, same data as type, April 6, 1940, and May 4-5, 1934 (F. K. To); one from Hainan Is., South China, Faan-na, 9 mi. so. of Nodoa, Tan-hsien Dist., July 10-11, 1932 (F. K. To) and one from Tonkin, Mt. Bavi, 800-1000 m., VII-1941 (A. deCooman).

Holotype, allotype and four paratypes returned to the California Academy of Sciences; one will be returned to Musèe Heude, Shanghai; one is in the Bishop Museum collection, Honolulu, T. H., and two are being deposited in the U. S. National Museum collection.

Plecia impostor, Brunetti.

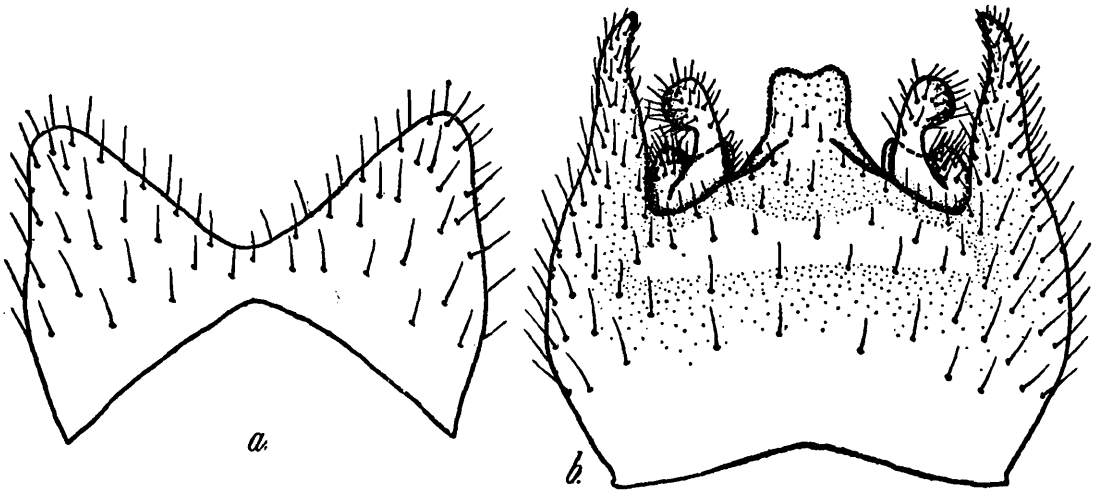
Plecia impostor Brunetti, 1912, *Rec. Ind. Mus.* vii, p. 446.

The status of this species has been most controversial and it has been impossible to accurately place it until after the type was restudied. The late Dr. F. W. Edwards had apparently studied the type and he left, at the British Museum (Natural History), some rough sketches of the dry genitalia and of the wing venation. These were reproduced and sent to the writer by Mr. Paul Freeman. The sketches did not show enough detail, however, and were of no value in placing this species. Four species were present in the British Museum under the name *impostor* none of these was correctly identified.

As is typical of the complex the body is predominantly brown to black except for the posterior two-thirds to three-fifths of the mesonotum which is orange to rufous; the antennae are also nine segmented. The male genital structures are strikingly different from those of the related species and will distinguish *impostor* from all known species of *Plecia*. Brunetti stated that *impostor* closely resembled *Penthetria melanaspis* Wied., that the whole insect is black except the hind part of the mesonotum which is rufous. His statement is misleading, the mesonotum of the type is not so extensively blackened as he has indicated.

Male genitalia: The ninth tergum is one and one-half times longer than wide, and is rather deeply concave on both the anterior and posterior margins but the sclerotized bridge joining the two lateral lobes is broader than that of *neglecta* and other related species (fig. 3*a*). The ninth sternum is developed into an elongate, slender, lobe on each posterior lateral margin. The median margin is produced into a prominent projection which extends as far as the apices of the claspers; the apex of this median process is very slightly concave and its apical edge is finely serrated. The claspers are conspicuous and terminate in a moderately large club-like head (fig. 3*b*). The claspers also possess an irregular basal lobe which arises from the dorsal side. *Thorax*: The anterior two-fifths of the mesonotum is black. This black coloration extends along the sides of the mesonotum to the postalar calli. The scutellum is dark reddish brown to black. *Wings*: Brownish fumose and with venation as in other species of the group except that the cubital vein appears to bend more sharply downward near its apex; the cubital cell at the wing margin is approximately equal in width to the length of the m-cu cross-vein.

Length: body, 5·0 mm.; wings, 6·2 mm.



TEXT-FIG. 3.—*P. impostor* Brunetti.
a. ninth tergum of male; *b*. male genitalia, ventral.

Female: Fitting the description of the male except for genital characters, the slightly larger size, eleven segmented antennae and chiefly rufous scutellum.

Length: body, 6·5 mm.; wings, 8·2 mm.

Type locality: Airadeo, Kumaon, India, 6880 feet.

Type in the Zoological Survey of India.

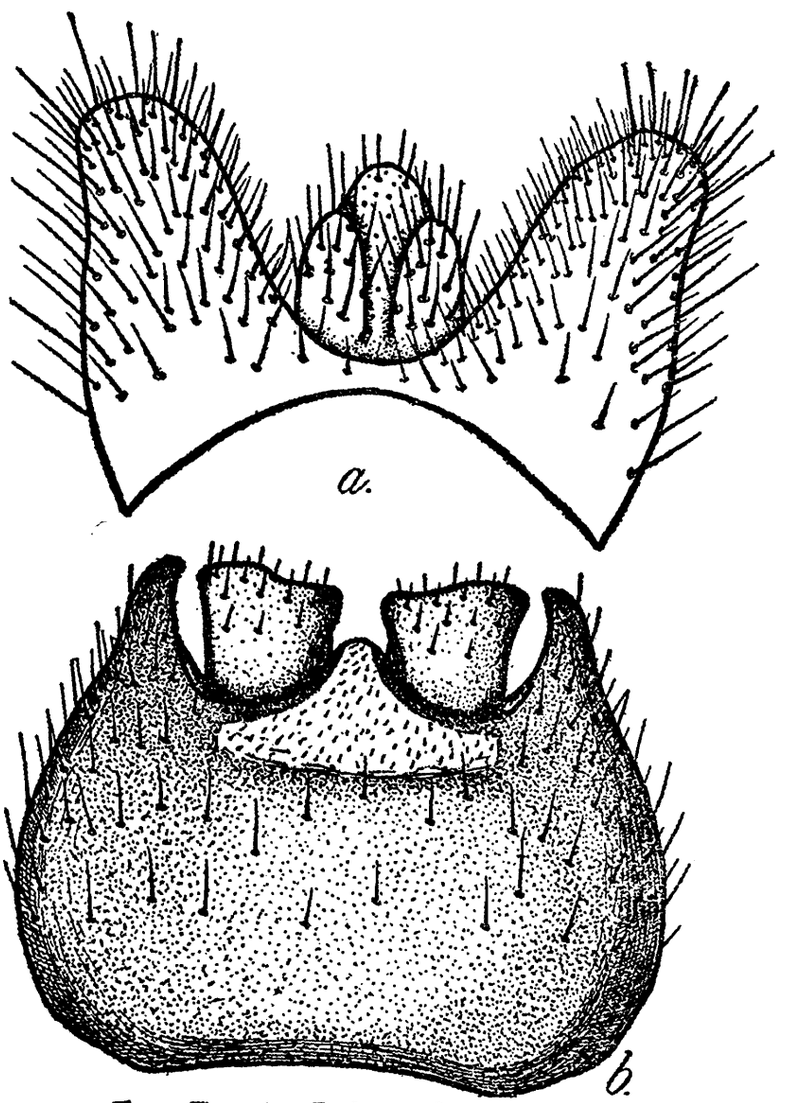
The writer has studied the type and a cotype and large series of specimens from the following localities: 6-10 mi. N. of Tinsukia, Assam, India, June 1944 (D. Elmo Hardy) (these were taken in the jungle which borders the Brahmaputra River), and Simla, N. W. India, August-September, 1898 (C. G. Nurse, B. M. 1934-8).

Plecia intercedens, sp. nov.

This species apparently belongs to the *impostor* complex although the discoloration of the front margin of the mesonotum is indistinct. The

genital characters certainly indicate that it is rather closely related to *impostor* Brunetti. This may possibly be the species which Brunetti* considered to be *tergorata* Rondani. The latter species occurs in Borneo and does not extend into India.

P. intercedens appears more closely allied to *P. decepta* sp. nov. than to any other species. It is distinguished by the inconspicuous discoloration of the front margin of the mesonotum and by male genital characters. The characteristic shape of the ninth sternum and the claspers will readily



Text-Fig. 4.—*P. intercedens*, sp. nov.
a. ninth tergum ; *b*. male genitalia, ventral.

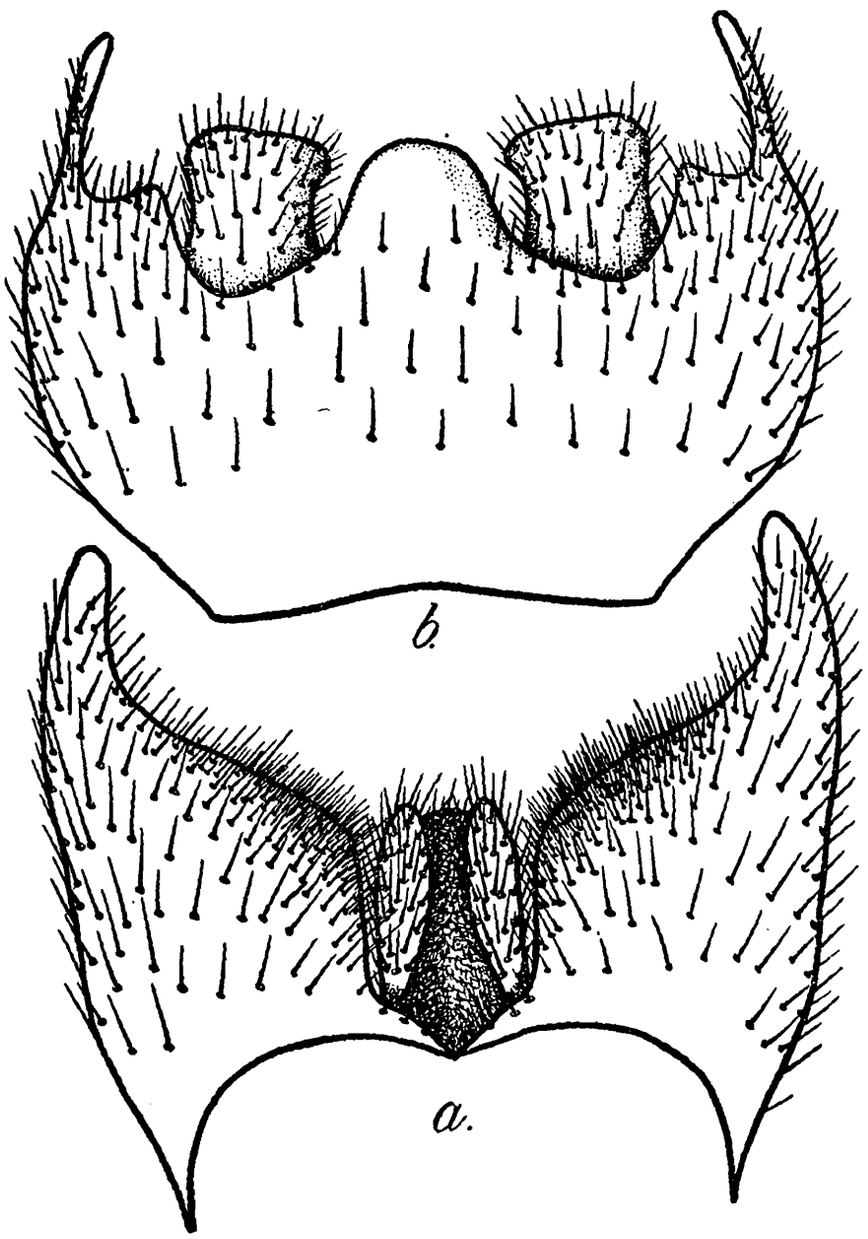
separate it. The claspers are nearly quadrate in shape and are about as wide as long. The posterior lateral margins of the ninth sternum are sharply pointed but the apices do not extend beyond the tips of the claspers (fig. 4*b*). The ninth tergum is also different in shape than it is in *decepta*. The posterior margin is more broadly " U " shaped, and the posterior lateral lobes are rounded (fig. 4*a*), not truncate at their apices.

The antennae are broken in the male specimen at hand ; the scape and pedicel are black and tinged with rufous at their apices. The females have

*Brunetti The Fauna British Ind. Diptera Nematocera, p. 27, 1912, *Rec. Ind. Mus* vii, p. 446, 1925.

eleven segments in the antennae. The apical segment is small and nipple-like, it is scarcely half as long as the penultimate segment. The mesonotum of the male is chiefly rufous, the anterior margin is discolored with brown. The scutellum is rufous and the pleura are predominantly brown to black. In the female the mesonotum is all rufous and the pleura are extensively rufous. The wings are brown fumose and the venation is the same as in other species of this group.

