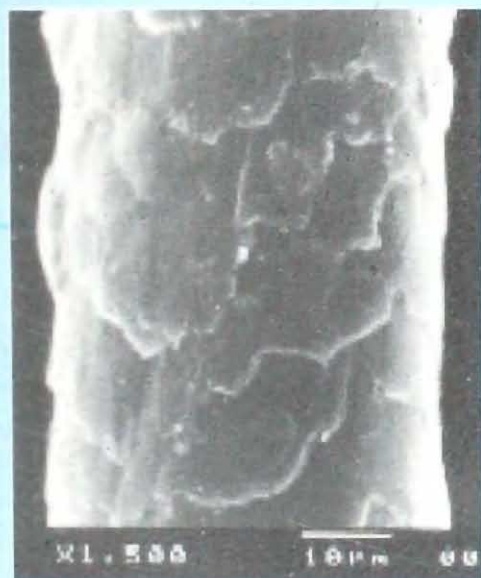


RECORDS OF THE ZOOLOGICAL SURVEY OF INDIA

Volume 109 (Part-2)

Year 2009



Zoological Survey of India



सत्यमेव जयते

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**Ministry of Environment and Forests
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Records of the Zoological Survey of India

Volume 109(Part-2)

Edited by the Director, Zoological Survey of India, Kolkata



सत्यमेव जयते

**Zoological Survey of India
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Director-in-charge
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These specimens will be registered and their data will be computerised. *They are further requested to deposit their type collection positively of ZSI and use the Registration number in their publication of the new taxon.*

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Introduction section should clearly describe the objectives of the study and provide enough background information to make it clear why the study was undertaken. Lengthy literature review is discouraged. Some earlier references of work may be cited.

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Silas, E.G. 1961. Occurrence of the Sea-cow *Halicore dugong* (Erxl) off Saurashtra coast. *J. Bombay nat. Hist. Soc.*, **58**(1) : 263-266.

State Fauna/Conservation Areas

Mukhopadhyay, S.K. 1999. Fresh water Oligochaetes. *Fauna of West Bengal, State Fauna Series*, **3**(Part-10) : 95-123. Published by Zool. Surv. India.

Radhakrishna, C. 2007. Amphibia. In : *Fauna of Kudermukh National Park, Karnataka, Conservation Area Series*, **32** : 20-25, Published by Zool. Surv. India.

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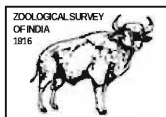
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Rec. zool. Surv. India, **109**(Part-2) : 1-12, 2009

FOUR NEW SPECIES OF CHALCIDOIDEA (HYMENOPTERA) FROM INDIA

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Three new species of Torymidae viz., *Palachia frontopuncta* Narendran sp. nov., *Palachia neorobusta* Narendran sp. nov., *Palmon kottiyooricus* Narendran sp. nov. and one new species of Eulophidae viz., *Kostjurixia laharaensis* Narendran sp. nov. are described from India and the differences from the closely resembling species are provided.

Keywords : *Palachia frontopuncta* Narendran sp. nov., *Palachia neorobusta* Narendran sp. nov., *Palmon kottiyooricus* Narendran sp. nov., *Kostjurixia laharaensis* Narendran sp. nov.

INTRODUCTION

The genus *Palachia* Bouček is represented by seven species from the Indian subcontinent. They are *Palachia mangalae* Narendran, *P. punctifrons* Narendran and Sureshan, *P. punctigastra* Narendran and Sureshan, *P. hayati* Narendran and Sureshan, *P. robusta* Bouček, *P. farooqi* Bouček, and *P. grisselli* Bouček (Bouček, 1976, 1998; Narendran; 1984, 1994; Narendran and Sureshan, 1988). Farooqi *et. al.*, (1990) described a new species of *Palachia* viz., *P. indica* which is synonymised with *P. hayati* by Bouček (1998). Grissell, (1995) gave a world catalogue of *Palachia* in his work on Toryminae. In the present paper two more new species viz., *Palachia frontopuncta* Narendran sp. nov., and *P. neorobusta* Narendran sp. nov. are described. The genus *Palmon* Dalman is represented by *P. greeni* (Crawford), *P. orchesticus* (Masi), and *P. alfredi* Sureshan from the Indian subcontinent. Besides these two more species viz., *P. ashmeadi* (Crawford) and *P. megarhopalus* (Masi) are known from other regions of the Orient (Narendran, 1994; Grissell; 1995, Sureshan, 2003). A new species *P. kottiyooricus* is described here from India. A key to the Oriental species of *Palmon* is also provided. The genus *Kostjurixia* Narendran (Eulophidae : Tetrastichinae) is so far known only by its type species viz., *K. ootiyensis* Narendran (Narendran, 2007). Another new species from Himachal Pradesh is described in this paper.

MATERIALS AND METHODS

The holotypes of *Palachia frontopuncta*, *P. neorobusta* and *Kostjurixia laharaensis* are deposited in the NPCI and *Palmon kottiyooricus* is deposited in DZUC (eventually will be transferred to NZSI). The terms and measurements follow Boucek (1998) and Narendran (1994).

Abbreviations used : F1-F7 = Funicular segments; MS = Malar sulcus; OOL = Ocellocular distance; PMV = Postmarginal vein; POL = Postocellar distance; SMV = Submarginal vein; STV = Stigmal vein; SMG = Scutellar grooves; MV = Marginal vein; T1 = First tergite; CC = Costal cell.

Depositories : DZUC = Department of Zoology, University of Calicut, India; NPCI = National Pusa Collection, Division of Entomology, Indian Agricultural Research Institute, New Delhi; NZSI = National Zoological Collections, Zoological Survey of India, Kolkata; ZDAMU = Zoology Department, Aligarh Muslim University.

Family TORYMIDAE

1. *Palachia frontopuncta* Narendran sp. nov.

(Figs. 1-4)

Holotype : Female : Length 2.27 mm. Ovipositor length 2 mm. Black with blue and violet refringence on head, green and blue refringence on mesoscutum, anterior part of propodeum, bronze refringence on pronotum (collum yellow), scutellum and a dark patch on hind coxa and on some parts of metasoma; antenna dark brown except pale yellow F4, F5, F6 and scape. Legs pale brownish yellow with a dark patch on dorsal side of hind coxa; pretarsi dark brown; gastral petiole pale yellow; gaster black with weak bronze refringence on some parts; ovipositor pale brownish yellow.

Head : 1.4x as broad as pronotum with large eyes; sculpture finely punctate without smooth part between ocelli and eyes (Fig. 1); vertex not elevated; POL = 17; OOL = 4; scrobe sculptured; MS indistinct, face not protuberant at toruli; scrobe moderately deep, ending vaguely about three ocellar diameters below from ocellus; scrobe reticulate; interantennal ridge narrow, reticulate, lower than slightly raised lateral sides of each torulus which continue downward as cross-striate areas separated by slight median depression; clypeus reticulate, lower margin mostly entire without a distinct median tooth; gena in lower half moderately convex; head length in front view equal to its width, upper face 1.57x as broad as high.

Relative measurements : head width = 11; length = 11; eye height 1.11x its width in side view, 4x length of MS; antennal flagellum plus pedicel 1.5x as long as width of head in front view; pedicel a little over 2.1x as long as broad; anellus subquadrate; funicular segments gradually widening, scape reaching front ocellus; clava as long as combined length of five preceding segments,

with micropilosity beneath, F2 at apex as broad as pedicel; F1 2x F7, 0.73x as long as broad; F4 barely longer than broad (Fig. 2).

Mesosoma : > 1.36 x as long as broad; weakly cross striate, remaining part strongly reticulate, pronotum 0.6x as long as its width; mesoscutum 0.67x as long as its width, longer than pronotum; scutellum wider than long, about as long as mesoscutum; mesoscutum and scutellum with strong raised reticulation; propodeum with strong reticulation, a little longer than scutellum, declining 70° to longitudinal axis of mesosoma, anteriorly a little depressed with a few short rugae at sides. Mesopleuron anterolaterally with distinct epicnemial edge, behind it almost flat and reticulate; mesepimeron smooth on upper anterior side, reticulate on lower side; mesopleuron with distinct crenulate groove along half length of metapleural margin. Legs rather strong, though tibiae and tarsi slender; hind coxa < 2.71 x hind femur, 3.45x (teeth excluded) as long as broad, coxa with a longitudinal (Fig. 3) row of short white pilosity on dorsal margin in side view; femur with a teeth confined to distal half. Forewing about 3x as long as broad. Relative length of costal cell = 47, MV = 32; PMV = 13.7; STV = 5; stigma knobbed, with slight infumation near parastigma (Fig. 4).

Metasoma : Petiole a little longer than broad; gaster strong with faint traces of wide meshed reticulation; hypopygium reaching apex of gaster; ovipositor 2.5x as long as hind tibia; metasoma a little longer than mesosoma (19 : 17).

Male : Similar to female except mainly : (1) antenna not clavate, brown with scape paler on ventral part; (2) head metallic green; (3) hind coxa concolourous with dark mesosoma with apex pale; (4) hind tibia black with base and apex pale; (5) colour in general darker than that of female.

Biology : Unknown.

Material Examined : *Holotype* : Female, India : Himachal Pradesh, Hamirpur, Anu kalan, 1.vii.2006. Coll. S.M.A. Badruddin & F.R. Khan (Deposited in NPCI). *Paratypes* : 1 Female and 2 males of same data of Holotype (1 Female and 1 male in ZDAMU).

Discussion : This species comes near *Palachia punctifronta* Narendran and Sureshan in having vertex with dense reticulations but differs from it in having (1) no smooth area between hind ocelli and eyes; (2) PMV shorter than half length of MV; (3) crenulate groove of mesopleuron short and not running full margin of metanotum and in several other character. This new species comes to *Palachia hayati* Narendran & Sureshan in the key to species by Boucek (1998) and by Narendran and Sureshan (1989) but differs from *P. hayati* in having : (1) T1 black with yellowish brown tinge on sides anteriorly (in *P. hayati* T1 completely metallic green), (2) in female head black with blue and violet refringence (in *P. hayati* head metallic green); (3) colour of other parts darker (not so in *P. hayati*); (4) mesosoma > 1.36 x as long as wide (in *P. hayati* mesosoma 1.88x as long as wide); (5) mesepimeron smooth and shiny on upper anterior part (completely reticulate in *P. hayati*); and (6) pronotal ledge, column and petiole pale yellow (not so in *P. hayati*). This new species

comes very close to *Palachia pulchra* Boucek in having column, lateral pronotal ledges as well as petiole and anterior part of T1 pale yellow or pale brownish yellow. However it differs from *P. pulchra* in very many characters and does not fit to the couplet of *pulchra* in the key to species by Boucek (1998).

2. *Palachia neorobusta* Narendran sp. nov.

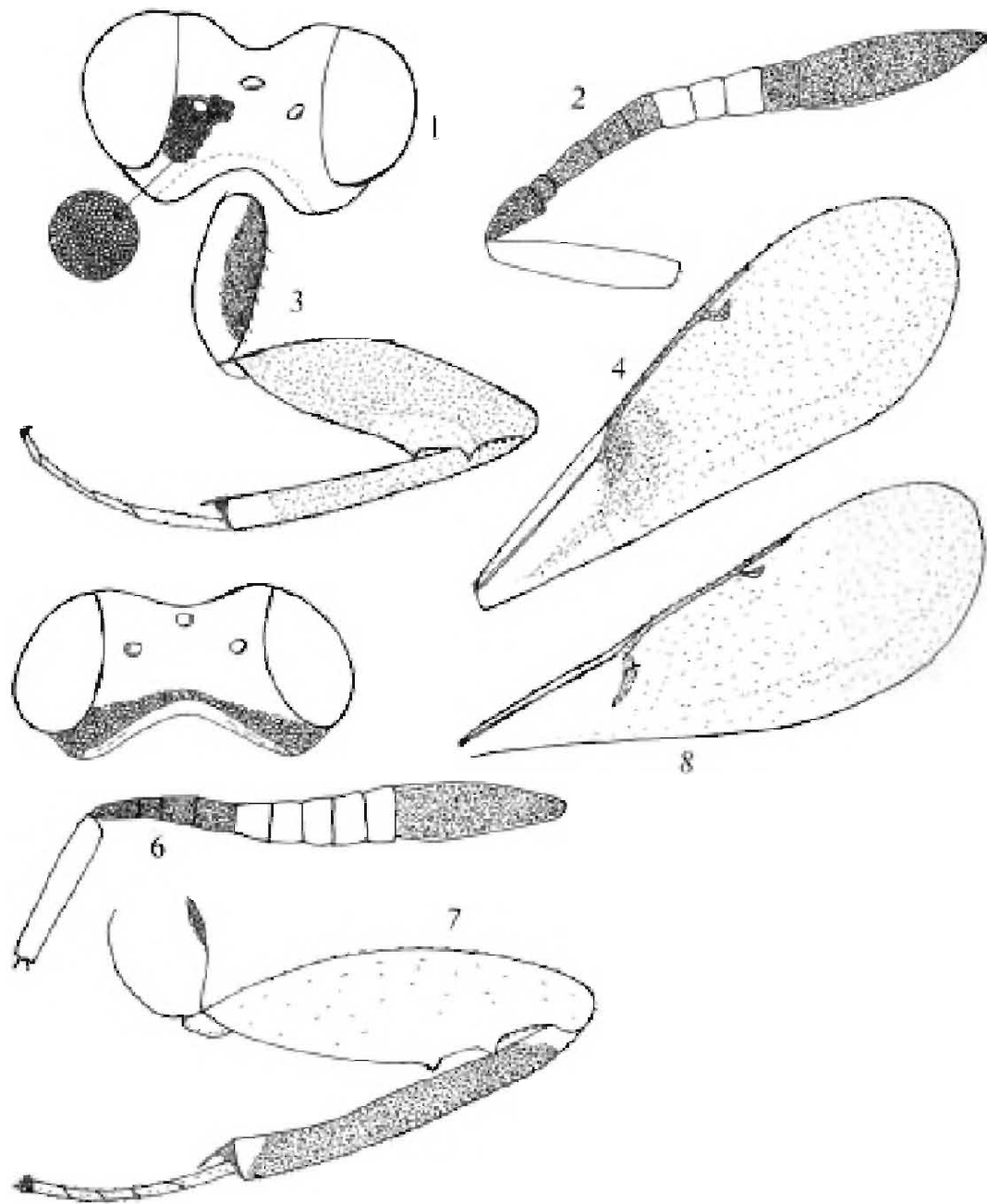
(Figs. 5-8)

Holotype : Female : Length 1.933 mm plus ovipositor 2.48 mm. Lower frons, face, gena bright metallic green; pronotum with lateral perpendicular panel and collum pale yellow, anterior half of remaining part dark metallic green, posterior half dark with slight bronze refringence; mid lobe of mesoscutum dark violet blue; most of scapulae and scutellum dark with bronze refringence; propodeum bright metallic greenish blue with bright bronze area in middle; antenna with scape, F3 to F7 pale yellow; pedicel, anellus, F1 and F2 brown; clava black; fore and mid legs pale yellowish white; hind coxa pale yellowish white with a small brownish patch on dorsal side, dorsal inner half of femur pale brown with ventral half pale yellowish white; hind tibia brown with base and apex pale; tarsi pale yellowish white; hind tibia brown with base and apex pale; tegula pale yellowish white; petiole pale yellowish white; gaster pale brown with median dorsal part slightly darker brown; ovipositor sheath dark brown; ovipositor brown with apex pale brown. Wings hyaline with very slight infumation attached to parastigma.

Head : 1.53x as broad as mesosoma; vertex smooth with reticulate area behind on the sloping posterior part above occipital carina (Fig. 5); hind ocellus distinctly nearer to front ocellus than to occipital carina; mid and lower frons with distinct (not very shallow as in *P. robusta*) reticulations which merges with dense reticulation in scrobe; latter reaching from ocellus but its sides vague; in side view face slightly protuberant at toruli; temple in dorsal view short; eye broadest in lower third; clypeus small, middle of its lower margin hardly produced; no paraclypeal tooth.

Relative measurements : Head width (anteriorly) 11 = 13; length = 12; POL = 19; OOL = 4; eye length : width in lateral view = 8.5 : 6; MS = 2.4; scape = 6; flagellum plus pedicel = 19; antenna as in figure 6.

Mesosoma : > 1.64x as long as broad; pronotum convex, anteriorly rounded, column weakly cross reticulate, remaining part with strong raised reticulations; pronotum 0.45x as long as its width; mesoscutum 0.46x as long as its width, 1.4x as long as pronotum; scutellum a little wider than long, subequal in length to mesoscutum; reticulation on mesoscutum and scutellum strong as that of pronotum; propodeum as long as scutellum, with strong raised reticulation, declining 60° to longitudinal axis of mesosoma, anteriorly a little depressed with short rugae on anterior margin. Mesopleuron anterolaterally with distinct epicnemial edge, behind it almost flat and reticulate; mesepimeron almost completely reticulate; mesopleuron with distinct crenulate groove



Figs. 1-4. *Palachia frontopuncta* Narendran sp. nov. Female. 1. Head—Dorsal view; 2. Antenna; 3. Hind leg; 4. Forewing.

Figs. 5-8. *Palachia neorobusta* Narendran sp. nov. Female. 5. Head—dorsal view; 6. Antenna; 7. Hind leg; 8. Forewing.

along metapleural margin. Legs not very strong; hind coxa 1.8x hind femur, 3.25x (teeth excluded) as long as broad, coxa dorsally with 2 longitudinal irregular row and a ventral irregular row of short white pilosity in side view; femur (Fig. 7) with teeth confined to distal half, with 6 minute teeth between distal large tooth and apex of femur. Forewing 3.2x as long as broad.

Relative length : costal cell = 47, MV = 26; PMV = 13; STV = 5; stigma hardly knobbed, with a strip of slight infumation near parastigma (Fig. 8).

Metasoma : Petiole a little longer than wide in side view; gaster smooth and shiny without distinct reticulations; hypopygium reaching apex of gaster, gaster subequal in length to mesosoma; ovipositor 3.5x as long as hind tibia.

Male : Similar to female except in having antenna without distinct clava, and gaster a little shorter than mesosoma (7 : 8).

Biology : Unknown.

Material Examined : *Holotype* : Female, India : Uttar Pradesh (U.P.), Lakhimpur, Imami Purva, 27.xi.2006. Coll. S.M.A. Badruddin & F.R. Khan (NPCI).

Paratypes : 2 males, U.P., Bahraich, Tikona Mod, 1.x.2006. Coll. F.R. Khan (ZDAMU).

Discussion : This species comes to *Palachia mangalae* Narendran in the key to species by Boucek (1998) but differs from it in having : (1) pronotum, mesoscutum and scutellum not dark cupreous (dark cupreous in *P. mangalae*), (2) F3 and F4 pale yellow (F3 and F4 black or dark brown in *P. mangalae*); (3) Gaster pale brown with median dorsal part without any metallic refringence (in *P. mangalae* gaster blackish brown with slight metallic refringence); (4) ovipositor sheath dark brown (in *P. mangalae* ovipositor sheath white with tip shortly blackish); (5) antennal flagellum plus pedicel as long as 1.67x width of head (in *P. mangalae* 1.56x width of head); (6) lateral ledge of pronotum pale yellow (lateral ledge of pronotum not so in *P. mangalae*); and (7) eye height in profile 3.3x as long as MS (in *P. mangalae* eye height in profile 5.4x as long as MS).

This new species resembles *Palachia robusta* Boucek in the colour of antenna, pronotal ledge and legs but differs from *P. robusta* in having : (1) ovipositor sheath dark brown (whitish in *P. robusta*); (2) hind ocellus distinctly nearer to front ocellus than to occipital margin (hind ocellus equidistant to front ocellus and occipital margin in *P. robusta*); (3) Scrobe reaching front ocellus (in *P. robusta* scrobe not reaching front ocellus); (4) hind femur with 6 minute black teeth between distal large tooth and apex of femur (in *P. robusta* hind femur with one relatively large tooth followed by irregular serration between large tooth and apex of femur as in Figure 31, Boucek 1998); (5) mesopleuron with complete crenulate groove at metapleural margin (in *P. robusta* crenulate groove short and weak); and (6) mid lobe of mesoscutum with raised reticulation (with weak wide meshed reticulation and shiny on the mid lobe of mesoscutum in *P. robusta*).

3. *Palmon kottiyooricus* Narendran sp. nov.

(Figs. 9-11)

Holotype : Female : Length 2.18 mm. Ovipositor length 2.42 mm. Head and mesosoma dark metallic green; eyes reddish brown; ocelli dark brown; scape and pedicel pale yellow; anellus and funicle pale brownish yellow with anterior margin slightly darker, mandible brown; fore and mid legs pale yellow; hind coxa pale yellow with a small dark patch dorsobasally; hind femur pale yellow with apical one-fourth brown, teeth black; hind tibia pale brownish yellow; hind tarsus pale yellow. Wings hyaline with veins pale brown; metasoma pale brown with dark circular parts basally and subapically as in figure 9, basal dark part with slight metallic green refringence; ovipositor sheath dark brown.

Head : 1.35x as broad as pronotum with large eyes; vertex and frons moderately reticulate; head width in dorsal view 2.25x its length; width in anterior view 1.08x its length; POL 3.33x OOL; distance between hind ocellus and front ocellus half of POL; occiput with a fine carina; scrobe reticulate reaching front ocellus; margin ecarinate; MS about 0.2x diameter of eye in profile; gena with fine posterior carina; eye separated from each other by 1.1x length of eye; antennal flagellum plus pedicel 1.57x as long as width of head in front view; scape almost reaching front ocellus; clava a little longer than flagellum (52 : 49); antennal segments as in figure 10.

Mesosoma : 1.8x as long as broad; uniformly provided with setigerous pits; pronotum 0.33x as long as its width; mesoscutum 0.59x as long as its width, 2x as long as pronotum; scutellum length subequal to its width, subequal in length to mesoscutum; propodeum a little shorter than scutellum, with strong raised pits and a strong cross carina slightly behind its middle, declining 50° to longitudinal axis of mesosoma; episternum weakly cross reticulate; epimeron with a deep pit between upper and lower halves; front margin of metapleuron straight; hind coxa with a moderately spaced somewhat long setae on dorsal margin in side view, hind femur length 2.27x its width (including teeth), ventral margin with 9 teeth (1 + a + b + c + 2 + d + 3 + 4 + 5 where 1-5 represent primaries and a-d represents secondaries) as in figure 11. Forewing 3.52x as long as broad; relative length of costal cell = 24, MV = 19; PMV = 7; STV = 3 (Fig. 9).

Metasoma : Excluding ovipositor longer than mesosoma (41 : 35), subequal in length to combined length of head plus mesosoma; hypopygium reaching apex of gaster; ovipositor sheath longer than head plus mesosoma plus metasoma (excluding ovipositor sheath) (83 : 91), 2.2x as long as gaster, 3.4x as long as hind tibia.

Male : Unknown.

Biology : Unknown.

Material Examined : *Holotype* : Female, India : Kerala, Kannur district, Kottiyoor, 18.xi.2004. Coll. Sabu. K.T. (Deposited in DZUC pending transfer to NZSI).

Discussion : This new species can be separated from all other Oriental species of *Palmon* by the following key :

KEY TO ORIENTAL SPECIES OF *PALMON* DALMAN

1. Ovipositor much shorter than 2x (less than 1.6x) length of rest of body 2
- = Ovipositor 2x as long as rest of body 5
2. Propodeum with a strong cross carina a little behind middle 3
- = Propodeum without a strong cross carina [ovipositor 2.92x as long as gaster and 1.4x as long as rest of body, length of antennal clava 1.3x preceding funicular segments and anellus together].....*P. alfredi* Sureshan
3. Ovipositor 1.45x as long as rest of body; head and mesosoma dull green; metasoma yellowish with base metallic and apical half brown; antennae yellowish with clava dark; hind coxa at base metallic, rest yellowish; hind femur and tibia more or less obscured with dusky colour *P. ashmeadi* (Crawford)
- = Ovipositor shorter than 1.2x rest of body; other characters may or may not be agreeable 4
4. Clava with apex broad and oblique (Fig. 17a, Masi 1926), as long as combined length of funicle segments and anellus; pedicel 0.45x length of scape; ovipositor 1.15x length of rest of body; PMV 3x as long as STV *P. megarhopalus* (Masi)
- = Clava (Fig. 10) with apex pointed, longer than combined length of funicle segments and anellus; pedicel 0.52x length of scape; ovipositor 1.11x length of rest of body; PMV shorter than 3x STV *P. kottiyooricus* sp. nov.
5. Hind coxa greenish black or bluish black with apex pale; forewing with an infuscated area attached to STV; gaster with T1 joining petiole at condyle away from its insertion at foramen *P. greeni* (Crawford)
- = Hind coxa yellow with a blackish patch on dorsal side of basal half; forewing without an infuscation attached to STV; gaster with T1 joining petiole at condyle near its insertion at foramen *P. orchesticus* (Masi)

Family EULOPHIDAE

4. *Kostjurixia laharaensis* Narendran sp. nov.

(Figs. 12-15)

Holotype : Female : Length 0.9 mm black; eye brown; ocelli dark brown; antenna brown with scape pale brown; tips of femora, tibiae and tarsi pale yellow; pretarsi brown; coxae concolourous with mesosoma. Wings hyaline, veins pale yellow; pilosity brown; tegula brown. Pubescence dirty white.

Head : Anteroposteriorly compressed; width in anterior view subequal to its anterior length; POL 1.33x OOL; occiput subvertical; frontofacial sutures as in figure 12, separated from each other and running to sides of front ocellus; lower margin of clypeus entire but with two minute lobes; mandibles bidentate; eyes sparsely pilose, 2x as long as MS, a little over 2x as long as wide in anterior view; MS straight, without a basal fovea; antennal formula 11233 (Fig. 13); scape not reaching front ocellus, a little shorter than eye height in profile, 2.63x as long as wide; pedicellus 1.4x as long as wide, longer than F1 (11 : 8); F1 a little wider than long (10 : 8); F2 a little longer than F1 (9 : 8), as long as its width; F3 subequal in length to F2, subequal in length to its width; clava 2.33x as long as wide (21 : 9), subequal in length to scape.

