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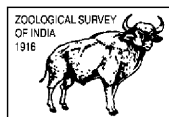
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A PRELIMINARY NOTE ON THE CONSERVATION OF SAPROXYLIC FLIES (INSECTA : DIPTERA) IN HIMACHAL PRADESH

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INTRODUCTION

Saproxylic flies comprise a diverse, species-rich and dominant functional group which depends (parts of their life) on dead or dying wood or dead trees (standing or fallen), or wood-inhabiting fungi. The importance of dead wood in forest ecosystems has been emphasised worldwide (Harmon *et al.* 1986, Hale, Pastor & Rusterholz 1999, McGee, Leopold & Nyland 1999, Siitonen 2001). The insects using the wood comprise a diverse fauna in terms of their nutritional ecology (Essen *et al.*, 1997). On the other hand, dead wood is one of the most important substrates for maintaining biodiversity in forest ecosystems, and a substrate that is strongly negatively impacted by human activities.

There is already a large body of knowledge on saproxylic insects and their interaction with dead wood and fungi. Gilbertson (1984) stated that dead wood provides habitat for both insects and fungi where insects act as vectors for fungi and fungi serve as food for the insects. Fruiting bodies of wood decay fungi are important microhabitats and many fungi species host unique insect faunas (Økland 1995, Komonen 2001, Komonen *et al.* 2004).

The conservation of saproxylic organisms has recently gained recognition as an important issue in the protection of European biodiversity (Mason *et al.* 2003). A large number of saproxylic species have suffered from loss and degradation of their habitats all over the world. Among this group of organisms, insects are particularly rich in species. In several European countries, special projects have been initiated to promote

the study and conservation of saproxylic insects (Cavalli and Mason 2003; Fayt *et al.* 2003). Some of these projects focus on particular taxonomic groups, like Diptera or even more specifically on the family Syrphidae (Rotheray and MacGowan 2000; Rotheray *et al.* 2001). In contrast to the large number of publication on saproxylic flies in other parts of the globe nothing has been known from India and particularly from Himachal Pradesh.

The Forests of Himachal Pradesh known for their grandeur and majesty are like a green pearl in the Himalayan crown. This life supporting systems are presently under great stress due to impact of modern civilization, economic development and growth in human and cattle population. But we have no record about how many species have suffered from loss and degradation of their habitats all over Himachal Pradesh or in threat. The threats against many hold-growth forest species cannot be reduced if our knowledge about the complex interactions between the species involved is lacking.

This communication reports 8 families of Diptera of Himachal Pradesh which are wholly/partially dependant on dead or decaying wood of managed or unmanaged ecosystems (Table-1).

SAPROXYLIC FLIES OF HIMACHAL PRADESH

Of the 38 families of Diptera known from Himachal Pradesh, 8 families are considered to be saproxylic in nature. The larvae of Ceratopogonidae (under bark or damp wood), Mycetophilidae (Fungus), Sciaridae (root

Table-1 : Habit and Habitats of Saproxyllic flies of Himachal Pradesh

Family name	Common Adult	Habit and Habitats	
		Adult	Immature stages
Cearatopogonidae	Biting Midges	Usually seen on flower	Under bark, damp wood
Mycetophilidae	Fungus Gnats	Nocturnal, found in damp, dark places in the day	Decaying wood, woody fungi
Sciaridae	Root Gnats	Terrestrial in woody vegetation, agricultural field	Rotten wood, under bark of fallen trees, decaying plant matters
Therevidae	Stiletto flies	Vegetation, grass meadows	Leaf mould, fungi, decaying wood
Asilidae	Robber flies	Vegetation, grass meadows	Plant roots
Empididae	Dance flies	On leaves, tree trunks, aquatic vegetation, or in stream beds and seepage habitats, agricultural fields, grasslands, marshes, coastal zones and beaches	Decaying wood, humus, moss
Syrphidae	Hover flies	Flower visitors and pollinators	Litter, dead wood, fungi, tubers, stems, leaves

and fungi), Scatopsidae (decaying plant matter). Therevidae (rotting bark and fungi), Asilidae (rotting wood). Empididae (decaying wood), and Syrphidae (rotting wood) are common in the forest of Himachal Pradesh.

The family Ceratopogonidae, commonly known as biting midges, no-see-ums or punkies are tiny, often with spotted wings of 1-6 mm. In the field, most adults can be recognized by the wings overlapping each other over the abdomen (when not flying) and the presence of front legs that are shorter than the hind legs. The larvae are rather easy to recognize. They are the only fly larvae in which there is a head capsule. Larvae occupy a variety of moist habitats, including soil, moss, under bark and in the rock pools; they may be algaeivorous, saprophagous, mycophagous or predaceous. In India, 220 species of biting midges are reported of which only a species *Atrichopogon montivagus* (Kieffer) is reported from Himachal Pradesh.

The second wood inhabiting family of Himachal Pradesh is the Mycetophilidae or “fungus gnats” and are very delicate flies of small or medium size (2.2-13.3 mm), bearing a resemblance to gnats or midges and exceedingly numerous individuals and species. Fungus

gnats usually are strikingly black, brown and yellowish, sometimes brightly coloured with pictured wings. The body is elongate, and compressed with the thorax more or less arched and sometime marked by so. Adults are mostly nocturnal and they are commonly met within damp, dark places, especially among forest undergrowth during the day. Most mycetophilids inhabit wet forests but are quite common in swamps. Of the 77 species so far reported from India only 21 species are reported from Himachal Pradesh.

The sciarids (“rootgnats” or Dark-winged fungus gnats) resemble the mycetophilids in most habits but more compact, separated from other related families by the usual dorsal extension of the eye which meet medially forming an ‘eye bridge’. Adults are about 1-22 mm long, slender to moderately robust, long legged, usually black, brown or yellowish in colour. Larvae have a shining black head, white translucent body and some species migrate in a snake like formation. Immature stages mostly found in rotten wood, under bark of fallen trees, in other kinds of decaying plant material, feeding in fungi or animal excrement. Out of 61 species reported from India only 9 species are reported from Himachal Pradesh.

The Scatopsidae are a species-poor, cosmopolitan family of small dark nematocerans (0.6 mm to nearly 5 mm) usually black, and wings with distinctly darkened and thickened anterior radial veins contrasting with paler posterior veins. Of the 3 species of India only a species *Ectaetia nigronitida* (Brunetti) is present in the Himachal Pradesh.

Therevids (Stiletto flies) are more or less elongate densely pubescent flies with slender non-prehensile legs. They are brightly coloured, elongate, with largely glabrous bodies. The antennae are sometimes very distinctive. They are found in a variety of habitats ranging from rainforest to desert. The snake-like larvae are very mobile and move with considerable speed through sand and loose soil. Larvae inhabit the soil in leaf-mould, fungi, decaying wood etc. The Therevidae are represented by 16 species in India of them only *Thereva bilineata* Brunetti known from Himachal Pradesh.

The Robber flies, or Asilidae, comprise one of the largest and most abundant families of Diptera. Adult stages are medium to large flies often observed on stems of plants, on the ground and grass or flying low. Species vary in appearance and some mimic wasps and bees. Most species are gray to black, hairy-bodied, have a long, narrow, tapering abdomen containing segments that may be banded, patterned or contrasting in color. The larva of Robber-flies is believed to be mostly herbivorous (vegetarian) but the adult flies are highly active carnivores. Of the 482 species reported from India 6 species are known from Himachal Pradesh.

The family "Empididae" in the traditional sense is a diverse group of medium to small sized (1 to 15 mm), grey, yellowish or dark very rarely metallic coloured flies. The head is variously shaped and usually narrower than thorax. The wings are of varied shape and size. They are commonly called as "dance-flies" and gain their common name from their courtship behaviour. Empidoids breed in a variety of habitats, including running water, tidal zones, decaying wood, and moist soil. Adults are often found in various forest habitats, on leaves, tree trunks, aquatic vegetation, or in stream beds and seepage habitats. Larvae are soil inhabitants, but also sometimes found in decaying wood, humus, dung, moss or in water. The family includes 57 species

in India with only 13 species being reported from Himachal Pradesh.

Flower Flies or hover flies belong to the family Syrphidae are abundant everywhere except in arid areas of the Old World and in the extreme southern latitudes. Their size ranges from 4 mm to over 25 mm and their coloration from bright coloration from bright yellow or orange to dull dark black or gray with a few iridescent forms. Larvae of the subfamily Syrphinae are predaceous on soft-bodied arthropods, although some may occasionally be scavengers. Most of the milesiines are saprophagous and found in litter and dead wood, some of the rhingiines are mycetophagous, and a few rhingiines and merodontines are phytophagous (as borers in tubers, stems, and wood, miners in leaves). 46 species of hoverflies are reported from Himachal Pradesh whereas 256 species known from India.

DISCUSSION

Invariably, insects are overlooked when forest management issues are discussed, because there are so many species, which are taxonomically intractable and so poorly known. Often people take the view that if you look after the vegetation and vertebrates, the insects will look after themselves. This may be true for some functional groups, but for saproxyllic insects, this seems unlikely. Their study deserves high priority, since they are dependent on the very resource "wood" whose removal from the ecosystem is the usual object of forest management (Grove S.J. and Stork N.E. 1999).

The ecological value of dead wood is broadly acknowledged worldwide. Recent research has highlighted their sensitivity to forest management, with managed or secondary forests generally supporting fewer individuals, fewer species, and different assemblages compared to old-growth or primary forests. This sensitivity is a product of their association with a habitat that tends to diminish in managed forests. Many saproxyllic insect species have declining populations and are regarded as threatened due to low habitat availability in managed forests.

The geographical area of Himachal Pradesh is 56,673 km². According to the State Forest Report, 1997 of FSI, the actual forest area in the state occupies only 22.5% of its area. Of them non-Forest : 74.2%, Very Dense

Forest (VDF) : 2.0%. Open Forest : 9.7%, Moderate Dense Forest (MDF) : 14.2%. Like all other parts of India, the forest cover of Himachal Pradesh is also decreasing mostly due to man made hazards.

To conserve the saproxylic flies there is a need of change of forest management in Himachal Pradesh. In recent years, data on the occurrence of Syrphidae in the Netherlands suggested that many saproxylic species had increased. According Reemer *et al.* (2003), it has been attributed to the tendency of leaving dead wood and ill trees in the forests. It is unfortunate that detailed studies on saproxylic flies of Himachal Pradesh and

their conservation for maintaining biodiversity of forest are rare, especially in our country, but hopefully this work can serve as baseline data for future research work.