Holotype male, allotype female and three female paratypes : Doom Dooma, Assam, India, April 22—May 23, 1943 (D. E. Hardy).



TEXT-FIG. 5.—*P. neglecta*, sp. nov.
a. ninth tergum ; *b.* male genitalia, ventral.

Type, allotype and one paratype returned to the United States National Museum. One paratype in the B. P. Bishop Museum, Honolulu, T. H., and one at the University of Hawaii.

Plecia neglecta, sp. nov.

This species was considered, by the writer, to probably be *impostor* Brunetti. Previous to the restudy of the type this is the only species of

the group, besides *Plecia tecta* Hardy, which had been seen from the Kumaon District of India.

The species is readily distinguished from others of the complex by the characteristics of the male genitalia. It is separated from *P. impostor* Brun. by the slender, long pointed, posterior lateral margins of the ninth tergum (fig. 5*a*) ; by the deep " U " shaped cleft in the middle of the hind margin of the tergum ; by the very slender posterior lateral margins of the ninth sternum (fig. 5*b*) and the much broader and shorter claspers. The median process on the hind margin of the ninth sternum is broadly rounded in *neglecta* (fig. 5*b*) and is concave in *impostor* (fig. 3*b*). The claspers are simple in *neglecta*, no basal lobe is developed as in *impostor*.

Length : body and wings, 4·0—5·0 mm.

Holotype male and allotype female, Chabua, Assam, India (about 30 mi. N. E. of Dibrugarh, Lakhimpur District), October 10, 1943 (D. E. Hardy). Twenty-five paratypes, eleven males and fourteen females : same data as type, June 1943—April 1944 (D. E. Hardy) ; Doom Dooma, Assam, May 1943 (D. E. Hardy) and Tanakpur, U. P.—India, November, 1949 (N. D. Waters).

Holotype, allotype and fourteen paratypes returned to the United States National Museum. Paratypes are being deposited in the following museums : British Museum (Natural History) ; Bishop Museum, Honolulu, T. H. ; Zoological Survey of India and University of Hawaii.

Plecia pullata rubicunda, var. nov.

A male specimen is at hand which fits in the *impostor* complex because of the predominantly red mesonotum, with only the anterior portion darkened ; it also has the nine segmented antennae which is typical of most members of this group. The genitalia are identical with those of *P. pullata* Hardy* and it is obviously just a red colored variety of this. Typical *pullata* are entirely opaque black with just a faint reddish tinge in the ground colour of the thorax. *P. pullata* var. *rubicunda* has the mesonotum all rufous with the anterior portion slightly discoloured with brown. The variety *rubicunda* also appears to be smaller than typical *pullata*.

Length : body, 6·0 mm. ; wings, 7·0 mm.

Female unknown.

Holotype male. Lower Ranges N. Khasi Hills, Assam, " 1878, 96-135 (A. Chennell)".

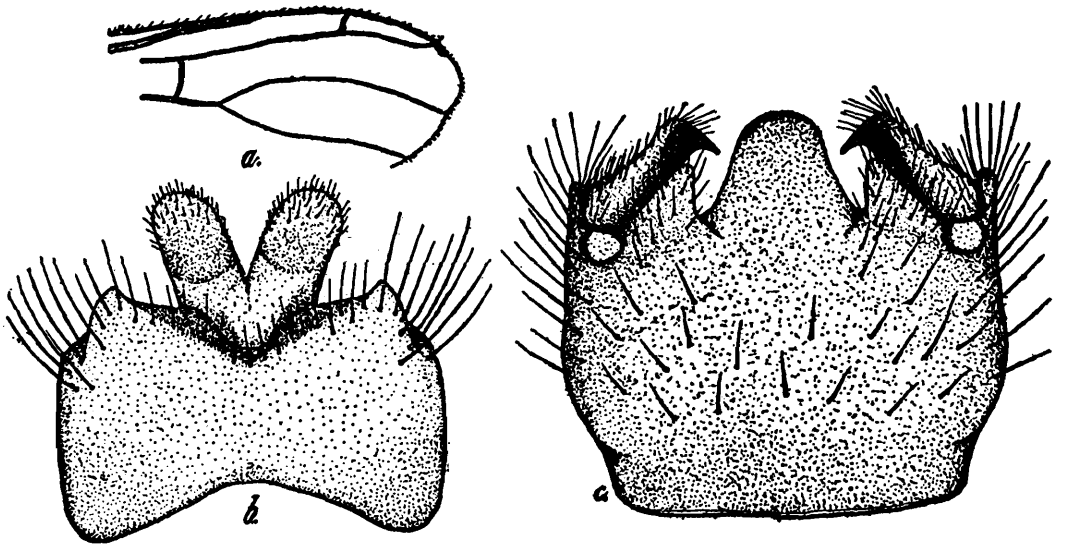
Type returned to the British Museum (Natural History).

Plecia septenrionalis, sp. nov.

This species belongs to the *aterrima* Brunetti complex but the male genitalia will distinguish it from all known species of *Plecia*. The species is characterized by its all black coloring, by the short vertical vein R_3 of the male and by the male genitalia as described and figured below.

*Hardy, D. E., *Musée Heude*, 13 (I), pp. 7-8, 1949.

Male. Head: The antennae are broken in the specimen at hand. The rostrum is poorly developed and scarcely protrudes beyond the oral margin. *Thorax*: Opaque brown to black, faintly dusted with grayish pollen; sparsely covered with black hairs. The mesonotal furrows are poorly developed, no distinct grooves are present. *Legs*: Dark brown to black, covered with black hairs. The segments are proportioned as in typical *Plecia*. *Wings*: smoky brown fumose, slightly darker along the costal margin. Vein R_3 is very short and almost vertical in position (fig. 6*a*). Vein R_{4+5} (that portion of Rs beyond the forking off of R_3) is about one-half as long as Rs between the r-m crossvein and R_3. *Abdomen*: Opaque black, with black pile. *Genitalia*: The ninth tergum is about one and one-half times broader than long and its hind margin is somewhat undulated and has just a small " U " shaped concavity in the middle (fig. 6*b*). The posterior margin of the tergum is broad and shelf-like and the inner edge folds in towards the aedeagus. The mound-like supporting structure which surrounds the aedeagus extends almost to the apices of the claspers. The claspers are large, conspicuous, and



TEXT-FIG. 6.—*P. septenrionalis*, sp. nov.
a. apex of wing; *b*. ninth tergum of male; *c*. genitalia, ventral.

each terminates in a rather slender, inward directed, beak-like point (fig. 6*c*). A pair of conspicuous lobes are developed on the posterior margin of the sternum just inside the bases of the claspers. The posterior lateral margins of the sternum are developed into small lobes (fig. 6*c*).

Length: body, 6·0 mm.; wings, 6·8 mm.

Female: Very similar to the male in general details except that vein R_3 is moderately curved and vein R_{4+5} is approximately equal in length to that portion of Rs between the r-m crossvein and the forking off of R_3.

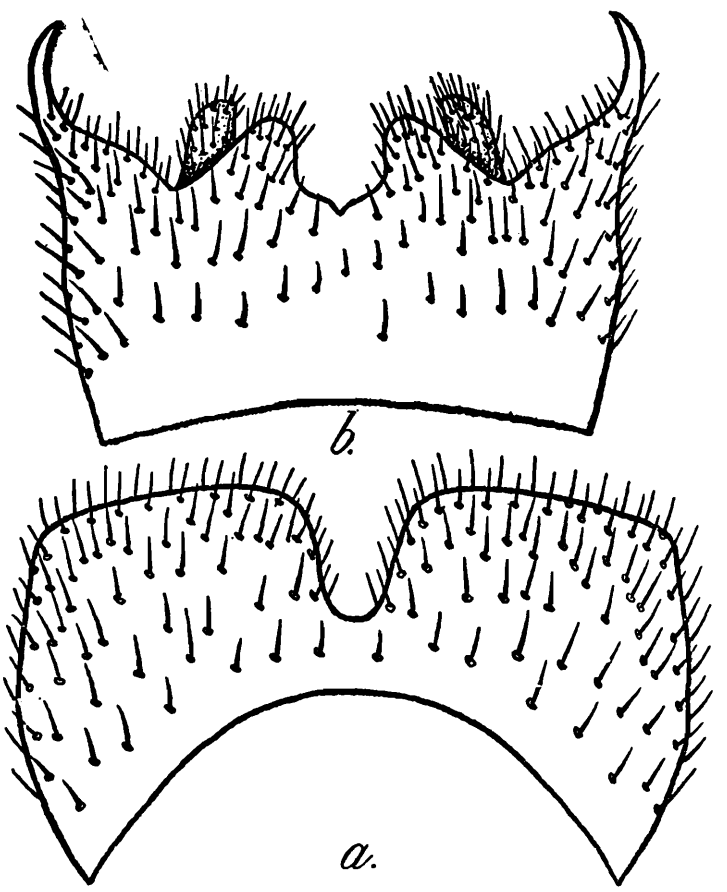
Holotype male and allotype female: Mandchourie, Prov. Kirin, Kao-lin-tze, July 6-10, 1939 and July 2, 1940 (M. Volkoff).

Both are to be returned to *Musee Heude*, Shanghai, China, when conditions permit.

Plecia siamensis, sp. nov.

This species is distinguished from all others of the *fulvicollis* complex (those species which have the entire thorax rufous) by its very characteristic genitalia.

Male. Head: Antennae chiefly brown to black, basal segments yellowish. Each is made up of nine, distinctly separated, segments. The ocellar tubercle is well developed. *Thorax:* Entirely bright orange, mesonotal furrows not very deep. Halteres dark brown to black. *Legs*: Black, densely black pilose. The femora are moderately enlarged towards their apices, the tibiae are not at all swollen. *Wings:* Smoky fumose, stigma and costal margin brown. Vein R_3 nearly straight, forming a 75° angle with R_{4+5}. Petiole of cell M_1 slightly longer than the m crossvein. Cubital cell wide open. *Abdomen:* Brown to black,



Text-Fig. 7.—*P. siamensis*, sp. nov.
a. ninth tergum; *b.* genitalia, ventral.

faintly shining and rather densely black pilose. *Genitalia:* Ninth tergum about two times wider than long and with a narrow " U " shaped cleft extending about one-half the length of the segment on the hind margin (fig. 7*a*). The ninth sternum has the posterior lateral margin produced into a pair of very slender, sharply pointed lobes. The median margin also has a pair of lobes, these are short and broadly rounded and are separated by a broadly " V " shaped concavity. The claspers are very small and simple (fig. 7*b*).

Length: body and wings, 6·0 mm.

Female. Antennae eleven segmented. Front lightly grayish, frontal ridge moderately developed, the tubercle just above the antennae is

very prominent and usually reddish coloured. The wings are more brownish gray fumose than in the male.

Length: body, 6·0 mm.; wings, 9·0—9·6 mm.

Holotype male and allotype female: Koh Chang Is., Aug. 2, 1929 (W. R. S. Ladell). Two paratype females: Talum, Siam, Jan. 20, 1902 (H. C. Robinson and N. Annandale).

Type, allotype and one paratype returned to the British Museum. One paratype deposited in the U. S. National Museum.