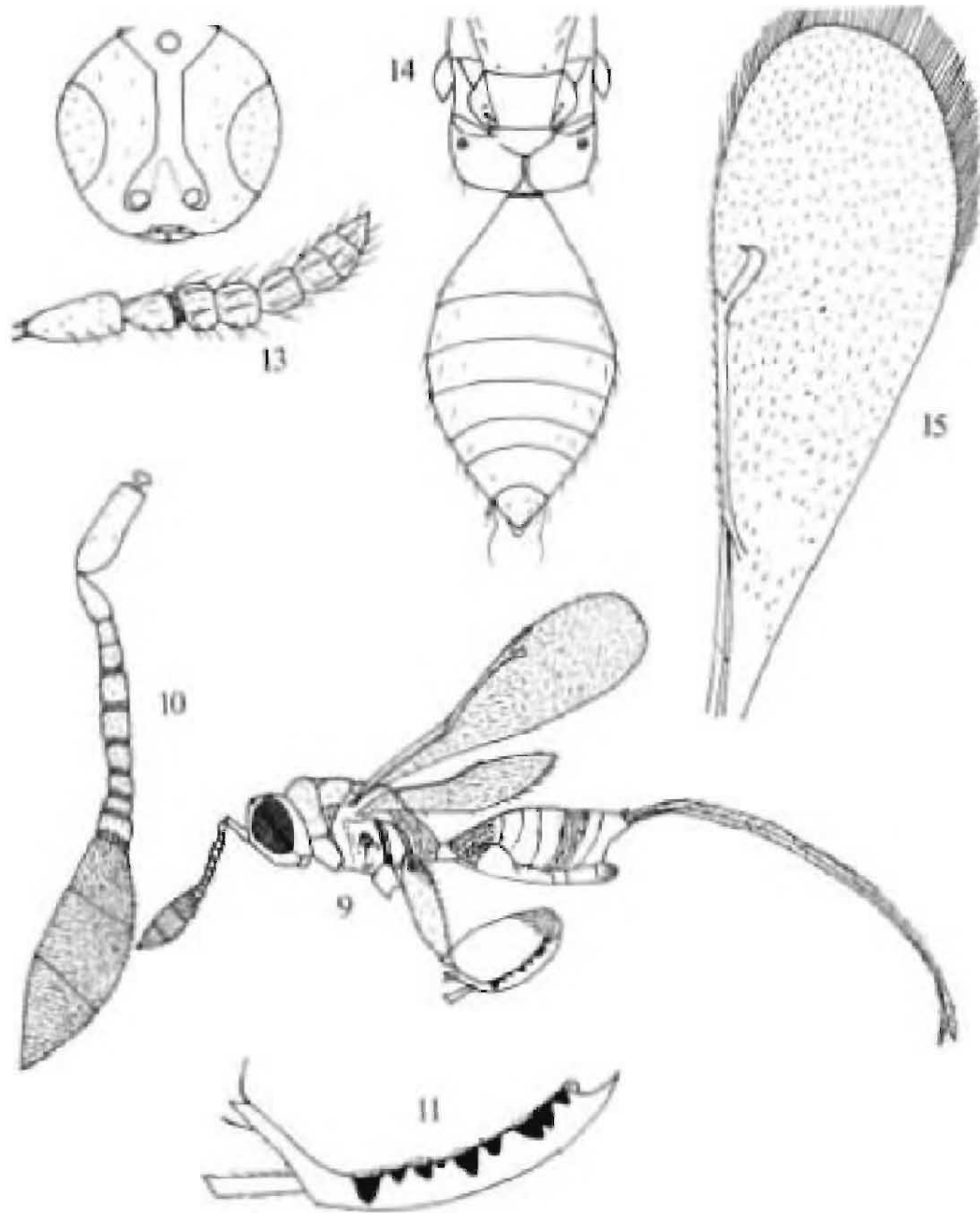
Mesosoma (Fig. 14) : Flat, with 3 depressed setae (posterior most pair worn but setal pits can be seen on careful observation under proper illumination) on either side; pronotum a little shorter than (15 : 17) mesoscutum, weakly reticulate; mesoscutum 1.53x as broad as long (22 : 17); scutellum 0.65x (11 : 17) as long as mesoscutum, 1.45x as broad as long, surface weakly reticulate; SMG distinct but weak, two pairs of setae present on posterior half; dorsellum lying over metanotum medially, touching propodeum; propodeum with a median carina and surface as in *Aceratoneuromyia*, as long as scutellum; propodeal spiracle separated from metanotum by about its own diameter; hind coxa mostly smooth with weak reticulation; hind femur 2.4x as long as wide; spur of mid tibia about as long as mid metatarsus; forewing (excluding marginal fringe) 3x as long as broad; CC a little shorter than MV; MV 3.46x as long as STV, marginal fringe 0.77x length of STV; speculum very small, closed behind by setae, not extending forward below MV (Fig. 15).

Metasoma : Longer than mesosoma, subequal to combined length of head plus mesosoma; hypopygium exceeding a little beyond middle of gaster.

Male : Similar to female except the funicular segments more transverse.

Biology : Unknown.

Material Examined : *Holotype* : Female, India : Himachal Pradesh, Mandi, Lahara, 23.vi.2006. Coll. S.M.A. Badruddin & F.R. Khan (NPIB/ZDAMU—HP2006.1) (Deposited in NPCI).



Figs. 9-11. *Palmon kottiyooricus* Narendra sp. nov. Female. 9. Body profile; 10. Antenna; 11. Teeth of hind femur.

Figs. 12-15. *Kostjurixia laharaensis* Narendran sp. nov. Female. 12. Head—front view; 13. Antenna; 14. Mesosoma and metasoma dorsal view; 15. Forewing.

Paratypes : 1 Female and 2 males of same data of Holotype (ZDAMU).

Discussion : This new species differs from *K. ootiyensis* Narendra in having : (1) MS straight (in *K. ootiyensis* MS curved), (2) pedicel 1.4x as long as wide (in *K. ootiyensis* pedicel length subequal to its width); (3) F2 a little longer than F1 (F2 shorter than F1 in *K. ootiyensis*); (4) F3 width subequal to its length (in *K. ootiyensis* F3 wider than long); (5) clava 2.33x as long as wide (clava 1.7x as long as wide in *K. ootiyensis*); (6) claval length subequal to length of scape (not so in *K. ootiyensis*); (7) mesoscutum 1.53x as broad as long (in *K. ootiyensis* mesoscutum 2.1x as broad as long); (8) mesosoma black (in *K. ootiyensis* mesosoma pale brown); (9) gaster black (gaster dark brown in *K. ootiyensis*); (10) hind femur 2.4x as long as wide (in *K. ootiyensis* hind femur about 3x as long as wide); (11) forewing 3x as long as broad (forewing shorter than 3x its width in *K. ootiyensis*); (12) pronotum a little shorter than mesoscutum (pronotum as long as mesoscutum in *K. ootiyensis*); and (13) General body colour black (in *K. ootiyensis* head and mesosoma light brown and gaster dark brown).

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Rec. zool. Surv. India, **109**(Part-2) : 13-20, 2009

**DESCRIPTION OF A NEW SPECIES OF *ABORICHTHYS*, CHAUDHURI
FROM NORTH-EAST INDIA (PISCES : CYPRINIFORMES :
BALITORIDAE)**

NIBEDITA SEN

Eastern Regional Station, Zoological Survey of India, Shillong-793 003

INTRODUCTION

The genus *Aborichthys* was first established by Chaudhuri (1913) with *A. kemp*i as the type species. Subsequently, three other species namely *A. elongatus* (Hora, 1921), *A. garoensis* (Hora, 1925) and *A. tikaderi* (Barman, 1984) were described. All the species of *Aborichthys* are restricted so far within North East India with *A. kemp*i having its distribution in Myanmar also.

Jayaram (1999) classified 12 genera under subfamily Nemacheilinae from Indian region, namely, *Aborichthys*, *Acanthocobitis*, *Neonemacheilus*, *Nemacheilus*, *Schistura*, *Mesonemacheilus*, *Physoschistura*, *Longischistura*, *Oreonectes*, *Triplophysa*, *Nemachilichthys* and *Yunnanilus*. Of these *Aborichthys*, *Acanthocobitis*, *Nemacheilus*, *Mesonemacheilus*, *Schistura* and *Neonemacheilus* are represented in North East India.

While studying the fish collections from Subansiri river, Dhemaji district, Assam, the author came across a single specimen (26.25 mm TL) which at a glance looked like the genus *Schistura* but on detailed study the forward position of vent (Plate I,B,C; Fig. 1A) revealed its identity as genus *Aborichthys*.

Subsequently, another 4 examples (19 -28 mm TL) were collected from Sippi river, Daporijo, Subansiri district, Arunachal Pradesh.

Diagnostic characters of Aborichthys : Body greatly elongated and compressed; vent situated far forwards; nostrils openings with barbel-like outgrowths; head flattened slightly, anteriorly rounded; snout conical and broadly rounded; dorsal fin inserted slightly behind pelvic fins; pelvic fins extend beyond anal opening; all fins greatly removed from one another; caudal fin lunate; lateral line incomplete, indistinct.

Diagnostic characters of Schistura : Body elongate, compressed posteriorly; vent situated nearer anal fin; head either depressed or compressed; snout usually blunt; dorsal fin short, inserted ahead or opposite pelvic fin; pelvic fin never crosses anal opening; caudal fin slightly emarginate, forked or truncate, never rounded; lateral line incomplete or complete.

The present specimen does not tally with other known species of the genus *Aborichthys* and hence it is described here as new species, *A. rosammai*. The distinct and prominent characters exhibited by these specimens motivated the author to describe it new to science.

ABBREVIATIONS

TL	: Total length	LD	: Length of dorsal fin
SL	: Standard length	LPC	: Length of pectoral fin
HL	: Head length	LPV	: Length of pelvic fin
HD	: Head depth	LA	: Length of anal fin
HW	: Head width	CL	: Length of caudal fin
BD	: Body depth	SN-PV	: Distance between tip of snout to origin of pelvic fin
EYD	: Eye diameter	PC-PV	: Distance between origin of pectoral and pelvic fins
SN	: Snout length	PV-A	: Distance between origin of pelvic and anal fins
IOR	: Inter orbital distance	A-CB	: Distance between origin of anal fin and base of caudal fin
SN-D	: Distance between snout to origin of dorsal fin	CPL	: Length of caudal peduncle
D-CB	: Distance between origin of dorsal fin to base of caudal fin	LHCP	: Least height of caudal peduncle
SN-V	: Distance between snout to vent	V/F/ERS	: Vertebrate/Fish/Eastern Regional Station
V-CB	: Distance between vent to base of caudal fin		

MATERIAL AND METHODS

The specimens are preserved in 5% formaldehyde. Morphological measurements were done with a slide caliper. Twenty two morphological characters have been taken into consideration for all the known species. Morphological data for 4 species namely, *kempi*, *elongatus*, *garoensis* and *tikaderi* have been taken from description of type species and comparative chart has also been incorporated (measurements converted into percentage from the original data). Measurements are expressed in percentage in relation to standard length. The mean value are shown in parenthesis (Table 2).

Measurements of different morphological characters of Holotype and Paratypes are shown in Table 1.

***Aborichthys rosammai* sp. nov.**

(Plate I & II, A, B, C; Fig. 1 A, B)

Material examined : *Holotype* : 1 example, 26.25 mm TL, Regd.no.V/F/ERS/2129, Locality : Pabomukh, Subansiri river, Dhemaji district, Assam (alt. 32 mts.) (Latitude : 27° 34', Longitude : 94° 14'), Collector : R. Mathew and party, Date of collection : 03.02.2006.

Paratype : 4 examples, 19-28 mm TL, Regd. no. V/F/ERS/2497, Locality : Sippi river near Daporijo, Subansiri district, Arunachal Pradesh (alt. 251 mts.) (Latitude : 28° 04', Longitude : 94° 09') Collector : R. Mathew and party, Date of collection : 05.06.2007.

Description : D.ii.7 $\frac{1}{2}$, P. i.10, V.i.6, A. ii.5, C. 16-18

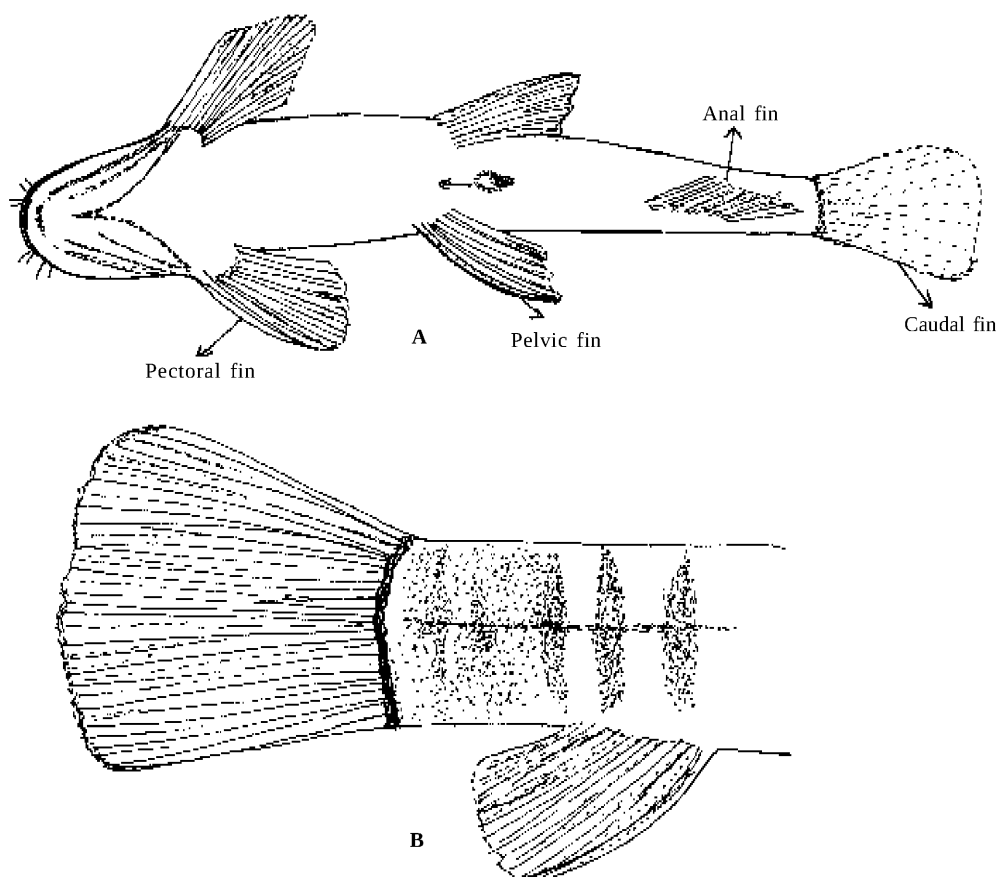


Fig. 1. Diagrammatic representation of (A) Ventral view of *Aborichthys rosammai* sp. nov. showing position of anus and different fins, (B) shape of caudal fin with band at base of the fin.

Table-1 : Measurements of different morphological characters of *A. rosammai* sp. nov. in relation of Standard length (in mm)

Sl. No.	Characters	Holotype	Paratypes (4 exs.)			
			1	2	3	4
1	Total length	26.25	28.00	23.00	24.00	19.00
2	Standard length	21.54	24.00	19.00	20.00	15.00
3	Head length	4.47	4.80	4.75	5.00	3.75
4	Head width	6.15	6.00	6.33	6.66	5.00
5	Head depth	8.72	8.00	9.50	10.00	7.50
6	Eye diameter	19.58	24.00	19.00	20.00	15.00
7	Inter-orbital distance	10.77	24.00	19.00	20.00	15.00
8	Snout length	10.77	12.00	9.50	10.00	7.50
9	Body depth	6.64	6.00	6.33	6.66	5.00
10	Predorsal distance	1.90	1.84	1.90	2.00	1.87
11	Prepectoral distance	4.30	4.00	3.80	4.00	3.75
12	Prepelvic distance	1.95	1.84	1.90	1.81	1.66
13	Preanal distance	1.28	1.26	1.26	1.33	1.36
14	Length of Dorsal fin	5.38	8.00	6.33	6.66	7.50
15	Length of Dorsal fin base	7.18	8.00	9.50	10.00	7.50
16	Length of Pectoral fin	5.24	6.00	6.33	6.66	5.00
17	Length of Pelvic fin	6.03	8.00	6.33	6.66	5.00
18	Length of Anal fin	6.22	6.00	6.33	6.66	7.50
19	Length of Anal fin base	10.77	12.00	12.66	13.33	15.00
20	Length of Caudal fin	4.57	6.00	4.75	5.00	5.00
21	Length of Caudal peduncle	5.38	6.00	6.33	6.66	7.50
22	Depth of Caudal peduncle	7.66	8.00	9.50	10.00	7.50
23	Distance between Pectoral and Pelvic fin	3.65	4.42	3.80	4.00	3.75
24	Distance between Pelvic and Anal fin	3.59	4.80	4.75	4.00	5.00
25	Distance between Snout to Vent	1.68	1.60	1.72	1.66	1.66
26	Distance between Vent to base of Caudal fin	2.42	2.40	2.71	2.50	2.50
27	Distance between Dorsal fin and base of Caudal fin	2.15	3.00	3.16	2.85	2.50
28	Distance between Anal fin and base of Caudal fin	5.38	6.00	6.33	6.66	7.50
29	Distance between Pelvic fin to vent	14.36	24.00	19.00	20.00	15.00
30	Distance between vent to base of Anal fin	5.38	6.00	6.33	6.66	7.50

Table-2 : Comparative chart of characters in different species of *Aborichthys*
All the measurements are in relation to Standard length (in percentage)

Characters	<i>A. garoensis</i>	<i>A. tikaderi</i>	<i>A. kempi</i>	<i>A. elongatus</i>	<i>Abrichthys n.sp.</i>
SL	85.80-89.50	100.0-110.0	53.50-71.30	60.70-74.00	15.0-24.0
CL	17.69-18.30 (17.96)	17.00-18.50 (17.83)	18.52-21.74 (20.38)	16.97-17.57 (17.27)	19.42-21.86 (20.64)
HL	15.50-16.20 (15.76)	16.36-17.31 (16.89)	18.70-22.06 (20.16)	18.12-18.38 (18.25)	22.12-22.33 (22.22)
BD	10.05-10.49 (10.28)	12.50-13.00 (12.74)	11.96-15.14 (13.72)	13.24-14.50 (13.87)	15.04-16.86 (15.95)
EYD	2.23-2.23 (2.27)	1.82-2.00 (1.91)	2.58-3.74 (3.26)	2.43-3.62 (3.03)	5.10-5.27 (5.18)
SN	7.23-7.39 (7.33)	7.00-6.69 (7.32)	7.78-9.35 (8.61)	8.11-8.24 (8.18)	9.28-10.54 (9.91)
IOR	3.50-4.48 (4.08)	4.55-4.81 (4.72)	3.53-6.17 (4.64)	4.05-4.61 (4.33)	5.27-9.28 (7.27)
HD	8.16-8.60 (8.39)	8.18-9.04 (8.74)	9.26-11.21 (10.18)	9.46-11.58 (10.00)	11.46-11.58 (11.52)
HW	12.07-12.35 (12.17)	10.91-11.35 (11.15)	12.09-14.95 (13.90)	9.46-12.85 (11.16)	16.24-16.86 (16.55)
CPL	21.56-23.46 (22.62)	22.00-23.64 (22.91)	15.03-19.07 (16.68)	18.12-20.00 (19.06)	15.19-18.57 (16.88)
LHCP	9.52-9.83 (9.67)	11.00-11.82 (11.45)	11.11-14.95 (13.10)	12.03-12.84 (12.44)	11.58-13.04 (12.31)
SN-V	49.50-49.60 (49.54)	48.00-48.18 (48.09)	50.07-58.15 (54.08)	58.51-61.94 (60.23)	59.37-60.09 (59.73)
V-CB	50.28-50.47 (50.38)	51.00-54.55 (52.49)	41.85-47.97 (44.52)	37.89-41.62 (39.76)	39.62-41.59 (40.60)
SN-D	43.67-44.25 (43.88)	43.27-44.55 (43.94)	46.13-53.33 (49.59)	50.68-51.40 (51.04)	52.50-52.53 (52.51)
D-CB	55.64-56.66 (56.08)	55.45-57.69 (56.71)	41.33-51.64 (48.76)	48.92-49.42 (49.17)	34.97-46.42 (40.69)
SN-PV	39.66-40.44 (40.14)	40.00-42.31 (41.10)	41.82-48.15 (45.70)	49.42-57.16 (53.29)	51.06-55.44 (53.25)
LD	11.19-12.85 (12.04)	11.54-12.00 (11.79)	13.85-15.33 (14.61)	12.16-13.51 (12.84)	14.15-18.57 (16.36)
LA	9.32-11.51 (10.15)	10.00-10.91 (10.50)	12.48-14.95 (13.33)	9.19-11.53 (10.36)	15.19-16.06 (15.62)
LPV	11.76-13.05 (12.55)	10.91-12.00 (11.48)	14.02-16.82 (15.30)	12.84-14.83 (13.84)	15.82-16.57 (16.19)
LPC	12.65-13.75 (13.27)	11.82-12.50 (12.17)	15.38-17.76 (16.91)	15.14-15.16 (15.15)	16.86-19.08 (17.97)
PC-PV	25.76-26.34 (26.12)	24.55-26.92 (25.82)	24.60-30.56 (28.15)	31.76-32.62 (32.19)	26.76-27.39 (27.07)
PV-A	30.30-31.28 (30.72)	18.84-33.64 (30.83)	28.97-30.20 (29.43)	26.36-26.49 (26.43)	21.72-27.85 (24.78)
A-CB	27.74-29.39 (28.49)	26.92-30.00 (28.31)	23.33-27.68 (25.29)	24.05-25.00 (24.53)	15.19-18.57 (16.88)

Body somewhat cylindrical, its depth 5.00-6.64 times in standard length. Dorsal and ventral profile of the body is almost parallel. Head slightly depressed, its depth 7.50-10.00, breadth 5.00-6.66, length 3.75-5.00 times in standard length. Eyes large, placed slightly nearer to snout, dorso-lateral in position; its diameter 4.00-5.00 times in head length. Snout rounded, 2.40-2.50 times in head length. Nostrils placed almost midway between eye and tip of snout, with short barbel like projection. Mouth slightly behind tip of snout, lower lip interrupted in middle. Barbels 3 pairs, all of equal length, longer than eye diameter. Length of dorsal fin 5.38-8.00, pectoral fin 5.00-6.66, pelvic fin 5.00-8.00, anal fin 6.00-7.50 and caudal fin 4.57-6.00 times in standard length. Predorsal distance 1.84-2.00, prepectoral distance 3.75-4.30, prepelvic distance 1.66-1.95 and preanal distance 1.26-1.36 times in standard length. Vent situated far forward towards pelvic fin, distinctly nearer base of caudal fin than tip of snout. The distance between snout to vent 1.60-1.72 and vent to base of caudal fin 2.40-2.71 times in standard length. Length of caudal peduncle 5.38-7.50 and height of caudal peduncle 7.50-10.00 times in standard length. Lateral line complete. The dorsal fin placed slightly behind or opposite to pelvic fins, its origin slightly nearer to base of caudal fin than to tip of snout. Longest ray of dorsal almost equal to body depth immediately below it. Anal fin nearer to base of caudal fin than to commencement of pelvic fins. Length of pectoral fins slightly shorter than head length (1.17-1.33 times). The distance between origin of pectoral and pelvic fins (3.42-4.00 times in standard length) shorter than the distance between pelvic and anal fins (3.59-5.00 times in standard length). Caudal fin more or less truncate; slightly rounded near edge (Plate II, C; Fig. 1B); its length slightly shorter than the head length. Caudal peduncle short, 1.00-1.50 times as long as high.

Colour : Dorsal surface of head greyish, body with 10-11 bands. In caudal peduncle region bands coalesced. A dark band at the base of caudal fin (Fig. 1 B). All the fins are dull white.

Etymology : The species has been named after the collector Smti. Rosamma Mathew

KEY TO THE SPECIES OF THE GENUS *ABORICHTHYS*

1. a) Vent situated equidistant between tip of snout and base of caudal fin or slightly nearer to snout 2
- b) Vent situated distinctly nearer to base of caudal fin than tip of snout 3
2. a) Depth of body 9.5-9.9 in standard length, eye diameter 6.6-7.2 in head length; 30-35 bands *garoensis*
- b) Depth of body 7.7-8.0 in standard length, eye diameter 8.5-9.0 in head length, 15-20 bands *tikaderi*
3. a) Body marked with several black bands; caudal fin rounded and marked with crescentic black rings; a black spot at upper end of base of caudal fin 4
- b) Body marked with 10-11 bands; caudal fin almost truncate without any coloured bands; a black band at the base of caudal fin *rosammai* n.sp.

4. a) Body marked with broad black rings alternating with Narrow yellowish bands , indistinct in anterior half; barbels as long as eye diameter *elongatus*
- b) Body marked with oblique black stripes indistinct in posterior third of body; barbels much longer than eye diameter *kempi*

DISCUSSION

To quote Hora (1925), “there is no doubt that fishes of the genus *Aborichthys* are evolved from those of the genus *Nemachilus* chiefly by the change in the position of the vent”. This is very much true for the present species. Except for the position of vent the present species is morphologically very much similar to genus *Schistura*. The diagnostic characters of *Aborichthys* such as ‘greatly elongated body, all fins greatly removed from one another, lunate caudal fin, a black spot at upper end of base of caudal fin’ - all these characters are lacking in the present species.

Out of the 22 morphological characters (shown in Table-2), the present specimens are showing differences in at least 12 -14 characters with other known species.

In morphometrics the species is closer to *kempi* but differences have been noticed in body depth (15.95% versus 13.72% mean value), head width (16.55% versus 13.90%), eye diameter (5.18% versus 3.26% mean value), inter orbital space (7.27% versus 4.64% mean value), length of dorsal fin (16.36% versus 14.61% mean value), anal fin (15.62% versus 13.33% mean value) and pectoral fins (17.97% versus 16.91% mean value), distance between tip of snout to vent (59.73% versus 54.08% mean value), between snout to base of dorsal fin (52.51% versus 49.59% mean value), between snout to base of pelvic fin (53.25% versus 45.70% mean value), which are more in *A. rosammai* but distance between origin of pelvic to anal fin (24.78% versus 29.43% mean value), vent to base of caudal fin (40.60% versus 44.52% mean value), dorsal fin to base of caudal fin (40.69% versus 48.76% mean value) origin of anal to base of caudal fin (16.88% versus 25.29% mean value) are less in *A. rosammai* (Histogram I).

The present species shows some similarity with *elongatus* in least height of caudal peduncle (12.31% versus 12.44% mean value), distance between tip of snout to vent (59.73% versus 60.23% mean value), vent to base of caudal fin (40.6% versus 39.76% mean value), snout to base of pelvic fin (53.25% versus 53.29% mean value) but differ in length of caudal fin (20.64% versus 17.27% mean value), head length (22.22% versus 18.25% mean value), body depth (15.95% versus 13.87% mean value), eye diameter (5.18% versus 3.03% mean value), snout length (9.91% versus 8.18% mean value), inter orbital distance 7.27% versus 4.33% mean value), head depth (11.52% versus 10.00% mean value), length of dorsal fin (16.36% versus 12.84% mean value), anal fin (15.62% versus 10.36% mean value), pelvic fin (16.19% versus 13.84% mean value), pectoral fin (17.97% versus 15.15% mean value) which are more in *A. rosammai*. In measurements like length of caudal peduncle (16.88% versus 19.06% mean value), distance between dorsal fin to base of caudal fin (40.69% versus 49.17% mean value), pectoral to pelvic fin (27.07% versus 32.19% mean value) and anal fin to base of caudal fin (19.68% versus 24.53% mean value) are less in *rosammai* (Histogram II).

With *garoensis* and *tikaderi* it shares some similarity only in distance between origin of pectoral and pelvic fins (27.07% in *rosammai*, 26.12% in *garoensis* and 25.82% in *tikaderi*). In other characters much differences have been noticed which have been shown in Table I and Histogram III & IV.

Hora (1925) opined that *A.elongatus* is the primitive form under this genus where vent is nearer to tip of caudal fin (snout-vent distance 58.51-61.94% and vent-base of caudal fin 37.89-41.62% in SL) and colour bands in the body somewhat similar as in the Indian species of *Schistura*. Subsequently, he placed *kempi* (snout-vent distance 50.07-58.15% and vent-base of caudal fin 41.85-47.97%) and *garoensis* (snout-vent distance 49.50-49.60% and vent-base of caudal fin 50.28-50.47%) based on movement of vent towards snout. In *tikaderi*, vent is more forward than *garoensis* (snout -vent distance 48.0-48.18% and vent-base of caudal fin 51.00-54.55%).

In the present species, position of vent (snout-vent distance 59.37-60.09% and vent-base of caudal fin 39.62-41.59%) is somewhat similar to *elongatus* but on the basis of body shape, presence of band at base of caudal fin and shape of the caudal fin it can be concluded that the present species is more primitive than *elongatus*.

ABSTRACT

A new species *Aborichthys rosammai* is described from North-East India. Other known species under the genus are *kempi*, *elongatus*, *garoensis* and *tikaderi*. The new species has been compared with all the known species to confirm for its separate identity. The genus is so far restricted to North East India with only *A. kempi* having its distribution in Myanmar also.

ACKNOWLEDGEMENTS

The author is grateful to Director, Zoological Survey of India, Kolkata for permission to publish the same. Thanks are due to R.Mathew and party for taking much interest in collecting mainly paratypes and D.Khynriam for helping in preparation of manuscript. Thanks are also due to C.Radhakrishnan, Additional Director, Zoological Survey of India, Kozikode, for reviewing the manuscript and necessary suggestions and comments.