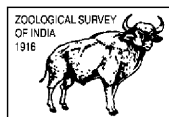
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REFERENCES

- Cavalli, R. and Mason, F. 2003. Techniques for re-establishment of Dead wood for Saproxylic Fauna Conservation. LIFE Nature Project NAT/IT/99/6245 Bosco della Fontana (Mantova, Italy).
- Essen, P.A., Ehnström, B., Ericson, L., and Sjöberg, K. 1997. Boreal forests. *Ecological Bullentins*, **46** : 16-47.
- Fayt, P., Branquart, E., Dufrene, M., Henin, J.M., Pontegnic, C. and Versteirt, V. 2003. Xylobios : patterns, roles and determinants of saproxylic diversity in Belgian deciduous forests. In McManus L., Liebhold A.M. (eds.), Proceedings ecology, Survey and management of Forest Insects, USDA Forest service, Delaware, Pp. 128-129.
- Gilbertson, R.L., 1984. Relationships between insects and wood-rotting basidiomycetes. in Q.B. Wheeler, M., editor. *Fungus-insect relationships : Perspectives in ecology and evolution*. Columbia University Press, New York, pp. 130-165.
- Grove S.J. and Stork N.E. 1999. The Conservation of Saproxylic Insects in Tropical Forests : A Research Agenda. *Journal of Insect Conservation*, 3(2) : 67-74.
- Hale, C.M., Pastor, J., and Rusterholz, K.A. 1999. Comparison of structural and compositional characteristics in old-growth and mature, managed hardwood forests of Minnesota, U.S.A. *Canadian Journal of Forest Research*, 29 : 1479-1489.
- Harmon, M.E., Franklin, J.F., Swanson, F.J., Sollins, P., Gregory, S.V., Lattin, J.D., Anderson, N.H., Cline, S.P., Aumen, N.G., Sedell, J.R., Lienkaemper, G.W., Cromack, K.J., and Cummins, K.W. 1986. Ecology of coarse woody debris in temperate ecosystems. *Advances in Ecological Research*, **15** : 133-302.
- Komonen, A. 2001. Structure of insect communities inhabiting old-growth forest specialist bracket fungi. *Ecological Entomology*, **26** : 63-75.
- Komonen, A., Jonsell, M., Økland, B., Sverdrup-Thygesonh, A. & Thunes, K. 2004. Insect assemblage associated with the polypore *Fomitopsis pinicola* : a comparison across Fennoscandia.
- Mason, F., Nardi, G., and Tisato M. (eds.) 2003. Proceedings of the International Symposium "Dead wood : a key to biodiversity", Mantova, Mayy 29-31st 2003. Sherwood 95 supplement, 2 : 1-100.
- McGee, G.G., Leopold, D.J., and Nyland, R.D. 1999. Structural characteristics of old-growth, maturing, and partially cut northern hardwood forests. *Ecological applications*, **9** : 1316-1329.
- Økland, B. 1995. Insect fauna compared between six polypore species in a southern Norwegian spruce forest. *Fauna Norvegica Serie B*, **42** : 21-46.
- Rotheray, G.E. and MacGowan, I. 2000. Status and breeding sites of three presumed endangered Scottish saproxylic syrphids (Diptera : Syrphidae). *J. Insect Conserv.* **4** : 215-223.

- Rotheray, G.E. Hancock, G., Hewitt, S., Horsfield, D., MacGowan, I., Robertson, D. & Watt, K. 2001. The biodiversity and conservation of saproxylic Diptera in Scotland. *J. Insect Conserv.*, 5 : 77-85.
- Reemer, M., Smit, J.T. and Steenis, W. van. 2003. Changes in ranges of hoverflies in the Netherlands in the 20th century Diptera : Syrphidae. In Reemer, M., Helsdingen, P.J. van and Klückers, R.M.J.C. (eds.) Proceedings of the 13th International Colloquium of the European Invertebrate Survey. Leiden, 2-5 September 2001. EIS-Nederland, Leiden, Pp. 53-60.
- Siitonen, J. 2001. Forest management, coarse woody debris and saproxylic organisms : Fennoscandian boreal forest as an example. *Ecological Bulletins*, 49 : 11-41.



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ONE NEW AND THREE KNOWN SPECIES OF THE GENUS *HELICOTYLENCHUS* STEINER, 1945 ASSOCIATED WITH BANANA FROM WEST BENGAL, INDIA

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INTRODUCTION

One new and three known species of plant parasitic nematodes belonging to the genus *Helicotylenchus* Steiner, 1945, *H. wasimi* n. sp., *H. crenacauda* Sher, 1966, *H. dihystra* (Cobb, 1893) Sher, 1961 and *H. hydrophilus* Sher, 1966 are being described and illustrated. The species were collected from rhizospheric soil of banana plantations (*Musa paradisiaca* L. cv Kanthali) in Paschim Medinipur district of West Bengal, India, during a taxonomic survey from March 2004 to February 2006. *H. wasimi* n. sp. is characterized by its rounded lip region without annulations, 26-27 μ m long spear with anteriorly indented knobs, posteriorly located (808-809 μ m from head end) vulva, anterior genital branch longer than posterior one, short hemispherical tail with thick cuticular rounded terminus, tail with four distinct striations and phasmids located opposite to anus. *H. hydrophilus* is the first record from India.

MATERIALS AND METHODS

Nematodes were collected from rhizospheric soil samples (250 gm) around banana plantations (*Musa paradisiaca* L. cv Kanthali). Soil sample was taken from an area of 10 cm $\times$ 10 cm up to the depth of 20 cm, at a distance of 25 cm from the main bole of the orchard. The specimens were extracted from soil by Cobb's sieving technique (Cobb, 1918) and decanting method followed by Modified Baermann's funnel technique (Christie and Perry, 1951); processed by Seinhorst's

slow dehydration method (Seinhorst, 1959); mounted on slides in anhydrous glycerin and sealed. Measurements were taken with the help of an ocular micrometer using BX 41 Olympus research microscope with drawing tube attachment. Dimensions were tabulated in accordance with De Man's Formula (De Man, 1884). Diagrams were drawn with the help of a camera lucida.

Abbreviations used in the text as well as in the table are as follows :

- L = body length
- a = body length / maximum body width
- b = body length / oesophageal length
- c = body length / tail length
- c' = tail length / body width at anus
- V = distance from head end to vulva $\times$ 100 / body length
- V' = distance from head end to vulva $\times$ 100 / distance from head end to anus
- m = length of conus $\times$ 100 / stylet length
- O = distance between stylet base and orifice of dorsal oesophageal gland $\times$ 100 / stylet length
- MB = distance between anterior end of body and center of median oesophageal bulb $\times$ 100 / oesophageal length
- G₁ = anterior genital branch $\times$ 100 / body length
- G₂ = posterior genital branch $\times$ 100 / body length

SYSTEMATIC ACCOUNTS

Systematic position

- Order TYLENCHIDA Thorne, 1949
 Suborder HOPLALAIMINA Chizhov & Berezina, 1988
 Superfamily HOPLALAIMOIDEA Filipjev, 1934 (Paramonov, 1967)
 Family HOPLALAIMIDAE Filipjev, 1934 (Wieser, 1953)
 Subfamily ROTYLENCHOIDINAE Whitehead, 1958
 Genus *Helicotylenchus* Steiner, 1945

Helicotylenchus wasimi n. sp.

Material examined : 15 females.

Measurements : Shown in Table 1.

Description : *Female* : Body arcuate, C-shaped after fixation. Cuticular annules 1.0-1.5 μ m wide at middle of

the body. Lip region hemispheroid, broadly rounded, continuous with body and without annulations. Lip region height slightly larger than half of lip region width. Lateral field about one-fourth of body width near middle, with four smooth incisures.

Stylet 3.6 times lip region width long; shaft part (15 μ m) 1.2 times in length than conus (12 μ m). Spear guide massive, spear knobs with anterior cupped surface measuring 3 μ m across and 2 μ m high. Dorsal oesophageal gland opening measures 14 μ m from posterior to base of stylet knobs; more than half of stylet length. Median oesophageal bulb more or less rounded in shape measuring 10 μ m across. The center of the bulb 81 μ m from the anterior extremity of the body. Hemizonid distinct, 2 annules wide and 3 annules anterior to excretory pore. Nerve ring 9 μ m posterior to base of median oesophageal bulb. Oesophago-intestinal

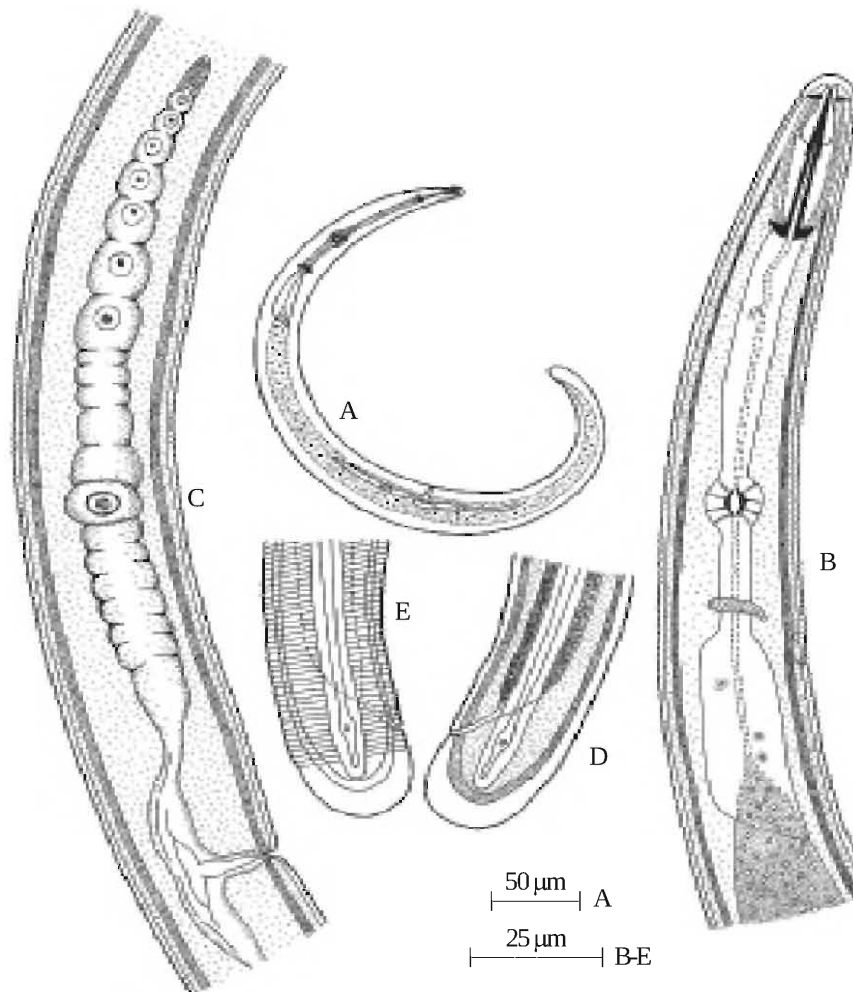


Fig. 1 : Camera lucida drawings of *Helicotylenchus wasimi* n. sp. A : Entire female; B : Neck region of female; C : Vulva with anterior gonad; D and E : Posterior portion of female.

junction 135 μm from head end. Excretory pore 37 μm anterior to oesophago-intestinal junction.

Reproductive system didelphic, with opposed genital branches. Vulva transverse located in the posterior half of the body, 808 μm from head end. Gonads asymmetrical, anterior gonad (140 μm) larger than posterior one (103 μm). Anterior and posterior ovary 78 μm and 59 μm respectively. Anterior oviduct with uterus (62 μm) longer than the posterior (44 μm) one. Oocytes arranged in a single row except tip of the gonad. Spearthecae small, without sperm. Vagina occupied almost half of the corresponding body width.