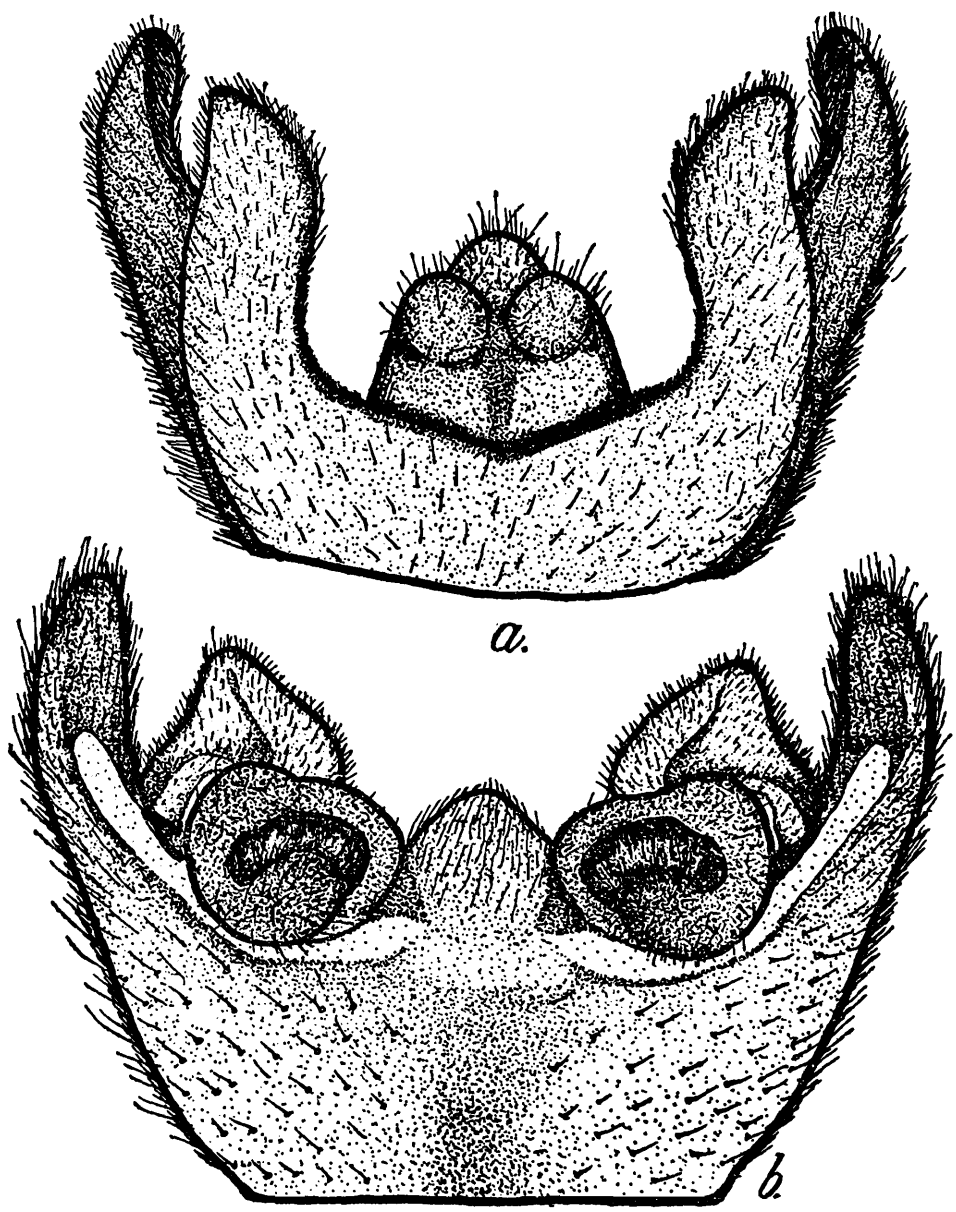
Plecia sinensis, sp. nov.

This species is related to *P. tergorata* Rondani but is readily distinguished by the male genital characters. The hind margins of the ninth tergum and sternum are not strongly forcipate as in *tergorata* and the clasping structures are very different in form. The shape of the claspers will characterize this species from all other *Plecia* known to the writer.

Male.—General colour dark brown to black, with the top of thorax entirely rufous. The pleura are largely blackish but the sternopleura are rufous tinged. The middle femora are very faintly tinged with rufous at their bases. *Head:* Rostrum moderately developed, extending about as long as the antennae but folded against the under side of the face when in resting position. Antennae nine segmented; the apical segment is small and scarcely over half as long as the penultimate segment. *Thorax:* Colour as described above, almost devoid of pile and with conspicuous mesonotal furrows. Halteres brown to black, the extreme bases are tinged with yellow. *Legs:* Densely covered with short dark coloured hairs. Femora moderately thickened on their apical portions. Tibiae slightly thicker on their apical portions but not noticeably swollen. Tarsal subsegments not at all swollen, the hind basitarsi are six times longer than wide. *Wings:* Yellowish brown fumose, darker along the costal margin. The stigma is concolorous with the other membrane in the costal region. Vein R_3 straight, forming about an 80° angle with R_{4+5}. Vein R_3 arises at the basal one-third of the distance along the radial sector from the r-m crossvein to the wing margin. The petiole of cell M_1, that portion of vein M_{1+2} from r-m crossvein to the furcation, is just slightly longer than the r-m crossvein. *Abdomen:* Dark brown to black, covered with dark coloured pile. *Genitalia:* The ninth sternum is developed into a moderately long lobe on each posterior lateral margin. These lobes are about equal in length to the remainder of the segment (fig. 8*b*). The claspers are very irregular in shape, they are large and rather circular in general outline. The inner portion is hollowed out in the middle so that it forms a heavily sclerotized ring which extends around the back part of a ventral median lobe (fig. 8*b*). The ninth tergum also has the posterior lateral margins lobate. The concavity between the two lobes extends two-thirds to three-fourths the length of the tergum (fig. 8*a*).

Length: body, 6·0 mm.; wings, 7·0 mm.

Female. Fitting the description of the male in most respects. The antennae are eleven segmented, counting the small nipple-like tip. The front is distinctly carinated; the carina is most prominent just above the antennae. The ocellar tubercle is well developed. The female genitalia are very similar to those of *P. gressitti*. The anal region is, however, more elongate, and rounded at the apex, and the cerci are rounded at their apices.



Text-Fig. 8.—*P. sinensis*, sp. nov.
a. ninth tergum; *b.* genitalia, ventral.

Length: body, 6·5 mm.; wings, 8·5 mm.

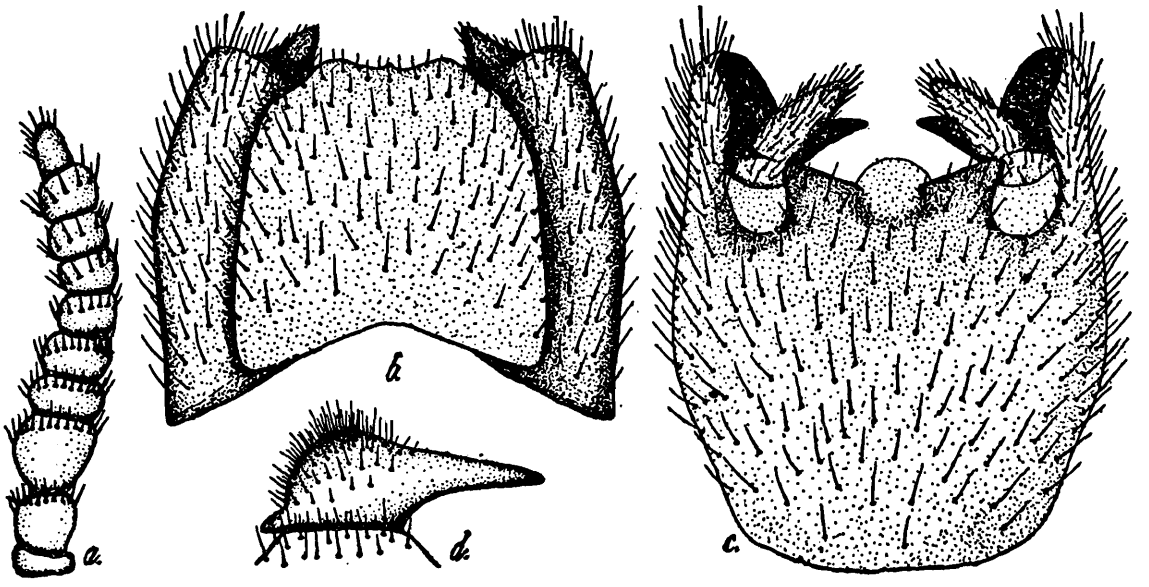
Holotype male and allotype female: Fukien, South China, Yen-Ping, Nan-Ping District, June and July, 1933 (D. C. Ngu). One paratype male from Ouyuen.

Holotype and allotype returned to the California Academy of Sciences. The paratype will be returned to Musee Heude, Shanghai.

Plecia yunnanica, sp. nov.

This species is related to *Plecia aterrima* Brunetti and fits Brunetti's original description in all details. *P. yunnanica* is distinguished from

aterrima by the characteristics of the male genitalia. The ninth segment of *P. yunnanica* is much more slender, not so broad as in *aterrima*. The ninth sternum is longer than wide and the tergum is about as long as wide. The posterior median margin of the ninth tergum of *yunnanica* has a small projection in the middle (fig. 9*b*). From a dorsal view the median portion of the ninth sternum is hidden by the posterior edge of the ninth tergum and the claspers are rather inconspicuous (fig. 9*b*). In *aterrima* the hind margin of the ninth sternum and the claspers are plainly visible from dorsal view. The posterior lateral margins of the ninth sternum are more strongly developed in *yunnanica* than in *aterrima*. They extend well beyond the apices of the claspers in the former (fig. 9*c*) and are much shorter than the claspers in the latter. The claspers of both species terminate in a long point on their inner apices (fig. 9*d*). The apical segment of the antenna appears to be more slender in *yunnanica* (fig. 9*a*) than in the specimens of *aterrima*



TEXT-FIG. 9.—*P. yunnanica*, sp. nov.

a. antenna of male; *b*. genitalia, dorsal; *c*. genitalia, ventral; *d*. male clasper, inside view.

which the writer has studied. As in *aterrima*, the male antennae possess ten segments and the female antennae are twelve segmented.

Male length: body, 9·0 mm.; wings, 9·5 mm.

Female length: body, 11·0 mm.; wings, 12·0 mm.

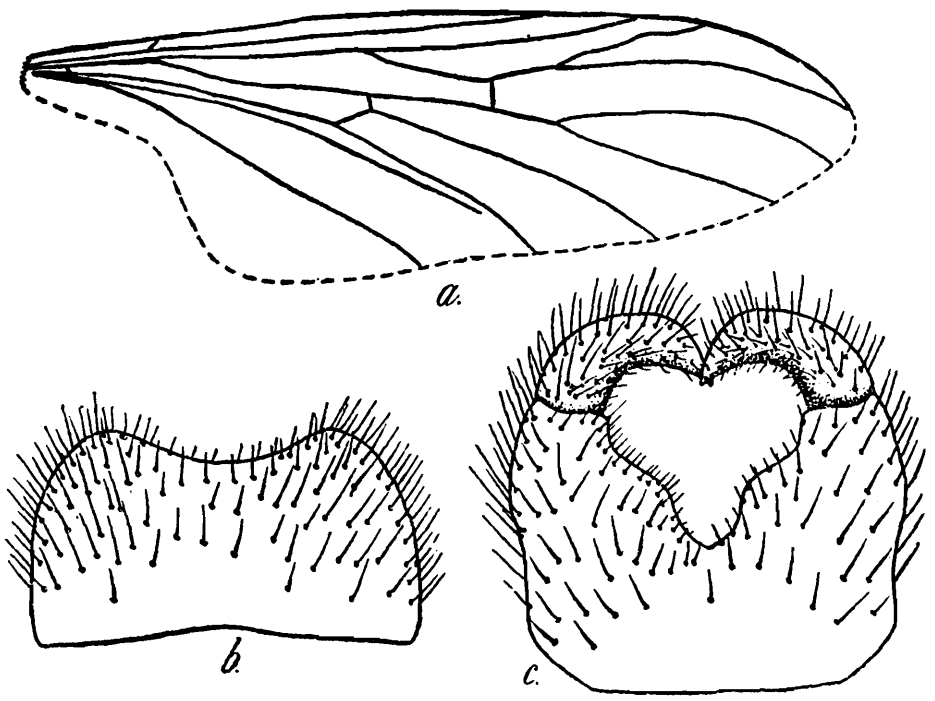
Holotype male and allotype female: *Yunnan*, 1918, (G. Forrest) M. J. Mansfield Coll. B. M. 1950-244.

Both have been returned to the British Museum (Natural History).

Penthetria formosana, sp. nov.

This species is related to *Penthetria takeuchii* Okada. It differs as follows: The body is entirely black; the antennae are twelve segmented. Vein R_3 is curved and only about one-half as long as vein R_{4+5}; vein M_{1+2} forks well beyond the r-m crossvein and the basal section of $_{+4}$ is only one-half as long as the m-cu crossvein.

Male: Rather slenderly built species, all black in colour except for the faintly reddish tinge in the legs and the red humeral ridges. Pile all black, short and rather sparse. *Head:* Eyes with sparse, microscopic hairs. Ocellar tubercle well developed, ocelli yellow. *Thorax:* Opaque, except for the lower portion of the sternopleura which are highly polished. *Legs:* All segments slender, femora and tibiae but slightly enlarged at their apices. The hind metatarsi are five to six times longer than wide. *Wings:* Yellowish fumose, stigmata and anterior margin of each wing brownish. Vein R_3 somewhat undulated, not straight. The section of the radial sector from the crossvein to the fork is two or more times longer than the r-m crossvein. The forking of M_{1+2} is opposite the forking of R_3 and R_{4+5} and the second section of M_{1+2} is also two times longer than the r-m. The m-cu crossvein is two to



Text-Fig. 10.—*Penthetria formosana*, sp. nov.

a. wing; *b.* ninth tergum; *c.* genitalia, ventral.

three times longer than the basal section of M_{3+4} (fig. 10*a*). *Abdomen:* Subshining black in ground colour, densely covered with grayish pubescence and with a moderate amount of short dark hairs. *Genitalia:* The ninth tergum is about two times wider than long and is gently concave on its hind margin (fig. 10*b*). The sternum is about as broad as long and is cleft about half its length on the hind margin. The claspers are rather strongly curved inwardly and are acutely pointed at apices (fig. 10*c*).