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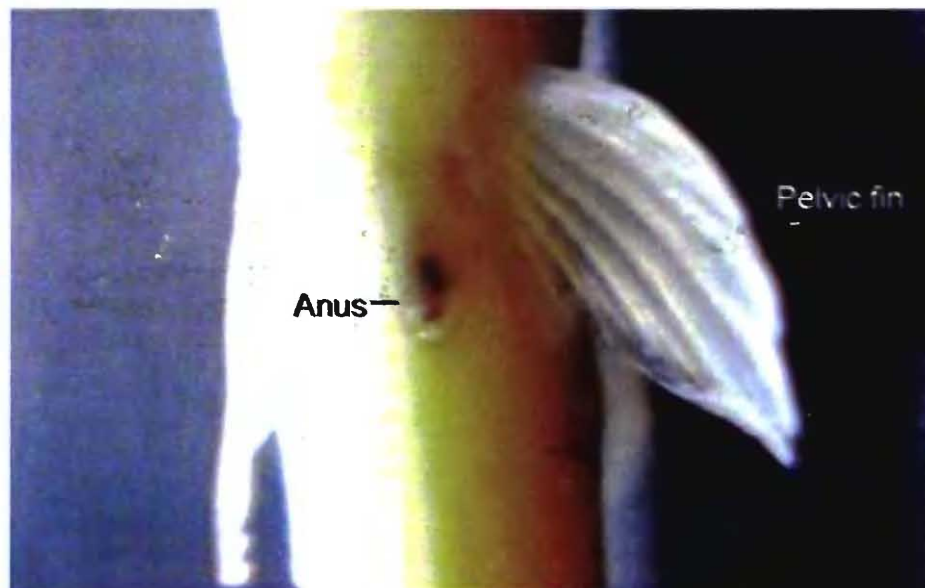
PLATE I



A. *Aborichthys rosammai* sp. nov. (Dorsolateral view)



B. *Aborichthys rosammai* sp. nov. (Ventral view showing position of vent)



C. *Aborichthys rosammai* sp. nov. (Position of vent)

PLATE II



A. *Aborichthys rosammai* sp. nov. (Lateral view from different angle)



B. *Aborichthys rosammai* sp. nov. (Lateral view from different angle)



C. *Aborichthys rosammai* sp. nov. (Shape of caudal fin)

PLATE III

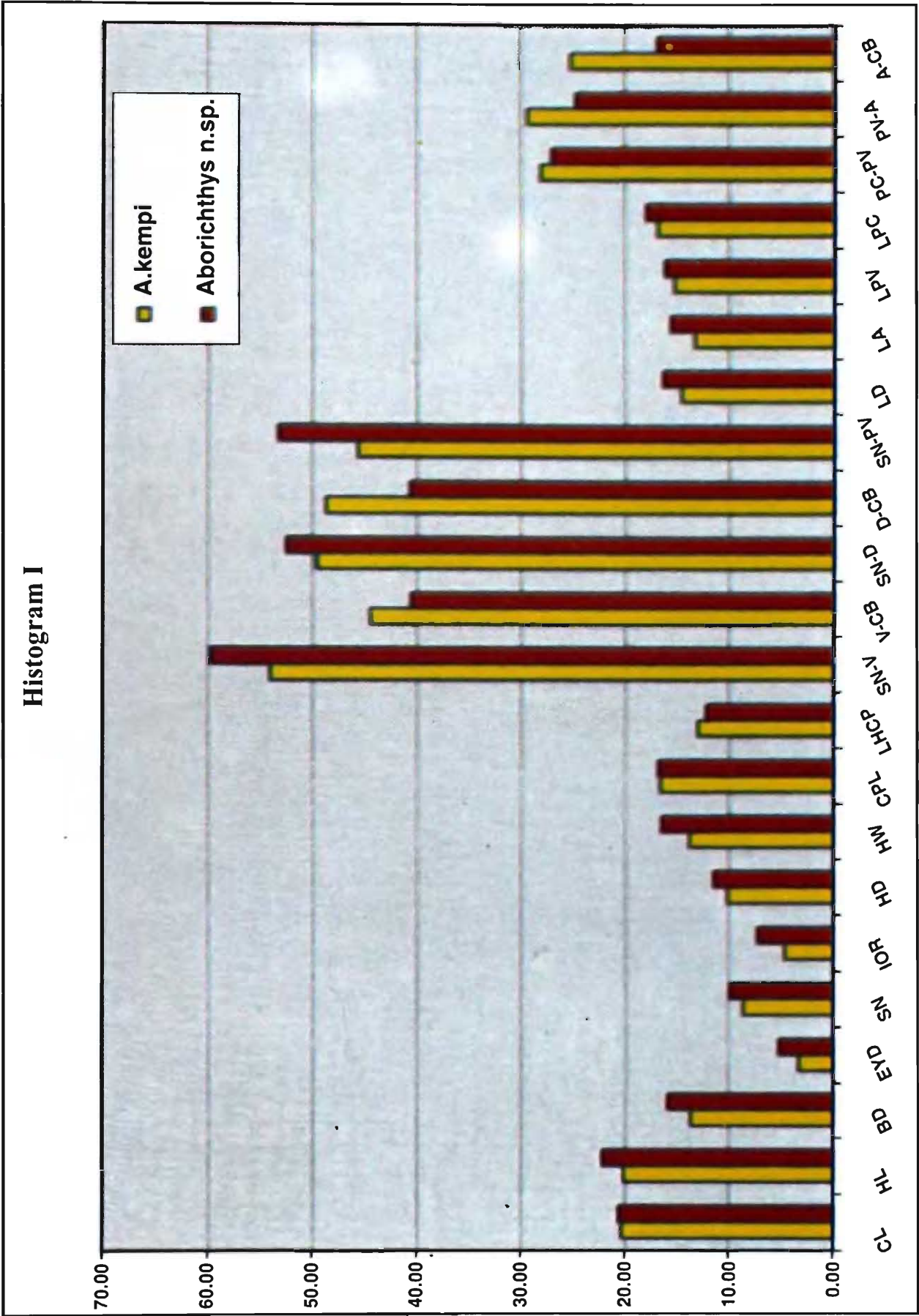


PLATE IV

Histogram II

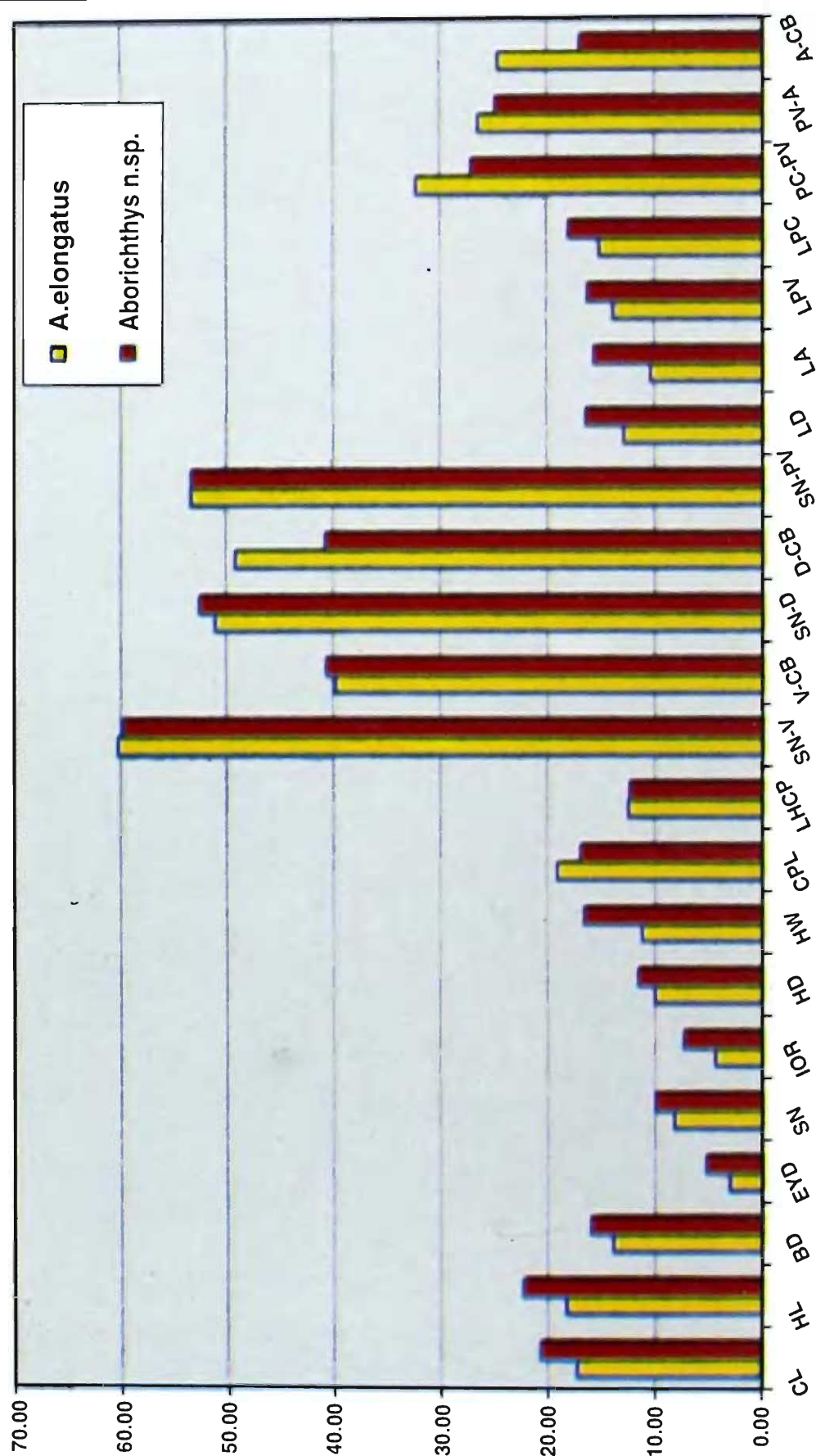


PLATE V

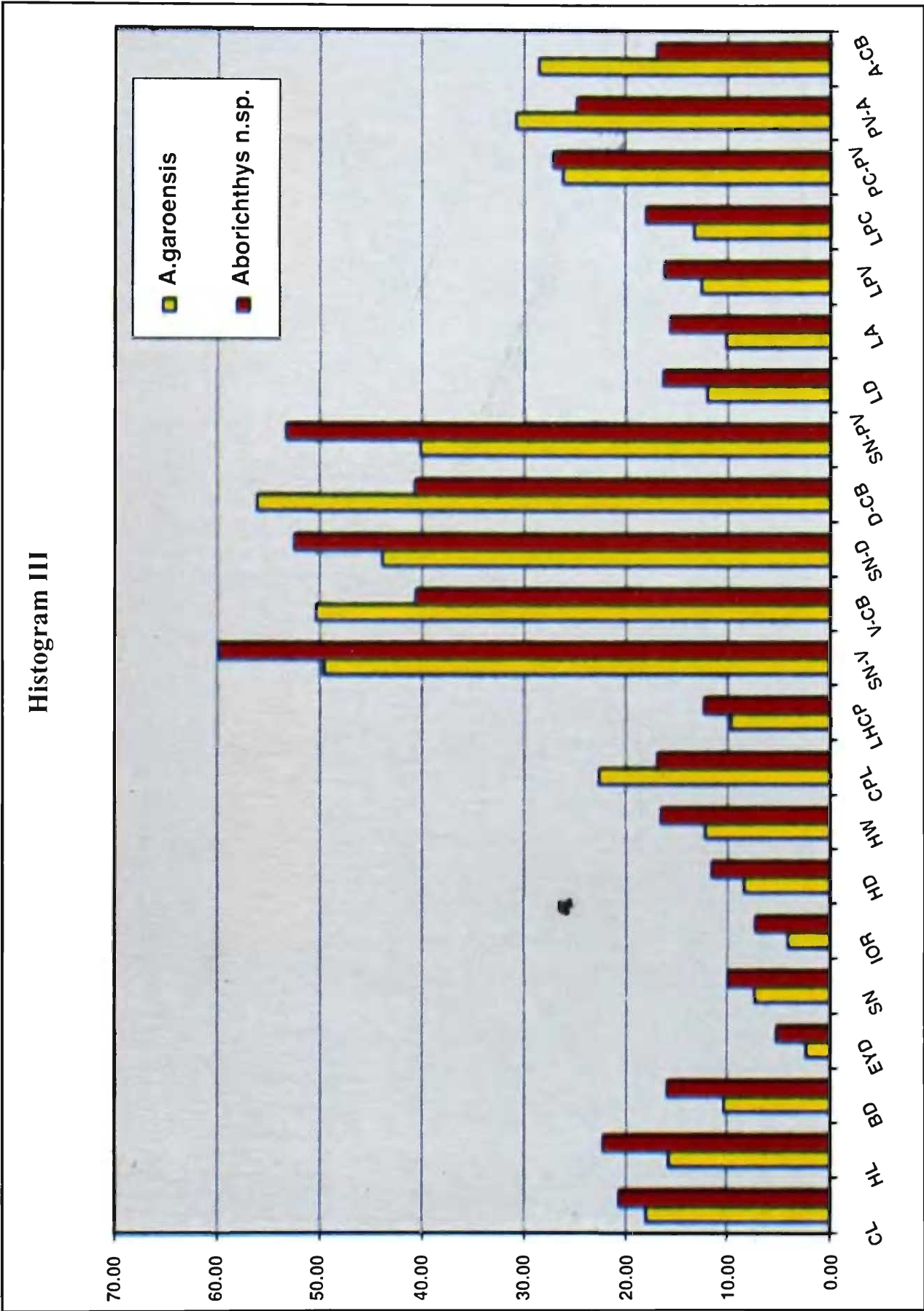
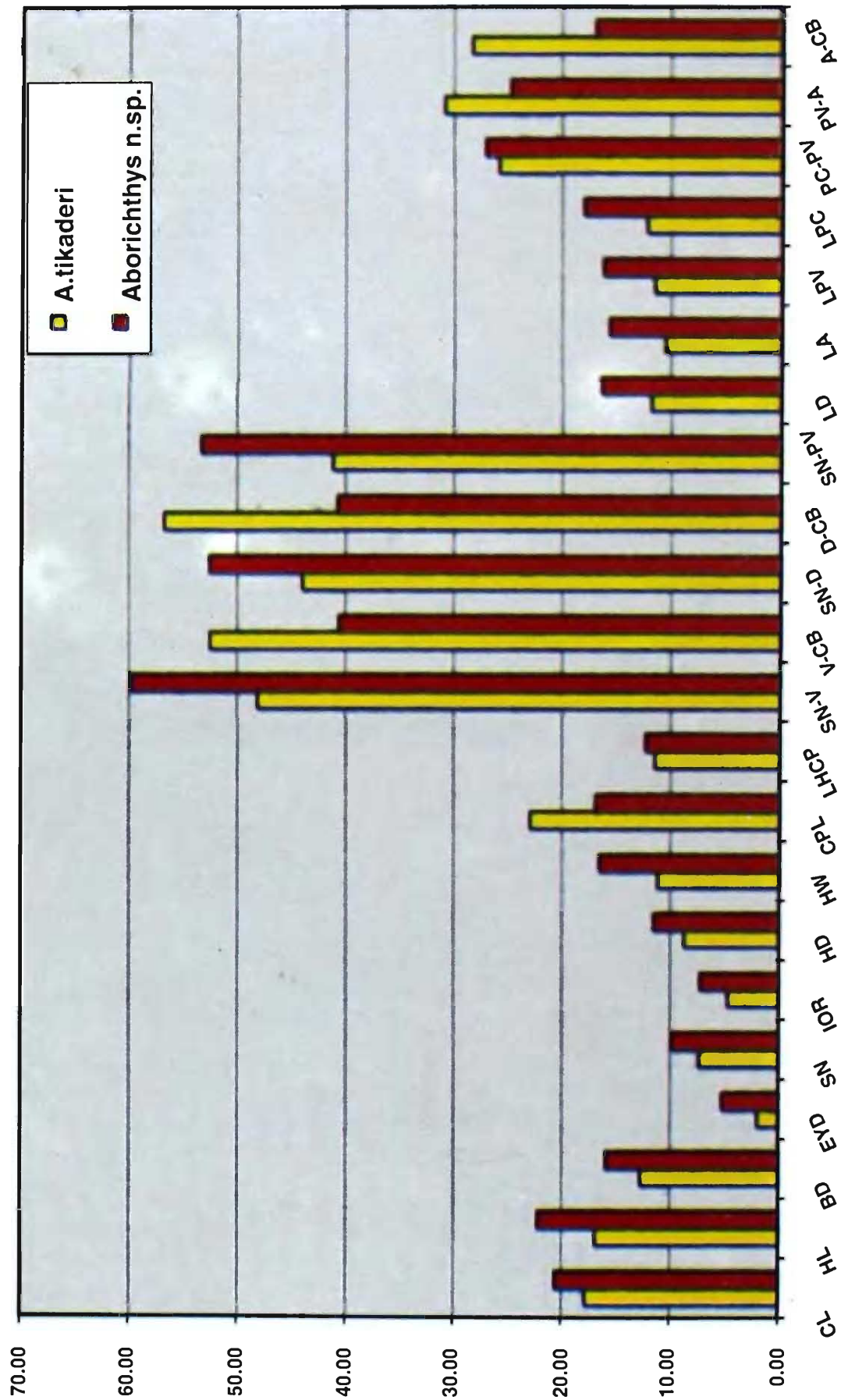


PLATE VI

Histogram IV





Rec. zool. Surv. India, **109**(Part-2) : 21-22, 2009

NEW RECORD OF *HORALABIOSA JOSHUAI* SILAS (PISCES : CYPRINIFORMES : CYPRINIDAE) FROM NORTH EAST INDIA

NIBEDITA SEN

Eastern Regional Station, Zoological Survey of India, Shillong-793 003

The genus *Horallabiosa* and species *H. joshuai* was first described by Silas (1953) from Peninsular India based on 13 specimens (27-49 mm TL). For a number of years the genus was considered as a hybrid between *Garra* and *Rasbora*. Talwar and Jhingran (1991) synonymised it with *Garra mullya* (Sykes). After getting several specimens (598 exs. 12-90 mm TL) from different drainages and altitudes (730-1330 mts.) from original type locality. Rema Devi (1992) redescribed the species exhibiting a few variations and established its validity (Jayaram 1999). Subsequently another new species *Horallabiosa palaniensis* was described from Western Ghat, South India by Rema Devi and Menon (1994).

While studying the fish collections from Subansiri river, Dhemaji district, Assam, India, the author came across two interesting specimens (25-26 mm TL) along with other known species of *Garra*. On detailed study the specimens having post-labial callous structure were identified as *Horallabiosa joshuai* Silas (Plate I A, B, C).

MATERIAL EXAMINED

1 ex. (26 mm TL, 21 mm SL), (Regd. no. V/F/ERS/2130), Pabomukh, Subansiri river, Dhemaji district, Assam; alt. 32 mts., Lat. 27°34', Long 94°14'; R. Mathew and party, 03.02.2006.

1 ex. (25 mm TL, 21 mm SL), (Regd. no. V/F/ERS/2131), Subansiri River, Dhemaji district, Assam; alt. 99 mts., Lat 27°32', Long 94°15'; R. Mathew and party, 02.02.2006.

Diagnostic characters : D. 3/6, P.1/12-13, V.1/6-7, A.2/5, C.19, L.1.31-32

Predorsal scales 11-12 Ltr. $3\frac{1}{2}$ -40/3.0-3 $\frac{1}{2}$. Body moderately elongate, head slightly longer than broad, length of head 5.0-5.7, body depth 6.3-7.4 in total length; head depth 1.3-1.6, head width 1.5-1.6, eye diameter 3.0-4.1, inter orbital distance 2.2-2.5 in head length; length of pectoral fin 5.2, pelvic fin 6.0-6.5, predorsal distance 2.1 in standard length; height of dorsal fin 0.7-0.8 in its body

depth. Callous pad is slightly longer than broad. The rostral and maxillary barbels are small but well developed, as long as or little shorter than eye, does not reach anterior border of orbit.

Remarks : The specimens are almost similar to those described by Rema Devi (1992) except few differences : length of head is more in present specimens, (5.0-5.7 versus 4.0-5.08 in total length); body depth (6.3-7.4 versus 5.08-7.22), length of pelvic fin (6.0-6.5 versus 4.09-6.0) are relatively longer; both rostral and maxillary barbels are almost of equal length and do not reach anterior border of orbit (versus maxillary extends beyond posterior margin of eye). The present specimens differ from *Horallabiosa palaniensis* Remadevi and Menon (1994) in presence of scales on predorsal, dorsal base and ventral region (absent in *palaniensis*); moreover lateral line scales are more (37) in *palaniensis* than *joshuai* (31-32).

It is interesting to note that the species recorded so far only from Peninsular India between altitude 730-1330 mts., whereas present specimens are collected between altitude 32-99 mts. only. The species has been recorded for the first time from North East India extending its range of distribution from Peninsular India to North East India justifying Hora's "Satpura Hypothesis".

ACKNOWLEDGEMENTS

The author is grateful to Director, Zoological Survey of India, Kolkata for permission to publish the same. Thanks are due to Mrs. R. Mathew and party for their collection.

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SEN : New record of *Horlabiosa joshua* Silas (Pisces : Cypriniformes : Cyprinidae)...etc.

PLATE I



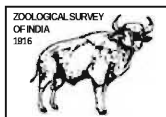
Lateral view of *Horlabiosa joshuai* Silas



Ventral view of head showing post labial callous pad



Ventral view of *Horlabiosa joshuai* Silas



Rec. zool. Surv. India, **109**(Part-2) : 23-26, 2009

ON TWO SPECIES OF CRINOIDEA, ECHINODERMATA FROM LAKSHADWEEP, ARABIAN SEA

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INTRODUCTION

While describing the echinoderm fauna of Lakshadweep James (1989) and Sastry (1991) reported no crinoids though, several are known from the nearby Maldives. However, James (op. cit.) could collect only a few bits of crinoid arms which could not be identified. Recently, one of us (ChS) while SCUBA diving at Lakshadweep atolls, collected two specimens of Crinoidea belonging to two species from the reef slopes which could be identified and a few arm bits of a third species which could not be identified. Thus, the two species of Crinoidea are additions to the echinoderm fauna of these atolls. Since the species are already known from the Indian coast, these are briefly described.

Phylum ECHINODERMATA

Class CRINOIDEA

Order COMASTERIDA

Family COMASTERIDAE

1. *Comatella nigra* (P.H. Carpenter)

(Fig. 1)

1876. *Actinometra nigra* Carpenter, P.H. *Journ. Anat. Physiol.*, **10** : 583.

1888. *Actinometra nigra* : Carpenter, P.H. "*Challenger*" *Reports, Zoology*, Vol. **26** : 304.

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2007. *Comaterlla nigra* : Sastry, D.R.K. Rec. zool. Surv. India, Occ. Paper No., **271** : 8.

Material : Kavaratti Island, upper reef slope outside the lagoon, 30 m, 19.04.2008, one specimen.

Description : Arms 38 in number, 80-100 mm long, terminal segments of proximal pinnules forming a comb. P₁ on second brachial segment, first brachial syzygy at 3 + 4. Br series of two ossicles, most II Br series with two III Br series. Cirri about 20, each of about 30 segments with tubercles on the dorsal side.

Distribution : India : Andamans (Sastry, 2007) and Lakshadweep.

Elsewhere : East Indies, Philippines, South China Sea and North Australia (Clark and Rowe, 1971).

***Comatella stelligera* (P.H. Carpenter)**

(Fig. 2)

1880. *Actinometra stelligera* Carpenter, P.H. J. Linn. Soc (Zool.), **15** : 198.

2007. *Comatella stelligera* : Sastry, D.R.K. Rec. zool. Surv. India, Occ. Paper No., **271** : 9.

Material : Kavaratti Island, upper reef slope outside the lagoon, 30 m, 19.04.2008, one specimen.

Remarks : Differs from *C. nigra* in having III Br series only on outer side of II Br. Arms 80-100 mm long; cirri more than 30 in number with more than 40 segments each.

Distribution : India : Tamil Nadu, Andamans (Sastry, 2007) and Lakshadweep.

Elsewhere : Bay of Bengal to South China Sea and North Australia (Clark and Rowe, 1971).

SUMMARY

Recent SCUBA diving collections from Kavaratti Island of Lakshadweep contained two species of Crinoidea, *Comatella nigra* and *C. stelligera*. This is the first report of Crinoidea from these islands. The finding also extends the distribution of the both the species westward into the Arabian Sea.

ACKNOWLEDGEMENTS

We are grateful to the Director, Zoological Survey of India, Kolkata, authorities of Lakshadweep Administration and Dr. M.V.M. Wafar, NIO, Goa, for the excellent facilities provided during the study.

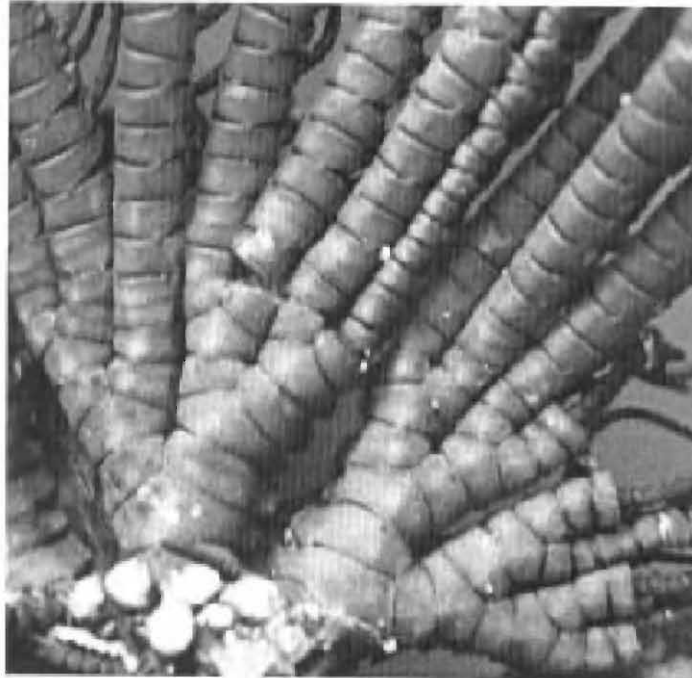


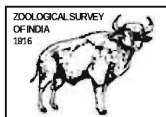
Fig. 1. *Comatella nigra*



Fig. 2. *Comatella stelligera*

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Rec. zool. Surv. India, **108**(Part-2) : 27-53, 2008

BIRDS OF LADAKH AND ANALYSIS OF THEIR STATUS

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INTRODUCTION

The Trans-Himalayan cold desert of Ladakh is located on the border between the Palaearctic and the Indo-Malayan zoogeographic zones and it harbours characteristic avifauna of both the regions (Pfister, 2004).

Ladakh is a land of high mountains, deep valleys and vast arid plains with a network of internal drainage system that opens into numerous marshes and lakes. These marshes and lakes provide foraging and breeding ground for a variety of resident and migratory birds like endangered Black-necked Crane, Bar-headed Goose, Great Crested Grebe, *etc.* (Islam and Rahmani, 2004).

Studies on the birds of Ladakh started way back in the second half of nineteenth century when Tibetan Plateau was open to the outsiders. Many workers such as Hume (1873), Richmond (1895), Ward (1906, 1908), Ludlow (1920, 1950), Wathen (1923), Whistler (1935, 1936), Osmaston (1925, 1926, 1927 a & b, and 1930); Meinertzhagen (1927), LaPearson (1928 a & b), Sillem (1935), Koelz (1939), Biswas (1950), Vaurie (1972), Gole (1978, 1992), Williams and Delaney (1985, 1986), Delaney *et al.* (1982), Holmes *et al.* (1983), Holmes (1986), Naryan *et al.* (1986), Jamdar (1987), Mallon (1987), Akhtar (1990), Fily and Perennou (1990), Pfister (1997, 1998, 1999 and 2004), Singh and Jaypal (2001), Sangha *et al.* (2003), Sanga and Naoroji (2005), Namgail (2005), *etc.* have explored the region for its avifauna.

Pfister (2004), based on the published literature as well as his own field observations, provided a checklist of 310 bird species for Ladakh, which has been utilised here but with the nomenclature after Manakadan and Pittie (2001).

Recently, the Zoological Survey of India, Solan conducted two general faunistic surveys in the eastern Ladakh : one in 2002 and the other in 2005. The survey parties sighted and recorded a total

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of 92 bird species, which are marked with an asterisk prefixed to their respective serial number (Table 1).

The present communication is, basically, an attempt to analyse the status of these 310 bird species in light of the recent literature (Tables 1-3).