Rectum about three-fourth of anal body width. Tail short, hemispheroid with rounded terminus; cuticle at tail terminus 4.8 μm thick. Striations on tail indistinct, four annules after cloaca are prominent. Phasmids clearly visible close to inner ventral incisures, located just opposite to anus.

Male : Not found.

Type habitat and locality : Specimens were collected by the first author on 17.7. 2005 from rhizospheric soil of banana plantations (*Musa paradisiaca* L. cv Kanthali) at Pathardaha village under Salbani block of Paschim Medinipur District, West Bengal, India.

Type materials : Specimens are deposited with the National Zoological Collections of Zoological Survey of India, Kolkata, West Bengal, India, under the Registration No.WN 970 (Holotype) and WN 971 (Paratypes) on slides.

Differential diagnosis and relationships : *Helicotylenchus wasimi* n. sp. comes close to *H. concavus* (Roman, 1961), *H. retusus* (Siddiqi and Brown, 1964) and *H. orthosomaticus* (Siddiqi, 1972) in general body shape but has many notable structural differences and may be claimed as a new species.

The new species comes close to *H. concavus* in the values of c' and m ($c' = 0.8-1.0$ and $m = 44-49$ in *H. concavus*). Lip region hemispherical without annulations, spear with anteriorly cupped knobs in both the species. But they differ in the values of L , a , b , c , V and O ($L = 0.64-0.86$ mm; $a = 26-33$; $b = 6-8$; $c = 42-51$; $V = 61-65$ and $O = 34-46$ in *H. concavus*). Spear length (29-32 μm) in *H. concavus* is larger than the present

species. Though tail terminus is hemispherical in both the species, yet in *H. concavus* it has a slight concavity on dorsal side with 6-12 annules, but in the present species, tail has four annules instead. Phasmids located more anterior to anus in *H. concavus* but they lie just opposite to anus in the present species.

H. wasimi n. sp. resembles with *H. retusus* in the values of c' , m and in spear length ($c' = 0.7-1.0$; $m = 47-50$; spear = 25-27 μm in *H. retusus*). Spear knobs with indented anterior surfaces, tail terminus hemispherical, sometimes slightly clavate in both the species. But the present species is distinguished from *H. retusus* by its body length and in the values of a , b , c , V and O ($L = 0.75-0.85$ mm; $a = 31-36$; $b = 6-7$; $c = 51-65$; $V = 60-64$ and $O = 41-48$ in *H. retusus*). Lip region with indistinct annulations in both the species; it is high hemispherical in *H. retusus* but more or less rounded in the present species. Phasmids are located opposite to anus in the present species, but it is 8-14 annules anterior to anus in *H. retusus*.

The present species shows resemblances with *H. orthosomaticus* in body length and in the values of b and c' ($L = 0.89-1.30$ mm; $b = 8-10$; $c' = 0.7-0.9$), but differs in the values of a , c , V , m and O ($a = 34-39$; $c = 53-64$; $V = 52-55$; $m = 49-50$ and $O = 23.5-31.0$). Lip region without annulations in both the species; but it is elevated, broadly rounded in *H. orthosomaticus*. Spear larger in *H. orthosomaticus* (34-36 μm) than the present species. Spear with anteriorly cupped knobs in the present species but it is rounded with slightly concave anterior surfaces in *H. orthosomaticus*. Tail hemispherical in both the species; with 15-19 annules in *H. orthosomaticus* but with four annules in the new species. Phasmids 11-19 annules anterior to anal latitude in *H. orthosomaticus* but they lie opposite to anus in the present species.

Etymology : The new species has been named after the renowned nematologist Dr. Wasim Ahmad, Professor of Zoology, Aligarh Muslim University, Aligarh, India.

Helicotylenchus crenacauda Sher, 1966

1966. *Helicotylenchus crenacanda* Sher, *Nematologica*, **12** : 1-56.

1979. *H. indentatus* Chaturvedi and Khara, *Zoological Survey of India, Technical Monograph No. 2* : 1-105.

Table-1 : Measurements of *Helicotylenchus wasimi* n. sp. (all measurements in μm except L in mm).

Morphometric characters	Holotype female	Paratype females (n = 14)	Mean $\pm$ SD
L	1.13	1.11-1.27	1.18 $\pm$ 0.04
a	58	57-59	58 $\pm$ 0.3
b	8.4	8.1-9.0	8.6 $\pm$ 0.3
c	77	76-78	77 $\pm$ 0.4
c'	0.9	0.8-1.0	0.9 $\pm$ 0.1
V	71.5	71.2-72.0	71.7 $\pm$ 0.3
V'	72.5	72.3-73.0	72.6 $\pm$ 0.2
m	45.5	45.2-46.0	45.7 $\pm$ 0.3
O	53	52.5-53.0	53.0 $\pm$ 0.3
MB	61.5	61.2-62.3	61.8 $\pm$ 0.4
G ₁	12.3	11.1-12.6	11.8 $\pm$ 0.5
G ₂	9.1	8.0-9.2	8.8 $\pm$ 0.4
Height of lip region	4.0	4.0-4.1	4.4 $\pm$ 0.2
Width of lip region	7.5	7.1-7.9	7.6 $\pm$ 0.3
Stylet length	27	26.5-27.2	27.0 $\pm$ 0.2
Nerve ring from anterior end	94.5	94.3-95.2	95.0 $\pm$ 0.3
Excretory pore from anterior end	102	102-103	102.4 $\pm$ 0.3
Vulva from anterior end	808	808-809	808 $\pm$ 0.4
Length of anterior gonad	140	139.4-140.6	140 $\pm$ 0.4
Length of posterior gonad	103	102.6-103.3	102.9 $\pm$ 0.2
Body width at vulva	19.5	19.4-20.2	19.8 $\pm$ 0.2
Body width at anus	16	15.8-16.3	16.1 $\pm$ 0.2
Tail length	15	14.3-15.5	15 $\pm$ 0.4

Material examined : 27 females.

Measurements : Female : L = 0.55-0.76 mm; a = 24-28; b = 5-6; c = 4-5; V = 59.5-64.0; O = 34-40; G₁ = 18-23; G₂ = 17-21.

Description : Female : Body spiral in shape upon fixation. Cuticle with distinct transverse striations; annules 1-2 μm in width. Lateral fields one-sixth to one-fourth of body width near mid-body; with four incisures of which the inner two fuse near middle of tail. Lip region continuous, broadly rounded and marked by 4-5 annules. Stylet 25-28 μm long; basal knobs indented anteriorly. Excretory pore anterior to level of oesophago-intestinal junction; 2-3 annules long. Hemizonid 2 annules anterior to excretory pore. Reproductive system amphidelphic; outstretched. Vulva a transverse slit; vagina about half of the corresponding body width. Spermatheca well developed, empty. Oocytes arranged in one or two rows. Phasmids 4-6 annules anterior to

anus. Tail indented terminally; pronounced ventral projection, 7-8 annules.

Male : Not found.

Habitat and locality : Specimens were collected by the first author from rhizospheric soil of banana plantations (*Musa paradisiaca* L. cv Kanthali) at Murarichak village (Sabang block), Kusumda (Mohanpur block), Maligram and Jamna (Pingla block) and Pathardaha village (Salbani block) of Paschim Medinipur District, West Bengal, India.

Materials deposited : Specimens are deposited with the National Zoological Collections of Zoological Survey of India, Kolkata, West Bengal, India, under the Registration No. WN 1280 on slides.

Distribution : India (West Bengal, Tripura, Rajasthan, Andaman and Nicobar Islands), U.S.A. and Bangladesh.

Remarks : The present specimens are in agreement with the original measurements and description of the species made by Sher, 1966 except in having slightly larger stylet (24-26 μm). Chaturvedi and Khera (1979) proposed a new species *Helicotylenchus indentatus*, but Baqri and Ahmad (1983) proposed this as new synonym of *H. crenacauda*. Baqri and Ahmad (1983) provided the allometric and morphometric variations in this species. Jairajpuri and Baqri (1991) reported that *H. crenacauda* has been distributed in many districts of West Bengal, India and Bangladesh.

- Helicotylenchus dihystra*** (Cobb, 1893) Sher, 1961
 1893. *Tylenchus dihystra* Cobb, *Agric. Gaz. N. South Wales*, **4** : 808-833.
 1930. *Tylenchus spiralis* Cassidy, *Hawaiian Planters Rec.*, **34** : 379-387.
 1945. *Helicotylenchus nannus* Steiner, *Proc. Helminth. Soc. Wash.*, **12** : 34-38.
 1960. *Helicotylenchus crenatus* Das, *Ztschr. Parasitenk.*, **19** : 553-605.
 1961. *Helicotylenchus dihystra* (Cobb, 1893) Sher, *Nematologica*, **6** : 155-169.

Material examined : 22 females.

Measurements :

Female : L = 0.54-0.83 mm; a = 25-32; b = 4-6; c = 35-41; V = 59-64; G_1 = 19-23; G_2 = 15-23.

Description : Female : Body spirally curved upon fixation. Lip region continuous, hemispherical and marked by 4-5 annules. Stylet 25-27 μm long; with anteriorly indented basal knobs. Excretory pore 117-125 μm from anterior end. Hemizonid 2 annules long, 2-3 annules anterior to excretory pore. Reproductive system amphidelphic, long, outstretched. Vagina extending about half of the corresponding body width. Spermatheca rounded, without sperm. Tail 14-18 μm long, dorsally convex-conoid, with slight ventral projection. Phasmids 6-8 annules anterior to anus.

Male : Not found.

Habitat and locality : Specimens were collected by the first author on 18-7-2004 from rhizospheric soil of banana plantations (*Musa paradisiaca* L. cv Kanthali) at Amlasuli village under the block Garhbeta-1 of Paschim Medinipur District, West Bengal, India.

Materials deposited : Specimens are deposited with the National Zoological Collections of Zoological Survey of India, Kolkata, West Bengal, India, under the Registration No.WN 1281 on slides.

Distribution : India (Gujarat, Himachal Pradesh, West Bengal, Karnataka, Orissa, Sikkim, Madhya Pradesh, Andaman and Nicobar Islands, Haryana, and Maharastra), Australia, Malaysia, Senegal, Ivory Coast, Nigeria, South Africa, Morocco, California, Java, Fiji Islands, Mauritius.

Remarks : The present specimens closely conform to the measurements and description of the species given by the earlier workers except smaller tail length (16-19 μm). Baqri and Ahmad (1983) discussed variations in different populations of *Helicotylenchus dihystra* from India. Baqri (1991) revealed that it is a widely distributed and highly variable species.

Helicotylenchus hydrophilus Sher, 1966

1966. *Helicotylenchus hydrophilus* Sher, *Nematologica*, **12** : 1-56.

Material examined : 3 females.

Measurements : Female : L = 0.72-0.81 mm; a = 27-29; b = 5-7; c = 40.5-46.0; c' = 0.7-1.0; V = 58.5-62.5; m = 47.5-49.0; O = 37.5-42.0.