Length: body, 7·5—8·0 mm.; wings, 7·5—7·8 mm.

Female unknown.

Holotype male and one paratype male: Hassenzan, Formosa, June 26, 1934 (L. Gressitt).

Both returned to the Museum of Comparative Zoology.

NOTES ON FISHES FROM RAJASTHAN, INDIA.

By Bhagwan Behari Lal Mathur, *Department of Zoology, University of Delhi, Delhi.*

(Received on 12th February 1952.)

Introduction.

In 1941 and 1948, the Zoological Survey of India conducted surveys of Rajputana (Rajasthan) to study its fish fauna, particularly of the Aravalli Range. The 1941 collection was made by Drs. B. N. Chopra and M. L. Roonwal and that of 1948 by Mr. K. S. Pradhan. They visited the States of Udaipur, Jodhpur, Sirohi and Palanpur and collected fishes from rivers, streams, waterfalls, tanks and pools. When I started research work in the Department of Zoology, University of Delhi, at the request of Dr. M. L. Bhatia, these fishes were sent to the Department of Zoology by Dr. S. L. Hora, Director, Zoological Survey of India, for my study and training in systematic ichthyology. This paper embodies the results of study of these two collections.

Description of Localities, with lists of Fishes collected from each.

1. *Soorpur ki nadi* (*River Soorpur*), *3 miles from Dungarpur town* (*Dungarpur State*). *26-10-1941.*

Barbus (*Tor*) *khudree* Sykes. *Labeo calbasu* (Ham.).

2. *Tanks and pools around Dungarpur town* (*Dungarpur State*). *28-10-1941.*

Chela clupeoides Bloch.

3. *Rajsamand near Kankroli ; the former is about 20 miles from Mavli Camp. 27-2-1948.*

The water is clear with plenty of aquatic vegetation ; it is more or less stagnant and is about 2 feet deep.

Chela clupeoides Bloch
Rasbora daniconius (Ham.)
Barilius bendelisis Ham.
Barbus (*Tor*) *khudree* Sykes.
Barbus (*Puntius*) *ticto* (Ham.).

4. *River Phulad, about 1 mile south of Phulad Railway Station. 1-3-1948.*

The current of this river is moderately swift flowing over a sandy bottom with small pebbles at certain places ; depth is about one and a half feet, with very little aquatic vegetation.

Esomus danricus (Ham.).
Barbus (*Puntius*) *sophore* Ham.
Garra mullya (Sykes).
Nemachilus denisonii Day.
Rasbora daniconius (Ham.).
Barbus (*Puntius*) *ticto* (Ham.).
Nemachilus botia Ham.
Ophicephalus punctatus Bloch.

5. *River Phulad, about one and a half miles south-east of Phulad Station. 1-3-1948.*

The river has clear water flowing over a bed of stones and pebbles ; no vegetation of any kind and the depth varies from 9 inches to 1 foot.

Rasbora daniconius (Ham.).
Barbus (Puntius) ticto (Ham.).
Garra mullya (Sykes).
Labeo boggut (Sykes).
Nemachilus botia Ham.
Nemachilus denisonii Day.
Mastacembelus armatus (Lacep.).

6. *Pools along the course of Kothian Jharna downward and westward of Pipli Yard. 2-3-1948.*

The pools are with rocky bed, have plenty of vegetation, especially algae, on the stones and the water is clear.

Garra mullya (Sykes).
Nemachilus denisonii Day.

7 *A place 5 yards away from the mouth of a stream issuing at the foot of a hill near Pipli village, about 18 miles east of Phulad. 2-3-1948.*

The stream is of moderately swift current flowing over a bed of stones with comparatively few pebbles and sand ; there is no vegetation and the depth is about one foot.

Nemachilus denisonii Day.

8. *Jogmandi Jharna about 12 miles east of Phulad station. 3-3-1948.*

The place of collection consisted of a shallow pond along the zig-zag course of a stream of rather swift current with very little vegetation.

Garra mullya (Sykes).
Nemachilus denisonii Day.

9. *Trevor Tal, Mount Abu, Sirohi State. 7-3-1948.*

The bottom of this tank is rocky and pebbly. Water is clear with no vegetation. Depth is considerable.

Garra mullya (Sykes).
Nemachilus denisonii Day.

10. *Jag Vilas palace tank, Mount Abu, Sirohi State. 7-3-1948.*

The water of this tank is clear having a depth of about six feet to eight feet. The bottom is rocky with slight mud mixed with sand.

Barbus (Puntius) sophore Ham.
Ophicephalus punctatus Bloch.

11. *A nala near Dilwara temple, Mount Abu, Sirohi State. 7-3-1948.*

This nala is fed by the water of Trevor Tal. Bottom is pebbly, gravelly and sandy with no vegetation. The nala is quite shallow.

Barbus (Puntius) sophore Ham.
Garra mullya (Sykes).
Nemachilus denisonii Day.

12. *Kudra Dam, Mount Abu, Sirohi State. 8-3-1948.*

The water is quite clear with rocky bottom having no aquatic vegetation. Depth is considerable.

Garra mullya (Sykes).

13. *Bendermere lake, Mount, Abu, Sirohi State. 8-3-1948.*

The water of this lake is stagnant and clear on a rocky bottom. Depth is more than 12 feet.

Danio devario (Ham.).
Barbus (Puntius) sophore Ham.

14. *Kudra Nala, Mount Abu, Sirohi State. 9-3-1948.*

This nala is near the Abu Cart Road. The depth varies from nine inches to one and a half feet. The bottom is rocky and pebbly. There are no water weeds, except some algae growing on stones.

Garra mullya (Sykes).

15. *Gora chapra nala, Mount Abu, Sirohi State. 10-3-1948.*

This nala is about 2 miles east of Dak-Bungalow. The bed of this nala is rocky, gravelly and pebbly and at places with plenty of mud mixed with sand.

Danio devario (Ham.).
Garra mullya (Sykes).
Nemachilus denisonii Day.

16. *River Banas near Wadaval (Palanpur State). 12-3-1948.*

This place is about six miles from Deesa Dak-Bungalow. The current of the water is swift, flowing over a sandy bed. The water is clear with no vegetation. Depth varies from 1 foot to 5 feet.

Chela clupeoides Bloch.
Barbus (Puntius) sophore Ham.
Labeo boggut (Sykes).
Glossogobius giuris (Ham.).
Barilius bendelisis Ham.
Labeo boga (Ham.).
Cirrhina reba (Ham.).

17. *River Banas (Near Akhol), about 2 miles from Deesa Dak-Bungalow. 13-3-1948.*

The bottom here is sandy with water weeds at the edge, otherwise the water is clear. The current is swift. Depth is from one and a half feet to two feet.

Chela clupeoides Bloch.
Barilius bendelisis Ham.
Barbus (Puntius) ticto (Ham.).
Labeo boggut (Sykes).
Danio devario (Ham.).
Barbus (Puntius) sarana (Ham.).
Labeo boga (Ham.).
Labeo nigripinnis Day.

18. *Deep-pool at Gakwar, about one mile from Deesa Dak-Bungalow. 14-3-1948.*

The bottom of this pool is sandy ; the water is very clear.

Barbus (Puntius) sarana (Ham.).
Barilius bendelisis Ham.
Labeo boggut (Sykes).

19. *Wadaval (Palanpur State), about 7 miles west of Camp Deesa. 15-3-1948.*

Depth of this varied from three feet to six feet.

Danio devario (Ham.).
Labeo nigripinnis Day.

20. *A stream about 2 miles north of Palanpur guest house. 15-3-1948.*

The current of this stream is rather swift with aquatic vegetation all along its course ; bottom is fairly sandy.

Lepidocephalichthys guntea Ham.
Ophicephalus punctatus Bloch.

21. *Balaram river, about 10 miles from Palanpur. 16-3-1948.*

The current of the river is swift, flowing over a rocky, pebbly and sandy bottom. The water is clear and its depth varied from two feet to eight feet. Aquatic vegetation is only at the edges of the river.

Rasbora daniconius (Ham.).
Barbus (Puntius) amphibius (C. V.).
Cirrhina reba (Ham.).
Lepidocephalichthys guntea (Ham.).
Nemachilus denisonii Day.
Mastacembelus armatus (Lacép.).
Barilius bendelisis Ham.
Barbus (Puntius) ticto (Ham.).
Labeo nigripinnis Day.
Nemachilus botia (Ham.).
Ophicephalus punctatus Bloch.

Systematic list of the species, with their known range of distribution.

Name of species.	Range of distribution.
Family : Cyprinidae.	
Sub-family : *Abramidinae.*	
1. *Chela clupeoides* Bloch . . .	Cutch, Peninsular India Vindhya-Satpura Mountains, Chota-Nagpur and Burma.
Sub-family : *Rasborinae.*	
2. *Barilius bendelisis* Ham. . . .	Throughout India.
3. *Danio devario* (Ham.)	All over Northern India.
4. *Esomus danricus* (Ham.) . . .	Throughout India.
5. *Rasbora daniconius* (Ham.) . . .	Widely distributed in the Oriental Region.
Sub-family : *Cyprininae.*	
6. *Barbus (Puntius) amphibius* (C. V.) .	Ceylon, Peninsular India and the Satpura-Vindhya mountains.
7. *Barbus (Puntius) sarana* (Ham.) .	Ceylon, India, Burma and S. China.
8. *Barbus (Puntius) sophore* Ham. .	India, Burma and S. China.
9. *Barbus (Puntius) ticto* (Ham.) . .	Ceylon, India, Burma and Siam.
10. *Barbus (Tor) khudree* Sykes . . .	Ceylon, Peninsular India and the Satpura-Vindhya Mountains.
11. *Cirrhina reba* (Ham.)	Throughout India.
12. *Garra mullya* (Sykes)	Peninsular India, Satpura-Vindhya mountains and the Chota-Nagpur plateau.
13. *Labeo boga* (Ham.)	Throughout India and Burma.
14. *Labeo boggut* (Sykes)	Peninsular India, Central Provinces (Satpura Vindhyas) and Malaya.
15. *Labeo calbasu* (Ham.)	India and Burma. Also known from China.
16. *Labeo nigripinnis* Day . . .	"Sind hills and rivers at their bases" Day.
Family : *Cobitidae.*	
17. *Lepidocephalichthys guntea* (Ham.) .	Ceylon, India and Burma.
18. *Nemachilus botia* Ham. . . .	Ceylon, India and Burma.
19. *Nemachilus denisonii* Day. . . .	Western-ghat, Satpura-Vindhya trend of mountains and the Chota Nagpur plateau.
Family : *Gobiidae.*	
20. *Glossogobius giuris* (Ham.) . . .	India, Burma and Further East.
Family : *Ophicephalidae.*	
21. *Ophicephalus punctatus* Bloch . .	India, Burma and Malaya.
Family : *Mastacembelidae.*	
22. *Mastacembelus armatus* (Lacép.)	Ceylon, India, Burma and Further East.

Palaeogeographical Observations regarding the Aravalli Hills Based on the Distribution of Fishes.

The fish fauna of Rajasthan, as reported above, can be divided into the following groups from a zoogeographical point of view :—

Group 1.—Species distributed throughout India, Burma and further east.

1. *Rasbora daniconius* (Ham.).
2. *Barbus* (*Puntius*) *sarana* (Ham.).
3. *Barbus* (*Puntius*) *sophore* Ham.
4. *Barbus* (*Puntius*) *ticto* (Ham.).
5. *Labeo boga* (Ham.).
6. *Labeo calbasu* (Ham.).
7. *Lepidocephalichthys guntea* (Ham.).
8. *Nemachilus botia* Ham.
9. *Glossogobius giuris* (Ham.).
10. *Ophicephalus punctatus* Bloch.
11. *Mastacembelus armatus* (Lacép.).

Group 2.—Species distributed throughout India.

1. *Bardius bendelisis* Ham.
2. *Esomus danricus* (Ham.).
3. *Danio devario* (Ham.).
4. *Cirrhina reba* (Ham.).

Group 3.—Species so far known from the Sind hills.

1. *Labeo nigripinnis* Day.

Group 4.—Species found all over the Peninsula, the Satpura-Vindhya trend of mountains and the Chota-Nagpur plateau.

1. *Chela clupeoides* Bloch.
2. *Barbus* (*Tor*) *khudree* Sykes.
3. *Barbus* (*Puntius*) *amphibius* (C. V.).
4. *Garra mullya* (Sykes).
5. *Labeo boggut* (Sykes).
6. *Nemachilus denisonii* Day.

Of the 22 species listed above, 11 are widely distributed in India, Burma and further east ; 4 are distributed all over India : 6 are found all over Peninsular India, including the Western ghats, the Vindhya-Satpura Mountains and the Chota-Nagpur plateau, while one is restricted to the Sind Hills. Of these, species widely distributed in the Oriental Region or in India proper are of little significance for a study of the Zoogeography of the Aravalli Hills and, therefore, need not be taken into consideration here. The occurrence of the fishes of the Sind Hills and of the Deccan Plateau in the Aravalli Hills, however, needs further consideration.