STUDY AREA

Ladakh (La = Pass; dakh = Land), the secluded wonderland of passes covers an area of 97,872 sq. km. It is situated in the northeastern part of the state of Jammu & Kashmir. It is located in the Trans-Himalayan region (2700 m to 6100 m) at coordinate 32°15'–36° N and 75°15'–80°15' E. It is sandwiched between two giant mountain ranges, viz., the Himalayas and the Karakoram. It is bounded by China (Tibet) in the east, Himachal Pradesh (Lahaul & Spiti district) in the south, valley of Kashmir in the west and by Pakistan in the north.

The area is broadly divisible in to two major topographical subdivisions, viz., the eastern plateau and the western mountainous. Due to its entire hilly rugged terrain, inhospitable semi-arctic climate, heavy snowfall, ultraviolet radiation, lack of moisture, very low rainfall (9.6 cm annually) and scanty vegetation Ladakh is also known as '*High Altitude Cold Desert*'.

The River Indus is the mainstay and the life giver for Ladakh. The principal tributaries of which are Zaskar, Shyok, Nubra and Hanle. It is bestowed with some very large brackish water lakes, viz., Pangong Tso, Tso Moriri (Ramsar site number 1213), Tso Kar etc. and many small and large freshwater lakes accompanied by vast marshes in the river valleys.

Floristically, Ladakh comes under "*Alpine Desert Flora*", and its natural vegetation can be described as shrubs (*Hippophae rhamnoides*, *Caragana pygmaea*) and thorny bushes, and herbaceous plants. The natural tree elements are largely lacking, except for more humid regions of Nubra valley and other river valleys. The most common trees in area are the Poplar and Willows.

METHODOLOGY

As stated above that recently two field surveys were undertaken in the eastern Ladakh using a departmental vehicle : one for 15 days in 2002 and the other for 20 days in 2005. Approximately 1000 km distance was covered in August 2002 and 1500 km in August-September 2005. The main localities surveyed were : Pang, Tanglang La (Moor Plains), Leh, Nyoma, Loma, Chushul, Thakum, Pangong Tso, Tangtse (Parma Valley), Lo Yogma, Dungti, Tigermala (Dumchock/upper Indus), Hanle (Neelamkhul Plains), Kalang Tar Tar Valley), Mahe, Tso Moriri, Sumdo and Tsokar.

The birds were observed with the aid of a 10 × 50 prismatic field binocular and identified with the help of various field guides (Ali & Ripley 1983 a & b, Grimmett *et al.* 1999, Krys 2000, and Kumar *et al.* 2005). For convenience, the classification at order level and at some places at family level, as given by Ali and Ripley (1983b), has also been added in the Table 1.

Table 1. : Showing systematic list and status of the birds recorded from Ladakh.

Sl. No.	Common names	Scientific names	Residentail status	Abundance status	Breeding status	BirdLife Int. 2004	Wlldlife (P) Act 1972	Jhunjunwala et al. (2001)
1	2	3	4	5	6	7	8	9
	I. Order 1. Grebes	PODICIPEDIFORMES Podicipedidae						
1.	Little Grebe (5)	<i>Tachybaptus ruficollis</i> (Pallas, 1764)	SV	1			IV	
*2.	Great Crested Grebe (3)	<i>Podiceps cristatus</i> (Linnaeus, 1758)	SV	3	br+		IV	
3.	Black-necked Grebe (4)	<i>Podiceps nigricollis</i> Brehm, 1831	SV	1			IV	
	II. Order 2. Cormorants/Shags	PELECANIFORMES Phalacrocoracidae						
4.	Little Cormorant (28)	<i>Phalacrocorax niger</i> (Vieillot, 1817)	SV	1			IV	
*5.	Great Cormorant (26)	<i>Phalacrocorax carbo</i> (Linnaeus, 1758)	PM	3			IV	
	III. Order 3. Herons, Egrets & Bitterns	CICONIIFORMES Ardeidae						
6.	Little Egret (49)	<i>Egretta garzetta</i> (Linnaeus, 1766)	PM	2			IV	
7.	Grey Heron (35-36)	<i>Ardea cinerea</i> Linnaeus, 1758	PM	3			IV	
8.	Large Egret (45-46)	<i>Casmerodius albus</i> (Linnaeus, 1758)	PM	2			IV	
9.	Cattle Egret (44)	<i>Bubulcus ibis</i> (Linnaeus, 1758)	SV	1			IV	
10.	Indian Pond-Heron (42-42a)	<i>Ardeola grayii</i> (Sykes, 1832)	SV	2	br+		IV	
11.	Black-crowned Night-Heron (52)	<i>Nycticorax nycticorax</i> (Linnaeus, 1758)	SV	2			IV	
12.	Little Bittern (55)	<i>Ixobrychus minutus</i> (Linnaeus, 1766)	PM	1			IV	
13.	Great Bittern (59) <i>Botaurus stellaris</i> (Linnaeus, 1758)	WV	1			IV		
	4. Storks	Ciconiidae						
14.	Black Stork (65)	<i>Ciconia nigra</i> (Linnaeus, 1758)	PM	3			IV	
	5. Ibises & Spoonbills	Threskiornithidae						
15.	Glossy Ibis (71)	<i>Plegadis falcinellus</i> (Linnaeus, 1766)	SV	1			IV	

Table 1. : (Cont'd.).

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1	2	3	4	5	6	7	8	9
	IV. Order 6. Swans, Geese & Ducks	ANSERIFORMES Anatidae						
16.	Greylag Goose (81)	<i>Anser anser</i> (Linnaeus, 1758)	PM	2			IV	
*17.	Bar-headed Goose (82)	<i>Anser indicus</i> (Latham, 1790)	SV	4	br+		IV	
*18.	Brahminy Shelduck (90)	<i>Tadorna ferruginea</i> (Pallas, 1764)	SV	4	br+		IV	
*19.	Gadwall (101)	<i>Anas strepera</i> Linnaeus, 1758	PM	3	br+		IV	
*20.	Eurasian Wigeon (103)	<i>Anas penelope</i> Linnaeus, 1758	PM	3	br+		IV	
21.	Mallard (100)	<i>Anas platyrhynchos</i> Linnaeus, 1758	PM	5	br+		IV	
22.	Northern Shoveller (105)	<i>Anas clypeata</i> Linnaeus, 1758	PM	4			IV	
23.	Northern Pintail (93)	<i>Anas acuta</i> Linnaeus, 1758	PM	4			IV	
*24.	Garganey (104)	<i>Anas querquedula</i> Linnaeus, 1758	PM	4	br+		IV	
25.	Common Teal (94)	<i>Anas crecca</i> Linnaeus, 1758	PM	4			IV	
*26.	Red-crested Pochard (107)	<i>Rhodonessa rufina</i> (Pallas, 1773)	PM	3	br+		IV	
*27.	Common Pochard (108)	<i>Aythya ferina</i> (Linnaeus, 1758)	PM	3	br+		IV	
28.	Ferruginous Pochard (109)	<i>Aythya nyroca</i> (Guldenstadt, 1770)	SV	2	br+	NT	IV	
29.	Tufted Pochard (111)	<i>Aythya fuligula</i> (Linnaeus, 1758)	PM	3	br+		IV	
*30.	Common Merganser (120-121)	<i>Mergus merganser</i> Linnaeus, 1758	R	3	br+		IV	
	V. Order Old World Vultures, Kites, Harriers	FALCONIFORMES Accipitridae						
31.	Oriental Honey-Buzzard (129-130)	<i>Pernis ptilorhynchus</i> (Temminck, 1821)	PM	2			I	
32.	Black-shouldered Kite (124)	<i>Elanus caeruleus</i> (Desfontaines, 1789)	PM	1			I	
33.	Red Kite (131)	<i>Milvus milvus</i> Linnaeus, 1758	SV	1			I	
*34.	Black Kite (132-134)	<i>Milvus migrans</i> (Boddaert, 1783)	SV	3	br+		I	

Table 1. : (Cont'd.).

Sl. No.	Common names	Scientific names	Residentail status	Abundance status	Breeding status	BirdLife Int. 2004	Wlldlife (P) Act 1972	Jhunjunwala et al. (2001)
1	2	3	4	5	6	7	8	9
35.	Pallas's Fish-Eagle (174)	<i>Haliaeetus leucoryphus</i> (Pallas, 1771)	PM	2		VU	I	
*36.	Bearded Vulture (188)	<i>Gypaetus barbatus</i> (Linnaeus, 1758)	R	3	br+		I	
37.	Egyptian Vulture (186-187)	<i>Neophron percnopterus</i> (Linnaeus, 1758)	PM	2			IV	
*38.	Himalayan Griffon (181)	<i>Gyps himalayensis</i> Hume, 1869	R	3	br+		IV	BRS (05)
39.	Cinereous Vulture (179)	<i>Aegypius monachus</i> (Linnaeus, 1766)	PM	1		NT	IV	
40.	Short-toed Snake-Eagle (195)	<i>Circaetus gallicus</i> (Gmelin, 1788)	PM	2			?	
41.	Western Marsh-Harrier (193)	<i>Circus aeruginosus</i> (Linnaeus, 1758)	PM	4			I	
42.	Hen Harrier (189) <i>Circus cyaneus</i> (Linnaeus, 1766)	PM	2			I		
43.	Pallid Harrier (190)	<i>Circus macrourus</i> (S.G. Gmelin, 1770)	PM	3		NT	I	
44.	Montagu's Harrier (191)	<i>Circus pygargus</i> (Linnaeus, 1758)	PM	3			I	
45.	Eurasian Sparrowhawk (147-148)	<i>Accipiter nisus</i> (Linnaeus, 1758)	SV	3	br+		I	
46.	Northern Goshawk (136)	<i>Accipiter gentilis</i> (Linnaeus, 1758)	PM	4			I	
47.	Long-legged Buzzard (153)	<i>Buteo rufinus</i> (Cretzschmar, 1827)	SV	2			I	
48.	Upland Buzzard (154)	<i>Buteo hemilasius</i> Temminck & Schlegel, 1845	SV	2	br+		I	
49.	Greater Spotted Eagle (170)	<i>Aquila clanga</i> Pallas, 1811	PM	1		VU	I	
50.	Steppe Eagle (169)	<i>Aquila nipalensis</i> Hodgson, 1833	PM	2			I	
*51.	Golden Eagle (166)	<i>Aquila chrysaetos</i> (Linnaeus, 1758)	R	3	br+		I	
52.	Booted Eagle (164)	<i>Hieraaetus pennatus</i> (Gmelin, 1788)	PM	3			I	
	8. Osprey	Pandionidae						
53.	Osprey (203)	<i>Pandion haliaetus</i> (Linnaeus, 1758)	PM	2			I	
	9. Falcons	Falconidae						
*54.	Common Kestrel (222-224)	<i>Falco tinnunculus</i> Linnaeus, 1758	SV	4	br+		IV	
55.	Merlin (217-218)	<i>Falco columbarius</i> Linnaeus, 1758	PM	2			IV	

Table 1. : (Cont'd.).

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56.	Eurasian Hobby (212-213)	<i>Falco subbuteo</i> Linnaeus, 1758	SV	3	br+		IV	
57.	Saker (206-207)	<i>Falco cherrug</i> J.E. Gray, 1834	PM	3		EN	I	
58.	Peregrine Falcon (209-211)	<i>Falco peregrinus</i> Tunstall, 1771	PM	2			I	
	VI. Order 10. Pheasants, Partridges, Quails	GALIFORMES Phasianidae						
59.	Snow Partridge (227)	<i>Lerwa lerwa</i> (Hodgson, 1833)	**	?			IV	BRS (05)
60.	Tibetan Snowcock (229-231)	<i>Tetraogallus tibetanus</i> Gould, 1854	R	3	br+		I	BRS (05)
61.	Himalayan Snowcock (232)	<i>Tetraogallus himalayensis</i> G.R. Gray, 1843	R	3	br+		IV	BRS (05)
*62.	Chukor (234-236) <i>Alectoris chukar</i> (J.E. Gray, 1830)	R	4	br+		IV		
*63.	Tibetan Partridge (248-249)	<i>Perdix hodgsoniae</i> (Hodgson, 1857)	R	3	br+		IV	BRS (05)
64.	Common Quail (250)	<i>Coturnix coturnix</i> (Linnaeus, 1758)	SV	2			IV	
65.	Rain Quail (252)	<i>Coturnix coromandelica</i> (Gmelin, 1789)	**	?			IV	BRS (11)
	VII. Order 11. Cranes	GRUIFORMES Gruidae						
66.	Siberian Crane (325)	<i>Grus leucogeranus</i> Pallas, 1773	**	?		CR	I	
67.	Demoiselle Crane (326)	<i>Grus virgo</i> (Linnaeus, 1758)	PM	1			IV	
*68.	Black-necked Crane (321)	<i>Grus nigricollis</i> Przevalski, 1876	SV	2	br+	VU	I	BRS (05)
	12. Rails, Crakes, Moorhens, Coots	Rallidae						
69.	Water Rail (327-328)	<i>Rallus aquaticus</i> Linnaeus, 1758	WV	2			IV	
70.	Corn Crake (334) <i>Crex crex</i> (Linnaeus, 1758)	PM	1			IV		
71.	Baillon's Crake (337)	<i>Porzana pusilla</i> (Pallas, 1776)	PM	3			IV	
72.	Spotted Crake (338)	<i>Porzana porzana</i> (Linnaeus, 1766)	PM	2			IV	
73.	Common Moorhen (347-347a)	<i>Gallinula chloropus</i> (Linnaeus, 1758)	PM	3			IV	
*74.	Common Coot (350)	<i>Fulica atra</i> Linnaeus, 1758	PM	3	br+		IV	

Table 1. : (Cont'd.).

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	VIII. Order 13. Jacanas	CHARADRIIFORMES Jacanidae						
75.	Pheasant-tailed Jacana (358)	<i>Hydrophasianus chirurgus</i> (Scopoli, 1786)	SV	1			IV	
	14. Plovers, Dotterels, Lapwings	Charadriidae						
76.	Pacific Golden-Plover (373)	<i>Pluvialis fulva</i> (Gmelin, 1789)	PM	3			IV	
77.	Grey Plover (371) <i>Pluvialis squatarola</i>	(Linnaeus, 1758) PM	2			IV		
78.	Common Ringed Plover (378)	<i>Charadrius hiaticula</i> Linnaeus, 1758	PM	1			IV	
*79.	Little Ringed Plover (379-380)	<i>Charadrius dubius</i> Scopoli, 1786	PM	3			IV	
80.	Kentish Plover (381-382)	<i>Charadrius alexandrinus</i> Linnaeus, 1758	PM	3			IV	
*81.	Lesser Sand Plover (384-384a)	<i>Charadrius mongolus</i> Pallas, 1776	SV	4	br+		IV	
82.	Greater Sand Plover (374)	<i>Charadrius leschenaultii</i> Lesson, 1826	**	?			IV	
83.	Northern Lapwing (364)	<i>Vanellus vanellus</i> (Linnaeus, 1758)	PM	3			IV	
	15. Sandpipers, Stints, Snipes, Godwits & Curlews	Scolopacidae						
84.	Solitary Snipe (404)	<i>Gallinago solitaria</i> Hodgson, 1831	PM	4			IV	BRS (05)
85.	Pintail Snipe (406)	<i>Gallinago stenura</i> (Bonaparte, 1830)	PM	2			IV	
86.	Common Snipe (409)	<i>Gallinago gallinago</i> (Linnaeus, 1758)	PM	4			IV	
87.	Black-tailed Godwit (389-390)	<i>Limosa limosa</i> (Linnaeus, 1758)	PM	2			IV	
*88.	Whimbrel (385-386)	<i>Numenius phaeopus</i> (Linnaeus, 1758)	PM	2			IV	
*89.	Eurasian Curlew (387-388)	<i>Numenius arquata</i> (Linnaeus, 1758)	PM	3			IV	
90.	Spotted Redshank (392)	<i>Tringa erythropus</i> (Pallas, 1764)	?	?			IV	
*91.	Common Redshank (393, 394)	<i>Tringa totanus</i> (Linnaeus, 1758)	SV	4	br+		IV	
92.	Marsh Sandpiper (395)	<i>Tringa stagnatilis</i> (Bechstein, 1803)	PM	2			IV	
93.	Common Greenshank (396)	<i>Tringa nebularia</i> (Gunner, 1767)	PM	3			IV	

Table 1. : (Cont'd.).

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94.	Green Sandpiper (397)	<i>Tringa ochropus</i> Linnaeus, 1758	PM	3	br+		IV	
95.	Wood Sandpiper (398)	<i>Tringa glareola</i> Linnaeus, 1758	PM	3			IV	
96.	Terek Sandpiper (400)	<i>Xenus cinereus</i> (Guldenstadt, 1774)	PM	2			IV	
*97.	Common Sandpiper (401)	<i>Actitis hypoleucos</i> Linnaeus, 1758	PM	4	br+		IV	
98.	Ruddy Turnstone (402)	<i>Arenaria interpres</i> (Linnaeus, 1758)	PM	2			IV	
99.	Little Stint (416)	<i>Calidris minuta</i> (Leisler, 1812)	PM	2			IV	
100.	Temminck's Stint (417)	<i>Calidris temminckii</i> (Leisler, 1812)	PM	4			IV	
101.	Dunlin (420, 421) <i>Calidris alpina</i> (Linnaeus, 1758)	PM	1			IV		
102.	Curlew Sandpiper (422)	<i>Calidris ferruginea</i> (Pontoppidan, 1813)	PM	3			IV	
*103.	Ruff (426)	<i>Philomachus pugnax</i> (Linnaeus, 1758)	PM	3			IV	
	16. Ibisbill, Avocets & Stilts	Recurvirostridae						
*104.	Ibisbill (433)	<i>Ibidorhyncha struthersii</i> Vigors, 1832	R	2			IV	BRS (05)
*105.	Black-winged Stilt (430-431)	<i>Himantopus himantopus</i> (Linnaeus, 1758)	PM	3			IV	
*106.	Pied Avocet (432)	<i>Recurvirostra avosetta</i> Linnaeus, 1758	PM	2			IV	
	17. Phalaropes	Phalaropidae						
107.	Red-necked Phalarope (428)	<i>Phalaropus lobatus</i> (Linnaeus, 1758)	PM	2			NLA	
	18. Coursers & Pratincoles	Glareolidae						
108.	Collared Pratincole (442)	<i>Glareola pratincola</i> (Linnaeus, 1766)	PM	2			NLA	
	19. Skuas & Jaegers	Stercorariidae						
109.	Parasitic Jaeger (448)	<i>Stercorarius parasiticus</i> (Linnaeus, 1758)	PM	1			NLA	
	20. Gulls, Terns & Noddies	Laridae						
110.	Heuglin's Gull (450)	<i>Larus heuglini</i> Bree, 1876	**	?			IV	
111.	Pallas's Gull (453)	<i>Larus ichthyaetus</i> Pallas, 1773	PM	4			IV	
*112.	Brown-headed Gull (454)	<i>Larus brunnicephalus</i> Jerdon, 1840	SV	4	br+		IV	BRS (05)

Table 1. : (Cont'd.).

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1	2	3	4	5	6	7	8	9
113.	Black-headed Gull (455)	<i>Larus ridibundus</i> Linnaeus, 1766	PM	3			IV	
114.	Little Gull (457)	<i>Larus minutus</i> Pallas, 1776	PM	2			IV	
115.	Gull-billed Tern (460-461)	<i>Gelochelidon nilotica</i> (Gmelin, 1789)	PM	3			IV	
116.	River Tern (463)	<i>Sterna aurantia</i> J.E. Gray, 1831	SV	1			IV	
*117.	Common Tern (464-465)	<i>Sterna hirundo</i> Linnaeus, 1758	SV	4	br+		IV	
118.	Arctic Tern (466a)	<i>Sterna paradisaea</i> Pontoppidan, 1763	**	?			IV	
119.	Little Tern (475-476)	<i>Sterna albifrons</i> Pallas, 1764	PM	2			IV	
120.	Whiskered Tern (458)	<i>Chlidonias hybridus</i> (Pallas, 1811)	PM	3	br+		IV	
121.	White-winged Black Tern (459)	<i>Chlidonias leucopterus</i> (Temminck, 1815)	PM	2			IV	
	IX. Order 21. Sandgrouse	COLUMBIFORMES Pteroclididae						
122.	Tibetan Sandgrouse (485)	<i>Syrrhaptes tibetanus</i> Gould, 1850	R	3	br+		IV	BRS (05)
	22. Pigeons & Doves	Columbidae						
*123.	Blue Rock Pigeon (516-517)	<i>Columba livia</i> Gmelin, 1789	R	4	br+		?	
*124.	Hill Pigeon (515)	<i>Columba rupestris</i> Pallas, 1811	R	4	br+		IV	
*125.	Snow Pigeon (513-514)	<i>Columba leuconota</i> Vigors, 1831	R	4	br+		IV	BRS (05)
126.	Eastern Stock Pigeon (518)	<i>Columba eversmanni</i> Bonaparte, 1856	**	?		VU	IV	
127.	European Turtle-Dove (529)	<i>Streptopelia turtur</i> (Linnaeus, 1758)	PM	2			IV	
*128.	Oriental Turtle-Dove (530-533)	<i>Streptopelia orientalis</i> (Latham, 1790)	SV	4	br+		IV	
129.	Little Brown Dove (541)	<i>Streptopelia senegalensis</i> (Linnaeus, 1766)	PM	2			IV	
130.	Spotted Dove (537-540)	<i>Streptopelia chinensis</i> (Scopoli, 1786)	**	?			IV	
131.	Red Collared-Dove (535-536)	<i>Streptopelia tranquebarica</i> (Hermann, 1804)	**	?			IV	
132.	Eurasian Collared-Dove (534)	<i>Streptopelia decaocto</i> (Fridvaldszky, 1838)	PM	3			IV	

Table 1. : (Cont'd.).

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1	2	3	4	5	6	7	8	9
	X. Order 23. Cuckoos, Malkohas & Coucals	CUCULIFORMES Cuculidae						
133.	Pied Crested Cuckoo (570-571)	<i>Clamator jacobinus</i> (Boddaert, 1783)	SV	1			IV	
*134.	Common Cuckoo (577-579)	<i>Cuculus canorus</i> Linnaeus, 1758	SV	3	br+		IV	
135.	Asian Koel (590-592)	<i>Eudynamys scolopacea</i> (Linnaeus, 1758)	PM	1			IV	
	XI. Order 24. Owls	STRIGIFORMES Strigidae						
136.	Pallid Scops-Owl (614)	<i>Otus brucei</i> (Hume, 1872)	PM	2			IV	
137.	Eurasian Eagle-Owl (625-627)	<i>Bubo bubo</i> (Linnaeus, 1758)	R	2	br+		IV	
138.	Little Owl (648-649)	<i>Athene noctua</i> (Scopoli, 1769)	PM	3	br+		IV	
139.	Long-eared Owl (663)	<i>Asio otus</i> (Linnaeus, 1758)	PM	2			IV	
140.	Short-eared Owl (664)	<i>Asio flammeus</i> (Pontoppidan, 1763)	PM	2			IV	
	XII. Order 25. Nightjars	CAPRIMULGIFORMES Caprimulgidae						
141.	European Nightjar (673)	<i>Caprimulgus europaeus</i> Linnaeus, 1758	PM	1			IV	
	XIII. Order 26. Swifts	APODIFORMES Apodidae						
142.	Alpine Swift (693-695)	<i>Tachymarptis melba</i> (Linnaeus, 1758)	PM	3			NLA	
*143.	Common Swift (696)	<i>Apus apus</i> (Linnaeus, 1758)	SV	4	br+		NLA	
144.	Pacific Swift (699-700)	<i>Apus pacificus</i> (Latham, 1801)	SV	3	br+		NLA	
145.	House Swift (702-706)	<i>Apus affinis</i> (J.E. Gray, 1830)	**	?			NLA	
	XIV. Order 27. Kingfishers	CORACIIFORMES Alcedinidae						
146.	Small Blue Kingfisher (722-724)	<i>Alcedo atthis</i> (Linnaeus, 1758)	SV	3			IV	

Table 1. : (Cont'd.).

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1	2	3	4	5	6	7	8	9
	28. Bee-eaters	Meropidae						
147.	Blue-cheeked Bee-eater (747)	<i>Merops persicus</i> Pallas, 1773	PM	2			NLA	
148.	European Bee-eater (746)	<i>Merops apiaster</i> Linnaeus, 1758	PM	2			NLA	
	29. Rollers	Coraciidae						
*149.	European Roller (754)	<i>Coracias garrulus</i> Linnaeus, 1758	PM	2			IV	
150.	Indian Roller (755-757)	<i>Coracias benghalensis</i> (Linnaeus, 1758)	**	?			IV	
	30. Hoopoes	Upupidae						
*151.	Common Hoopoe (763-766)	<i>Upupa epops</i> Linnaeus, 1758	SV	4	br+		NLA	
	XV. Order 31. Woodpeckers	PCICIFORMES Picidae						
152.	Eurasian Wryneck (796)	<i>Jynx torquilla</i> Linnaeus, 1758	SV	3	br+		IV	
153.	Large Scaly-bellied Green Wood-pecker (806-807)	<i>Picus squamatus</i> Vigors, 1831	SV	2			IV	
	XVI. Order 32. Larks	PASSERIFORMES Alaudidae						
154.	Eastern Calandra-Lark (892)	<i>Melanocorypha bimaculata</i> (Ménétrières, 1832)	PM	1			IV	
155.	Long-billed Calandra-Lark (893-894)	<i>Melanocorypha maxima</i> Blyth, 1867	SV	3	br+		IV	BRS (05)
*156.	Greater Short-toed Lark (885-886)	<i>Calandrella brachydactyla</i> (Leisler, 1814)	PM	4			IV	
*157.	Hume's Short-toed Lark (887-888)	<i>Calandrella acutirostris</i> Hume, 1872	SV	4	br+		IV	BRS (05)
158.	Asian Short-toed Lark (888b)	<i>Calandrella cheleensis</i> (Swinhoe, 1871)	**	?			IV	
159.	Common Crested Lark (898-900)	<i>Galerida cristata</i> (Linnaeus, 1758)	SV	1			IV	
*160.	Eastern Skylark (904-909)	<i>Alauda gulgula</i> Franklin, 1831	SV	4	br+		IV	
*161.	Horned Lark (895-897)	<i>Eremophila alpestris</i> (Linnaeus, 1758)	AM/LM	4	br+		IV	

Table 1. : (Cont'd.).

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1	2	3	4	5	6	7	8	9
	33. Swallows & Martins	Hirundinidae						
162.	Sand Martin (911)	<i>Riparia riparia</i> (Linnaeus, 1758)	SV	3			NLA	
163.	Plain Martin (912)	<i>Riparia paludicola</i> (Vieillot, 1817)	PM	3			NLA	
*164.	Eurasian Crag-Martin (913)	<i>Hirundo rupestris</i> Scopoli, 1769	SV	4	br+		NLA	
165.	Common Swallow (916-918)	<i>Hirundo rustica</i> Linnaeus, 1758	PM	4	br+		NLA	
166.	Wire-tailed Swallow (921)	<i>Hirundo smithii</i> Leach, 1818	SV	1	br+		NLA	
167.	Red-rumped Swallow (923-928)	<i>Hirundo daurica</i> Linnaeus, 1771	PM	3			NLA	
*168.	Northern House-Martin (930)	<i>Delichon urbica</i> (Linnaeus, 1758)	SV	4	br+		NLA	
*169.	Asian House-Martin (931)	<i>Delichon dasypus</i> (Bonaparte, 1850)	?	?			NLA	
	34. Wagtails & Pipits	Motacillidae						
170.	Forest Wagtail (1874)	<i>Dendronanthus indicus</i> (Gmelin, 1789)	PM	1			IV	
*171.	White Wagtail (1885-1890)	<i>Motacilla alba</i> Linnaeus, 1758	SV	4	br+		IV	
172.	Large Pied Wagtail (1891)	<i>Motacilla maderaspatensis</i> Gmelin, 1789	SV	1			IV	
*173.	Citrine Wagtail (1881-1883)	<i>Motacilla citreola</i> Pallas, 1776	SV	4	br+		IV	
*174.	Yellow Wagtail (1875-1880)	<i>Motacilla flava</i> Linnaeus, 1758	PM	3	br+		IV	
*175.	Grey Wagtail (1884)	<i>Motacilla cinerea</i> Tunstall, 1771	SV	3	br+		IV	
176.	Eurasian Tree Pipit (1854-1855)	<i>Anthus trivialis</i> (Linnaeus, 1758)	PM	4			IV	
177.	Oriental Tree Pipit (1852-1853)	<i>Anthus hodgsoni</i> Richmond, 1907	**	?			IV	
178.	Red-throated Pipit (1864)	<i>Anthus cervinus</i> (Pallas, 1811)	PM	2			IV	
179.	Rosy Pipit (1865) <i>Anthus roseatus</i> Blyth, 1847	PM	3			IV	BRS (05)	
180.	Water Pipit (1871)	<i>Anthus spinoletta</i> (Linnaeus, 1758)	PM	2			IV	BRS (05)
	35. Shrikes	Laniidae						
181.	Red-backed Shrike (941)	<i>Lanius collurio</i> Linnaeus, 1758	PM	2			NLA	

Table 1. : (Cont'd.).