Description : Female : Body spiral in shape upon fixation; annules about 2 μm wide at mid body. Lip region hemispherical, continuous, with 4-5 annules. Stylet 29-31 μm long, with rounded basal knobs. Median oesophageal bulb oval-shaped; dorsal oesophageal gland opening 17-18 μm posterior to base of stylet knobs. Excretory pore 117-120 μm from anterior end. Hemizonid one annule wide; one annule anterior to excretory pore. Vagina extends half of the corresponding body width. Genital system amphidelphic, ovary out stretched; oocytes arranged in a single row. Spermatheca rounded, without sperm. Tail with pronounced ventral projection, terminus hemispherical, with 7-8 annules. Phasmids 4-5 annules anterior to anus.

Male : Not found.

Habitat and locality : Specimens were collected by the first author on 09-01-2005 from rhizospheric soil of banana plantations (*Musa paradisiaca* L. cv Kanthali) at Amalda village under Keshpur block of Paschim Medinipur District, West Bengal, India.

Materials deposited : Specimens are deposited with the National Zoological Collections of Zoological Survey of India, Kolkata, West Bengal, India, under the Registration No.WN 1282 on slides.

Distribution : India (West Bengal), U.S.A. (Florence, South Carolina).

Remarks : The present specimens agree in most respect with the types, described by Sher (1966); slightly smaller in size (0.75-0.82 mm). He reported it from swamp soil, from U.S.A. This is the first report from India. Banana is the new host record of the species.

SUMMARY

One new and three known species of tylenchid nematodes, *Helicotylenchus wasimi* n. sp., *H. crenacauda* Sher, 1966, *H. dihystra* (Cobb, 1893) Sher, 1961 and *H. hydrophilus* Sher, 1966 associated with banana plantations (*Musa paradisiaca* L. cv Kanthali) in Paschim Medinipur district of West Bengal, India have been described and illustrated. *H. hydrophilus*

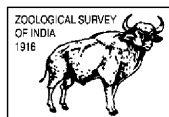
has been reported first time from India. Banana is a new host record of the species.

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REFERENCES

- Baqri, Q.H. 1991. Contribution to the fauna of Sikkim : Nematodes associated with citrus from Sikkim, India. *Records of the Zoological Survey of India; Occasional Paper No. 128* : 103 pp.
- Baqri, Q.H. and Ahmad, N. 1983. Nematodes from West Bengal (India) XVI. On the species of the genus *Helicotylenchus* Steiner, 1945 (Hoplolaimidae : Tylenchida). *J. Zool. Soc. India*, **35** (1&2) : 29-48.
- Chaturvedi, Y. and Khera, S. 1979. Studies on taxonomy, biology and ecology of nematodes associated with jute crop. *Technical Monograph, Zoological Survey of India*, **2** : 105 pp.
- Christie, J.R. and Perry, V.G. 1951. Removing nematodes from soil. *Proceedings of Helminthological Society of Washington*, **18** : 106-108.
- Cobb, N.A. 1893. *Nematodes, mostly Australian and Fijian*. Linn Soc New South Wales, Macleay Memorial Vol. : 59 pp.
- Cobb, N.A. 1918. Estimating the nema population of the soil. *Agricultural Technology Circular I. Bureau of Plant Industry, United States, Department of Agriculture*, 48 pp.
- De Man, J.G. 1884. Die frei in der reinen Erde und im sussen Wasser lebenden Nematoden der niederlandischen Fauna. Leiden, 206 pp.
- Jairajpuri, M.S. and Baqri, Q.H. 1991. *Nematode Pests of Rice*. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 66 pp.
- Roman, J. 1961. A new species of the genus *Helicotylenchus* (Nematoda : Hoplolaimidae) attacking sugarcane. *Journal of Agricultural University, Puerto Rico, South Africa*, **45** : 300-303.
- Seinhorst, J.W. 1959. A rapid method for the transfer of nematodes from fixative to anhydrous glycerine. *Nematologica*, **4** : 67-69.
- Siddiqi, M.R. 1972. On the genus *Helicotylenchus* Steiner, 1945 (Nematoda : Tylenchida), with descriptions of nine new species. *Nematologica*, **18** : 74-91.
- Siddiqi, M.R. and Brown, K.F. 1964. *Helicotylenchus retusus* n. sp. (Hoplolaiminae) found around sugarcane roots in Negros Oriental, Philippines. *Proceedings of Helminthological Society of Washington*, **3X** : 209-211.
- Sher, S.A. 1961. Revision of the Hoplolaiminae (Nematoda). I. Classification of nominal genera and nominal species. *Nematologica*, **6** : 155-169.
- Sher, S.A. 1966. Revision of the Hoplolaiminae (Nematoda) VI. *Helicotylenchus* Steiner, 1945. *Nematologica*, **12** : 1-56.
- Steiner, G. 1945. *Helicotylenchus*, a new genus of plant parasitic nematodes and its relationship to *Rotylenchus* Filipjev. *Proceedings of Helminthological Society of Washington*, **12** : 34-38.



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TWO NEW SPECIES OF *ZAISCHNOPSIS* ASHMEAD (HYMENOPTERA : EUPELMIDAE) FROM INDIA AND A REVISED KEY TO ORIENTAL SPECIES

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INTRODUCTION

Ashmead (1896) erected the genus *Ischnopsis* (type species *I. ophthalmica* Ashmead). As the name *Ischnopsis* is preoccupied by *Ischnopsis* Walsingham (1881) in Lepidoptera, Ashmead (1904) provided a replacement name, *Zaischnopsis*, for *Ischnopsis* Ashmead. Boucek (1988) synonymised *Zaischnopsis* with *Anastatus* Motschulsky. Gibson (1995) reestablished the generic status of *Zaischnopsis* and also synonymised *Eupelmoides* Masi (1917) with *Zaischnopsis*. This genus is represented in all regions and is very speciose in the tropical regions where there are numerous undescribed species (Gibson, 1995). The genus *Zaischnopsis* contains 27 species in the world of which 8 species are from the Oriental Region and three species from the Indian subcontinent (from India) (Walker, 1852, 1862; Girault, 1915, 1919; Narendran *et al.*, 2004, 2007; Gibson, 2005; Noyes, 2009). In this paper, two new species viz., *Zaischnopsis mampadicus* Narendran and Girish Kumar sp. nov. and *Zaischnopsis stom* Narendran and Girish Kumar sp. nov. are described from India. A revised key to separate Oriental species of *Zaischnopsis* is also provided.

The Holotypes of the new species described here are deposited in the 'National Zoological Collections' of the Zoological Survey of India, Kolkata (NZSI).

MATERIALS AND METHODS

All the species were collected by using triangular sweep net specially made for the purpose. The collected

specimens were killed by using ethyl acetate and were mounted on cards. The mounted specimens were held on No. 3 Asta insect pins of size 38 mm × 0.5 mm. Taxonomic studies were done by using Wild Heerbrugg Stereozoom microscope (made in Switzerland) and drawings were made using the drawing tube of the microscope.

The following abbreviations are used in the text: F1- F8 = Funicular segments 1 to 8; MV = Marginal vein; NZSI = 'National Zoological Collections' of the Zoological Survey of India, Kolkata; PMV = Postmarginal vein; SMV = Submarginal vein; STV = Stigmal vein; T1= First gastral tergum.

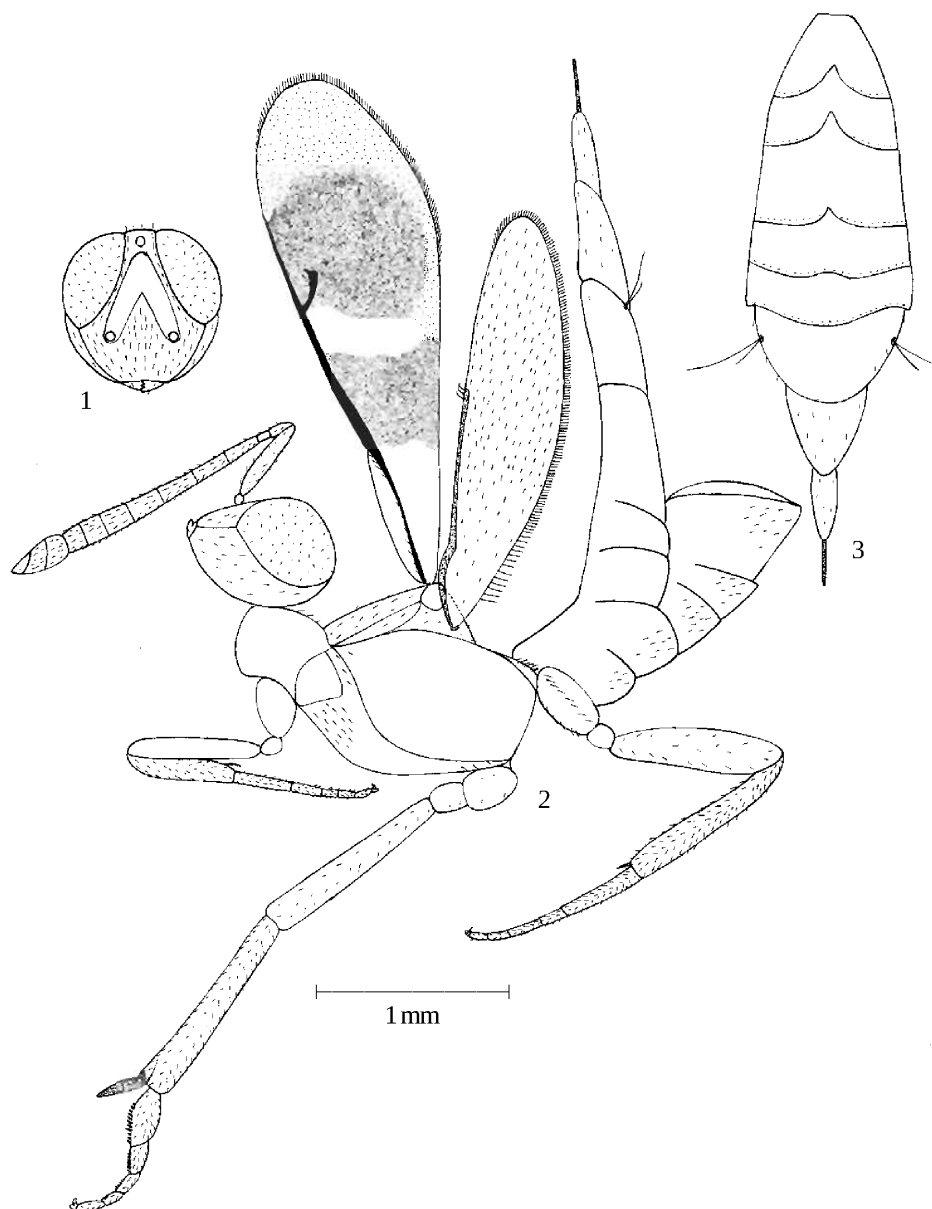
RESULTS

Zaischnopsis mampadicus Narendran and Girish

Kumar sp. nov.