Owing to the folding movements that took place with the rise of the Himalayas, it is well-established fact that the northern portion of the Peninsula sagged and the Himalayas actually rode over it. Auden (1935) has discovered the Aravalli rocks on the northern face of the Himalayas indicating thereby that in that region Aravallis must have been secondarily lifted up. In referring to the above palaeogeographical findings, our purpose is to indicate that the Aravallis during the more recent geological epochs tilted towards the north and in this process carried the fauna of the Peninsula, more particularly of the Satpuras, northwards. Owing to the foredeep in front of the Himalayas and the possibility of a large river flowing through it, this Peninsular fauna could not extend to the Himalayas and, for the same reason, the Himalayan fauna could not spread to the Aravallis. The absence of any characteristic Himalayan species in the Aravallis is very significant in this connection. The common species of the plains could, however, become widely distributed in this process. It will thus be seen that the distribution of fishes in the Aravallis is more or less similar to what Hora (1949) had already observed in the case of the Rihand River fishes of the Kaimur Range, north of the Vindhyas in the Mirzapur District of U. P.

There is a sunken ridge below the desert areas of Rajasthan and Sind which once connected the Aravalli Hills with the Sind Hills through the Sangla Hills in the Punjab (Auden, 1950, 18). The occurrence of *Labeo nigripinnis* in such widely separated areas as the Sind Hills and the Aravalli Hills today indicates that once its range would have been continuous over the sunken ridge.

CONCLUSION.

The fish fauna of the Aravalli Hills has not yet been systematically investigated or thoroughly studied. The collection dealt with here shows very clearly that their study can be of great value in understanding the palaeogeography of this region.

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AUDEN, J. B., 1950.—Introductory report on the ground-water resources of western Rajasthan. *Bull. Geol. Surv. India* (B), pp. 1-59.

HORA S. L., 1949.—The fish fauna of the Rihand river and its Zoogeographical significance. *J. Zool. Soc. India*, 1, pp. 1-7.

A NEW SPECIES OF THE GENUS *MELANIA* FROM THE COROMANDEL COAST OF INDIA (MOLLUSCA, GASTROPODA: FAMILY MELANIIDAE).

By H. C. Ray, *M.Sc., D. Phil., Assistant Zoologist, Zoological Survey of India, Jabakusum House, Calcutta.*

(Received on 15-2-1952.)

Introduction.

In 1949, I published a paper dealing with a large collection of Molluscs[1] obtained from the Coromandel Coast of India. Amongst the material listed therein, there were six specimens of the genus *Melania* which had been misplaced by the Varuna flood of 1943 at Banaras. Fortunately, those missing specimens were found when the unnamed spirit collection of the Zoological Survey of India was being sorted out and rearranged after the re-transfer of the office from Banaras to Calcutta.

The characters displayed by the shells appeared so peculiar and interesting that they could hardly be assigned to any of the known forms. So, being desirous of ascertaining the exact identity, I sent all the specimens to Dr. W J. Rees of the British Museum (Nat. Hist.), London, for identification. He was kind enough to refer them to *Melania siamensis* Brot. This identification aroused some suspicion in my mind which prompted me to consult the original paper of Dr. Brot with a view to know the details about that species recorded from Raheng in Siam (1886)[2]. Strangely enough, after carefully examining both the description and figures of *siamensis* I found that the specimens concerned could not be assigned to that species on account of the colouration and sculpture being markedly different. Moreover, a careful comparison of the shells in question with two identified specimens of *M. siamensis* in our named collection also pointed to the same conclusion. So, in order to demonstrate clearly the remarkable difference in shape and sculpture between these two types of shells I have spared no pains to reproduce here the original figures of *siamensis* Plate 1, figs. 7, 8 side by side with those of the specimens before me which may justify their separate specific ranks rather than indicating their exact identity. Now, I intend to designate the specimens in question as *Melania blisteri*, for having on the surface of the shells characteristic blister-like granules of varying shape and size.

I offer my cordial thanks to Dr. W. J. Rees of the British Museum, London, for the trouble he has so kindly taken in examining the specimens. Thanks are also due to Sri A. K. Mondal for drawing the figures with care and attention.

[1] Ray, H. C. *Rec. Ind. Mus.* XLVI, pp. 87-122 (1949).
[2] Brot, A. *Rec. Zool. Suisse*, IV, pp. 90-92, pl. vii, figs. 3, 3a, 3b (1886).

Melania blisteri, sp. nov.

(Plate I, Figs. 1 to 6 & 1a to 6a).

Shell medium, solid, dextral, oblong-conical, decollated, brownish in colour, adorned on the surface with very fine regular close concentric striae together with a few thick and reddish-brown vertical lines of growth here and there, but more remarkable is the presence of numerous distinct blister-like granules varying greatly in shape and size and most irregularly distributed too, gradually increasing in number with growth; whorls 4 to 5, regularly increasing in size, slightly convex—bodywhorl being the largest of all, tumid, obliquely angular below—the angular area found encircled with a narrow band of lighter hue (starting from the upper end of the aperture and ending dorsally at the middle of the margin of the outer lip), and its length (varying from 11 mm. to 13 mm.) appearing to exceed that of the spire (measuring 8·5 mm. to 11·5 mm.) ; suture somewhat pronounced ; columella thick, whitish, oblique in the middle but straight and produced below somewhat-like that of *M. siamensis ;* outer lip thin, slightly expanded below but curving inwards unites with the inner lip forming an obtuse angle there—the degree of angulation may vary according to the nature of downward projection of both the columella and outer lip ; aperture oval, longer than broad, anterior end much more narrowed and acutely angled, interior white—the brown band on the bodywhorl may be faintly visible from inside.

Measurements in Millimetres.

Serial No. of Shells.	Length of Shell.	Breadth of Shell.	Length of Bodywhorl.	Breadth of Bodywhorl.	Length of Aperture.	Breadth of Aperture.
1 . .	19 mm.	10 mm.	11 mm.	8·5 mm.	9·5 mm.	5 mm.
2 .	19 mm.	9 mm.	11 mm.	9·5 mm.	8 mm.	5 mm.
3	20 mm.	9·5 mm.	11·5 mm.	10·5 mm.	9·5 mm.	5 mm.
4 .	21 mm.	10 mm.	12 mm.	10 mm.	9 mm.	5 mm.
5 . .	21·5 mm.	9·5 mm.	11·5 mm.	11 mm.	9 mm.	5·5 mm.
6 .	22·5 mm.	10 mm.	13 mm.	11·5 mm.	10 mm.	6 mm. *(Holotype)*

Type-locality. Coromandel Coast of India.
Holotype. Reg. No. M 16129/2. Zool. Surv. Ind.
Paratypes. Reg. No. M 16130/2. Zool. Surv. Ind.

Remarks—The new species *Melania blisteri* appears remarkable for having on the surface of its shell numerous fine regular close concentric striae as well as blister-like granules of varying shape and size which are most irregularly distributed throughout. It may bear some resemblance to *M. siamensis* Brot regarding the character of the inner and outer lips as well as of the aperture. But *siamensis* seems to differ essentially from *blisteri* in having a slightly thinner shell of different shape, size and colouration (olivaceous green), with more convex whorls and stronger and prominent concentric striae intersected by the longitudinal striae—the point of intersection giving very slight indications as to the formation of fine tubercles.

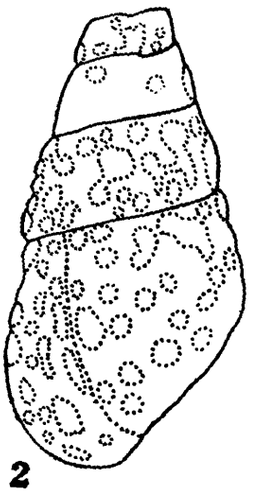
EXPLANATION OF PLATE. II.

FIGS. 1 to 6. Dorsal view of the shells of *Melania blisteri*, sp. nov. from the Coromandel Coast of India. ×3.

FIGS. 1a to 6a. Ventral view of the same. ×3.

FIGS. 7 & 8. Shells of *Melania siamensis* Brot from Raheng in North Siam (after Dr. A. Brot). ×1½.

1



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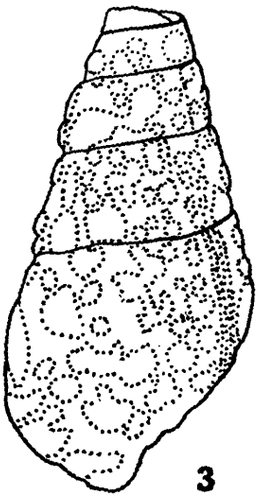

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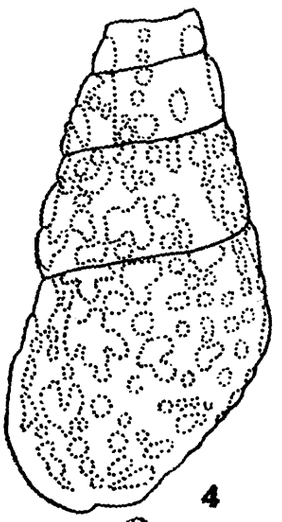

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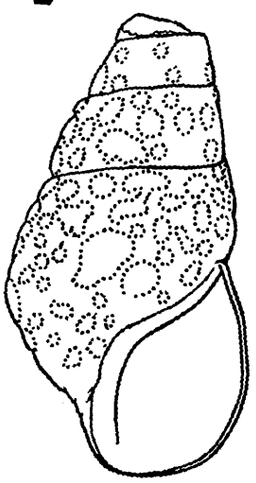

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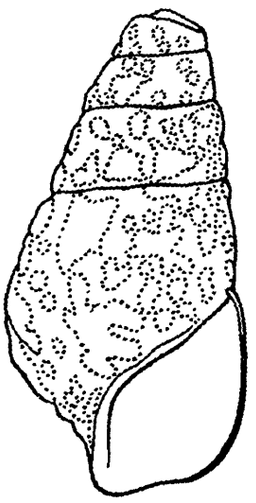

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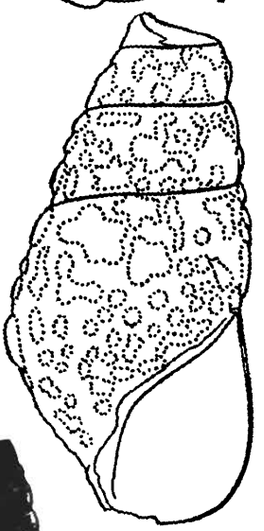

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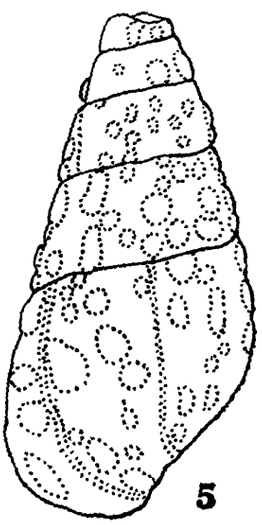

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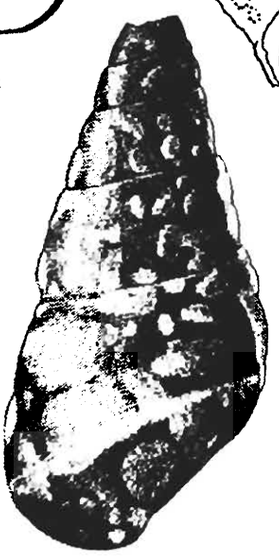

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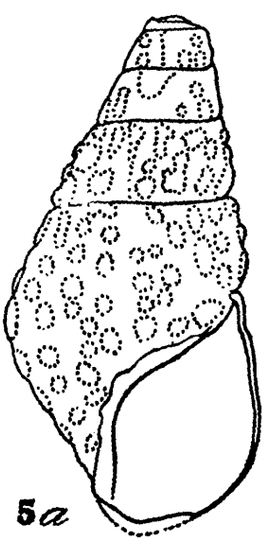

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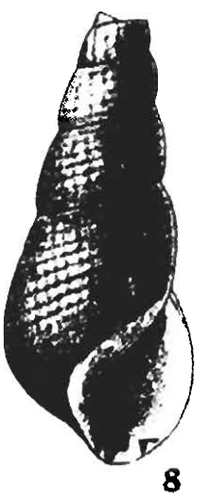

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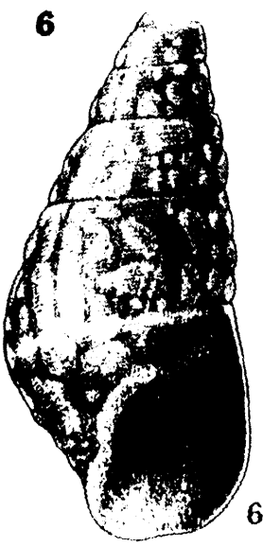

6a

TAXONOMIC STUDIES ON SOME INDIAN CHIROPTERA.