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182.	Rufous-tailed Shrike (942-943)	<i>Lanius isabellinus</i> Hemprich & Ehrenberg, 1833	PM	3			NLA	
*183.	Rufous-backed Shrike (946-948)	<i>Lanius schach</i> Linnaeus, 1758	SV	3	br+		NLA	
184.	Grey-backed Shrike (944-945)	<i>Lanius tephronotus</i> (Vigors, 1831)	SV	3	br+		NLA	BRS (05)
185.	Lesser Grey Shrike (937)	<i>Lanius minor</i> Gmelin, 1788	PM	2			NLA	
186.	Southern Grey Shrike (933-935)	<i>Lanius meridionalis</i> Temminck, 1820	PM	1			NLA	
	36. Dippers	Cinclidae						
*187.	White-throated Dipper (1772-1774)	<i>Cinclus cinclus</i> (Linnaeus, 1758)	AM/LM	3	br+		NLA	
*188.	Brown Dipper (1775-1776)	<i>Cinclus pallasii</i> Temminck, 1820	R	4	br+		NLA	
	37. Wrens	Troglodytidae						
189.	Winter Wren (1769-1771)	<i>Troglodytes troglodytes</i> (Linnaeus, 1758)	R	3	br+		IV	
	38. Accentors	Prunellidae						
*190.	Alpine Accentor (1777-1779)	<i>Prunella collaris</i> (Scopoli, 1769)	R	3			NLA	BRS (05)
191.	Altai Accentor (1780)	<i>Prunella himalayana</i> (Blyth, 1842)	WV	1			NLA	BRS (05)
*192.	Robin Accentor (1781)	<i>Prunella rubeculoides</i> (Moore, 1854)	AM/LM	4	br+		NLA	BRS (05)
193.	Rufous-breasted Accentor (1782-1783)	<i>Prunella strophia</i> (Blyth, 1843)	R	3			NLA	BRS (07)
194.	Siberian Accentor (1787a) (EL)	<i>Prunella montanella</i> (Pallas, 1776)	**	?			NLA	
195.	Brown Accentor (1784-1785)	<i>Prunella fulvescens</i> (Severtzov, 1873)	AM/LM	4	br+		NLA	BRS (05)
196.	Black-throated Accentor (1786-1787)	<i>Prunella atrogularis</i> (Brandt, 1844)	PM	3			NLA	BRS (07)
	39. Thrushes, Warblers, Flycatchers, etc.	Muscicapidae						
	39a. Thrushes, Forktals, Wheaters, etc.	Turdinae						
197.	Rufous-tailed Rock-Thrush (1722)	<i>Monticola saxatilis</i> (Linnaeus, 1766)	PM	3			IV	
*198.	Blue Rock-Thrush (1725-1726)	<i>Monticola solitarius</i> (Linnaeus, 1758)	SV	4	br+		IV	

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*199.	Blue Whistling-Thrush (1729-1730)	<i>Myiophonus caeruleus</i> (Scopoli, 1786)	SV	4	br+		IV	
200.	Tickell's Thrush (1748)	<i>Turdus unicolor</i> Tickell, 1833	PM	2			IV	BRS (08)
201.	Eurasian Blackbird (1751-1757)	<i>Turdus merula</i> Linnaeus, 1758	PM	1			IV	
202.	Dark-throated Thrush (1763-1764)	<i>Turdus ruficollis</i> Pallas, 1776	WV	4			IV	
203.	Dusky Thrush (1765)	<i>Turdus naumanni</i> Temminck, 1820	WV	2			IV	
204.	Song Thrush (N)	<i>Turdus philomelos</i> Brehm, 1831	WV	1			IV	
*205.	Himalayan Rubythroat (1647-1649)	<i>Luscinia pectoralis</i> (Gould, 1837)	?	?	br+		IV	BRS (07)
*206.	Bluethroat (1644-1646a)	<i>Luscinia svecica</i> (Linnaeus, 1758)	SV	4	br+		IV	
207.	Orange-flanked Bush-Robin (1654-1656)	<i>Tarsiger cyanurus</i> (Pallas, 1773)	PM	1			IV	
208.	Rufous-tailed Scrub-Robin (1641)	<i>Cercotrichas galactotes</i> (Temminck, 1820)	SV	1			IV	
209.	Eversmann's Redstart (1669)	<i>Phoenicurus erythronotus</i> (Eversmann, 1841)	PM	2			IV	BRS (07)
*210.	Blue-capped Redstart (1670)	<i>Phoenicurus caeruleocephalus</i> (Vigors, 1831)	SV	1	br+		IV	BRS (07)
*211.	Black Redstart (1671-1672)	<i>Phoenicurus ochruros</i> (Gmelin, 1774)	SV	4	br+		IV	
212.	Common Redstart (1673)	<i>Phoenicurus phoenicurus</i> (Linnaeus, 1758)	PM	2			?	
213.	Hodgson's Redstart (1674)	<i>Phoenicurus hodgsoni</i> (Moore, 1854)	**	?			IV	BRS (05)
*214.	Guldenstadt's Redstart (1678)	<i>Phoenicurus erythrogaster</i> (Guldenstadt, 1775)	AM/LM	4	br+		IV	BRS (05)
215.	Blue-fronted Redstart (1675)	<i>Phoenicurus frontalis</i> (Vigors, 1832)	SV	1			IV	
*216.	White-capped Redstart (1716)	<i>Chaimarrornis leucocephalus</i> (Vigors, 1831)	SV	4	br+		IV	
217.	Grandala (1683)	<i>Grandala coelicolor</i> Hodgson, 1843	?	?			IV	BRS (05)
*218.	Little Forktail (1684)	<i>Enicurus scouleri</i> Vigors, 1832	SV	2			IV	

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*219.	Common Stonechat (1695-1698)	<i>Saxicola torquata</i> (Linnaeus, 1766)	SV	3			IV	
220.	Hume's Wheatear (1714)	<i>Oenanthe alboniger</i> (Hume, 1872)	**	?			IV	
221.	Variable Wheatear (1712)	<i>Oenanthe picata</i> (Blyth, 1847)	SV	3	br+		IV	
222.	Pied Wheatear (1715)	<i>Oenanthe pleschanka</i> (Lepechin, 1770)	SV	3	br+		?	
*223.	Desert Wheatear (1709-1710)	<i>Oenanthe deserti</i> (Temminck, 1825)	SV	4	br+		IV	
224.	Isabelline Wheatear (1706)	<i>Oenanthe isabellina</i> (Temminck, 1829)	PM	3			IV	
	39b. Laughingthrushes, etc.	Timaliinae						
225.	Streaked Laughingthrush (1312-1316)	<i>Garrulax lineatus</i> (Vigors, 1831)	**	?			IV	BRS (07)
226.	Variegated Laughingthrush (1289-1290)	<i>Garrulax variegatus</i> (Vigors, 1831)	**	?			IV	BRS (07)
	39c. Goldcrest, Warblers, etc.	Sylviinae						
227.	Goldcrest (1628-1631)	<i>Regulus regulus</i> (Linnaeus, 1758)	PM	1			IV	
228.	Long-billed Bush-Warbler (1491)	<i>Bradypterus major</i> (Brooks, 1871)	SV	3		NT	IV	BRS (07)
229.	Sedge Warbler (N)	<i>Acrocephalus schoenobaenus</i> (Linnaeus, 1758)	PM	1			IV	
230.	Black-browed Reed-Warbler (1555)	<i>Acrocephalus bistrigiceps</i> Swinhoe, 1860	PM	1			IV	
231.	Paddyfield Warbler (1557-1558)	<i>Acrocephalus agricola</i> (Jerdon, 1845)	PM	2			IV	
232.	Blyth's Reed-Warbler (1556)	<i>Acrocephalus dumetorum</i> Blyth, 1849	PM	3			IV	
233.	Eurasian Great Reed-Warbler (1553)	<i>Acrocephalus arundinaceus</i> (Linnaeus, 1758)	PM	1			?	
234.	Stoliczka's Tit-Warbler (1633-1634)	<i>Leptopoeile sophiae</i> Severtzov, 1873	R	3			IV	BRS (05)
*235.	Common Chiffchaff (1574-1575)	<i>Phylloscopus collybita</i> (Vieillot, 1817)	PM	3			IV	
*236.	Mountain Chiffchaff (1576)	<i>Phylloscopus sindianus</i> Brooks, 1879	SV	4	br+		IV	
237.	Plain Leaf-Warbler (1577)	<i>Phylloscopus neglectus</i> Hume, 1870	**	?			IV	

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238.	Dusky Warbler (1584-1586)	<i>Phylloscopus fuscatus</i> (Blyth, 1842)	PM	1			IV	
239.	Tickell's Warbler (1579)	<i>Phylloscopus affinis</i> (Tickell, 1833)	SV	4	br+		IV	BRS (05)
*240.	Olivaceous Leaf-Warbler (1581)	<i>Phylloscopus griseolus</i> Blyth, 1847	SV	4	br+		IV	BRS (05)
241.	Orange-barred Leaf-Warbler (1587-1589)	<i>Phylloscopus pulcher</i> Blyth, 1845	?	?			IV	BRS (07)
242.	Hume's Warbler (1590-1591)	<i>Phylloscopus humei</i> (Brooks, 1878)	PM	4	br+		IV	
243.	Greenish Leaf-Warbler (1602-1605)	<i>Phylloscopus trochiloides</i> (Sundevall, 1837)	SV	3			IV	
244.	Large-billed Leaf-Warbler (1601)	<i>Phylloscopus magnirostris</i> Blyth, 1843	SV	3			IV	BRS (07)
245.	Tytler's Leaf-Warbler (1578)	<i>Phylloscopus tytleri</i> Brooks, 1872	**	?		NT	IV	RRS (4)
246.	Western Crowned Warbler (1606)	<i>Phylloscopus occipitalis</i> (Blyth, 1845)	?	?			IV	BRS (07)
247.	Garden Warbler (N)	<i>Sylvia borin</i> (Boddaert, 1783)	PM	2			IV	
248.	Greater Whitethroat (1566)	<i>Sylvia communis</i> (Latham, 1787)	PM	2			IV	
249.	Common Lesser Whitethroat (1567-1568)	<i>Sylvia curruca</i> (Linnaeus, 1758)	SV	4	br+		IV	
250.	Barred Warbler (1564a)	<i>Sylvia nisoria</i> (Bechstein, 1795)	PM	2			IV	
	39d. Flycatchers	Muscicapinae						
251.	Spotted Flycatcher (1403, 1404)	<i>Muscicapa striata</i> (Pallas, 1764)	PM	3			IV	
252.	Sooty Flycatcher (1405-1406)	<i>Muscicapa sibirica</i> Gmelin, 1789	PM	1			IV	
253.	Asian Brown Flycatcher (1407)	<i>Muscicapa dauurica</i> Pallas, 1811	**	?			IV	
254.	Rusty-tailed Flycatcher (1409)	<i>Muscicapa ruficauda</i> Swainson, 1838	SV	1			IV	BRS (07)
255.	Red-throated Flycatcher (1411-1412)	<i>Ficedula parva</i> (Bechstein, 1792)	PM	2			IV	
	40. Penduline-Tits	Remizidae						
256.	Eurasian Penduline-Tit (1817)	<i>Remiz pendulinus</i> (Linnaeus, 1758)	**	?			IV	
257.	Fire-capped Tit (1815-1816)	<i>Cephalopyrus flammiceps</i> (Burton, 1836)	SV	3			IV	BRS (07)

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1	2	3	4	5	6	7	8	9
	41. Tits	Paridae						
258.	Simla Crested Tit (1804)	<i>Parus rufonuchalis</i> Blyth, 1849	WV	1			IV	BRS (07)
*259.	Great Tit (1790-1797)	<i>Parus major</i> Linnaeus, 1758	R	4	br+		IV	
260.	Green-backed Tit (1799)	<i>Parus monticolus</i> Vigors, 1831	SV	2			IV	BRS (07)
261.	Yellow-browed Tit (1813-1814)	<i>Sylviparus modestus</i> Burton, 1836	**	?			IV	BRS (07)
	42. Nuthatches, Wallcreeper	Sittidae						
*262.	Wallcreeper (1839)	<i>Tichodroma muraria</i> (Linnaeus, 1766)	SV	3	br+		NLA	BRS (05)
	43. Tree-Creepers, Creepers	Certhiidae						
*263.	Bar-tailed Tree-Creeper (1845-1848)	<i>Certhia himalayana</i> Vigors, 1832	WV	1			?	BRS (07)
	44. Buntings	Emberizidae Emberizinae						
264.	Yellowhammer (N)	<i>Emberiza citrinella</i> (Linnaeus, 1758)	WV	1			IV	
265.	Pine Bunting (2042)	<i>Emberiza leucocephalus</i> Gmelin, 1771	WV	3			IV	
*266.	Rock Bunting (2051-2052)	<i>Emberiza cia</i> Linnaeus, 1766	SV	3	br+		IV	
267.	Grey-necked Bunting (2050)	<i>Emberiza buchanani</i> Blyth, 1845	**	?			IV	
268.	Ortolan Bunting (2049)	<i>Emberiza hortulana</i> Linnaeus, 1758	PM	1			IV	
269.	Little Bunting (2056)	<i>Emberiza pusilla</i> Pallas, 1776	PM	1			IV	
270.	Chestnut Bunting (2045)	<i>Emberiza rutila</i> Pallas, 1776	**	?			IV	
271.	Red-headed Bunting (2044)	<i>Emberiza bruniceps</i> Brandt, 1841	PM	2			IV	
272.	Reed Bunting (2058-2059)	<i>Emberiza schoeniclus</i> (Linnaeus, 1758)	WV	2			IV	
	45. Finches	Fringillidae						
273.	Brambling (1980) <i>Fringilla montifringilla</i>	<i>Fringilla montifringilla</i> Linnaeus, 1758	PM	1		IV		
*274.	Fire-fronted Serin (1998)	<i>Serinus pusillus</i> (Pallas, 1811)	R	4	br+		IV	

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*275.	Eurasian Goldfinch (1987-1989)	<i>Carduelis carduelis</i> (Linnaeus, 1758)	SV	3	br+		IV	
*276.	Twite (1995-1996)	<i>Carduelis flavirostris</i> (Linnaeus, 1758)	AM/LM	4	br+		IV	
277.	Eurasian Linnet (1994)	<i>Carduelis cannabina</i> (Linnaeus, 1758)	PM	1			IV	
*278.	Hodgson's Mountain-Finch (1999-2000)	<i>Leucosticte nemoricola</i> (Hodgson, 1836)	SV	4	br+		IV	BRS (05)
*279.	Black-headed Mountain-Finch (2001-2005)	<i>Leucosticte brandti</i> Bonaparte, 1850	R	4	br+		IV	BRS (05)
280.	Crimson-winged Finch (2009)	<i>Rhodopechys sanguinea</i> (Gould, 1838)	**	?			IV	BRS (05)
281.	Mongolian Finch (2007)	<i>Bucanetes mongolicus</i> (Swinhoe, 1870)	R	3	br+		IV	
*282.	Common Rosefinch (2010-2013)	<i>Carpodacus erythrinus</i> (Pallas, 1770)	SV	4	br+		IV	
*283.	Red-mantled Rosefinch (2018)	<i>Carpodacus rhodochlamys</i> (Brandt, 1843)	SV	1			IV	BRS (05)
284.	White-browed Rosefinch (2020-2022)	<i>Carpodacus thura</i> Bonaparte & Schlegel, 1850	SV	1			IV	BRS (07)
*285.	Streaked Great Rosefinch (2028)	<i>Carpodacus rubicilloides</i> Przevalski, 1876	AM/LM	4	br+		IV	BRS (05)
*286.	Common Great Rosefinch (2027)	<i>Carpodacus rubicilla</i> (Guldenstadt, 1775)	R	3	br+		IV	BRS (05)
287.	Red-fronted Rosefinch (2029-2031)	<i>Carpodacus puniceus</i> (Blyth, 1845)	R	2			IV	BRS (05)
	46. Weaver Birds 46a. Sparrows & Snowfinches	Ploceidae Passerinae						
*288.	House Sparrow (1938-1939a)	<i>Passer domesticus</i> (Linnaeus, 1758)	R	4	br+		IV	
289.	Spanish Sparrow (1940)	<i>Passer hispaniolensis</i> (Temminck, 1820)	SV	1			IV	
290.	Tibetan Snowfinch (1952)	<i>Montifringilla adamsi</i> Adams, 1858	AM/LM	4	br+		IV	BRS (05)
*291.	Mandelli's Snowfinch (1953)	<i>Pyrgilauda taczanowskii</i> (Przevalski, 1876)	SV	2	br+		IV	BRS (05)
292.	Rufous-necked Snowfinch (1954)	<i>Pyrgilauda ruficollis</i> Blanford, 1871	?	?			IV	BRS (05)
293.	Plain-backed Snowfinch (1955)	<i>Pyrgilauda blanfordi</i> Hume, 1876	SV	2	br+		IV	BRS (05)
	47. Starlings & Mynas	Sturnidae						
294.	Brahminy Starling (994)	<i>Sturnus pagodarum</i> (Gmelin, 1789)	SV	3	br+		IV	BRS (11)

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*295.	Rosy Starling (996)	<i>Sturnus roseus</i> (Linnaeus, 1758)	PM	3			IV	
*296.	Common Starling (997-1001)	<i>Sturnus vulgaris</i> Linnaeus, 1758	PM	3			IV	
	48. Orioles	Oriolidae						
297.	Eurasian Golden Oriole (952-953)	<i>Oriolus oriolus</i> (Linnaeus, 1758)	SV	3	br+		IV	
	49. Drongos	Dicruridae						
*298.	Black Drongo (962-964)	<i>Dicrurus macrocercus</i> Vieillot, 1817	SV	1			IV	
	50. Crows, Jays, Treepies, Magpies	Corvidae						
299.	Eurasian Jay (1020-1021)	<i>Garrulus glandarius</i> (Linnaeus, 1758)	**	?			IV	
300.	Black-headed Jay (1022)	<i>Garrulus lanceolatus</i> Vigors, 1831	**	?			IV	BRS (08)
301.	Yellow-billed Blue Magpie (1025-1026)	<i>Urocissa flavirostris</i> (Blyth, 1846)	**	?			IV	BRS (07)
*302.	Black-billed Magpie (1029-1030)	<i>Pica pica</i> (Linnaeus, 1758)	R	4	br+		IV	
303.	Hume's Groundpecker (1041)	<i>Pseudopodoces humilis</i> (Hume, 1871)	SV	3			IV	BRS (05)
*304.	Red-billed Chough (1046-1047)	<i>Pyrrhocorax pyrrhocorax</i> (Linnaeus, 1758)	R	4	br+		IV	
*305.	Yellow-billed Chough (1045)	<i>Pyrrhocorax graculus</i> (Linnaeus, 1766)	R	4	br+		IV	BRS (05)
306.	Eurasian Jackdaw (1053)	<i>Corvus monedula</i> Linnaeus, 1758	SV	3			IV	
307.	House Crow (1048-1051)	<i>Corvus splendens</i> Vieillot, 1817	SV	1	br+		V	
308.	Carriion Crow (1058, 1058a)	<i>Corvus corone</i> Linnaeus, 1758	R	4	br+		IV	
*309.	Jungle Crow (1054-1057)	<i>Corvus macrorhynchos</i> Wagler, 1827	SV	3	br+		IV	
*310.	Common Raven (1059-1060)	<i>Corvus corax</i> Linnaeus, 1758	R	4	br+		IV	

Note : * = Species oobserved during field surveys undertaken in 2002 and 2005; ** Species not recorded after 1960; R = Resident; AM/LM = Altitudinal or local mitrant; SV = Summer visitor; WV = Winter visitor; PM = Passage migrant; ? = Information not available; br+ = after Singh & Jaypal (2001) and Sanga & Naoroji (2005); 5 = Abundant/Very common, 4 = Common, 3 = Occasional, 2 = Rare, 1 = Vagrant, ? = records need further; CR = Critical; EN = Endangered; VU = Vulnerable; NT = Near Threatened; I = Schedule I, IV = Schedule IV, V = Schedule V of the Wildlife (Protection) Act 1972 (amended up to 1993) as given BNHS (2002); NLA = Not Listed in the Act; RRS (4) = Species occur in Endemic area number 4 i.e. Western Himalayas; BRS (05) = Eurasian High Montane (Alpine and Tibetan), BRS (07) = Sino-Himalayan Temperate Forest, BRS (08) = Sino-Himalayan Subtropical Forest, BRS (11) = Indo-Malayan Tropical Dry Zone.

The residential and abundant status presented here is after Pfister (2004). The breeding status is from the recent publications by Singh and Jaypal (2001), and Snaga and Naoroji (2005). The conservation status has been worked out at two levels, viz., the threatened and the protection. For threatened level status, the data provided by BirdLife International (2004) have been used. While for protection level status, the information pertinent to Wildlife (Protection) Act, 1972 (amended up to 1993) as given in BNHS (2002), and for Restricted Range Species (RRS) and the Biome Restricted Species (BRS) the data provided by Jhunjhunwala *et al.* (2001) have been utilized.

ANALYSIS AND RESULTS

The present checklist on birds of Ladakh region incorporates a total of 310 species (25% of the Indian bird diversity 1240 species) belonging to 150 genera, 6 subfamilies, 50 families and 16 Orders. Of these, 29 species have not been seen after 1960, which are highlighted with double asterisks (**). Of the 310 species, 153 are non-passerines and the remaining 157 passerines (Table 1 & 2 and Fig. 3).

Table 2. : Avian Diversity of Ladakh.

Sl. No.	Order	Family	Subfamily	Genera	Species
I	PODICIPEDIFORMES	1	–	2	3
II	PELECANIFORMES	1	–	1	2
III	CICONIIFORMES	3	–	10	10
IV	ANSERIFORMES	1	–	6	15
V	FALCONIFORMES	3	–	16	28
VI	GALIFORMES	1	–	5	7
VII	GRUIFORMES	2	–	6	9
VIII	CHARADRIIFORMES	8	–	23	47
IX	COLUMBIFORMES	2	–	3	11
X	CUCULIFORMES	1	–	3	3
XI	STRIGIFORMES	1	–	4	5
XII	CAPRIMULGIFORMES	1	–	1	1
XIII	APODIFORMES	1	–	2	4
XIV	CORACIIFORMES	4	–	4	6
XV	PCICIFORMES	1	–	2	2
XVI	PASSERIFORMES	19	6	62	157
	TOTAL : 16	50	6	150	310
	*(21)	*(88)	*(11)	*(423)	*(1342)

Note : * = Avian diversity in Indian Subcontinent in parenthesis is after Ali and Ripley (1983 a & b).

The family-wise analysis indicates that family Muscicapidae, the most crowded and the most diverse family of the passerine birds, dominates the scene with 59 species, followed by Accipitridae (22), Scolopacidae (20), Anatidae and Fringillidae (15 each), Laridae and Corvidae (12 each), Motacillidae (11), Emberizidae (09), Alaudidae (08), and so on (Table 1).

Residential status : The various subcategories of the residential status are as follows (*vide* Table 1 and Fig. 1) :

Status	No. of species	Percentage
Resident (R)	31 species	(10.0%)
Altitudinal/local migrant (AM/LM)	08 species	(02.5%)
Winter visitor (WV)	11 species	(03.5%)
Summer visitor (SV)	89 species	(28.7%)
Passage migrant (PM)	135 species	(43.5%)
Species not recorded after 1960 (**)	29 species	(09.4%)
Information not available (?)	07 species	(02.3%)
Total	310 species	(99.9%)

Abundance status : The various subcategories of abundance are given below (*vide* Table 1 and Fig. 2) :

Very common (5)	01 species
Common (4)	65 species
Occasional (3)	89 species
Rare (2)	66 species
Vagrant (1)	53 species
Information not available (?)	36 species
Total	310 species

Breeding status (br+) : presented here for 106 species is after Singh and Jaypal (2001), and Snaga and Naoroji (2005) (Table 1).

Conservation status : The following eleven species are treated as Threatened (Six Globally Threatened : one Critical, one Endangered, four Vulnerable; and five Near Threatened) by the BirdLife International (2004). Therefore, these species are significant from the conservation point of view (Table 3). Of these, three species, *viz.*, Siberian Crane, Eastern Stock Pigeon, and Tytler's Leaf-Warbler have not been recorded after 1960 (Pfister 2004).

Of the 310 species, 24 species are listed under Schedule I of the Indian Wildlife (Protection) Act 1972 amended up to 2003, 245 under Schedule IV, and one under Schedule V, while 34

species are not listed under the Act (NLA) (Bombay Natural History Society 2002). Information on the remaining six species is not available, which is indicated with the help of question mark (?) (Bombay Natural History Society 2002) (Table 1).

Only one Species, viz., Tytler's Leaf-Warbler (*Phylloscopus tytleri*) is a Restricted Range Species and categorized as RRS (4), which means that it occurs in Endemic area number 4 i.e., Western Himalayas. A total of 63 species from the area are categorized as the Biome Restricted Species (BRS). Of these, 40 species are from the Eurasian High Montane (Alpine and Tibetan)-Biome (05); 19 from the Sino-Himalayan Temperate Forest-. Biome (07); two from the Sino-Himalayan Subtropical Forest-Biome (08); and two from the Indo-Malayan Tropical Dry Zone-Biome (11) Jhunjhunwala *et al.* (2001) (Table 1).