(Figs. 1-3)

Female : Holotype : Length including ovipositor sheath 5.2 mm (exserted part of ovipositor 0.25 mm). Head slightly dark with metallic green lustre; eyes brown; ocelli reflecting pale yellow; palpi dark brown; mandible dark brown with base slightly paler. Antenna brownish black with slight metallic green lustre on scape. Mesosoma dark with metallic green lustre on metapleuron and sides of pronotum. Forewing (Fig. 2) infusate beyond base of parastigma except for a hyaline cross band extending from MV towards posterior margin, but not reaching posterior margin,



Figs. 1-3 : *Zaischnopsis mampadicus* Narendran and Girish Kumar sp. nov. Female. Fig. 1. Head front view; Fig. 2. Body profile; Fig. 3. Gaster dorsal view

infuscation slightly lighter at apical part. Legs brownish black with following yellowish to white : mid and hind tarsi except last tarsal segment and claws brown to brownish black; mid tibial spur and apical pegs of mid tibia and tarsi black. Gaster black without any metallic lustre; syntergum pale brown except at base brownish black; ovipositor sheath pale brown.

Head : Scrobal depression with distinct dorsal margin separated from anterior ocellus by a distance less than the diameter of anterior ocellus (Fig. 1). Frontovortex strongly reticulate from scrobal channel

to posterior ocelli; gena posterior to malar sulcus strongly and longitudinally striate- reticulate with conspicuous white lanceolate scattered setae. channel and scrobes strongly reticulate to transversely reticulate strigose; frons strongly reticulate; interantennal region strongly reticulate, with sparse setae; lower parascrobal region with scattered white setae not differentiated from other setae on face. Eyes with minute sparse pubescence; vertex and occiput coriaceous- reticulate with short pale white setae. Antenna (Fig. 2) with scape reticulate- strigose on outer and inner sides; flagellum

elongate, increasing in width towards apex with apical funicular segment transverse.

Mesosoma : Pronotum with a median deep furrow; mesoscutum entirely striate- reticulate, moderately setose, setae white and lanceolate. Scutellar- axillar complex punctate-reticulate. Acropleuron anteriorly with sparse white lanceolate setae. Metacoxa with dense, lanceolate white setae ventrolaterally and dorsally. Propodeum with callus broadly bare posterior to spiracle, setose anterior to and mesal to spiracle and with dense white setae postero-laterally. Forewing (Fig. 2) 3.21x as long as wide; relative lengths of veins: SMV = 32; MV = 33; STV = 9; PMV = 20; forewing distinctly shorter in length than metasoma (excluding ovipositor sheath).

Metasoma (Fig. 3) : 1.84x as long as mesosoma in profile, excluding ovipositor sheaths; syntergum 0.71x preceding tergum in lateral view (Fig. 2); ovipositor sheaths exerted distinctly beyond syntergal flange, 0.09x gaster length in lateral view.

Male : Unknown.

Host : Unknown.

Biology : Unknown.

Distribution : India : Kerala.

Material examined : Holotype : Female, India, Kerala, Malappuram dist., Mampad, 10 km west of Nilambur, 26-31.xii.2007, coll. Santhosh, S. (NZSI Reg. No. 11487/H3).

Discussion : This new species comes close to *Zaischnopsis keralensis* Narendran but distinctly differs from it in having: (1). Mid tibial spur black (in *Z. keralensis* mid tibial spur yellow); (2). Gaster distinctly longer than mesosoma (1.84x) (in *Z. keralensis* gaster a little longer than mesosoma (1.09)); (3). Ovipositor sheaths distinctly exerted beyond syntergal flange (in *Z. keralensis* ovipositor sheaths exerted only very slightly beyond syntergal flange); (4). MV almost equal or slightly longer than SMV (33 : 32) (in *Z. keralensis* MV distinctly longer than SMV (58 : 46)); (5). Antenna with last funicular segment transverse (in *Z. keralensis* antenna with apical three funicular segments transverse); (6). Scrobal depression separated from anterior ocellus by a distance less than the diameter of anterior ocellus (in *Z. keralensis* scrobal depression

separated from anterior ocellus by a distance equal to 2x diameter of anterior ocellus).

Etymology : The species is named after the locality from where the holotype is collected.

Zaischnopsis stom Narendran and Girish Kumar
sp. nov. (Figs. 4-8)

Female : **Holotype** : Length including ovipositor sheath 3.94 mm (exserted part of ovipositor 0.53 mm). Head slightly dark with metallic green lustre; palpi and mandible dark brown. Antenna brownish black. Eyes and ocelli reddish brown. Mesosoma dark with metallic green lustre on metapleuron and sides of pronotum. Forewing (Fig. 6) hyaline basally and a hyaline spot below MV and a very narrow longitudinal hyaline stripe at the lower margin opposit to the base of MV, infuscation moderate with lighter at apical part. Legs yellow with following blackish brown parts: fore and hind coxa entirely, mid coxa basally, fore and hind femur except at base and apex, fore tibia except at base and apex, apical pegs of midtibial and apical pegs of mid tarsi, all claws. Gaster black without any metallic lustre, syntergum concolorous with preceding gastral segments. Ovipositor sheath brown except at apices yellow.

Head : Dorsal margin of scrobal depression not distinct (Fig. 4); frontovertex strongly reticulate from scrobal channel to posterior ocelli; frons strongly reticulate; interantennal region strongly reticulate, with sparse setae; lower parascrobal region with scattered white setae not differentiated from other setae on face; channel and scrobes finely reticulate to transversely reticulate strigose; vertex and occiput coriaceous-reticulate with short pale white setae; gena posterior to malar sulcus strongly and longitudinally striate-reticulate with conspicuous white lanceolate scattered setae. Eyes with sparse minute pubescence; Antenna (Fig. 5) with scape reticulate- strigose on outer and inner sides; flagellum elongate, slightly increasing width towards clava, apical funicular segments not transverse.

Mesosoma : Pronotum with a median deep furrow; mesoscutum entirely striate- reticulate, sparsely setose, setae white and lanceolate. Scutellar- axillar complex punctate- reticulate. Acropleuron anteriorly with sparse

white lanceolate setae. Metacoxa with dense, lanceolate white setae ventrolaterally and dorsally. Propodeum with callus broadly bare posterior to spiracle, setose anterior to and mesal to spiracle and with dense white setae postero-laterally. Forewing (Fig. 6) 2.96x as long as wide; relative lengths of veins: SMV = 31.5; MV = 34.5; STV = 12; PMV = 23; forewing slightly longer than mesosoma (excluding ovipositor sheath).

Metasoma (Fig. 8) : 2.07x as long as mesosoma in profile excluding ovipositor sheaths; syntergum 0.20x preceding tergum in dorsal view; ovipositor sheaths exerted distinctly beyond syntergal flange, 0.29x gaster length in profile.

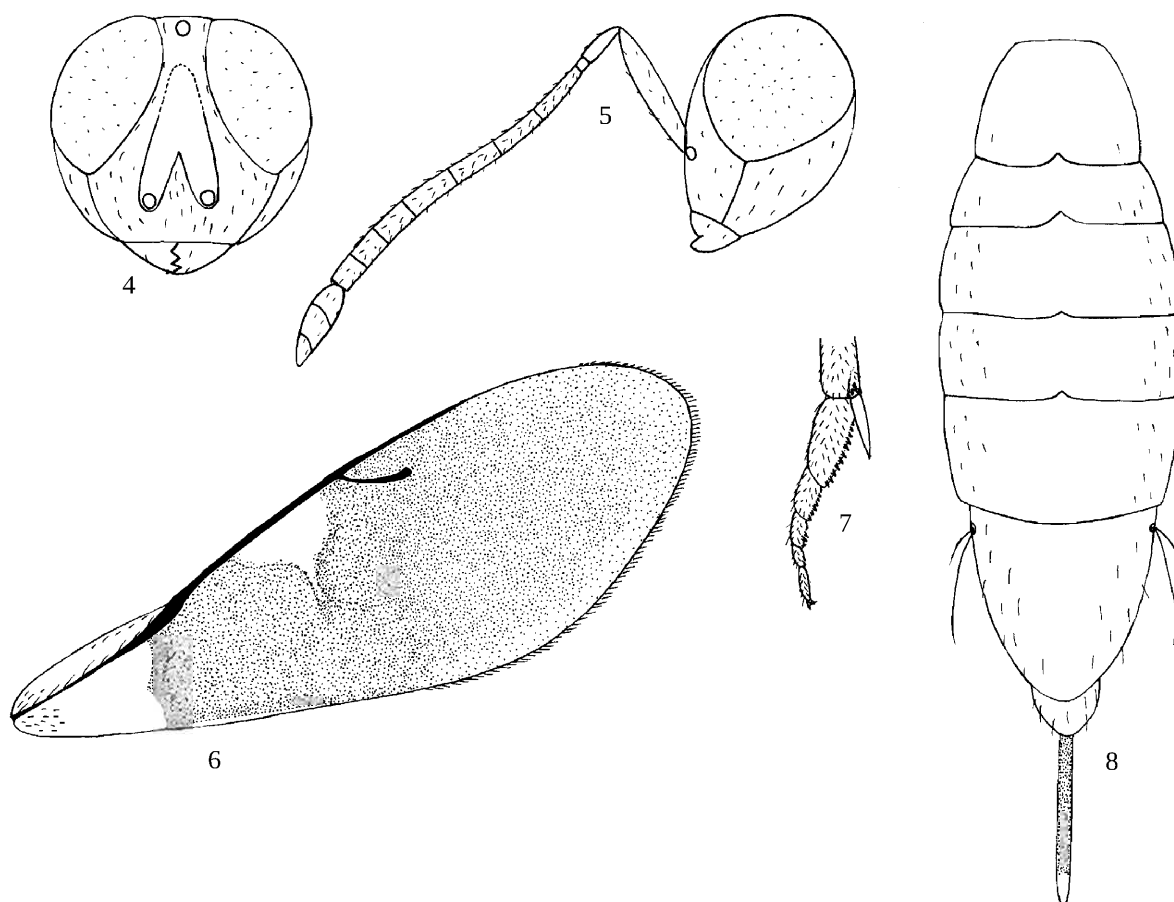
Male : Unknown.

Biology : Unknown.

Distribution : India : Kerala.

Material examined : Holotype : Female, India, Kerala, Malappuram Dist., Calicut University Campus, 3.x.2001, coll. T.C. Narendran and Party (NZSI Reg. No. 11491/H3).

Discussion : This new species comes close to *Zaischnopsis bathericus* Narendran but distinctly differs from it in having: (1). Forewing with one hyaline spot in the middle (in *Z. bathericus* forewing with two hyaline spots in the middle); (2). A very narrow longitudinal hyaline stripe at the lower margin of forewing opposite to the base of MV (in *Z. bathericus* no such longitudinal hyaline stripe at the lower margin of forewing opposite to the base of MV); (3). Legs yellow with following blackish brown parts: fore and hind coxa entirely, mid coxa basally, fore and hind femur



Figs. 4-8 : *Zaischnopsis stom* Narendran and Girish Kumar sp. nov. Female. Fig. 4. Head front view; Fig. 5. Head and antenna side view; Fig. 6. Forewing; Fig. 7. Apex of mid tibia with tarsi; Fig. 8. Gaster dorsal view.

except at base and apex, fore tibia except at base and apex, apical pegs of midtibia and apical pegs of mid tarsi, all claws (in *Z. bathericus* legs black with the following parts yellowish white: apex of mid tibia, apex of hind coxa, hind trochanter, base of hind femur, basal half and apical one third of hind tibia and all tarsi of all legs (except black pegs of apex of mid tibia and of mid tarsi)); (4). Ovipositor sheaths exerted distinctly beyond (5x as long as) syntergal flange (in *Z. bathericus* ovipositor sheath exerted a little beyond syntergal flange).