By H. KHAJURIA, *M.Sc., Zoological Survey of India, Indian Museum, Calcutta.*

Received on 16 February 1952.

1. INTRODUCTION.

The present report is based on a number of small collections of spirit preserved bats in the possession of the Zoological Survey of India. The specimens have been collected from all over India and the adjoining countries in various seasons. Important variations and detailed measurements of body parts and skulls of twenty forms in all are presented in this paper. Geographical distributions of some of the forms, namely, *Taphozous melanopogon* Temminck, *Scoteinus pallidus* (Dobson), *Myotis caliginosus* (Tomes), *Pipistrellus mimus glaucillus* Wroughton, and *Kerivoula crypta* Wroughton, have been elucidated. Some light has also been thrown on the breeding seasons of *Cynopterus sphinx gangeticus* Andersen and *Megaderma lyra lyra* Geoffroy. The principal works followed during the study are Miller (1907), Andersen (1912), Wroughton (1918), Chasen (1940), and Simpson (1945).

Care has been taken to take measurements of only those body parts which could suffer but a negligible contraction due to the action of the preservative. The following abbreviations have been used in the measurements.—

BODY.

d2(mt), metacarpal of second digit ; *d2(ph1)*, first phalanx of second digit ; *d2(ph2)*, second phalanx of second digit ; *d3(mt)*, metacarpal of third digit ; *d3(ph1)*, first phalanx of third digit ; *d4(mt)*, metacarpal of fourth digit ; *d4(ph1)*, first phalanx of fourth digit ; *d5(mt)*, metacarpal of fifth digit ; *d5(ph1)*, first phalanx of fifth digit ; *f*, forearm ; *ft*, foot ; *p*, pollex ; *p(mt)*, metacarpal of pollex ; p(*ph1*), first phalanx of pollex ; *t*, tibia.

SKULL.

c1-c1, the shortest distance between the outer surfaces of the roots of the upper canines ; *cb*, condylobasal length, measured from the hindermost point of the occipital condyle of one side to the anteriormost point of the premaxilla* of that side ; *c1-m1*, maximum length between the anterior surface of the root of the upper canine and the posterior surface of the root of the first upper molar of that side ; *c1-m3*, similar distance between the upper canine and the upper third molar ; c_1-m_3, similar distance between the lower canine and the third lower molar ; *cr*, coronoid height, measured from the highest point of the mandibular condyle to the lowermost point on the under surface of the mandibular ramus of that side ; *cw*, cranial width, the maximum width of the cranium measured just above the squamosal roots of the zygomatic arches ; *iw*, the least interorbital width, measured between the inner borders of the orbits at right angles to the axis of the skull ; *l*, maximum length of the skull, measured from the hindermost point of the occipital surface in the middle line to the anteriormost point of the premaxillary symphysis or of the maxilla if the premaxillae are absent ; *mdo*, median depth of the occiput, measured from the highest point on the upper surface of the occiput to the lowermost point on the lower border of the foramen magnum ; *ml*, mandibular length

* Maxilla is substituted where premaxilla is absent.

the distance between the hindermost point of the mandibular condyle to the anteriormost point on the symphysis of the two rami ; *m1-m1*, the distance between the outer surfaces of the last upper molars ; *m3-m3*, the distance between the outer surfaces of the third upper molars ; *on*, occipitonasal length, measured from the hindermost point of the occiput to the anteriormost point on the nasals ; *pl*, palatal length, measured from the posterior border of the root of the upper incisors to the hindermost point of the palate ; *pml*, postmolar length, measured from the posterior surface of the last molar to the posterior surface of the condyle of that side ; *zw*, the greatest zygomatic width, the greatest distance between the outer surfaces of the zygomatic arches at right angles to the axis of the skull.

All the measurements are in millimeters and represent the shortest distances between the two points defined.

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2. SYSTEMATIC ACCOUNT.

Suborder *MEGACHIROPTERA*

Family PTEROPODIDAE

Subfamily *PTEROPODINAE*

Cynopterus sphinx gangeticus Andersen.

1910. *Cynopterus sphinx gangeticus* Andersen, *Ann. Mag. Nat. Hist.* (8)VI, p. 623 (Lucknow).

6♂, 10♀, and 1 sub-ad. ♀.—Uttar Pradesh (United Provinces): Lucknow (18-21 March, 1945), Banaras (4 June 1948). 1♂ and 1♀—Madhya Pradesh (Central Provinces) : Nagpur (1949).

*Measurements.**

Abbreviations of measurements.	Males.		Females.	
	Lucknow.	Nagpur.	Lucknow.	Nagpur.
Body.				
.	72·7-77·3(75·3) .	77·0	70·2-77·3(73·6)	70·7
p(mt)	9·9-11·4(10·4) .	13·5	9·1-12·2(10·2)	10·3
p(ph1) .	14·3-18·5(17·0) .	15·7	14·7-18·3(17·2)	15·7
d2(mt) .	32·6-36·6(34·6)	35·5	29·1-35·6(33·3)	30·7
d2(ph1) .	8·5-10·3(9·4)	9·5	8·4-10·1(9·4)	8·7
d2(ph1) .	6·2-7·7(6·9) .	6·9	5·2-7·6(6·7)	5·6
d2(mt) .	48·0-52·2(49·5)	49·5	44·4-52·1(48·7)	46·0
d3(ph1)	29·7-33·7(32·0) .	32·1	28·3-33·9(31·9)	30·5
d4(mt) ..	46·2-48·5(47·9)	46·2	41·0-50·2(46·1)	42·5

*Only the adult specimens are measured. Figures in parentheses indicate mean values.

*Measurements**—contd.

Abbreviations of measurements.	Males.		Females.	
	Lucknow.	Nagpur.	Lucknow.	Nagpur.
Body—*contd.*				
d4(ph1)	21·5-26·0(23·8)	26·0	22·1-30·4(25·1)	23·2
d5(mt)	46·9-50·0(48·4)	48·2	43·3-50·7(49·2)	44·3
d5(ph1)	21·0-24·4(23·1)	23·1	21·8-24·5(22·8)	21·2
ft	15·1-17·7(16·2)	..	13·7-18·4(16·8)	13·6
t	27·4-32·2(28·6)	28·4	26·7-31·6(29·4)	27·6
Skull	(Lucknow specimens only).			
l	32·6-34·7(33·6) (4 specimens)		31·2-34·7(33·4)	
eb	31·7-33·9(33·2) (4 specimens)		30·3-33·2(31·9) (9 specimens).	
on	33·1-33·9(33·2) (3 specimens)		30·1-34·0(32·7)	
zw	20·8-22·4(21·6) (4 specimens)		20·8-22·6(21·7)	
iw	6·0-6·6(6·3) (5 specimens)		5·8-6·7(6·3)	
cw	14·0-14·6(14·3)		13·1-14·6(14·3)	
mdo	7·8-8·2(8·0)		6·9-8·4(7·6) (7 specimens).	
pml	19·3-20·6(20·0) (4 specimens)		18·7-20·0(19·5) (9 specimens).	
pl	17·2-18·6(17·9) (5 specimens)		17·3-18·7(18·0) (7 specimens).	
c1-m1	11·1-11·7(11·4)	„	10·2-12·0(11·3)	
c_1-m_2	11·8-13·7(13·0)	„	10·7-13·8(13·0)	
m1-m1	10·0-10·7(10·3)	„	9·4-10·7(10·2)	
c1-c1	6·9-7·7(7·3)	„	6·7-8·2(7·4)	
ml	25·3-26·7(26·0)	„	23·7-26·7(25·7)	
cr	14·4-13·6(12·9)	„	11·7-13·7(12·3) (8 specimens).	

The general pattern agrees with that given by Andersen (1912). The ventral side is paler than the back and the throat still paler. All the females have fully developed young ones in their uteri, indicating that the end of March or beginning of April is the time when young ones are brought forth. The male from Nagpur is very peculiar inasmuch as the tail is about 2·5 mm. This reduction does not seem to be due to any injury. An attempt was made to obtain more specimens from Nagpur, but none could be obtained with the tail reduced to such an extent. I would, therefore, consider the specimen only as an abnormal individual of the race.

Kemp (1924) recorded the sub-species from Garo Hills, Assam. His specimens were identified by Mr. Robinson of the Federated Malays States Museums, Singapore. According to the findings of the Mammal

*Only the adult specimens are measured. Figures in parentheses indicate mean values.

Survey, however, Assam falls within the range of distribution of the nominate race. As shown by measurements, there is no sexual dimorphism in size.

Cynopterus sphinx sphinx (Vahl).

1797. *Vespertilio sphinx* Vahl, *Skr. Nat. Selsk.*, IV, p. 123 (Madras).

1♂.—Bengal: Calcutta (16-12-1939). 1 sub-ad. ♂.—Madras: Bimlipatam, Dist. Vizagapatam (18-9-1947).

Measurements.—Specimen from Calcutta.—*Body : f*, 71·7 ; *p(mt)*, 8·6 ; *p(ph1)*, 14·7 ; *d2(mt)*, 30·4 ; *d2(ph1)*, 8·7 ; *d2(ph2)*, 4·8 ; *d3(mt)*, 41·7 ; *d3(ph1)*, 25·7 ; *d4(mt)*, 38·6 ; *d4(ph1)*, 20·4 ; *d5(mt)* ; 39·2 ; *d5(ph1)*, 18·7 ; *t*, 27·6.

Skull : l, 33·2 ; *cb*, 31·7 ; *on*, 32·3 ; *zw*, 21·1 ; *iw* 6·7 ; *cw*, 13·8 ; *mdo*, 8·0 ; *pml*, 19·6; *pl*, 17·7 ; *c1-m1*, 10·8 ; c_1-m_2, 12·5 ; *m1-m1*, 10·4 ; *c1-c1*, 7·3 ; *ml*, 24·5.

The male from Calcutta is darker with underside slightly paler here and there. Its rump is paler than the fore-back. The bones of its arms and digits are in highly pathological condition showing numerous swellings and constrictions.

Pteropus giganteus giganteus (Brünnich).

1782. *Vespertilio gigantea* Brünnich, *Drynes Historie*, I, pp. 45 and 59 (Bengal).

One unsexed adult skin from Goa.

Suborder *MICROCHIROPTERA*

Family Rhinopomatidae

Rhinopoma hardwickei Gray.

1831. *Rhinopoma hardwickei* Gray, *Zool. Misc.*, p. 37 ("India").

2♂.—Uttar Pradesh (United Provinces): Bainti, Pratabgarh (June, 1949).

Measurements.—*Body : f*, 59·2—62·6 ; *p(mt)*, 5·0-5·9 ; *p(ph1)*, 5·2-6·7 ; *d2(mt)*, 42·1-44·3 ; *d2(ph1)*, 4·2-5·0 ; *d3(mt)*, 43·1-46·9 ; *d3(ph1)*, 8·4-9·2 ; *d4(mt)*, 35·8-40·0 ; *d4(ph1)* 11·7-12·0 ; *d5*(mt), 42·1-45·7 ; *d5(ph1)*, 9·7-9·9 ; *t*. 28·5-29·4.

Skull : l, 18·7-19·2 ; *cb*, 17·5-18·0 ; *on* 16·4-16·7 ; *zw*, 11·5 ; *iw*, 3·0-3·1 ; *cw*, 8·2-9·0 ; *mdo*, 6·2 ; *pml*, 10·5-10·7 ; *c1-m3*, 6·4-6·7 ; c_1-m_3 7·3-7·5 ; *m3-m3*, 8·6-8·9 ; *c1-c1*, 4·7-5·1 ; *ml*, 13·0.

Jerdon (1867, p. 31) gave the length of tibia as 1½ inches (=37·5 mm.) which appears to be abnormal for the species.

Rhinopoma kinneari Wroughton.

1912. *Rhinopoma kinneari* Wroughton, *J. Bombay Nat. Hist. Soc.*, XXI, p. 767 (Bhuj, Kuchh).

1♂.—Madhya Pradesh (Central Provinces): Nagpur (August, 1949).

Measurements.—*Body : f*, 71·5 ; *p(mt)*, 5·5 ; *p(ph1)*, 7·4 ; *d2(mt)*, 51·6 ; *d2(ph1)*, 5·5 ; *d3(mt)*, 51·2 ; *d3(ph1)*, 11·5 ; *d4(mt)*, 43·2 ; *d4(ph1)*, 16·2 ; *d5(mt)*, 50·2 ; *d5(ph1)*, 11·3 ; *t*, 27·8.

Skull : l, 21·3 ; *cb*, 20·4 ; *on*, 18·5 ; *zw*, 12·5 ; *iw*, 2·6 ; *cw*, 9·2 ; *mdo*, 6·7 ; *pml*, 11·9 ; *c1-m3*, 8·5 ; *m3-m3*, 9·5 ; *c1-c1*, 5·5 ; *ml*, 15·2.

There is a large deposit of fat at the posterior hairless part of the body. Such accumulations of fat are also present in specimens from Agra and Kuchh in the collection of Zoological Survey of India. This character does not seem to have been recorded as occurring in this species.