REMARKS

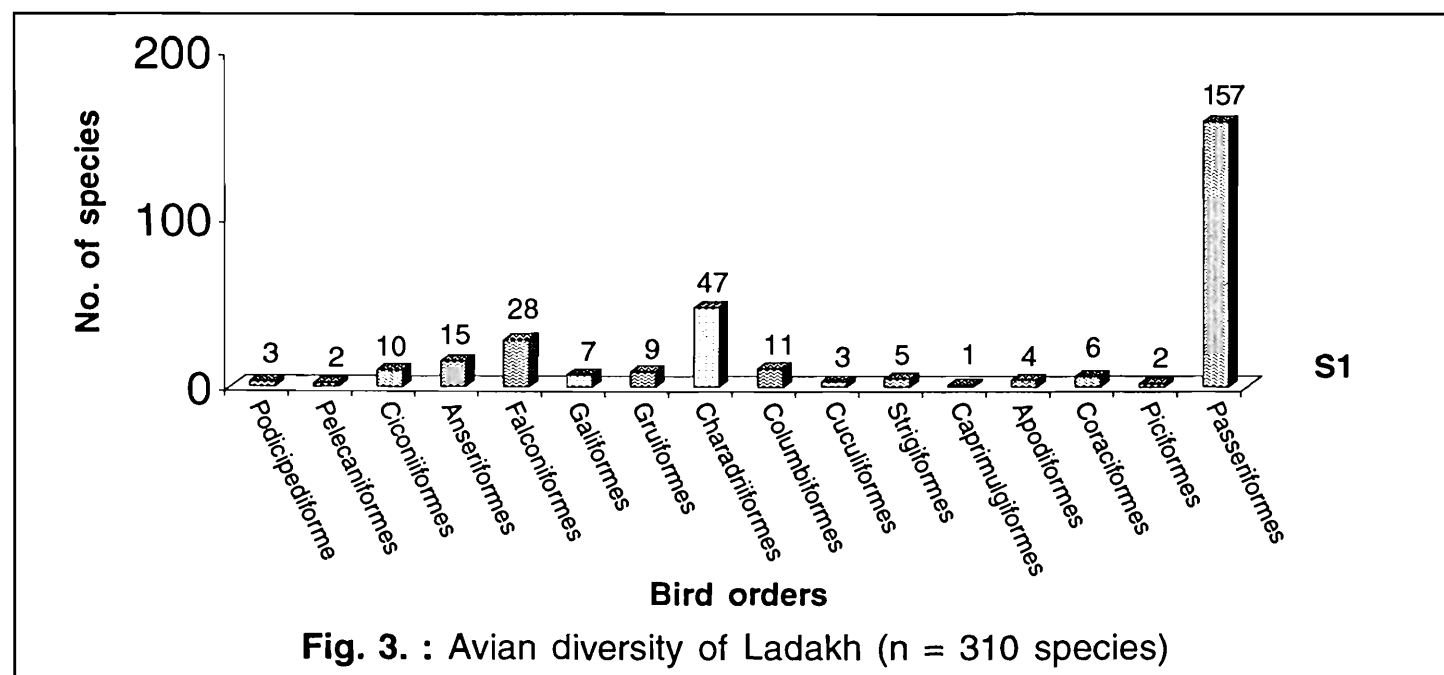
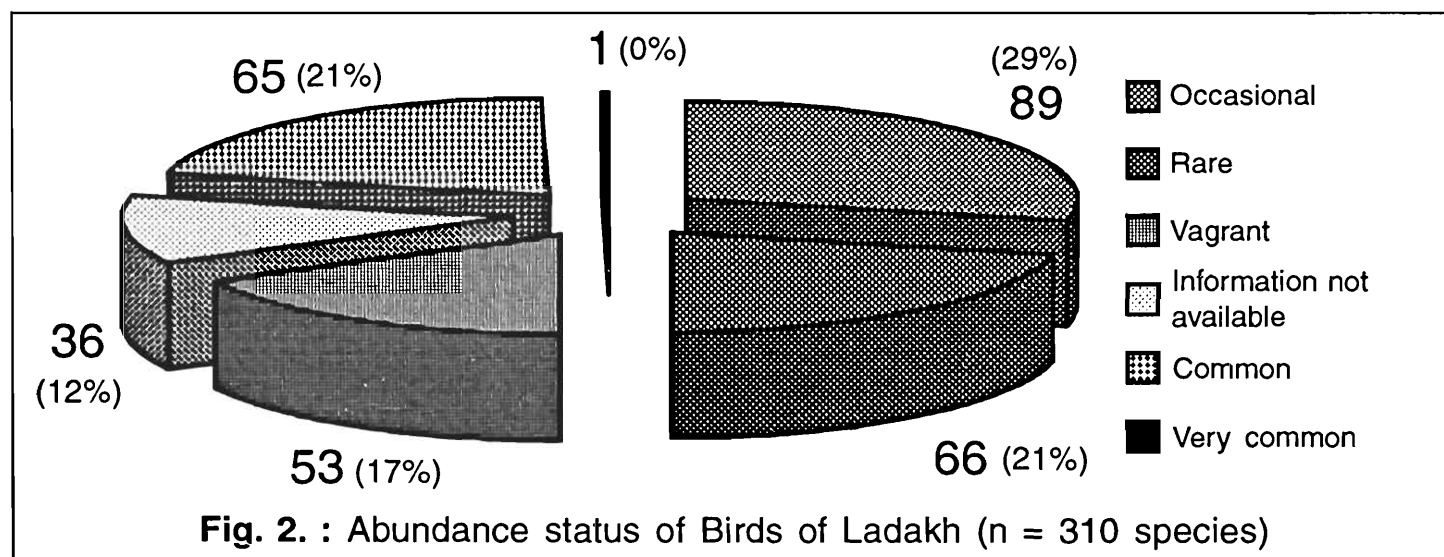
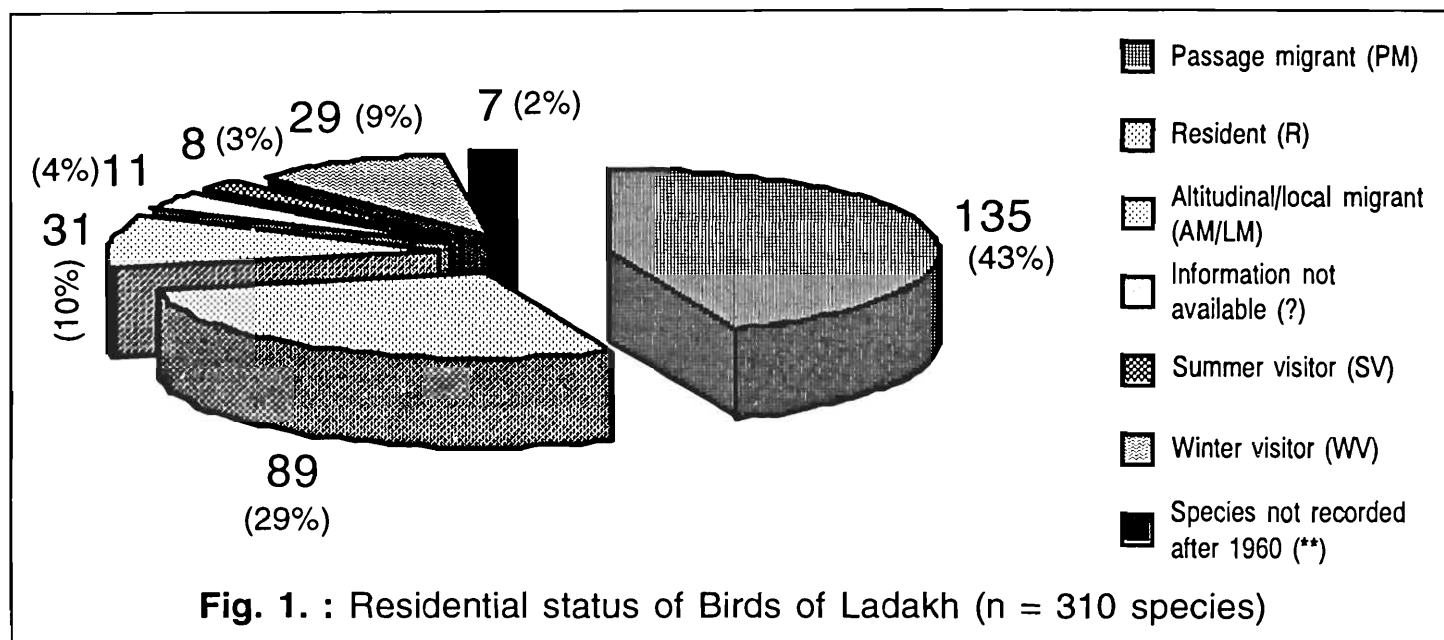
Ladakh constitutes over 80% of the Trans-Himalayan tract in India. As a National Policy on wildlife conservation, the Govt. of Jammu & Kashmir State has already established a Protected Area Network of 13 Wildlife Sanctuaries, one National Park (Hemis National Park) covering an area of approximately 14,500 km² (nearly 15% of its geographical area), and one Ramsar site no. 1213, namely, Tsomoriri (120 km²). Ladakh hosts typical bird species from the Palaearctic and the Indo-Malayan zoogeographic regions. In addition, characteristic Tibetan birds extend their home ranges well into eastern Ladakh. The dry sunny summer months, again, attract a multitude of breeders and being the last or first accessible place during spring and autumn migration, it is an important stage for aggregations of birds while crossing the lofty Himalayan range. These diverse ornithological influences make Ladakh a real melting pot of bird movement (Pfister 2004).

The region provides habitat for more than 25% of the Indian bird diversity (310 out of 1240 species) and preferred breeding ground to more than one-third bird species (106 species) of the area. The avian community of this area is dominated by the passage migrants (135 out of 310 species), followed by the summer visitors (89), residents (31), winter visitors (11), and the altitudinal or local migrants (08). Further, the occurrence of 11 Threatened species (six Globally five Near Threatened), 24 Schedule I species, one RRS and a total of 63 BRS is, perhaps, an indication towards some better management as well as developmental practices in the area by the competent authorities. There is an immediate need to develop a strategy and action plan for the conservation and management of Ladakh's natural heritage, especially the high altitude wetlands and lakes throughout Changthang and Rupshu, namely Tso Moriri, Tso Kar and Nuro Sumdo. Prompt steps need to be initiated by involving all the stakeholders-local communities, tour operators, development agencies and defence forces (Sanga and Naoroji, 2005).

Table 3. : Showing status of the threatened birds reported from Ladakh.

Sl. No.	Common name	Scientific name	Status					
			Residential	Abundance	Breeding	BirdLife International 2004	Wldlife (P) Act 1972	Jhunjunwala et al. (2001)
1.	Siberian Crane	<i>Grus leucogeranus</i>	**	?		CR	I	
2.	Saker	<i>Falco cherrug</i>	PM	3		EN	I	
3.	Pallas's Fish-Eagle	<i>Haliaeetus leucoryphus</i>	PM	2		VU	I	
4.	Greater Spotted Eagle	<i>Aquila clanga</i>	PM	1		VU	I	
5.	Black-necked Crane	<i>Grus nigricollis</i>	SV	2	br+	VU	I	BRS (05)
6.	Eastern Stock Pigeon	<i>Columba eversmanni</i>	**	?		VU	IV	
7.	Ferruginous Pochard	<i>Aythya nyroca</i>	SV	2	br+	NT	IV	
8.	Cinereous Vulture	<i>Aegypius monachus</i>	PM	1		NT	IV	
9.	Pallid Harrier	<i>Circus macrourus</i>	PM	3		NT	I	
10.	Long-billed Bush-Warbler	<i>Bradypterus major</i>	SV	3		NT	IV	BRS (07)
11.	Tytler's Leaf-Warbler	<i>Phylloscopus tytleri</i>	**	?		NT	IV	RRS (4)

Note : For details of the abbreviations used in the Table 3 vide the footnote given for the Table 1.



ACKNOWLEDGEMENTS

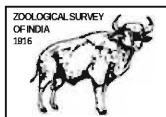
The authors are grateful to the Director, Zoological Survey of India, Kolkata for encouragements throughout. We are also thankful to the Officer-in-Charge, Zoological Survey of India, Solan and Officer-in-Charge, Zoological Survey of India, Dehra Dun for various facilities.

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TAXONOMIC NOTES ON THE *SATYRIUM SASSANIDES* (KOLLAR) (LYCAENIDAE : THECLINAE : EUMAENINI) FROM NORTH-WEST INDIA

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INTRODUCTION

Satyrium sassanides (Kollar) has been misidentified as a species under *Strymon* Hubner by most workers viz., Evans (1931), Wynter-Blyth (1957), Cantlie (1963) and Varshney (1997). As per the diagnosis of *Strymon* by Clench (1967), the male genitalia possess single acuminate cornutus in the aedeagus and small basally directed teeth on the tip of the valvae whereas as per diagnosis of genus *Satyrium* Scudder, the male genitalia possess two terminal cornuti and a ventral keel (Clench, 1978). Though the earlier workers had placed the species under *Strymon*, Bridges (1988) had rightly placed it separately under *Satyrium*. The male and female genitalia of *Satyrium sassanides* are being studied for the first time. During the course of present study, when the male genitalia of *Satyrium sassanides* examined, it was observed that the ventral keel was impregnated with two terminal cornuti in the aedeagus and not just one cornutus. This clearly substantiates the placement of the above mentioned species under *Satyrium* by Bridges (1988) and not under *Strymon*.

OBSERVATIONS

Genus ***Satyrium*** Scudder

1876. Scudder, *Bull. Buffalo Soc. Nat. Sci.*, **3** : 106; Clench, 1961, *How to know butts. In Ehrlich and Ehrlich* : 102; Clench, 1978, *J. Lep. Soc.*, **32**(4) : 279.
1876. *Callipsyche* Scudder, *Bull. Buffalo. Nat. Sci.*, **3** : 106.
1907. *Edwardsia* Tutt, *Nat. Hist. Brit. Butts.*, **2** : 142.
1907. *Felderia* Tutt, *Nat. Hist. Brit. Butts.*, **2** : 142.
1907. *Kollaria* Tutt, *Nat. Hist. Brit. Butts.*, **2** : 142.

1907. *Erschoffia* Tutt, *Nat. Hist. Brit. Butts.*, **2** : 142.
 1907. *Nordmannia* Tutt, *Nat. Hist. Brit. Butts.*, **2** : 142.
 1907. *Chattendenia* Tutt, *Nat. Hist. Brit. Butts.*, **2** : 142.
 1911. *Thecliolia* Strand, *Ent. Rundsch.*, **27** : 162.
 1911. *Superflua* Strand, *Ent. Rundsch.*, **27** : 162.
 1911. *Pseudothecla* Strand, *Ent. Rundsch.*, **27** : 162.
 1951. *Necovatia* Verity, *Rev. fr. Lep. Suppl.*, : 183.

Type-species : *Lycaena fulginosa* Edwards.

1861. Edwards, *Proc. Acad. Nat. Sci. Philad.* 1861 : 164.

Generic diagnosis : Forewing with 10 veins, hindwing tailless or with one or two tails but never a tail at 1A + 2A; male genitalia with vinculum laterally broad, abruptly becoming very slender towards saccus; saccus small, the latter prominent due to slenderness of adjacent vinculum; valvae contiguous proximally, distally abruptly divergent; aedeagus with ventral keel, impregnated with two terminal cornuti.

***Satyrium sassanides* (Kollar)**

Common name : Whiteline Hairstreak.

1849. *Thecla sassanides* Kollar, *Denkschr K. Akad. Wiss. Wien.*, **1** : 51.
 1932. *Strymon sassanides* Evans, *Ident. Indian Butts.*, (2nd Ed.) : 248.
 1978. *Satyrium sassanides* Clench, *J. Lep. Soc.*, **32**(4) : 280.
 1865. *Thecla deria* Moore, *Proc. Zool. Soc. Lond.*, 1865(2) : 507.
 1874. *Thecla mirabilis* Erschoff, *mem. Soc. Amis Sci. nat. Moscou*, **11**(2) : 7.

Adult : Sexes similar, frontoclypeal area dressed with dark brown and white scales; eyes sparsely hairy; labial palpi with second segment long, below clothed with white and black scales; antenna with club not clearly differentiated, nudum limited to club. Thorax dorsally dark brown, ventrally decorated with white hair; each leg with a pair of tibial spurs, tarsi spiny. Forewing costa and tornus convex, above dark brown, below pale brown, a narrow white discal band present, and the latter inwardly edged black, marginal line and marginal spots obscure. Hindwing oval, termen concave between veins Cu1a and 1A + 2A, dorsum concave between vein 3A and tornus, tailed at Cu1b, tail 3.5 mm long, black with apex white; undersurface pale brown with a narrow white discal band, the latter inwardly edged black, a linear white marginal line present, three orange crowned and inwardly black edged spots present in Cu1a, Cu1b and at tornus, marginal spots in M₂ and M₃ minute.

Venation : Forewing with discal cell more than half the length of the wing, veins Sc and R₁ approximating, veins R₃ and R₄ absent, veins R₅ and M₁ widely separated at base, vein M₂ closer to

vein M_1 than vein M_3 , discocellulars complete; hindwing discal cell less than half of the wing, vein M_2 equidistant between veins M_1 and M_3 , discocellular veins present.

Male genitalia : Uncus with each lobe broad, apex rounded, pilose; brachia slender, curved at base, arms narrow, pointed; subscaphium very long, band-like; tegument large, broad; vinculum very wide proximally, suddenly becomes narrow distally to receive short saccus, the latter with rounded apex. Valva penguin-shaped, basal half oval, costa and sacculus narrow, upper half narrow, slightly curved downwards with pointed apex, pilose; juxta absent; aedeagus long, slender, narrow, suprazonal portion fairly larger than subzonal portion, slightly curved, ductus entering dorsad, coecum very short, apex with a keel, vesica with two cornuti, the latter well developed.

Female genitalia : Lodix small, irregular, somewhat star shaped.; genital plate absent; ductus seminalis entering at junction of ductus bursae and corpus bursae; ductus bursae well sclerotized; corpus bursae fairly large, globular, base sclerotized, a pair of triangular signae present; apophysis anterioris absent; apophysis posterioris long, narrow; papilla analis elongated, pilose.

Wing expanse : Half : Male : 15.0-17.0 mm.

Female : 16.0-18.0 mm.

Material examined : 3 exs., 16.VII.1992, Trilokinath, Lahaul and Spiti, Himachal Pradesh; 1 ex., 17.VII.1992, Tandy Bridge, Rohali, Keylong, Himachal Pradesh; 6 exs., 19.VII.1992, Purthi, Chamba, Himachal Pradesh; 2 exs., 22.VII.1992, Kellar, Chamba, Himachal Pradesh (A.K. Sidhu and H.S. Rose collections).

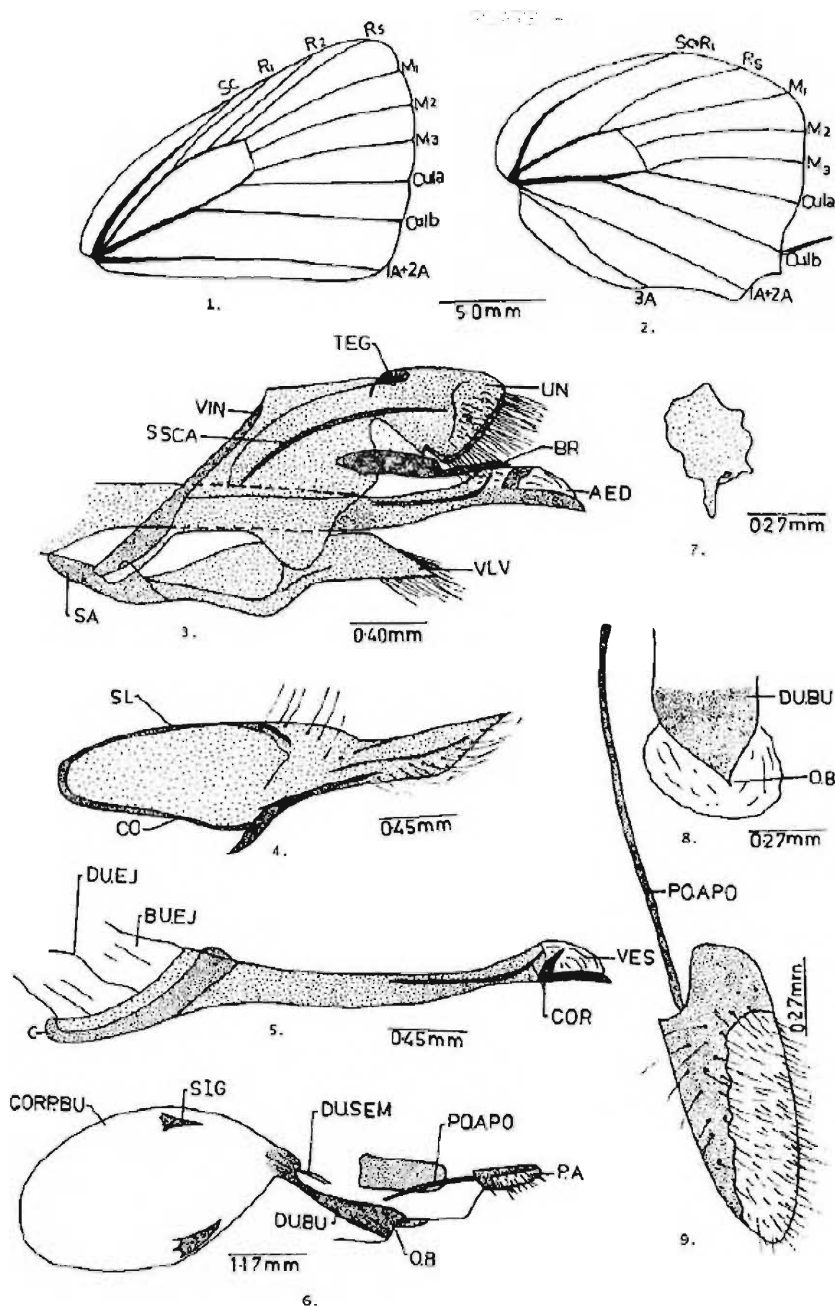
Former distribution : Kashmir, Ladak, Pangi, Mussoorie, Shimla hills, Chitral, Afghanistan, Baluchistan, Persia.

Photo 1 : Male (dorsal view)

Photo 2 : Male (ventral view)

Satyrium sassanides (Kollar) (Male)

PLATE I



Explanation to figures (Plate-1) : 1. Venation of forewing; 2. Venation of hindwing; 3. Male genitalia (lateral view); 4. Valva (inner view); 5. Aedeagus (lateral view); 6. Female genitalia (lateral view); 7. Lodix; 8. Genital plate; 9. Papilla analis.

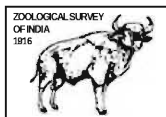
Remarks : The survey shows that the species is commonly available in Pangri valley from where it has earlier been reported by de Niceville (1890). The first record of the species is from localities Trilokinath and Keylong. However, the species could not be collected from localities such as Mussoorie and Shimla inspite of repeated surveys from 1992-1995 and then 2005-2006.

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SCANNING ELECTRON MICROSCOPE STUDY OF SOME OF THE INDIAN PRIMATE HAIRS

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INTRODUCTION

Earlier workers have used only light microscopy for hair studies, but advent of SEM has made possible analysis of hairs for ultra-structural details. Mammal hairs have been examined under SEM by other workers (Hausman, 1920; 1924; Short, 1978; Riggott and Wyatt, 1980) abroad. In India, few studies are available on SEM of hairs of mammals. Kopikar and Sabnis (1976, 1977) have done some work on surface details of hairs of Indian mammals. Venkataraman *et al.* (1994) have also done scanning electron microscopic studies of 17 species of carnivorous mammals of India. On Indian non-human primates, De (1993) has mentioned SEM details of *Macaca fascicularis*, *Macaca assamensis* and *Macaca mulatta*.

Quite a few of the Indian non-human primates have been listed in Schedule I of Wild life Protection Act (1972) and Appendix I of CITES (Table 1). The present work, therefore, has a focus on SEM of some of the Indian primate hairs to study their ultra-structure.

METHODS

Dorsal guard hairs have been taken for analysis provided by the National Zoological Collection. The selected species have been shown in Table 1. Hairs were washed in alcohol and at a time a single hair strand was mounted on stub and gold coated in sputtering apparatus. The coated specimens were viewed in SEM Jeol Model JSM-5200 at 15 KV. Cuticular scale patterns and terminology described by Hausman(1920) have been followed here.

RESULTS

The outcome of the study has been shown in a tabular form in Table 1. The scanning electron microphotographs have been presented in Fig 1.

Table 1 : Details on the basis of SEM of hairs of some of the Indian non-human primates.

Species	Family	Average hair shaft diameter μm	Scale shape	Average Proximo-Distal measurement of cuticular scale μm
<i>Loris tardigradus</i> WPA-SchI(1) CITES-II	Lorisidae	24.97	Imbricate elongate	23.99
<i>Macaca arctoides</i> WPA-Sch II(1) CITES-II	Cercopithecidae	45.26	Imbricate crenate	11.93
<i>Macaca mulatta</i> WPA-Sch II(1) CITES-II	Cercopithecidae	48.13	Imbricate crenate	10.64
<i>Macaca radiata</i> WPA-Sch II(1) CITES-II	Cercopithecidae	43.98	Imbricate crenate	10.66
<i>Trachypithecus phyllae</i> WPA- Sch I(1) CITES-II	Cercopithecidae	48.79	Imbricate crenate	12.49
<i>Trachypithecus johnii</i> WPA-Sch I(1) CITES-II	Cercopithecidae	47.47	Imbricate crenate	11.82
<i>Trachypithecus geei</i> WPA-Sch I(1) CITES-I	Cercopithecidae	51.46	Imbricate crenate	10.19
<i>Bunopithecus hoolock</i> WPA-Sch I(1) CITES-I	Hylobatidae	46.16	Imbricate crenate	12.82

DISCUSSION

The outcome of present study has shown that the diameter of hair shaft ranged from 24.97 to 51.46 micron and cuticular scale shape was imbricate crenate except for *Loris tardigradus* where scale shape was imbricate elongate type and hair shaft diameter was 24.97 μm . Earlier studies on non-human primates found outside India have shown that in Proboscis monkey (*Nasalis larvatus*) and Spider monkey (*Ateles geoffroi*), the scales are also of imbricate crenate type while in Squirrel monkey (*Chrysotrrix sciurea*), the scales are of imbricate flattened type (Hausman, 1920). In an earlier study on three Indian species of non-human primates (*Macaca fascicularis*, *Macaca assamensis* and *Macaca mulatta*), scales have been found to be of crenate type and were in the diameter range of 37.30-62.50 micron, 35.25-52.25 micron and 29.00-42.50 micron respectively (De, 1993). Short (1978) has stated that cuticular scales of hair are of limited taxonomic use. Combined with other features such as pigment distribution, medullary patterns, cross-sectional appearance etc., SEM may be of some utility in identifying some of the species.

SUMMARY

Hairs of eight Indian non-human primates belonging to three different families (Lorisidae, Cercopithecidae, Hylobatidae) from dorsal guard region were examined under SEM. The diameter ranged from 24.97 to 51.46 micron and scale shape was imbricate crenate except for *Loris tardigradus* where it was imbricate elongate type. Combined with other features such as pigment distribution, medullary patterns, cross-sectional appearance, SEM may be of some utility in identifying some of the species.

ACKNOWLEDGEMENTS

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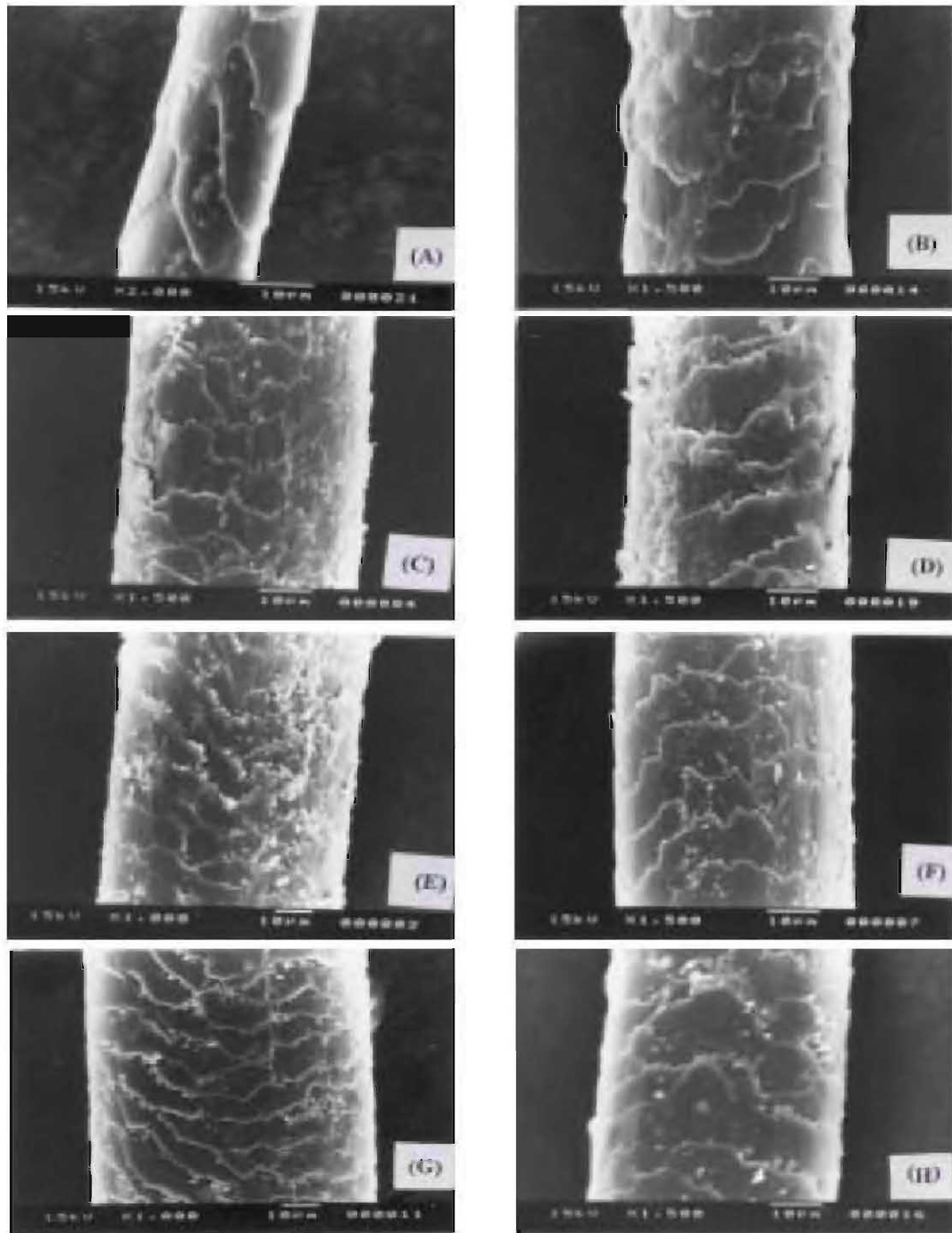
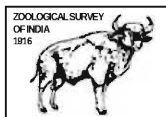


Fig. 1. Scanning electron microphotographs of some of the Indian non-human primate hair (A). *Loris tardigradus* (2000x), (B) *Macaca arctoides* (1500x), (C) *Macaca mulatta* (1000x), (D) *Macaca radiata* (1500x), (E) *Trachypithecus phyllaris* (1000x), (F) *Trachypithecus johnii* (1500x), (G) *Trachypithecus geei* (1000x), (H) *Bunopithecus hoolock* (1500x).