Etymology : The species name is arbitrary combination of letters.

Key to Oriental species of *Zaischnopsis* Ashmead

(Modified from Narendran *et al.*, 2007)

1. F6 and clava white; F3 to F5 brown; PMV longer than MV which is 'punctiform'; STV longer than PMV; dorsum of mesosoma except sides narrowly of scutellum black. Singapore. *kooki* (Girault)
 - Characters not as above; partly or completely different. 2
2. Scape foliaceously dilated; gaster completely metallic; F2- F4 equal in size, 2x longer than wide; F1 quadrate; mesoscutum without a raised median area but with a median carina; middle tibial spur black, at least at base. Indonesia (Java). *magniscapus* (Girault)
 - Characters not as above; partly or completely different. 3
3. F2 to F4 equal, longest funicular segment 3x longer than F1 which is sub quadrate; F5 and F6 longer than wide; F8 nearly square; pedicel as long as F3; PMV 2x as long as STV; middle tibial spur metallic; raised triangle of 'cephalic' scutum (= mesoscutum) about one- third surface, with a nearly complete median carina from it; coxae, femora and most of tibiae with metallic lustre; host: eggs of locusts. Indonesia (Java). *locustae* (Girault)
 - Characters not as above; partly or completely different. 4
4. Gaster cupreous, lanceolate, varied with green; head black with bluish green reflection on lower

part; hind femur completely dark brown; MV a little shorter than SMV. Indonesia.

- *fascipennis* (Walker)
- Characters not as above; partly or completely different. 5
- 5. Mid tibial spur black; legs coppery coloured; gaster spindle shaped, depressed, purple, hairy, very much longer than 'the chest' (= mesosoma); ovipositor sheath 'tawny' (= brownish yellow), very short; forewing brown, colourless at base and having an almost colourless band across the middle. China (Hong Kong). *tubiatus* (Walker)
 - Characters not as above; partly or completely different. 6
- 6. Forewing with one (Fig. 6) or two hyaline spots in the middle. 7
 - Forewing with a single hyaline cross band in the middle (Figs. 2). 9
- 7. Forewing with one or two hyaline spots in the middle (Fig. 6); a very narrow longitudinal hyaline stripe at the lower margin of forewing opposit to the base of MV. India (Kerala). *stom* Narendran and Girish Kumar sp. nov.
 - Forewing with two hyaline spots in the middle; no longitudinal hyaline stripe at the lower margin of forewing opposit to the base of MV. 8
- 8. Forewing with an opaque hyaline spot near base of MV; F6 wider than long; clava longer than combined length of F6+ F7+ F8. India (Kerala). ... *bathericus* Narendran
 - Forewing without an opaque hyaline spot near base of MV; middle hyaline spot not as above; F6 longer than wide; clava shorter than combined length of F6 + F7 + F8. India (Bihar). *biharensis* (Narendran)
- 9. Mid tibial spur black; gaster distinctly longer than mesosoma; ovipositor sheath exerted distinctly beyond syntergal flange; MV almost equal or slightly longer than SMV (33 : 32); scrobal depression separated from anterior ocellus by a distance less than the diameter of front ocellus. India (Kerala). *mampadicus* Narendran and Girish Kumar sp. nov.

- Mid tibial spur yellow; gaster a little longer than mesosoma; ovipositor sheath exerted only very slightly beyond syntergal flange; MV distinctly longer than SMV; scrobal depression separated from anterior ocellus by a distance equal to 2x the diameter of front ocellus. India (Kerala).
..... *keralensis* Narendran

SUMMARY

Two new species of *Zaischnopsis* Ashmead viz., *Zaischnopsis mampadicus* Narendran and Girish Kumar

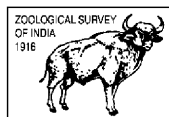
sp. nov. and *Z. stom* Narendran and Girish Kumar sp. nov. are described from India and their affinities to the closest relatives are discussed. A revised key to separate Oriental species of *Zaischnopsis* is also provided.

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REFERENCES

- Ashmead, W.H. 1896. On the genera of Eupelmidae. *Proc. Ent. Soc. Washington*, **4** : 4-20.
- Ashmead, W.H. 1904. New generic names in Chalcidoidea. *Proc. Ent. Soc. Washington*, **6** : 126.
- Boucek, Z. 1988. Australasian Chalcidoidea (Hymenoptera). A Biosystematic Revision of Fourteen Families with a Reclassification of species. Wallingford: C.A.B. International, 832 pp.
- Gibson, G.A.P. 1995. Parasitic wasps of the subfamily Eupelminae : Classification and revision of World genera (Hymenoptera : Chalcidoidea : Eupelmidae). *Memoirs on Entomology International*, **5** : 421 pp.
- Gibson, G.A.P. 2005. The species of *Zaischnopsis* of America north of Mexico, with a checklist of described world species (Hymenoptera : Eupelmidae). *Acta Soc. Zool. Bohemoslovenicae*, **69** : 89-112.
- Girault, A.A. 1915. Australian Hymenoptera Chalcidoidea-VII. The family Encyrtidae with descriptions of new genera and species. *Mem. Queensland Mus.*, **4** : 1-184.
- Girault, A.A. 1919. Javanese Chalcid flies. *Treubia*, **1** : 53-59.
- Masi, L. 1917. Chalcididae of the Seychelles Islands. *Novitates zoologicae*, **24** : 121-230.
- Narendran, T.C., Anitha, P.V. and Kumar, K. (2004). On a new species of *Anastatus* Motschulsky (Hymenoptera : Eupelmidae) associated with lac insects in Bihar, India. *J. Advanced Zoology*, **25** : 16-18.
- Narendran, T.C., Santhosh, S., Abhilash Peter, Jilcy, M.C. and Anitha, P.V. 2007. Two new species of *Zaischnopsis* Ashmead (Hymenoptera : Eupelmidae) from southern India and a key to Oriental species. *Zoos' Print J.*, **22**(6) : 2706-2709.
- Noyes, J.S. 2009. Universal Chalcidoidea Database. The Natural History Museum, London. Website : <http://www.nhm.ac.uk/entomology/Chalcidoidea>.
- Walker, F. 1852. VI-Notes on Chalcidites and descriptions of various new species. *Ann. Mag. Nat. Hist.*, (2) **9** : 39-43.
- Walker, F. 1862. Notes on Chalcidites and characters of undescribed species. *Trans. Ent. Soc. London*, (3) **1** : 345-397.
- Walsingham, L. 1881. On the Tortricidae, Tineidae and Pterophoridae of south Africa. *Trans. Ent. Soc. London* : 71-88.



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A NEW FISH SPECIES OF THE GENUS *BARILIUS* (CYPRINIDAE : RASBORINAE), FROM RIVER SIANG, D'ERING MEMORIAL WILDLIFE SANCTUARY, ARUNACHAL PRADESH, INDIA

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INTRODUCTION

Arunachal Pradesh is known as global biodiversity hotspot in Eastern Himalaya and located in the transition zone between the Himalayan and Indo-Burmese region. The total geographical area of the Arunachal Pradesh is 83,743 km², which is predominantly hilly and mountainous, and largely covered with extremely varied and dense vegetation/ forests, crisscrossed by six major rivers and their tributaries (Kaul and Haridasan, 1987; FSI 2000; Kalita and Haridasan, 2001). These habitats carry fairly large populations of faunal elements belonging to various groups of invertebrates and vertebrates (Editor-Director 2006 a&b; Kumar and Ramakrishna 2009). During last one decade several new species of vertebrates and invertebrates have been discovered from the state (Borang *et al.* 2005; Datta *et al.* 2008; Kumar and Ramakrishna, 2009; Kumar *et al.*, 2005; Mishra and Datta, 2007). As per records of Zoological Survey of India (ZSI), fish fauna of Arunachal Pradesh comprises of 143 species under 61 genera, 21 families and 8 orders (Editor-Director, 2006a). It includes 50 new records from the state. The family *Cyprinidae* forms the largest group with 65 species followed by *Homolopteridae* (17 species), *Sisoridae* (12 species), *Bagridae* (7 species), *Channidae* and *Cobitidae* (6 species each) and the rest with one, two or three species. Of the 50 new records, 12 fish species are recorded exclusively from the state of Arunachal Pradesh.

Most of the fishes of hill streams belong to the Genus *Barilius*. Review of the literature reveals that in most cases the information on systematics of these taxa was provided only up to generic level. Howes (1980) reported the details of lateral line as complete, incomplete or absent. Nevertheless all the species either reported from India or adjoining countries has complete lateral line but none reported the absence or presence of interrupted lateral line at the species level. Similarly all seven species reported from the State of Arunachal Pradesh (Nath and Dey 2000; Sen 2006) showed the presence of complete lateral line.

In the present investigation we are reporting a new species of fish of genus *Barilius* from D'Ering Memorial Wildlife Sanctuary, Eastern Arunachal Pradesh. (Fig. 1) In this regard it may be mentioned that the support for the new species has been thoroughly investigated with all known species (including all synonymies) of the genus *Barilius* so far reported from the region and adjoining areas. Further, it may be mentioned that Tilak *et al.* (1984) and Talwar & Jhingran (1991) reported of sexual dimorphism pertaining to few characters like coloration of the body, fan shaped paired fins, body size in synonymies of *B. bendelisis*. When compared with the reported species, *B. arunachalensis* it revealed many interesting and new characters which were found sufficient to authenticate the reported species as new to science particularly in respect of barbels (totally absent), lateral line (incomplete, ceases at the 35th scale),

lateral line scales (with single large spots and a few bilobed spots), dorsal fin (fan shaped enclosed in a sheath with strong rays), snout (deeply humped), 'V' shaped band one on each side of gill opening, caudal fin (unequal).

STUDY AREA AND HABITAT

D'Ering Memorial Wildlife Sanctuary (hereafter DWS) is located in the eastern Arunachal Pradesh and one of the bio-diversity rich areas of the state. It was notified as Lali Wildlife Sanctuary in 1978 vide notification no. FOR/284/78/2 dated 23-08-1978. Later on it was named as Daying Ering Memorial Wildlife Sanctuary vide notification no. CWL/37/83/D/T/4524-54 dt. 27-10-1986. The total area of sanctuary is about 190 km² including aquatic area of Siang River. The sanctuary located between 95°22' to 95°29' E and 27°51' to 28°05' N, and divided into three ranges namely Anchalghat, Namsing and Borguli.