Family EMBALLONURIDAE

Taphozous longimanus Hardwicke.

1824. *Taphozous longimanus* Hardwicke, *Trans. Linn. Soc.*, XIV, p. 525 (Calcutta).

2♂.—Madhya Pradesh (Central Provinces) : Nagpur (1949).

Measurements.—Body : f, 58·7-61·6 ; *p(mt)*, 6·2-6·3 ; *p(ph1)*, 4·2-4·7 ; *d2(mt)*, 56·6-56·8 ; *d3(mt)*, 58·6-59·8 ; *d3(ph1)*, 21·6-22·2 ; *d4(mt)*, 46·2-48·1 ; *d4(ph1)*, 12·4-12·0 ; *ft*, 10·3-11·0 ; *t*, 23·8-23·9.

Skull : l, 18·2-19·3 ; *cb*, 18·5-18·7 ; *on*, 17·6-18·4 ; *zw*, 12·3 ; *iw*, 4·8-5·2 ; *cw*, 9·7 ; *mdo* 6·7-7·3 ; *pml*, 11·4 ; *pl*, 7·6-7·7 ; *c1-m3*, 8·4-8·5 ; c_1-m_3, 9·6-9·7 ; *m3-m3*, 8·7-8·8 ; *c1-c1* 4·2-4·3 ; *ml*, 16·0-16·2.

In one of the specimens there is a large blind tubular structure with thickened border on the throat.

Taphozous melanopogon Temminck.

1841. *Taphozous melanopogon* Temminck, *Mon. Mammal.*, II, p. 287 (Java).

4♀.—Andaman Islands (4-11-1931).

Measurements.—Body : f, 59·5-64·7(62·2) ; *p (mt)*, 4·5-5·7(5·3) ; *p(ph1)*, 4·1—4·7(4·4) ; *d2(mt)*, 53·3-57·9(55·6) ; *d3(mt)*, 54·4-57·7(56·1) ; *d3(ph1)*, 2 specimens, 19·4-21·0 ; *d4(mt)* 43·4-46·8(45·9) ; *d4(ph1)*, 12·2-13·5(12·4) ; *d5(mt)*, 34·2-35·5(35·0) ; *ft*, 2 specimens, 9·6-10·7 ; *t*, 22·5-23·1(22·5).

Skull : l, 19·6-19·7(19·6) ; *cb*, 18·5-19·2(18·8) ; *on*, 18·2-18·3 (18·2) ; *zw*, 12·0-12·5(12·2) ; *iw*, 5·2-5·3(5·2) ; *cw*, 9·6-10·2(9·9) ; *mdo*, 6·9-7·1(7·0) ; *pml*, 11·2-11·5(11·4) ; *pl*, 7·3-7·7(7·5) ; *c1-m3*, 8·2-8·6(8·5) ; c_1-m_3, 9·6-9·8(9·7) ; *m3-m3*, 8·6-8·8(8·7) ; *c1-c1*, 4·0-4·4(4·2) ; *ml*, 15·6-16·1(15·9).

So far as I know, the species has not heretofore been reported from the Andaman Islands.

Taphozous kachhensis kachhensis* Dobson.

1872. *Taphozous kachhensis* Dobson, *J. Asiat. Soc.*, p. 221 (Kachh).

1♂.—Bengal : Calcutta (21-4-1939).

Measurements.—Body : f, 72·7 ; *p(ph1)*, 5·7 ; *d2(mt)*, 61·7 ; *d3(mt)*, 66·8 ; *d3(ph1)*, 26·7 ; *d4(mt)*, 53·3 ; *d4(ph1)*, 16·7 ; *d4(ph2)*, 8·3 ; *d5(mt)*, 46·8 ; *d5(ph1)*, 14·2 ; *d5(ph2)*, 8·2 ; *ft*. 13·7 ; *t*, 30·3.

Skull : l, 25·2 ; *cb*, 23·6 ; *zw*, 15·5 ; *iw*, 5·3 ; *cw*, 12·5 ; *mdo*, 7·7 ; *pml*, 14·0 ; *c1-m3*, 14·0 ; c_1-m_3, 12·5 ; *m3-m3*, 10·7 ; *c1-c1*, 5·7 ; *ml*, 20·1.

There is no accumulation of fat at the root of the tail in this specimen. This is evidently due to its collection in the beginning of summer. Certain differences from the Type Specimen, which is present in the collection of the Zoological Survey, have been noted. In the skull the occipital crest is markedly blunt and the sagittal and the occipital ridges are not developed. The size is larger and the gular pouch deeper. Due to the lack of sufficient material, however, no more useful remarks on the identity of the specimen can be given.

Family MEGADERMATIDAE

Megaderma lyra lyra Geoffroy.

1810. *Megaderma lyra* Geoffroy, *Ann. Mus., Hist. Nat.*, XV, p. 190 (East coast of Madras).

*Thomas (1922, p. 266) separated this species, along with the allied forms, to a distinct genus *Liponycteris*, but I agree with Tate (1941) that the groups can better be considered as a sub-genus.

5♂ and 4♀.—Uttar Pradesh (United Provinces) : Lucknow (21-3-1945).

Measurements.

Abbreviations of measurements.	Males.	Females.
Body.		
f	63·9-69·7(65·3)	66·2-68·3(67·2)
p(mt)	7·7-9·2(8·2)	8·7-9·7(9·2)
p(ph1)	6·8-7·7(7·2)	6·7-9·2(8·0)
d2(mt)	51·2-60·3(55·2)	56·6-58·7(58·0)
d2(ph1)	5·0-6·9(6·3)	6·8-7·7(7·4)
d3(mt)	44·8-50·4(46·8)	48·8-49·5(48·9)
d3(ph1)	25·7-28·6(26·9)	28·1-29·6(28·5)
d4(mt)	50·0-56·7(52·2)	53·5-56·3(55·2)
d4(ph1)	15·3-16·5(15·8)	15·7-16·8(16·4)
d5(mt)	55·7-61·6(58·5)	58·3-60·9(59·6)
d5(ph1)	17·3-20·5(18·3)	18·3-19·6(19·1)
ft	13·5-15·3(14·3)	14·6-16·6(15·4)
	30·4-33·9(32·2)	32·9-34·2(33·7)
Skull.		
l	26·6-27·8(27·3)	27·3-28·0(27·7)
cb	24·0-25·0(24·5)	25·1-26·1(25·5)
on	21·5-22·9(22·2)	22·2-22·7(22·5)
zw	16·1-16·8(16·4)	16·3-16·5(2 specimens).
iw	4·6-5·0(4·8)	4·7-5·0(4·9)
cw	12·0-12·6(12·3)	12·2-12·7(12·5)
mdo	7·0-7·8(7·4)	6·9-7·4(7·1)
pml	13·7-14·4(13·9)	14·0-14·6(14·3)
pl	10·0-10·6(10·3)	10·2-10·9(10·6)
c1-*m*3	10·2-11·0(10·5)	10·1-11·2(10·5)
c_1-m_3	11·7-12·3(12·1)	11·7-12·2(12·0)
m3-m3	9·6-10·1(9·4)	9·4-10·9(10·1)
c1-c1	5·5-5·9(5·7)	5·5-6·2(5·8)
ml	19·1-20·4(19·6)	19·4-20·5(19·5)

The characters of the specimens closely agree with those given by Dobson (1876) and Blanford (1891). In one of the specimens, the wing membrane originates from a point just behind the third toe and not from the first or from the space between the first and the second. The fur surrounding the bases of the ears is white and is distinctly contrasted with that on the rest of the body. On the posterior surfaces of the pinnae it extends upward for some distance. The white fur is also scattered here and there on the other parts of the pinnae, especially on the sides of the angle formed by the union of the two pinnae.

Each female has a single foetus in the uterus. This is in conformity with the observations of Hodgson (quoted by Blandord, 1891), except that the specimens examined by him were collected at the end of February. He also observed that the males greatly exceed females in number. However, out of the nine specimens examined by me, five were males. As shown by the measurements, the females appear to be slightly larger than the males.

Family HIPPOSIDERIDAE

Hipposideros fulvus Gray.

1838. *Hipposideros fulvus* Gray, *Mag. Zool. Bot.*, II, p. 492 (Dharwar).

1♂.—Uttar Pradesh (United Provinces) : Banaras (12-3-1945). 1.♂—Bombay : Panchgani, Satara (4,000′—5,000′).

Measurements.

Abbreviations of measurements.	Banaras.	Bombay.
Body.		
f	38·6	39·2
p(mt)	5·9	6·0
d2(mt)	31·1	32·0
d3(mt)	28·4	28·1
d3(ph1)	18·1	18·4
d4(mt)	29·3	29·6
d4(ph1)	11·1	11·6
d5(mt)	30·0	30·0
d5(ph1)	11·6	12·6
t	17·8	18·1
ft	6·2	6·8

Measurements—contd.

Abbreviation of measurements.	Banaras.	Bombay.
Skull.		
l	16·3	16·6
cb	14·2	14·2
on	14·9	14·9
zw	8·6	8·6
iw	2·6	2·3
ow	7·6	8·0
mdo	4·3	4·5
pml	8·7	8·8
pl	2·7	2·7
cl-m3	5·4	5·4
c_1-m_3	6·2	6·3
m3-m3	6·2	6·2
c1-c1	3·6	3·2
ml	10·7	10·7

Family VESPERTILIONIDAE

Subfamily *VESPERTILIONINAE*

Myotis caliginosus (Tomes).

1859. *Vespertilio caliginosus* Tomes, *Proc. Zool. Soc.* London, p. 73 ('India').

1♀.—Chamba State, Himachal Pradesh (May, 1927).

Measurements.—Body : f, 33·3 ; *p*, 3·0 ; *d2(mt)*, 29·6 ; *d3(mt)*, 31·3 ; *d3(ph1)*, 11·6 ; *d4(mt)*, 31·3 ; *d4(ph1)*, 9·6 ; *d5(mt)*, 30·3 ; *d5(ph1)*, 8·0 ; *ft*, 5·3 ; *t*, 13·1.

Skull : l, 12·6 ; *on*, 11·6 ; *zw*, 7·8 ; *iw*, 3·4 ; *cw*, 6·2 ; *mdo*, 3·6 ; *pl*. 6·2 ; *c1-m3*, 5·0 ; c_1-m_3, 5·9 ; *m3-m3*, 5·4 ; *c1-c1*, 3·1 ; *ml*, 9·2.

The species has so far been known from Sikkim and Simla. The present record extends the range further northwestward.

Scoteinus pallidus (Dobson).

1876. *Scotophilus pallidus* Dobson, *Cat. Asiat. Chiropt.*, p. 186 (Mian Mir, Panjab).

1 ♂.—Uttar Pradesh (United Provinces) : Lucknow (23-3-1945).

Measurements.—Body : f, 35·9 ; *p*, 4·6 ; *d2(mt)*, 31·6 ; *d3(mt)*, 34·5 ; *d3(ph1)*, 10·5 ; *d4(mt)*, 34·3 ; *d4(ph1)*, 10·3 ; *d5(mt)*, 33·8 ; *d5(ph1)*, 9·1 ; *ft*, 6·7 ; *t*, 13·1.

Skull : l, 13·8 ; *cb*, 13·7 ; *on*, 11·5 ; *iw*, 4·1 ; *mdo*, 7·5 ; *pml*, 5·2 ; *pl*, 8·5 ; *c1-m3*, 5·1 ; c_1-m_3, 5·6 ; *m3-m3*, 6·3 ; *c1-c1*, 4·9 ; *ml*, 10·8.

The easternmost record of this species is from Mian Mir, Lahore District, Punjab. My specimen from Lucknow, coupled with another preserved in the collection of the Zoological Survey from Rajmahal, Eastern Bihar, extends the range much further eastward. The colour of the Type specimen was described by Dobson (*loc. cit.*) as ' pale buff or very pale approaching white ' On examination, it was found to have become perfectly white. Compared with the description given by Dobson as well as with other specimens in the collection of the Zoological Survey, the present specimen is quite darker.

Pipistrellus ceylonicus indicus (Dobson).

1878. *Vesperugo indicus* Dobson, *Cat. Chiropt. (Brit. Mus.)*, p. 222 (Mangalore, Malabar Coast).

1 ♂ and 2♀.—Bombay : Belgaum (1928).

Measurements.

Abbreviations of measurements.	Males.	Females.
Body.		
f	34·7	35·5—38·0
p	5·7	5·7—6·6
d2(mt)	31·4	32·8—35·3
d3(mt)	32·5	33·4—37·0
d3(ph1)	11·2	11·7—13·6
d4(mt)	30·6	32·2—35·6
d4(ph1)	10·4	12·0—12·9
d5(mt)	35·7	32·1—34·7
d5(ph1)	7·2	7·4—8·4
ft	6·3	6·7—6·8
t	13·6	13·6—14·6
Skull (damaged).		
iw	4·1	3·8 (one specimen)
ow	7·1	6·5 ,,
pl	6·7	6·6 ,,
c1-m3	5·4	5·5 ,,
c_1-m_3	5·6	5·6 ,,
m3-m3	6·6	6·3 ,,
c1-c1	4·7	4·4 ,,
ml	10·3	10·5 ,,

Except the slight differences in size, the specimens closely agree with the description given by Dobson (*loc. cit.*). The tips of hairs on the dorsal surface are more lighty coloured than the bases, but this may possibly be due to bleaching.