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Rec. zool. Surv. India, **109**(Part-2) : 67-71, 2009

STUDY OF LIFE CYCLE OF *SENIORWHITEA RECIPROCA* (WALKER) (DIPTERA : SARCOPHAGIDAE) ON COASTAL FISH *PANNA MICRODON* (BLEEKER) IN LABORATORY CONDITIONS

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INTRODUCTION

Seniorwhitea reciproca (Walker) is reported from the Oriental region and partly from the Palaearctic region. In India, it is well distributed. The life cycle of this species and larval stages were not studied before in India. Life cycle of this fly on coastal fish *Panna microdon* (Bleeker) along with the larval stages were studied.

Key words : Life cycle, *Seniorwhitea reciproca* (Walker), coastal fish *Panna microdon* (Bleeker)

Observation : Adult male and female fly was found to copulate from the 4th day of emergence to the 9th day. During copulation, the male fly suddenly attack the female individual and grasp the head of the female with its fore legs, as well as thoracic part of the female with its meso and metathoracic legs; then place the penis on the ovipositor of the female and copulate for 22-48 minutes.

A single female fly mated with several male individuals and a single male fly often mated with several female individuals. Mating may occur more than one time in a day. Duration of mating was variable.

On the 4th day of emergence, a male and a female fly mated for 48 minutes; on the 7th day of emergence, the same couple copulated for 22 minutes and on the 9th day of emergence, they mated for 33 minutes. On the 10th day of emergence, the gravid female fly started to deposit larvae. During its total deposition of 152 larvae from nine depositions, maximum of 38 larvae was deposited on the 3rd deposition and then the numbers were decreased gradually with days.

Number of larvae deposited by a female fly–

Days of emergence	Number of larvae
10	20
15	26
21	38
25	16
27	14
33	12
37	13
43	8
45	5
	Total 152 larvae

Description of different stages : (Figs. 1-12)**Larvae :**

There were three larval instars; all the instars showed clearly defined 12 body segments and cephalopharyngeal sclerite in the first three thoracic segments.

First instar larva : (Fig. 1)

Larvae ranged in size from 3.5-5.5 mm. in length and 0.5-0.8 mm. in diameter at the widest region.

Segments 2-10 each bordered anteriorly with a complete band of spines on segment 11 and 12 restricted to dorsal and ventral surface; posterior band of spines on segment 6 and 7 restricted to ventral surface only, that of segment 8 interrupted on dorsal surface; segments 9-10 with complete posterior bands of spines.

Cephalopharyngeal sclerite : (Fig. 2)

Slightly pigmented except mouth-hook which is deeply pigmented; hook part strong and curved; antero-dorsal process extended; dorsal and ventral cornu comparatively wide and dorsal cornu slightly longer than ventral cornu.

Spiracles : There was no anterior spiracle.

Posterior spiracles (Fig. 3) not prominent, situated in a hollow cavity and each with 2 spiracular openings, elongated and lying side by side; peritreme absent.

1st instar larvae transformed into 2nd instar larvae after 9-11 hrs.

Second instar larva : (Fig. 4) 6-8 mm in length with diameter 1.4-1.7 mm.

Distribution of spines similar to that of 1st instar.

Cephalopharyngeal Sclerite : (Fig. 5) slightly pigmented, only the mouth-hook deeply pigmented; parastomal bar prominent; basal piece strong; dorsal and ventral cornu both with window; window of dorsal cornu wider and open.

Spiracles; Anterior spiracles (Fig. 6) each with 12-14 branches;

Posterior spiracles (Fig. 7) large, paired, higher than wide, each composed of 2 slit-like openings situated in a deep cavity; peretreme incomplete; inner projections of peretreme well developed; button absent; ventral arc short; inner arc ill-developed, curved and pointed.

2nd instar larvae transformed into 3rd instar after 24-27 hrs.

Third instar larva : (Fig. 8) Length of 3rd instar larva 16-18 mm with diameter 3-3.8 mm.

Segments 2-12 each bordered anteriorly with a complete band of spines. Segments 6-11 with complete posterior band of spines.

Inner pair of tubercles on upper border of anal segment separated by a distance equal to the distance between inner and outer tubercles.

Cephalopharyngeal sclerite : (Fig. 9) Heavily pigmented; incision between cornu very deep; both dorsal and ventral cornu long and same in length; dorsal cornu with open window.

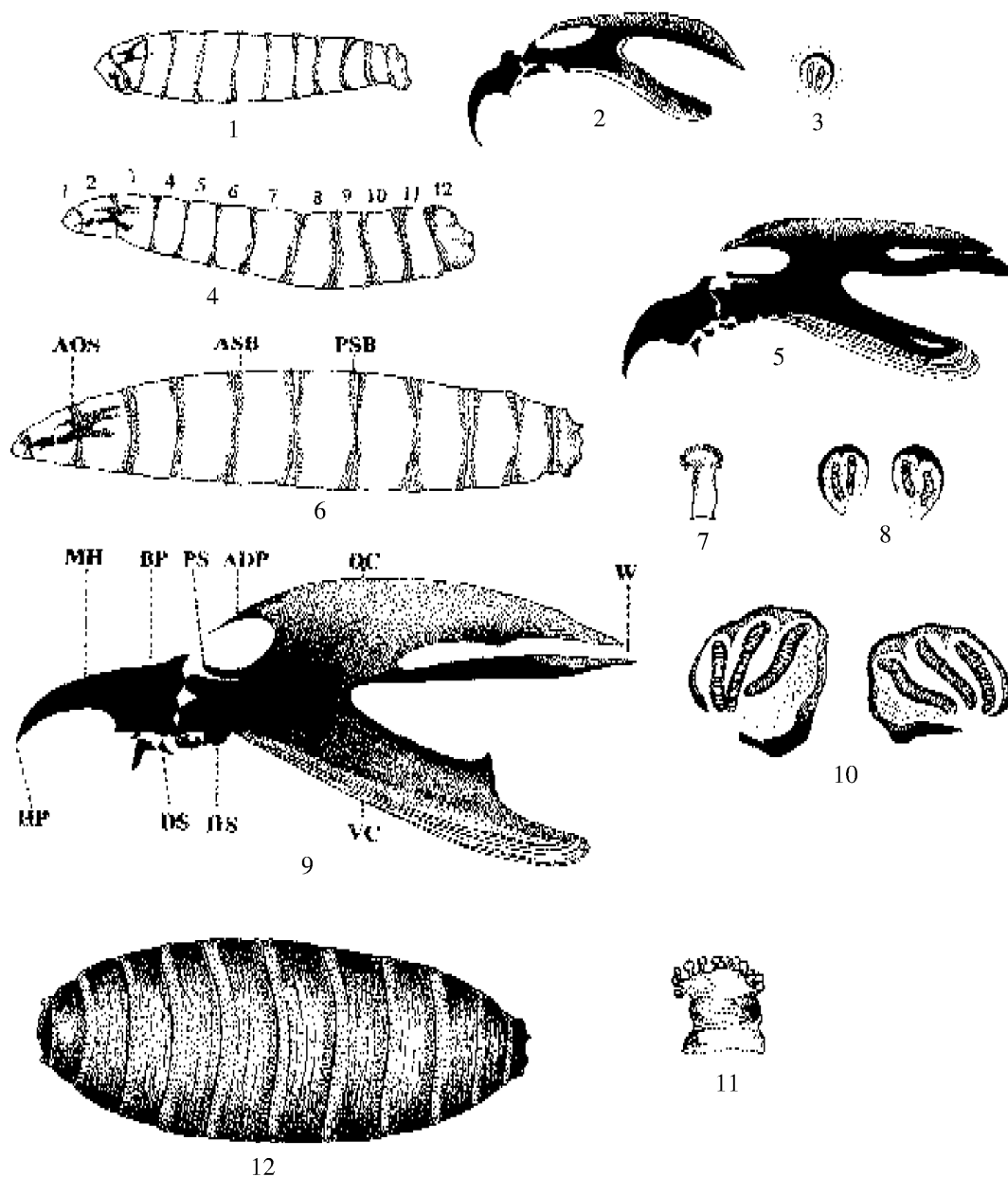
Spiracles : Anterior spiracle (Fig. 11) broad with 12-14 branches; openings of anterior spiracle arranged in a single row.

Posterior spiracle (Fig. 10) medium sized; peretreme fairly narrow. Inner projections of peretreme well developed; slits not so long; button absent; inner arc long with loop-shaped tail touching the inner slits; ventral arc well developed; posterior spiracles separated by a distance about 1/3rd the width of one spiracle.

3rd instar larvae pupated after 32-41 hrs. (65-67 hrs. of hatching)

Puparium : (Fig. 12) Puparia ranged in length from 9-10.8 mm and diameter in widest part ranged from 4-4.5 mm. Cylindrical in shape, tapering on both ends; colour deep-brown; anterior spiracles with short-stalks; posterior spiracles situated in a deep cavity, spine bands on segments prominent, numerous transverse striations are found between segments. Pupal stage lasted for an average of 186-188 hrs.

Total time required for completion of the life cycle of this species from first instar larvae to adult is about 293-301 hrs.



Figs. 1-12. Larval body parts of *Seniorwhitea reciproca* (Walker)

1-1st instar larva; 2-Cephalopharyngeal sclerite of 1st instar larva; 3-Posterior spiracle of 1st instar larva; 4-2nd instar larva; 5-Cephalopharyngeal sclerite of 2nd instar larva; 6-Anterior spiracles of 2nd instar larva; 7-Posterior spiracles of 2nd instar larva; 8-3rd instar larva; 9-Cephalopharyngeal sclerite of 3rd instar larva; 10-Posterior spiracles of 3rd instar larva; 11-Anterior spiracles of 3rd instar larva; 12-Puparium.

DISCUSSION

This is a common species which is found on dead fishes, animals and other decaying organic matters. This species is attracted to *Aristolochia ridicula* flowers (Aristolochiaceae), human excrement and dead *Achatina* sp (Gastropoda). The larvae of this species breed in dead *Achatina fulica*, grasshoppers, sphingid and other lepidopterous larvae. the larvae feeding on the waxy secretion of fulgorid (Hemiptrea) and on a Noctuid (Lepidoptera).

SUMMARY

This paper describes the life cycle of the sarcophagid fly *Seniorwhitea reciproca* (Walker) along with the larval stages and puparium on coastal fish *Panna microdon* (Bleeker).

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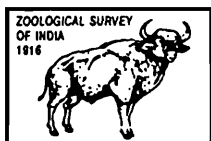
The author is grateful to Dr. B. C. Nandi for proper guidance and laboratory facilities and to the Ministry of Environment and Forests for financial support.

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TERMINOLOGY

aos = anterior spiracle, asb = anterior spine band, psb = posterior spine band. adp = antero dorsal process, bp = basal plate, dc = dorsal cornu, ds = dental sclerite, hp = hook part, hs = hypostomal sclerite, mh = mouth hook, ps = parastomal sclerite, vc = ventral cornu, w = window, ia = inner arc. Va = ventral arc.



Rec. zool. Surv. India, 109(Part-2) : 73-78, 2009

STUDIES ON THE POPULATION STRUCTURE OF SOIL MICROARTHROPODS IN SALINE AND NON-SALINE SOILS OF NORTH AND SOUTH 24-PARGANAS DISTRICTS OF WEST BENGAL

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A good amount of works have been done on various aspects of soil arthropod fauna in different types of soil in West Bengal by Bhattacharya and Joy (1978), Bhattacharya and Roychowdhury (1979), Hazra and Chowdhury (1983), Sanyal (1982, 1991), and Sen *et al.* (1999, 2002). Besides these some attempts were also made by Bhattacharya and Roychowdhury (1977), Sanyal (1981a, b, 1988), Sanyal and Sarkar (1983), Dey *et al.* (2005) to establish the relationship between the association of oribatid mites and salinity. The present work is an attempt to study the population structure of soil microarthropods in the saline and non-saline soils of North and South 24-Parganas districts of West Bengal.

MATERIALS AND METHODS

The present study was under taken in June, 2002 to January, 2004 in some areas of North and South 24-Parganas districts of West Bengal. In all 180 soil samples were collected from North and South 24-Parganas districts during summer, rainy and winter seasons. Sampling was made by selecting a 10m² plots of cultivated and uncultivated grassland and 500 c.c. of soil sample was taken from the plot. The soil samples were taken from the rhizospheres of different plants and grass. For extraction of the soil arthropod fauna 500 c.c. of soil sample was put in a modified Tulgren Funnel apparatus using 40 watt Electric bulb as heat source. Usually the samples were kept in the funnel for 72 hours.

Apart from the extraction of microarthropods, the soil samples were analysed to determine the pH using Systronic pH meter and the soil salinity was determined by using the Refractometer. The soil temperature was recorded at the time of sampling by inserting a soil thermometer in the soil of the sampling site.

RESULTS AND DISCUSSION

The pH of soil samples varied from 6.09 to 8.16 in non-saline alluvial soil and 4.46 to 8.05 in saline soil. The soil temperature ranges from 32°C to 40°C, 27°C to 30°C and 19°C to 23°C in summer, monsoon and winter seasons in the non-saline soil respectively and that in the saline soil ranges from 29°C to 30°C, 27°C to 31°C and 18°C to 22°C in summer, monsoon and winter seasons respectively (Table-1). The soil having salinity below 0.5ppt is considered as non-saline soil.

It was observed that total population of soil microarthropods was always higher in number in summer months in both saline and non-saline soils than in monsoon and winter seasons (Table-1) and this result was supported by the observations of Sanyal (1981a, b, 1982, 1988), Sanyal and Sarkar (1983). From the results it was revealed that the total population of soil microarthropods was always higher in grassland than in the cultivated soil (Table-2). From the results it was also observed that in the summer and winter seasons the mite population was always higher than the collembola and in winter the mite population occupied about 84.61% and 73.72% in saline and non-saline soils respectively and in summer it occupied about 96.66% and 96.96% in saline and non-saline soils respectively. On the contrary at the same time collembolan population occupied 12.79% and 22.88% in winter and 3.34% and 3.03% in summer in saline and non-saline soils respectively (Fig. 1). But in monsoon the collembolan population was comparatively higher than that in winter and summer in both the types of soil. During monsoon mites occupied 54.80% and 67.34% and collembolae occupied about 44.64% and 32.65% of total population in saline and non-saline soils respectively. Among the acarine population about 80% was occupied by the oribatid

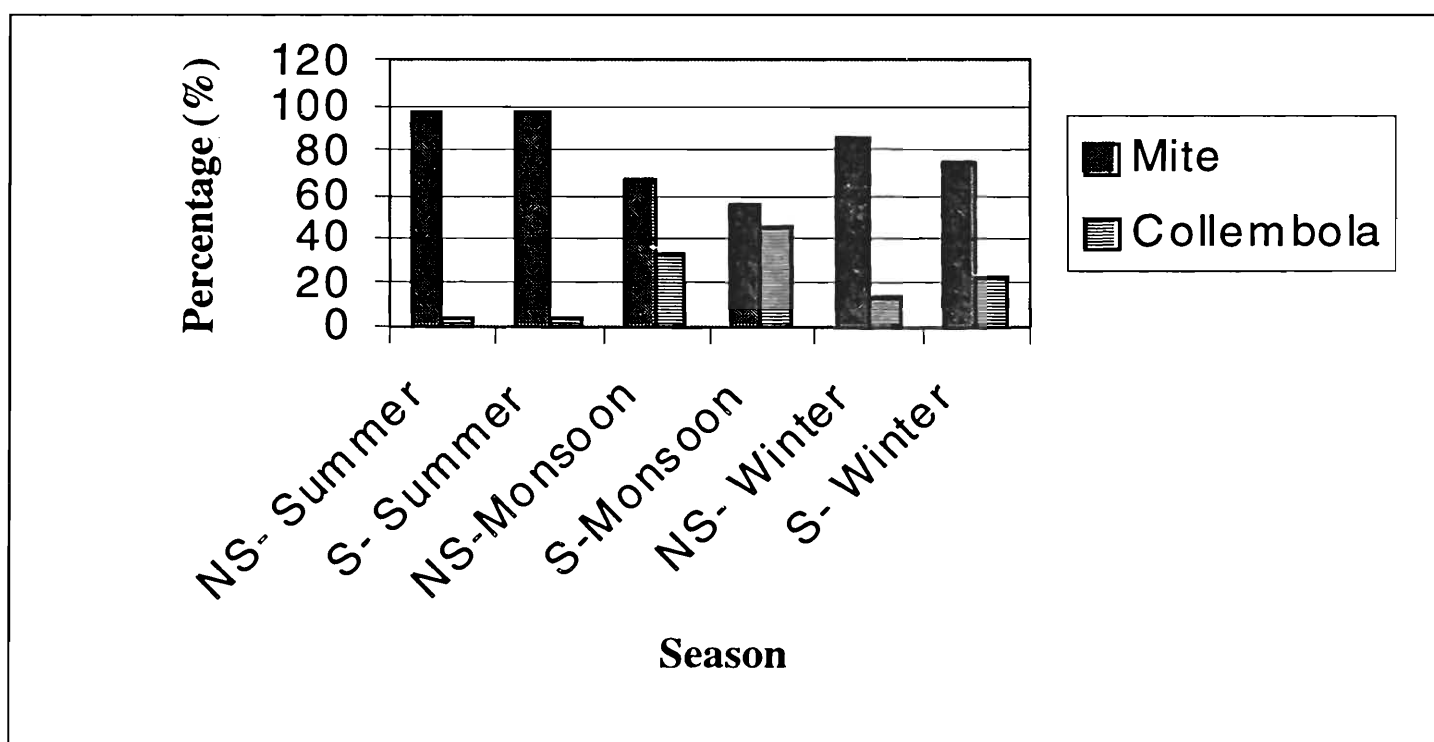
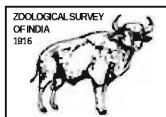


Fig. 1. Relative abundance of Mite and Collembola population in different seasons in non-saline and saline soils



Rec. zool. Surv. India, **109**(Part-2) : 73-78, 2009

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MATERIALS AND METHODS

The present study was under taken in June, 2002 to January, 2004 in some areas of North and South 24-Parganas districts of West Bengal. In all 180 soil samples were collected from North and South 24-Parganas districts during summer, rainy and winter seasons. Sampling was made by selecting a 10m² plots of cultivated and uncultivated grassland and 500 c.c. of soil sample was taken from the plot. The soil samples were taken from the rhizospheres of different plants and grass. For extraction of the soil arthropod fauna 500 c.c. of soil sample was put in a modified Tulgren Funnel apparatus using 40 watt Electric bulb as heat source. Usually the samples were kept in the funnel for 72 hours.

Apart from the extraction of microarthropods, the soil samples were analysed to determine the pH using Systronic pH meter and the soil salinity was determined by using the Refractometer. The soil temperature was recorded at the time of sampling by inserting a soil thermometer in the soil of the sampling site.

Table-1. shows the edaphic factors and the total arthropod population per sample of the study area.

Soil type in relation to salinity.	Season	Range of pH	Range of soil temperature	Average number of arthropods in 500c.c. of soil.
Non-saline alluvial soil.	Summer	6.09—8.16.	32 ⁰ c—40 ⁰ c	38.5
Non-saline alluvial soil	Monsoon	6.09—8.16	27 ⁰ c-30 ⁰ c	33.5
Non-saline alluvial soil	Winter	6.09—8.16	19 ⁰ c—23 ⁰ c	12.5
Saline soil	Summer	4.46—8.05	29 ⁰ c—30 ⁰ c	35.2
Saline soil	Monsoon	4.46—8.05	27 ⁰ c—31 ⁰ c	11.0
Saline soil	Winter	4.46—8.05	18 ⁰ c—22 ⁰ c	20.8

Table-2. Total arthropod population in different seasons in grasslands and cultivated lands in saline and non -saline soils.

Soil type in relation to salinity	Vegetation	Season	Average arthropod population in 500 c.c. of soil
Saline soil	Grass	Summer	53.5
Saline soil	Cultivated	Summer	16.7
Saline soil	Grass	Monsoon	15.5
Saline soil	Cultivated	Monsoon	6.5
Saline soil	grass	Winter	27
Saline soil	Cultivated	Winter	15
Non -saline soil	Grass	Summer	57.6
Non -Saline soil	Cultivated	Summer	20
Non- saline soil	Grass	Monsoon	55
Non-saline soil	Cultivated	Monsoon	12
Non -saline soil	Grass	Winter	19.5
Non -saline soil	Cultivated	Winter	6.5

SUMMARY

180 soil samples were collected from saline and non -saline soils of cultivated and uncultivated grasslands during June, 2002 to January, 2004.

The total arthropod population was always higher in grassland samples than in the cultivated one.

Mite population was always higher in all the seasons than the collembolan in saline and non - saline soils.

Among the acarine population oribatid mites occupied about 80% and 6 species of oribatid mites have been identified and the genus *Scheloribates* shows the dominance.

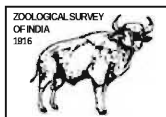
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STUDIES OF THE CEYLONE FROGMOUTH, *BATRACHOSTOMUS MONILIGER* BLYTH FROM INDIA, WITH THE DESCRIPTION OF A NEW SUB-SPECIES FROM WESTERN GHATS

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INTRODUCTION

The Western Ghats is one of the globally recognized 'Hot Spots' for biodiversity in India (Mayers, 1990). The Western Ghats, a continuous chain of hill ranges from 20 to 2600 m altitude, falls under 'Malabar botanical provinces' Hooker's (1907). It has similar type of tropical rain forest with that of NE Himalaya and having some Indo-malayan avian elements (Hora, 1938-53; Dilger, 1952; Ali, 1948 and Ripley, 1949).

Blyth (1846) described *Batrachostomus moniliger* on the Layard's material taken from Ceylone (=Sri Lanka). Baker (1927) provided its range as Ceylone, Travancore and Wayanad, Ripley (1961), further extended its range as far as Western Ghats strip of North Kanara in Mysore (Karnataka). Ali & Ripley (1970) stated its range from 15°N latitude south to Trivanathapuram and Sri Lanka. The avian samples collected during the field survey in 1977 from the northern part of its range, viz., Jog Falls, Shimoga Dist., and Sampaje, Coorg Dist., Karnataka revealed that the northern population is different from the southern population and thus warranting a new name. The southern birds are in the intergrading zone and more akin to the Sri Lankan form.

Keywords : Western Ghats, Jog Falls, Shimoga district, Sampaje, Coorg district, Karnataka, Podargidae, *Batrachostomus moniliger roonwali* sp. nov.

DESCRIPTION : *Batrachostomus moniliger* Blyth

The description given by Blyth (1846); Baker (1927) and Ali & Ripley (1970) for Ceylon Frogmouth, *Batrachostomus moniliger* are inadequate. Hence a detail description is given below on the basis of specimens preserved in the National Zoological Collections, Zoological Survey of India, Kolkata.

MATERIAL EXAMINED OF NOMINATE SPECIES

- Crown** : In male, feathers are vermiculated dark with apical black spot edged with white, spots many. In female, feathers are finely vermiculated chestnut with apical black spot edged with rufous, spots few.
- Back** : In male, feathers are mottled dark brown having lanceroate crescent, tips pale. In female, feathers are mottled chestnut having pure chestnut terminal part with a crescent of black sub-apical spot, tip well pronounced pale chestnut; in lower back spots are obsolete or absent.
- Scapulars** : In male, feathers are grey and white finely vermiculated with apical semi lunar rufous spot followed by a crescent of black spot with a minute white tip. In female, feathers are vermiculated rufous with a white apical spot followed by a thin black crescent.
- Wing** : In male, primaries are dark brown but outer web distinctly barred with white and rufous spots joining outward. Inner secondaries as in scapulars, outermost quills leaning to primaries, exposed part well mottled, all secondary quills have a triangular black tip.

In female are primaries dark brown but outerweb rufous with indistinct bars. Secondaries vermiculated rufous with white tip having black marking behind, outerwing pale terminal part.
- Underwing** : Pale fulvous in both male and female but marked by very faint black bars in male and clouded with brown in female.
- Wing coverts** : Heavily mottled, on secondaries a bold white spot on the outer web followed by a black apical tip; the coverts in female are chestnut but having similar spots as in male.
- Back** : In male, feathers are dark brown heavily mottled with a lanceroate black apical spot margined by chestnut crescent behind, tip pale rufous. In female, feathers are finely mottled chestnuts having pure chestnut terminal part with a black sub apical crescent spots are obsolete or absent on lower back.
- Tail** : In male, feathers are heavily mottled brown with paler bands of mottled gray and white lined by wavy black lines well marked behind, a sub apical black bar and rufous tip.

In female feathers are mottled chestnut, pale band indistinct throughout the black lining behind well defined, tips rufous followed by a black band.

- Chin and throat** : In male, pale brown those on throat feathers having a black spot following the white tip. In female, feathers are chestnut having similar spots on throat as in male but white is replaced by rufous at tip.
- Throat band** : In male, feathers are having a bold white spot towards tip and margined by black sharply pronounced behind, but in female, the anterior black margin is absent.
- Breast** : In male, breast feathers mottled brown but those on lower breast having similar spots like throat band forming the breast band, few lanceolate black spots on sides grading into feathers with white spot.
In female, upper breast is mottled chestnut, lower breast well spotted, feathers having white apical spots well marked by black margins, more pronounced basally, forming the second band.
- Abdomen** : In male mottled white with large white spot apically.
In female, feathers mottled rufous brown with large white spots well marked by black on the base of the white spot.
- Vent** : In male, pale fulvous with white spots and faint black lines showing up as faint bars. In female, rufous feathers having white spots with well marked black basal margin.
- Sides** : Correspond to that in male and female abdomens.

DISTRIBUTION OF NOMINATE SPECIES

The Western Ghats from c. 15°N, Kana'ra dist. (Mysore) south to the Thiruvananthapuram dist. (Kerala) up to c. 1200 m; Ceylon, throughout the forest areas up to c. 1800 m. (Ali & Ripley 1970).

Study area : Chatterjee (1940), classified the Western Ghats in four broad phytogeographic regions. The present study area falls in the "River Kalinadi to Coorg" which included part of Karnataka. This region consists of valleys surrounded by deep gorges 3-5 km. across and 300 m. deep and lies within 12°25'-14°15'N and 74°35'-75°E. The area has thick and dense Moist Evergreen Forest. Major rivers are Sharavati, Tunga and Bhadra. The area is further thickly covered with trees where the undergrowth is profuse and trangled with twinnings and climbers and very much swampy, damp in nature and surrounded by a couple of streams and nullas.