The sanctuary area mainly consists of two types of habitats. (i) Most of the land area (about 75%) is alluvial grassland and semi evergreen forest patches covering the rest (ii) While the aquatic area covering the sanctuary proper comprises of two major islands i.e. Jopong and Balun formed between Siang River and its tributary Sibya River (Fig. 2 and Fig. 3). Both the rivers are divided into streams, which intersect the sanctuary and form several smaller islands also. The topography of these islands changes from time to time depending upon the season, rainfall and flooded water. The surrounding area of the sanctuary is mainly composed of agriculture fields and thick forests. The main agriculture crop is paddy, while thick forest composed of mixed vegetation such as *Bombax ceiba*, *Albizia procera*, *Dipteria wallichii*, *Talauma hodgsonii*, *Daubanga grandiflora*, *Solanum torvum* and *Ficus dumosa* etc. The sanctuary support a large number of endangered, rare aquatic and terrestrial species of animals such as White-winged Duck, Bengal Florican, Gangetic Dolphin, Tiger, Hispid Hare and some rare species of invertebrates (Kumar, 2009).

MATERIALS AND METHODS

The fauna of the sanctuary has not been documented properly. With reference to the ongoing research project of the Zoological Survey of India for

the documentation of fish fauna of Arunachal Pradesh, a field survey was undertaken w.e.f. 03.10.2006 to 23.10.2006. During the survey different localities of DWS and surrounding areas were visited. Some fish specimens were also collected for identification and photographs were taken, from outside the sanctuary areas. During the survey on 07.10.2008, an interesting species was seen in the shallow water of Agari River mouth (Fig. 2). Few specimens were collected (about 8 of them) with the help of a local fishing person and photographed with scale (Fig. 4). Preliminary identification revealed that this species had some peculiar features and assumed that it may be new to science. On 08.10.2008, while surveying the southwest side of Jopong Island, the same species was seen in the shallow water streams in good number (about 11 individuals were seen). For confirmation and identification two of them were trapped, photographed and released immediately at the same place of trapping. Morphometric measurements and counts were made with dial calipers and recorded. The measurements of head length and body parts has been presented as proportion of standard length (SL). The subunits of head are presented as proportion of head length (HL). Counts and measurements were made on the left side of the specimen whenever possible. The system of classification of fish followed is after Jayaram (1999).

Type Material : Holotype : Reg. No. APFS/ZSI/P-502 dt. 8th October 2006, 16.5 cm. TL, O⁻, Agari river mouth, D'Ering Memorial Wildlife Sanctuary, near Pasighat, East Siang District, Arunachal Pradesh, India.

Paratypes : Reg. No. APFS/ZSI/P-503 dt. 8th October 2006, 11.5-16.8 cm TL, 4 ex., O⁻, 7 ex., O⁺; other details as of holotype.

RESULTS

This new species differs from the other reported species of the Genus *Barilius* on various scores viz. (1) On the numbers of fin rays (D.i.7, P.ii.11, V.i.8, A.ii.8, C.18); shape of dorsal fins, fan like supported by strong and robust branched rays embedded in a muscular tough skin like pad. (2) Snout and lower lip beset with rough, prominent tubercles. (3) Snout deeply humped. Nostrils with prominent nares. (4) Mouth upturned, lips unequal and gape of mouth does not reach the orbit.

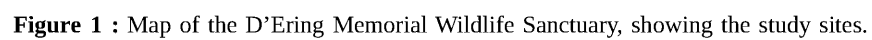




Figure 2 : Photograph is showing the confluence of Siang River and its tributary Agari River near Borguli village in north-east peripheral area of the sanctuary.



Figure 3 : Photograph is showing the general topography and habitat of the fish at Jopong island inside the sanctuary area.



Figure 4 : Indigenous method of the fishing in study area. Tribes of the area, mostly use bamboo made conical baskets (as shown in photo) for fish trapping in the minor rivers/ streams for livelihood.

(5) Pectoral tip reaches the base of ventral fin. (6) Caudal fin unequal, lower longer than upper. (7) Barbels totally absent. (8) Lateral line interrupted at the 35th scale. (9) Scales with oval shaped spot at the dorsal side and diamond shaped spots at its tip below the lateral line and lateral line scales with single large spots and a few bilobed spots. (10) Dorsal fin inserted nearer to caudal base. (11) Two longitudinal bands giving a 'V' shaped on each side behind gill opening. (12) Caudal fin with a prominent streak at the bifurcation of caudal lobes.

On account of the above mentioned specific characteristics, the species has therefore been described as a new species of the Genus *Barilius*. However while describing the new species, an attempt has been made for providing the key to identification of the available valid species (Menon 1999) of the Genus *Barilius* in the text.

KEY TO THE SPECIES OF THE GENUS BARILIUS

- | | |
|---|---|
| 1. Lateral line complete, snout smooth. Barbels maybe present or absent (2) | Snout deeply humped. Barbels absent
..... <i>Barilius arunachalensis</i> . Sp. Nov |
| Lateral line incomplete, ceases at the 35 th scale. | 2. Barbels present (3) |
| | Barbels absent (14) |
| | 3. Barbels 2 pairs (4) |
| | Barbels 1 pair (10) |
| | 4. Vertical bars on the body absent
..... <i>Barilius radiolatus</i> (Günther) |
| | Vertical bars on the body present (5) |
| | 5. Anal Fin short (A.ii.iii.7-8) (6) |
| | Anal Fin long (A.ii.iii.10-12) (7) |
| | 6. Maxillary barbel longer than rostral pair. Two black spots at the base of lateral line
..... <i>Barilius bendelisis</i> (Hamilton-Buchanan) |
| | Maxillary barbels shorter than rostral pair. Black spots at the base of lateral line absent
..... <i>Barilius shacra</i> (Hamilton-Buchanan) |
| | 7. Vertical bars extends to lateral line. Muscular pad at the base of pectoral. Pre-dorsal scales not less than 22 (8) |

- Vertical bars does not reach lateral line. Muscular pad at pectoral absent. Pre-dorsal scale either more or less than 22 (9)
8. Body shallow, its depth 4.6-4.8 in SL. Lateral line scales more than 43. Caudal unequal, lower lobe longer *Barilius barila* (Hamilton-Buchanan)
Body deep, its depth 3-3.3 times in SL. Scales not less than 43. Caudal equal
.... *Barilius ngawa* Vishwanath & Manoj Kumar
9. Pre-dorsal scales 21-26. Tubercles on snout and lower jaw. Rostral shorter than eye diameter
..... *Barilius vagra* (Hamilton-Buchanan)
Pre-dorsal scales 19-21, Tubercles on head. Rostral about one third eye diameter
..... *Barilius barnoides* Vinciguerra
10. Barbels –a maxillary pair rudimentary. Lateral line scales 60-75. Mouth gape wide extends beyond middle of orbit (11)
Barbels –a rostral pair may be short or fairly long. Mouth gape extends to orbit or middle of orbit. Lateral line scales 39-43 (12)
11. Upper jaw longer. Lateral line scales 65-75. Body with two-three irregular rows of spots.....
..... *Barilius tileo* (Hamilton-Buchanan)
12. Lower jaw slightly longer. Lateral line scales 60-66. Body with 2-4 rows of irregular spots
..... *Barilius dimorphicus* Tilak & Hussain
12. Pre-dorsal scales not below 15. Dorsal extends to the third anal rays or does not reach anal fin. Lateral line scales 40 or more (13)
Pre-dorsal scales more than 15. Dorsal fin inserted over half of anal fin. Lateral line scales less than 40 *Barilius dogarsinghi* Hora
13. Vertical bars present Lateral line scales 39-40
..... *Barilius gatensis* (Valenciennes)
Vertical bars absent. Lateral line scales 42-43
..... *Barilius modestus* Day
14. Anal rays not more than 14 (A ii. iii 12-14) ... (15)
Lateral line scales 37-38 Anal rays less than 14 (A ii. iii. 10-13) Lateral line scales 40-42 (16)
15. Body with a single row of spots. Dorsal fin nearer to caudal base. Pre-dorsal scale 16.
..... *Barilius bakeri* Day
Body with a double row of spots, Dorsal fin midway between caudal base and snout tip. Pre-dorsal scales 15 *Barilius canarensis* (Jerdon)
16. Body with vertical bars 11, last ray of dorsal extends to caudal base
..... *Barilius barna* (Hamilton- Buchanan)



Figure 5 : Photograph of the head region of the fish, showing the absence of barbels.

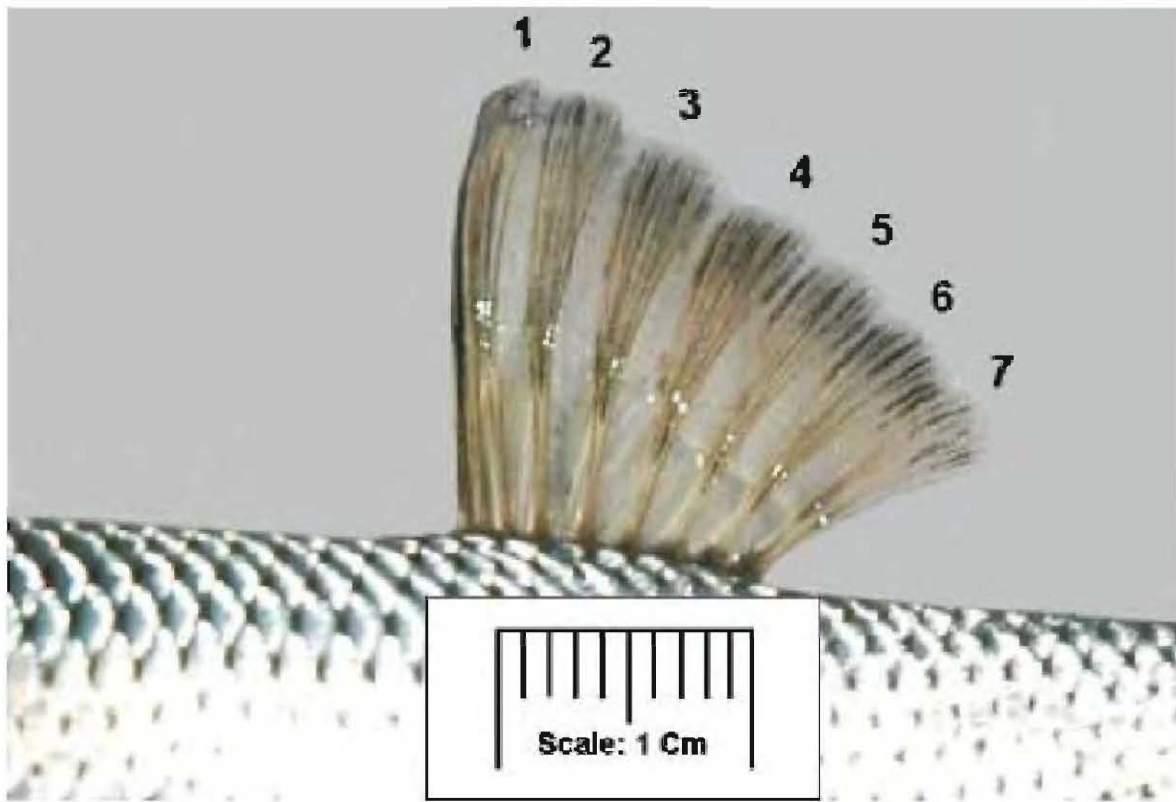


Figure 6 : Showing the physical structure and number of dorsal fin rays.