Pipistrellus babu Thomas.

1915. *Pipistrellus babu* Thomas, *J. Bombay Nat. Hist. Soc.*, XXIV, p. 30 (Murree, 8,000′, Panjab).

4 ♂ and 1♀.—Bombay : Panchgani, Satara, 4,000′—4,500′.

Measurements.—4♂.—*Body : f*, 34·7—35·6(35·4) ; *p*, 4·7—5·7(5·2) ; *d2(mt)*, 2 specimens, 32·6—34·5 ; *d3(mt)*, 2 specimens, 33·3—35·6 ; *d3(ph1)*, 10·3—13·1(11·6) ; *d4(mt)*, 2 specimens, 32·5—35·6 ; *d4(ph1)*, 2 specimens, 12·1—12·2 ; *d5(mt)*, 28·6—33·9 (31·1) *d5(ph1)*, 7·3—8·4(7·7) ; *ft.* 6·1—6·6(6·4) ; *t*, 13·2—14·1(13·5).

1♀ (damaged).—*f*, 33·5.

Skull (2 specimens) : l, 14·6 ; *cb*, 13·1—13·6 ; *on*, 12·4 ; *iw*, 3·9—4·0 ; *ow*, 7·1—7·5 ; *mdo*, 5·3 ; *pml*, 7·7—8·0 ; *pl.* 6·1—6·5 ; *c1-m3*, 4·6—5·3 ; *m3-m3* ; 6·3—6·7 ; *c1-c1*, 4·2—5·1 ; *ml*, 10·6.

In all the specimens, the cusp of the first upper incisor is considerably reduced. There is a variation in the distribution of fur on the interfemoral membrane. From the typical condition in which it covers the basal third of this membrane, it varies to its restriction to only the root of the tail, and there are intermediates between the two extremes. The skull in these specimens seems to be slightly larger on the average. The metacarpal bones in all the males are in pathological condition showing great softening of their distal ends.

Pipistrellus coromandra Gray.

1838. *Scotophilus coromandra* Gray, *Mag. Zool. Bot.*, XX, p. 498 (Coromandel Coast).

3 ♂ and 6♀.—Upper Burma : Indawgyi Lake, Myitkyina Dist. (1926).

Measurements.

Abbreviations of measurements.	Males.	Females.
Body.		
f	30·0—31·8 (31·3)	30·1—31·8 (31·1)
p	3·9—4·5 (4·3)	4·2—4·7 (4·5)
d2(mt)	28·5—29·7 (29·3)	29·5—31·6 (30·4)
d3(mt)	30·0—31·2 (30·5)	30·2—32·7 (31·4)
d3(ph1)	11·1—12·6 (12·1)	11·6—13·6 (13·0)
d4(mt)	28·0—31·4 (29·9)	30·0—32·6 (31·0)
d4(ph1)	11·6—12·6 (12·3)	11·6—12·6 (12·3)
d5(mt)	28·7—30·6 (2 specimens)	29·1—30·6 (29·6)

Measurements—contd.

Abbreviations of measurements.	Males.	Females.
Body—*contd.*		
d5(ph1)	7·7—8·7 (2 specimens)	7·6—8·7 (8·0)
ft.	4·4—4·5 ,,	4·4—5·3 (4·8)
t	12·7—13·1 ,,	11·7—13·4 (13·1)
Skull.		
l	12·3 (1 specimen)	12·1—12·4 (12·4)
cb	11·3 ,,	11·5—11·7 (11·6)
on	10·8 ,,	10·6
zw	——	7·5—7·7 (2 specimens)
iw	3·3 (1 specimen)	3·2—3·4 (3·3)
cw	5·9 ,,	5·9—6·3 (6·1)
mdo	——	4·1—4·6 (4·2)
pml	6·4 (1 specimen)	6·5—7·2 (6·9)
pl	——	5·5—5·8 (5·7)
c1-m3	4·4 (1 specimen)	4·4—4·6 (4·5)
c_1-m_3	4·5 ,,	4·4—4·6 (4·5)
m3-m3	5·3 ,,	5·0—5·7 (5·2)
c1-c1	3·8 ,,	3·6—3·9 (3·8)
ml	——	8·2—8·9 (8·6)

Dobson (1876), who considered the species as synonymous with *Vesperugo abramus*, remarks that the fur on the wing membrane below extends to a line drawn from the elbow to the knee-joint. Neither in these specimens nor in other identified ones in the collection of the Zoological Survey of India, the fur extends to such an extent. It is more restricted in its distribution.

Pipistrellus mimus glaucillus Wroughton.

1911. *Pipistrellus mimus glaucillus* Wroughton, *J. Bombay Nat. Hist. Soc.* XXVI, p. 769 (Multan, Panjab).

1♀.—North-West Frontier Province (Pakistan) : Drosh, Chitral (1929).

Measurements.—Body : f, 29·4 ; *p.* 2·6 ; *d2(mt)*, 28·6 ; *d3(mt)*, 30·1 ; *d3(ph1)*, 10·8 *d4(mt)*, 29·4 ; *d4(ph1)*, 6·6 ; *ft.* 5·5 ; *t*, 10·7.

Skull : l, 11·4 ; *cb*, 10·7 ; *on*, 10·1 ; *zw*, 7·2 ; *iw*, 3·4 ; *cw*, 6·1 ; *mdo*, 4·1 ; *pml*, 6·4 ; *pl*, 4·9 ; *c1-m3*, 4·2 ; c_1-m_3, 4·3 ; *m3-m3*, 3·1 ; *c1-c1*, 8·1.

The subspecies has so far been known from the Punjab only. The present record extends the range further northwestward. The fur is thicker and longer than in *mimus*.

Pipistrellus mimus Wroughton.

1900. *Pipistrellus mimus* Wroughton, *J. Bombay Nat. Hist. Soc.*, XII, p. 722 (Maheshkatri, Surat Dangs).

1 ♂.—Bengal : Palta, Calcutta (25-8-1938). 1 ♂.—Bombay : Ratnagiri (29-10-1912).

Measurements.

Abbreviations of measurements.	Palta.	Ratnagiri.
Body.		
f	24·2	27·2
p	4·2	3·6
d2(mt)	23·2	23·8
d3(mt)	24·5	24·7
d3(ph1)	9·3	9·1
d4(mt)	24·6	23·1
d4(ph1)	9·6	7·7
d5(mt)	23·2	24·2
d5(ph1)	6·8	5·6
ft	5·3	4·5
t	11·1	9·9
Skull.		
l	10·3	..
cb	9·4	..
on	9·2	..
iw	3·5	..
cw	6·0	..
mdo	4·2	..
pml	5·7	..
c1-m3	3·5	4·2
c_1-m_3	3·5	..
m3-m3	..	5·1
c1-c1	..	3·6

Scotophilus kuhli Leach.

1821. *Scotophilus kuhli* Leach, *Trans. Linn. Soc.*, XIII, p. 71 (Madras).

1♀.—Uttar Pradesh (United Provinces) : Banaras (6-6-1945). 1♀.—Burma, Nayunglabin (7-11-1926). 1 sub-ad. ♂ and 1♀.—Madhya

Pradesh (Central Provinces) : Nagpur, 1♀.—Bombay : Panchgani, Satara.

Measurements.

Abbreviations of measurements	Banaras.	Burma.	Nagpur.	Panchgani.
Body.				
f	60·4	60·8	58·1	63·0
p(ph1)	5·7	6·5	6·0	6·3
d2(mt)	57·3	60·3	55·9	59·6
d3(mt)	58·7	59·3	57·4	61·6
d3(ph1)	19·1	19·7	20·7	20·1
d3(ph2)	17·0	16·2	17·2	17·7
d4(mt)	56·2	58·5	58·7	60·6
d4(ph1)	15·2	16·7	16·2	16·0
d5(mt)	52·7	54·0	55·8	57·3
d5(ph1)	9·7	10·4	10·4	10·7
ft	11·1	11·9	11·3	11·6
Skull.				
l		21·0		21·4
cb		19·5		18·8
on		18·0		18·3
zw		15·5		15·9
iw		5·3		5·3
cw		10·6		10·4
mdo		9·0		9·2
pml		12·2		1·6
pl		9·7		10·2
c1-m3		7·3		7·8
c_1-m_3		8·0		..
m3-m3		9·8		10·1
c1-c1		7·3		7·5
ml		15·7		15·6

Scotophilus wroughtoni Thomas.

1897. *Scotophilus wroughtoni* Thomas, *J. Bombay Nat. Hist. Soc.*, XI, p. 275.

1♀.—Bengal: Palta, Calcutta. 1♀.—Madhya Pradesh (Central Provinces): Nagpur. 1♀.—Bombay: Panchgani, 4,000′—4,500′.

Measurements.

Abbreviations of measurements.	Calcutta.	Nagpur.	Panchgani.
Body.			
f	47·0	50·0	48·9
p(ph1)	4·8	5·0	3·8
d2(mt)	45·4	50·1	48·0
d3(mt)	46·7	50·0	48·9
d3(ph1)	16·3	17·7	16·3
d3(ph2)	13·2	12·5	12·2
d4(mt)	46·4	50·1	47·0
d4(ph1)	12·7	14·2	12·2
d5(mt)	41·8	46·4	44·9
d5(ph1)	8·1	8·5	7·7
ft	8·7	8·2	8·5
t	18·2	19·8	17·2
Skull.			
l	17·9	18·6	18·4
cb	16·7	17·2	17·0
on	15·3	15·9	16·1
zw	13·0	13·2	..
iw	4·8	4·9	5·0
cw	9·4	9·3	9·0
mdo	7·2	7·5	7·7
pml	10·2	10·7	..
pl	8·5	8·7	..
c1-m3	6·5	6·2	6·3
c_1-m_3	8·0	7·4	7·3
m3-m3	8·7	8·3	8·6
c1-c1	6·3	6·2	6·2
ml	12·9	14·0	13·3

Subfamily *KERIVOULINAE*

Kerivoula crypta Wroughton.

1912. *Kerivoula crypta* Wroughton, *J. Bombay Nat. Hist. Soc.*, XXII, p. 14 (Shimoga, Mysore).

10 ♂ and 5♀.—Assam : Chekrima, Naga Hills (17-2-1937).

Measurements.

Abbreviations of measurements.	Males.	Females.
Body.		
f	30·6—33·7 (32·7)	31·5—32·5 (31·9)
p	5·6—6·9 (6·5)	5·8—6·9 (6·5)
d2(mt)	31·0—34·4 (32·1)	33·7—36·4 (34·5)
d3(mt)	34·4—35·9 (35·6)	34·5—36·9 (35·7)
d3(ph1)	15·0—16·0 (15·6)	14·5—16·4 (15·8)
d4(mt)	34·4—35·7 (34·4)	34·1—36·3 (34·9)
d4(ph1)	10·2—11·6 (10·3)	10·3—11·7 (10·5)
d5(mt)	32·7—34·7 (33·4)	32·3—35·9 (33·7)
d5(ph1)	7·8—9·0 (8·3)	8·2—9·3 (8·9)
ft	5·7—6·9 (6·0)	5·6—6·9 (6·0)
t	15·7—16·7 (16·2)	14·5—16·7 (15·8)
Skull.		
l	13·4—14·1 (13·5)	13·3—13·7 (13·6)
cb	12·2—13·2 (12·9)	12·6—13·1 (12·9)
on	11·0—11·8 (11·7)	11·1—11·7 (11·4)
zw	8·4—8·7 (8·6)	8·5—8·9 (2 specimens).
iw	3·1—3·6 (3·3)	3·1—3·5 (3·3)
cw	6·8—7·7 (7·2)	7·0—7·4 (7·3)
mdo	4·6—5·1 (4·9)	4·6—4·7
pml	7·1—7·7 (7·4)	7·3—7·7 (7·5)
pl	6·9—7·7 (7·4)	7·2—8·0 (7·5)
c1-m3	5·2—5·7 (5·5)	5·4—5·6 (5·5)
c_1-m_3	5·4—5·9 (5·7)	5·6 (2 specimens)
m3-m3	5·4—5·7 (5·5)	5·2—5·7 (5·5)
c1-c1	3·4—3·7 (3·6)	3·3—3·6 (3·4)
ml	9·1—10·4 (9·4)	10·1 (1 specimen)

So far the species has only been recorded from North-West Mysore. The present investigation shows that it has a much wider range. As the specimens have been preserved in spirit for quite a long time, the true nature of their colour cannot be judged. A study of the fresh material will reveal whether or not the population from the Naga Hills differs from that of Mysore.

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MGIPC—M—8 ZSI—22-12-52—450.