Materials and Methods : All the material, 2♂, 2♀, were collected from Vanathipuram, Madurai district, and Bana Thirtham, Tirunelveli district of Tamil Nadu. All were preserved and deposited in

the National Zoological collections, Zoological Survey of India, Kolkata. Comparative studies of morphometric characters and comparison of other biodatas were made as per standardisation adopted by Baker (1927) and Ali & Ripley (1970).

Abbreviations : Reg. No. : Register Number; ZSI : Zoological Survey of India.

Order CAPRIMULGIFORMES

Family PODARGIDAE

***Batrachostomus moniliger roonwali* new subspecies**

Type Locality : Jog Falls, Shimoga District, Karnataka, India.

Holo-Type : ZSI Reg. No. 40208; Adult Male; Collected by Dr. V. C. Agrawal on 21 Jan 1977 from Jog (=Jog Falls), Shimoga District, Karnataka, India.

Para-Types : ZSI Reg. No. 40207; Adult Female; taken on 15 Jan. 1977, other details as in the Holotype. ZSI Reg. No. 40209; Sub-adult Male; taken on 3 Feb. 1977 from Sampaje, Coorg District, Karnataka, collector Dr. V. C. Agrawal. Other comparative material : ZSI Reg. No. 40201; Adult Female; taken on 25 Feb. 1986m ZSI Reg. No. 40211; Adult Male taken on 27 Feb. 1986, both taken from Vanathiparai, Madurai District, Tamil Nadu. ZSI Reg. No. 39128; Adult Male taken on 17 Sep 1992 from Bana Thirtham, Tirunelveli District, Tamil Nadu; all collected by S. S. Saha. Repository, Zoological Survey of India, Kolkata.

*Key to the subspecies of **Batrachostomus moniliger** Blyth*

Male

Wing patch grey, under parts spotted white *B. m. moniliger*

Wing patch fulvous grey, under parts spotted fulvous *B. m. roonwali*

Female

Wing patch chestnut, crown spotted, tail barred *B. m. moniliger*

Wing patch bright chestnut, crown unspotted, tail not barred *B. m. roonwali*

DESCRIPTION

Male : General colour above heavily spotted dark speckled brown. A conspicuous whitish collar and an oblique pale grey patch along the inner wing and scapulars, tail barred. Under parts brown much paler than above, having heavily spotted breast with double bands, one on lower throat and the other on lower breast, the latter extending along the sides. Abdomen lighter with fulvous bold spots, each with wavy dark brown lines. Head heavily spotted, each mottled feather has a sub-apical black spot margined by apical fulvous tip. Lower neck warmer, followed by the

collar band. Each feather of the collar band has a terminal black spot and a subterminal whitish bar, margined by a thin black band. Back vermiculated dark brown, splattered with black and chestnut markings. Tail with alternate bands of light and dark brown, the light band margined by black, well marked distally; tip pale fulvous.

Female : General colour above very finely vermiculated chestnut. A white collar and the oblique pale patch on the wing is replaced by pale chestnut feathers, having black and white spottings on tip; spotting absent on inner scapulars. Under parts paler than above. Throat band not so conspicuous as in male. Abdomen paler than breast but heavily spotted, spots are on the outer web of terminal part of the feather.

Sub adult Male : An admixture of male and female plumage. General colour like female but dark and light spottings as of male, complete with wing patch, collar, bands, and tailbars. Tail has bands but vermiculated and with more solid apical black markings.

Distribution : Southern Western Ghats strip from about Jog Falls, Shimoga Dist., and Sampaje, Coorg Dist. Karnataka. The distribution of nominate subspecies *moniliger* would be from Madurai district down to Tirunelveli district of Tamil Nadu barring the zone from Coorg south to Madurai being the intergrading zone of two population.

Etimology : The name *roonwali* has been given as my homage to Late Dr. M. L. Roonwal ex-Director of Zoological Survey of India and ex-vice-Chancellor of Jodhpur University who substantially contributed to Zoology.

Discussion/Museum diagnosis : Comparison of diagnosis characters of both *B. m. roonwali* sp. nov. and *B. m. moniliger* Blyth.

Male

Ventral View

01. Black drops on the lower breast and upper abdomen are more in *roonwali* than in *moniliger*.
02. (i) Feathers of the abdomen and vent are chestnut brown with broad black crescent marking in *roonwali*.
- (ii) Feathers largely light brown with bold white drops together with faint blackish brown minute spots sometime forming broken lines in *moniliger*.

Dorsal view

01. Colour of tail feathers is more saturated in *roonwali* than *moniliger*.
02. Brownish white bare on tail are boldly edged with black in *roonwali* and fainting edged with black in *moniliger*.

Female**Ventral view**

01. Bold white drops on abdomen and vent are more in *moniliger* than in *roonwali*.

Dorsal view

01. Whole crown with black spots and are more in fore crown in *moniliger* and absolutely no black spot on the crown in *roonwali*.
02. Entire tail feathers with thin transverse black bars in *moniliger* and no such black bars on tail in *roonwali*.
03. Bold white drops edged with black on the scapular region are more in *moniliger* and one or no spots 1 *roonwali*.

Dorsal view :

- 0.1 Whole crown with black spots and are more in fore crown in *moniliger* and absolutely no black spot on the crown in *roonwali*.
02. Entire tail feathers with then transverse black bars in *moniliger* and no such black bars on tail in *roonwali*.
03. Bold white drops edged with black on the scapular region are more in *moniliger* and one or no spots 1 *roonwali*.

B.m. roonwali produces a loud guttural rapid series of note like. “Toro..... Toro..... Toro Toro..... repeated monotonously every two seconds against a soft “Kooroo..... Kooroo.....” or a fairly louo liquid chuckle ahwoo repeated monotonously every 2 or 3 seconds (Ali) by *B.m. moniliger*.

Table-1. Morphometric measurements (in mm) of *B. m. roonwali* (Holotype and Paratype) and *B. m. moniliger*.

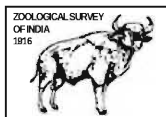
Body parts	<i>B. m. roonwali</i>		<i>B. m. moniliger</i>
	Holotype	Paratypes	
Wing	120+	125–120	124, 122, 122
Tail	116	110–103	115, 110, 110
Tarsus	15.5	14.5–14.5	14.5 (2), 13
Bill (from skull)	21.5	21.6–21.0	21, 21
Bill (from gape)	33.6	32–33.6	34, 32.5, 32

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A PRELIMINARY NOTE ON THE MOSQUITO FAUNA (DIPTERA : CULICIDAE) OF SOUTHERN COASTAL DISTRICTS OF ORISSA

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INTRODUCTION

The family Culicidae consists of 41 genera and 3500 species known all over the world. Of these, 320 species of 37 genera of mosquitoes are reported from India. Barraud (1934) studied the Indian mosquito fauna and recorded 250 species of Culicinae with type localities in greater India. The mosquito fauna of coastal Orissa was first studied by Fry (1912) and reported the presence of 5 anopheline species. After a gap of over three decades Rodenwaldt recorded 21 sps. of Anopheles mosquitoes (Diptera : Culicidae) from the coastal belt of Orissa. Subsequently Nagpal and Sharma (1983) recorded 32 species of mosquitoes belonging to six genera from coastal districts of Orissa. Later Dash *et al.* (2000) reported 8 sps. of Culicinae and 14 spp of Anopheline mosquitoes from Chilika Lake area; Rajavel *et al.* (2005a, b) reported 74 species belonging to 12 genera and 20 subgenera from Jeypore hill tracks of Orissa and fortythree species of mosquitoes belonging to 21 subgenera and 13 genera, from mangrooves of Bhiterkanika.

The need for the identification of the mosquitoes is urgently required because some of the mosquito species are the vectors of important tropical diseases including malaria, dengue, filariasis, etc. Although the organizations such as National Centre for Malaria Research (NIMR), Regional Medical Research Centre (RMRC, Bhubaneswar), Vector Control Research Centre (VCRC) and National Institute of Communicable Diseases (NICD) are doing a handful work on mosquito biology, but the taxonomy of Indian mosquito is far from complete. The need to identify and inventorise the mosquito species from the Orissa state is very essential because the state is known to experience a series of epidemics of mosquito-borne diseases. Keeping in view of the major outbreaks of cerebral malaria, filariasis, chikungunia, dengue and other vector borne diseases an attempt has

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been made here by the authors to report the mosquito fauna collected from the unexplored shoreline habitats of Puri, Khurda and Ganjam District.

COLLECTION OF MATERIALS

The mosquitoes were collected from Puri district i.e., Kushabhadra Estuary, Satpara, Alipara, Rambhartya Island, Giquala. Khurda district : Chhedapadar, Bidharpur, Rajni Reserve Forest, Balugaon Ganjam district : Berhampur, Gopalpur. The collections were made with sucking-tubes and aspirators. The indoor collections of resting mosquitoes were made by spray of pyrethrum solution in a closed room on white cotton bed-sheets. Human bait collection methods were also employed in outdoor situations by flashing light. Only adult mosquitoes were collected and preserved for identification. A total of 140 examples of mosquito specimens were collected during this preliminary survey and identified with reference to Christophers (1933), Barraud (1934), Nagpal *et al.* (2005), Iyengar and Menon (1955).

RESULTS AND DISCUSSION

The current higher level of classification, taxonomic citation of species studied, their distribution, breeding sources and biology in relation to disease vector status were provided in order. The taxonomic arrangement of species in the paper follows the work of Bram (1967), Rajavel *et al.* (2005), Illango (2006), Tewari *et al.* (1987), Nagpal and Sharma (1995). The species marked with asterisk were collected and observed in the present study.

SYSTEMATIC ACCOUNT

Family CULICIDAE

Subfamily ANOPHELINAE

Genus *Anopheles* Meigen

1. *Anopheles aconitus* Donitz

1902. *Anopheles aconitus*, Donitz, 1902 *Zeitschrift Fur Hygiene und Infektionskrankheiten*, **41** : 15-18.

Recorded : Coastal plains of Orissa.

Distribution : India : Widely prevalent except Haryana, Himachal Pradesh, Jammu and Kashmir, Punjab, Rajasthan.

Remarks : Species breeds in clean-water tanks with grassy edges, ponds, streams, water drains, river bed pools and rice fields (at least 45 cm long).

2. *Anopheles aitkenii* James

1903. *Anopheles aitkenii* James, In : Theobald, *Mon. Cul.*, **3** : 22-23.

Recorded : Mayurbhanj, Keonijhar, Koraput districts of Orissa.

Distribution : India : Widely prevalent in Andaman Islands, Andhra Pradesh, Assam, Bihar, Karnataka, Kerala, Maharashtra, Manipur, Meghalaya, Orissa, Punjab, Sikkim, Tamilnadu, Uttar Pradesh and West Bengal.

Remarks : Breeds in a variety of places such as small pools and seepages in the jungle, tea garden drains which are shaded by tea plants, swamps, marshes, channels, river, rock pools, streams heavily shaded with trees, wells etc.

3. *Anopheles annularis* Vander Wulp

1884. *Anopheles annularis* Van der Wulp. *Notes from the Leyden Museum*, **6** : 248-256.

Recorded : Singhbhum, Chilika lake area, Puri, Keonjhar, Koraput of Orissa.

Distribution : India : Commonly found in Bihar, Coastal Orissa, and West Bengal.

Remarks : Mixed dwellings during day. Also found at outdoor in small numbers.

4. *Anopheles culicifacies* Giles

1901. *Anopheles culicifacies* Giles, *Entom. Month. Mag.*, **37** : 196-198.

Recorded : Balangir, Balighai, Bhadrak, Chatikona, Cuttack, Ganjam, Jeypore, Kesinga, Phulbani, Sambalpur of Orissa.

Distribution : India : Throughout the country except Andaman & Nicobar Islands.

Remarks : It rests in cattle sheds and houses during the day. They were also collected from Straw, mud cakes etc., near stables and from dense vegetation under the bushes and tree holes.

5. *Anopheles fluviatilis* James

1902. *Anopheles fluviatilis* James, *Sci. Mem. govt. Indian n.s.*, **2** : 106.

Recorded : From Jeypore, Koraput, Mayurbhanj districts of Orissa.

Distribution : India : Widely distributed.

Remarks : Mostly adults rest at human habitats than cattle sheds in day time. It also rests in outdoors.

6. *Anopheles jeyporiensis* James

1902. *Anopheles jeyporiensis* James, *Sci. Mem. govt. Indian n.s.*, **2** : 106.

Recorded : Reported from Jeypore hills of Orissa after which it has been named.

Distribution : India : Recorded from Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Goa, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Orissa, Rajasthan, Sikkim, Tamilnadu, Uttar Pradesh, Uttaranchal, West Bengal.

Remarks : Adults found largely in cattle sheds but also inside houses. Found at altitudes between 2000 to 6000m.

Subgenus *Ceillia* Theobald

7. *Anopheles (Cellia) karwari* (James)

1902. *Anopheles karwari* (James), In : Theobald, 1903. *Mon. Cul.*, **3** : 102-104.

Distribution : India : Andaman & Nicobar Islands, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chennai, Goa, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Mizoram, Orissa, Rajasthan, Tripura, Uttar Pradesh, Uttaranchal, West Bengal.

Remarks : Breeds mainly in seepages. Not regarded as vector of Malaria.

8. **Anopheles maculatus* Theobald

1901. *Anopheles maculates* Theobald, *Mon. Cul.*, **1** : 171-174.

Recorded : All over Orissa.

Materials Examined : 1 ex., E, Sulia Colony, Khurda Dist., 28.i.2006, Coll. S. Dash.

Distribution : India : Widely distributed.

Remarks : Prefers bright sunlit breeding places and shade has a deleterious effect. Breeding is more pronounced in pre and post monsoon months.

9. *Anopheles majidi* Young and Majid

1928. *Anopheles majidi* Young and Majid, *Ind. Jour. Med. Res.*, **16** : 469-471.

Recorded : Koraput district, Orissa.

Distribution : India : Arunachal Pradesh, Assam, Goa, Karnataka, Kerala, Meghalaya, Mizoram, Orissa, Tamilnadu, Tripura, West Bengal.

Remarks : Breeds in grassy slow-running streams, breeding also recorded from open drains in tea gardens and fallow rice fields.

10. ***Anopheles minimus*** Theobald

1901. *Anopheles minimus* Theobald, *Mon. Cul.*, **1** : 186-88.

Recorded : All over Orissa, Mostly in Jeypore Hills.

Distribution : India : Widely distributed in Arunachal Pradesh, Assam, Madhya Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura. It has sporadic distribution in Andhra Pradesh, Bihar, Karnatak, Kerala, Orissa, Tamilnadu, in the foothills of Uttar Pradesh, West Bengal.

Remarks : It also breeds in burrow pits, rice fields and seepages. The species prefers shady places.

11. ***Anopheles moghulensis*** Christophers

1924. *Anopheles moghulensis* Christophers, *Ind. Jour. Med. Res.*, **12** : 295-301.

Recorded : From all over Orissa.

Distribution : India : Recorded from Andhra Pradesh, Bihar, Jammu & Kashmir, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamilnadu.

Remarks : Rests in human dwellings and occasionally in cattle sheds.

12. ****Anopheles nigerimus*** Giles

1900. *Anopheles nigerimus* Giles, *A handbook of the Gnats or Mosquitoes giving the Anatomy and Life History of Culicidae*, 1-374.

Material Examined : 2E, Gopalpur, Ganjam Dist., 21.i.2006, Coll. S. Dash.

Recorded : From all over Orissa especially from coastal Orissa.

Distribution : India : Occurs throughout except Himachal Pradesh.

Remarks : Breeds in standing water with good aquatic vegetation.

13. ***Anopheles pallidus*** Theobald

1901. *Anopheles pallidus* Theobald. *Mono Cul.*, **1** : 132-134.

Recorded : From all over Orissa.

Distribution : India : Cosmopolitan.

Remarks : Mixed dwellings.

14. *Anopheles pseudojamesi* Strickland and Chowdhury

1927. *Anopheles pseudojamesi*, Strickland and Chowdhury. *Ind. Med. Gaz.*, **62** : 240-243.

Recorded : Coastal plains of Orissa.

Distribution : India : Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Goa, Maharashtra, Meghalaya, Orissa and West Bengal.

Remarks : Breeds in rainwater pools, tanks and swamps, Adults rest in houses and cattle sheds.

15. *Anopheles sergetii* (Theobald)

1907. *Anopheles sergetii* (Theobald), *Mon. Cul.*, **4** : 68-69.

Recorded : In Orissa recorded from Koraput Dist.

Distribution : India : Recorded from Jabalpur (Madhya Pradesh) and Koraput (Orissa).

Remarks : Rests in human dwellings and cattle sheds but sometimes in underground aqueducts.

16. *Anopheles sinensis* Wiedemann

1828. *Anopheles sinensis* Wiedemann, *Aussereuropaisch Zweifflugelige Insekten*, Vol. **1**, 608 pp.

Recorded : From all over Orissa especially from Koraput District.

Distribution : India : Assam, Delhi, Manipur, Meghalaya, Mizoram, Orissa, Punjab and Tamilnadu.

Remarks : The main breeding ground is the rice fields.

17. **Anopheles subpictus* Grassi

1899. *Anopheles subpictus* Grassi, In : Grassi, Bigami and Bastianelli, 1899. alti dell, *Accademic Nazionale dei Lincei. Rendiconti*, **8** : 100-104.

Material examined : 2 exs. E, Chedapadar, Dist. Khurda 27.i.2006, Coll. S. Dash.

Recorded : From all over Orissa.

Distribution : India : Occurs in all main lands.

Remarks : Breeds in flowing stagnant waters, clear or turbid waters, water with or without vegetation, shaded or slightly shaded places, wells, burrow pits, channels, lake margins, ponds, tanks, ground pools, fallow and freshly flooded rice fields, cement cisterns, tree-holes, fresh or brackish waters.

18. *Anopheles tessellates*, Theobald

1901. *Anopheles tessellates* Theobald, *Mon. Cul.*, **1** : 175.

Recorded : All over Orissa.

Distribution : India : Andaman and Nicobar Islands, Andhra Pradesh, Assam, Bihar, Goa, Gujarat, Karnataka, Kerala, Lakshadweep, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Nagaland, Orissa, Rajashtan, Sikkim, Tamilnadu, Tripura, Uttar Pradesh, Uttaranchal, West Bengal.

Remarks : Mixed dwellings cattlesheds and outdoors rests particularly on the lower part of the walls.

19. **Anopheles theobaldi* Giles

1901. *Anopheles theobaldi* Giles, *Entomol Month mag.*, **37** : 196-198.

Material examined : 2E, Alipada, Dist. Puri, 24.i.2006. Coll. S. Dash.

Recorded : All over Orissa.

Distribution : India : It is found all over the country but concentrated mainly in central and western part of Peninsula.

Remarks : Forest species and basically a stream breeder, also breeds in ponds, tanks, rice fields and riverbed pools.

20. **Anopheles vagus* Donitz

1902. *Anopheles vagus* Donitz., *Zeitschrift fur Hygiene and Infektionskrankheiten*, **41** : 15-88.

Material examined : 3 exs. E, Chedapadar, Dist. Khurda 26.i.2006, Coll. S. Dash.

Recorded : From all over Orissa.

Distribution : India : Throughout the country except Delhi, Himachal Pradesh, and Punjab.

Remarks : Adults rest indoors in cattle sheds and mixed dwellings. Cattle sheds are regarded more attractive. Outdoor resting to a limited extent.

21. *Anopheles varuna*, Iyengar

1924. *Anopheles varuna* Iyengar, *Ind. Jour. Med. Res.*, **12** : 23-29.

Recorded : Jeypore Hills, Orissa.

Distribution : India : Andaman Islands, except Himachal Pradesh, Haryana, Jammu and Kashmir. Lakshadweep, Punjab, Rajasthan, throughout India.

Remarks : Breeds profusely in freshwater tanks, ponds, rice fields, drains, irrigation channels, wells etc., with algal and other aquatic vegetation.

Genus *Armigeres* Theobald

Subgenus *Armigeres* Theobald

22. *Armigeres subalbatus* (Coquilett)

*1898. *krmigeres subalbatus* (Coquilett), *Proc. U.S. Nat. Mus.*, **xxi**, p. 302.

Material examined : 7E, Nuanai Muhan, Dist. Puri, 23.i.2006, Coll. S. Dash.

Recorded : From all over Orissa.

Distribution : India : Cosmopolitan.

Remarks : Resting on vegetations, coconut shell, bamboo, septic tanks.

23. *Armigeres (Armigeres) theobaldi* Barraud

*1908. *Armigeres (Armigeres) theobaldi*, Barraud *Rec. Ind. Mus.*, **iv**, p. 5.

Specimen examined : 4E, Giqala, Dist. Puri, 24.i.2006. Coll. S. Dash.

Distribution : India : Cosmopolitan.

Recorded : Only from Orissa till now.

Remarks : It breeds in bamboo stalk.

Genus *Culex* Linnaeus

Subgenus *Culex* Linnaeus

24. *Culex (Culex) bitaeniorhynchus* Giles

1901. *Culex bitaeniorhynchus* Giles, *Entom.*, **xxxiv** (July) : 196.

Recorded : From all over Orissa.

Distribution : India : Widely distributed.

Remarks : Breeds in Irrigation canal, pond, ground pool, paddy field, slow-moving stream with algae.

25. *Culex (Culex) cornutus* Edwards

1922. *Culex cornutus* Edwards, *Ind. Journ. Med. Res.*, **X** : 283.

Recorded : From all over Orissa especially from Jeypore Hills.

Distribution : India : Occurs in all main lands.

Remarks : The adults rest on the vegetation.

26. ***Culex (Culex) fuscocephalus*** Theobald

1907. *Culex fuscocephalus* Theobald, *Mon. Cul.*, **4** : 420.w.

Recorded : From all over Orissa especially from Bhitarkanika and Jeypore Hills.

Distribution : India : Widely distributed.

Remarks : Breeds in ground pool, paddy field, adults rests in human dwelling.

27. ***Culex (Culex) gelidus*** Theobald

1901. *Culex (Culex) gelidus* Theobald, *Mon. Cul.*, **ii**, p. 180.

Recorded : From all over Orissa.

Distribution : India : Widely distributed.

Remarks : Breeds mainly in ground pools having weeds, marshy tracks and cement tanks. Adults rests mainly in cow sheds.

28. ***Culex (Culex) mimulus*** Edwards

1915. *Culex mimulus* Edwards, *Bull. Ent. Res.*, **V**, p. 284.

Recorded : From all over Orissa, especially from Jeypore Hills.

Distribution : India : Widely distributed but mainly concentrated in Uttar Pradesh, Uttarakhand and Assam.

Remarks : Breeds in rainwater pool, pond, stream and riverbed pool with algae. Adults rest in vegetation.

29. ****Culex (Culex) quinquefasciatus*** Say

1823. *Culex quinquefasciatus* Say, *J. Acad. nat. Sci. Phila.*, **3** : 10.

Material examined : 14E, Balugaon, Dist. Khurda, 27.i.2007, Coll. S. Dash.

Recorded : Common throughout Orissa.

Distribution : India : Widely distributed.

Remarks : Found in human dwelling and cattle sheds.

30. **Culex (Culex) sinensis* Theobald

1903. *Culex sinensis* Theobald, *Mon. Cul.*, **iii**, P. 180.

Material examined : 4E, Gopalpur, Dist. Ganjam 21.i.2006, Coll. S. Dash.

Recorded : From coastal Orissa.

Distribution : India : Widely distributed.

Remarks : Inhabits pond banks.

31. *Culex (Culex) sitiens* Wiedeman Aussereur

1828. *Culex sitiens* Wiedeman Aussereur, *Zweifl. Insec.*, **i**.

Recorded : Common in coastal areas of Orissa.

Distribution : India : Cosmopolitan in Distribution.

Remarks : Breeds in swamp pool, coir retting pit. Adults rest in vegetation and crab hole.

32. *Culex (Culex) tritaeniorhynchus* Giles

1901. *Culex tritaeniorhynchus* Giles, *Journ. Bomb. Nat. Hist. Soc.*, **xiii**.

Recorded : Common throughout Orissa.

Distribution : India : Cosmopolitan in Distribution.

Remarks : Breeds in irrigation canal, pond, ground pool, paddy fields.

33. **Culex (Culex) vishnui* Theobald

1901. *Culex vishnui* Theobald, *Mon. Cul.*, **1** : 355.

Material examined : 11E, Balugaon, Dist. Khurda, Gopalpur, Dist. Ganjam, 28.i.2006 and 19.i.2006 respectively, Coll. S. Dash.

Recorded : From rice fields, ponds and cement tanks of Orissa.

Distribution : Widely distributed in India.

Remarks : It breeds in ground pools, rice fields, salt marshes etc.

34. *Culex (Culex) whitei* Barraud

1923. *Culex whitei* Barraud, *Ind. Journ. Med. Res.*, **xi**.

Recorded : From shorelines of Orissa.

Distribution : India : Mainly found in the north-eastern region.

Remarks : It breeds in ground pools.

35. *Culex (Culex) whitmorei* (Giles)

1904. *Culex whitmorei* (Giles) *J. trop. Med.*, **7** : 367.

Recorded : Hilly areas of Orissa.

Distribution : India : Widely distributed.

Remarks : Breeds in ground pool and cement tank. Adults rest in vegetation.

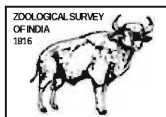
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Short Communication

ON THE FIRST RECORD OF THE PEN SHELL, *PINNA INCURVA* GMELIN (MOLLUSCA : BIVALVIA : PTEROIDA : PINNIDAE) FROM DIGHA COAST OF WEST BENGAL

INTRODUCTION

During the marine invertebrates survey along the Digha-Junput coast of Bay of Bengal, the authors came across four specimens of living Pen shells *Pinna incurva* Gmelin from trash collection deposit at Digha Mohana fishing harbour.

Molluscan fauna of West Bengal coast were well studied by Subba Rao *et al.* (1992). The occurrence of living pen shell *Pinna (Atrina) pectinata pectinata* Linnaeus belonging to family Pinnidae was reported by Mitra *et al.* (2002). So it is the first record of this species from the coast of West Bengal.

A brief description of this species is given below.

DESCRIPTION OF THE SITE

Digha beach, a famous tourist spot of West Bengal, situated at the southern most part of West Bengal. It's a sandy beach. A big fishing harbour, Shankarpur is situated just 5 km. east of Digha beach. Two canals namely Ramnagar canal and Champa canal open here in Bay of Bengal by providing necessary facilities for forming a fishing harbour. Between the two canals there is a large sand dunes where the trash collections of trawl catches are normally deposited.

MATERIALS AND METHODS

Four living specimens were collected from the trash materials deposited on the northern side of Champa canal. The soft parts were removed, and the two valves of the shells were washed in 70% alcohol and finally kept in boxes.

SYSTEMATIC ACCOUNT

Phylum MOLLUSCA

Class BIVALVIA

Order PTERIOIDA

Family PINNIDAE

Pinna incurva Gmelin, 1791

1791. *Pinna incurva* Gmelin Syst. Nat. 13th ed., vol., 1(6) : 3021-3910.

Material examined : 4 exs, Digha-Mohana. Coll. S. Mitra. Regd. no. 2091. Dated 21.i.99.

Figs. 1. *Pinna incurva* Gmelin

Diagnosis : Valves thin, fragile and sculptured with nearly obsolete radiating ribs. Shell translucent, or nearly transparent, colour light reddish brown, surface smooth and shining. Posterior margin extremely arcuate, attenuate and wedge shaped in outline. Nacreous lobe iridescent, well separated by longitudinal sulcus forming a deep V shaped. Dorsal and ventral nacreous lobe obliquely truncated and sloping from sulcus. Posterior abductor muscles not touching to posterior margin of nacreous lobe and never extended on the ventral lobe. Radial sculpture hardly observable consists of about six ribs limited to posterior slope.

Measurements (in mm) : Length 290.00-268.00; Height 78.00-68.00; Width 25.00-18.00.

Distribution : India : West Bengal (Midnapore), Tamil Nadu (Gulf of Mannar), Nicobar Islands.

Elsewhere : Myanmar, Philippines and North Australia.

Remarks : These specimens inhabitants of Sandy-Muddy substratum, below the low tide mark, at a depth of in 9-12 fathoms. Here these are collected from fishing trawler, which are operated beyond 20-30 km from the shore; or the offshore area of West Bengal coast.

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