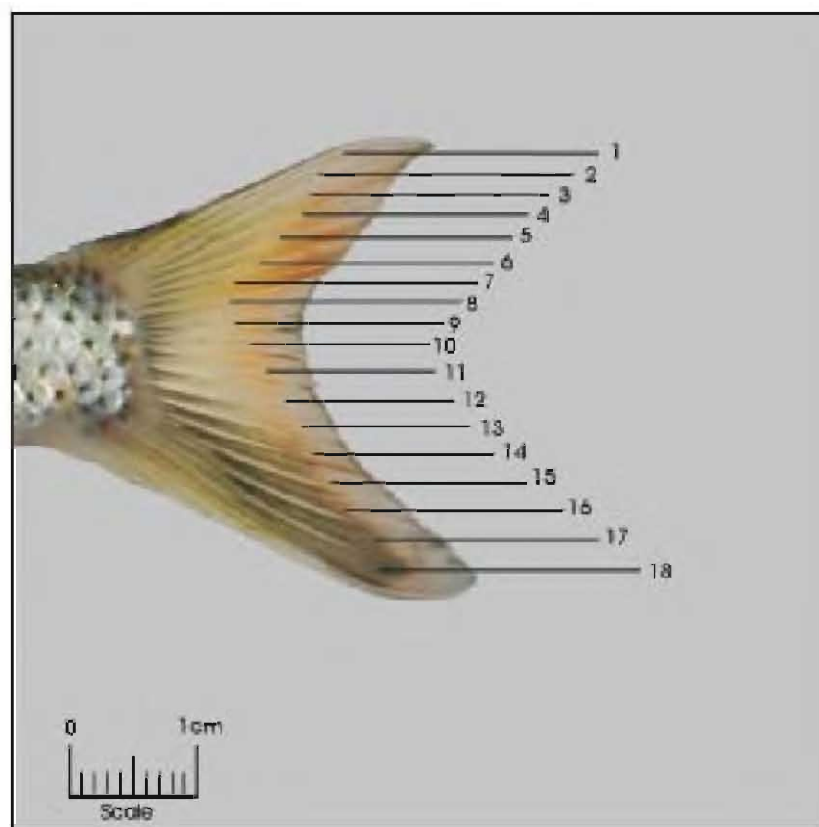


Figure 7 : Showing the physical structure and number of caudal fin rays.

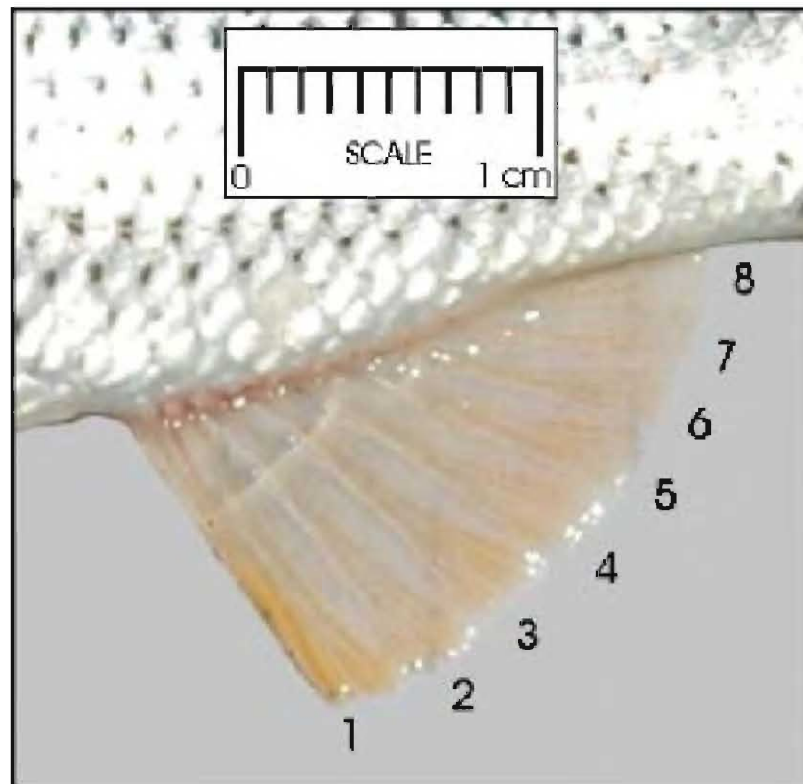


Figure 8 : Showing the physical structure and number of anal fin rays.



Figure 9 : Photograph of the fresh fish specimen *Barilius arunachalensis* sp. nov.

Body with a band, vertical bar absent, Dorsal fin extends to 4th ray of anal
..... *Barilius evezardi* Day

Fin Formula : Barbels absent, Dorsal i.7, Pectoral ii. 11, Ventral i.8, Anal ii.8, Caudal 18

DIAGNOSIS

Body broad & deep, its depth 4.8-4.9 times in standard length (SL). Head long & broad, its length 3.7-4.0 in SL, its maximum width 1.2-1.3 times and inter nostril distance 4.0-4.1 times in HL, gill opening almost at the base of pectoral fins. Eyes fairly large, its diameter 5.0-6.1 times in HL; inter orbital distance 2.27-2.46 times in H.L. Snout deeply humped and tip with rough,

prominent tubercles. Mouth moderate in size, up turned and its gape far away from orbit. Lips thick, sub-equal, lower lip with tubercles and longer than upper. Barbels absent (Fig. 5) Paired fins, well built dorsal fin nearer to caudal base. Dorsal fin fan like supported by strong and branched rays, robust in nature & embedded in a skin-like sheath (Fig. 6). Its posterior end extends to 3rd ray of anal. Anal fin also supported by strong, cartilaginous branched rays & looks like a reed of a harmonium or piano (Fig. 8). Caudal fin unequal, lower lobe longer (Fig. 7). Scales cycloid fairly large; lateral line ceases at the 35th scale. Body color silvery, dorsal fin with a streak of longitudinal band; scales with oval spots at the dorsal side and almost diamond shaped at

Table-1 : Morphometric data for *Barilius arunachalensis* Sp. nov. (n = 8). Measurements are in cm (mean $\pm$ SE).

Sl. No.	Morphological Characters	Measurements (Ranges in parenthesis)
I	Head length (HL)	
1	Snout length	3.17 $\pm$ 0.27 (2.5-3.7)
2	Eye diameter	0.75 $\pm$ 0.07 (0.65-0.9)
3	Inter-orbital distance	0.59 $\pm$ 0.03 (0.5-0.65)
4	Post-orbital distance	1.27 $\pm$ 0.09 (1.1-1.5)
5	Post-orbital distance	1.27 $\pm$ 0.09 (1.1-1.5)
II	Body measurements	
1	Total length	14.12 $\pm$ 1.38 (11.5-16.8)
2	Standard length	11.9 $\pm$ 1.33 (9.4-14.4)
3	Body depth	2.43 $\pm$ 0.29 (1.9-3.0)
4	Pre-dorsal length	6.4 $\pm$ 0.66 (5.2-7.6)
5	Post dorsal length	4.3 $\pm$ 0.13 (4.0-4.6)
6	Pre-pectoral length	3.18 $\pm$ 0.38 (2.5-3.9)
7	Post-pectoral length	8.49 $\pm$ 0.96 (6.8-10.2)
8	Pre-ventral length	5.9 $\pm$ 0.66 (4.7-7.1)
9	Post-ventral length	5.71 $\pm$ 0.74 (4.4-7.0)
10	Pre-anal length	8.1 $\pm$ 0.89 (6.5-9.7)
11	Post-anal length	3.6 $\pm$ 0.44 (2.8-4.5)
12	Caudal fin length (upper)	2.34 $\pm$ 0.05 (2.2-2.4)
13	Caudal fin length (lower)	2.65 $\pm$ 0.06 (2.5-2.8)
14	Dorsal fin base length	1.45 $\pm$ 0.17 (1.1-1.8)
15	Dorsal fin height	1.86 $\pm$ 0.12 (1.6-2.15)
16	Pectoral fin base length	0.7 $\pm$ 0.09 (0.6-0.9)
17	Pectoral fin height	1.8 $\pm$ 0.06 (1.7-1.95)
18	Ventral fin base length	0.58 $\pm$ 0.1 (0.4-0.8)
19	Ventral fin height	1.58 $\pm$ 0.12 (1.35-1.8)
20	Anal fin base length	2.0 $\pm$ 0.25 (1.6-2.5)
21	Anal fin height	0.9 $\pm$ 0.03 (0.9-1.05)
22	Length of caudal peduncle	1.14 $\pm$ 0.05 (1-1.25)
23	Depth of least height of caudal peduncle	1.02 $\pm$ 0.11 (0.8-1.3)

the ventral surface & abdomen and lateral line scales with single large spots and a few with bilobed spots; caudal with a blue strip at the bifurcation of its lobe, two 'V' shaped bands on each side behind gill openings. Fins yellowish, tinged with pink. The morphometric measurements depicted at Table-1.

Besides, the species under report (*B. arunachalensis*) has also been compared with the valid species of the Genus *Barilius* and has been shown in Table-2. The distinguishing features in regard to the *Barilius arunachalensis* strongly supports for the establishment as a new species. From the comparative chart it could also be revealed that the *Barilius arunachalensis* Sp. nov. has a close affinity with *Barilius bendelisis* except for the absence of barbels, body coloration, lateral line incomplete, lips unequal, dorsal fin fan shaped supported with strong rays enclosed in a sheath, cleft of mouth does not reach orbit, snout deeply humped, lateral line scales with single large spots and a few bilobed spots, 'V' shaped band on each side of gill opening, caudal lobe unequal justify for the separation of the reported fish as a new species.

DISTRIBUTION

The fish samples were collected from the Agari River mouth just outside the D'Ering Memorial Wild Life Sanctuary through which passes river Sibya forming one of the tributaries of a major river Siang. The fish specimens were also seen inside the sanctuary at the south west of Jopong Island. The Sanctuary is located adjacent to the Pasighat town, the Headquarters of East Siang district of Arunachal Pradesh. The location of the collection centre is at an altitude of 160 m (msl).

ETYMOLOGY

The species *Barilius arunachalensis* is named after the state of Arunachal Pradesh. One of the authors namely Anil Kumar collected the fish specimens during his field survey to D'Ering Memorial Wildlife Sanctuary & its adjacent areas.

DISCUSSION

The new species *Barilius arunachalensis* to some extent has a close resemblance with *Barilius bendelisis*:
(i) Presence of prominent tubercles on snout & lower

lip (*versus* tubercles small and poorly developed in *Barilius bendelisis*) (ii) Dorsal fin ray (i.7), Pectoral (ii. 11), Ventral (i.8), Anal (ii.8) (*versus* D. ii.7, A.ii.iii. 7-8, P.i.14, V.i 8 in *Barilus bendelisis*) (iii) Lateral line incomplete and ceases at 35th scale (*versus* Lateral line scales 40-45 in *B. bendelisis*); (iv) Dorsal fin fan like (*versus* dorsal fin not fan like in *B. bendelisis* of Day, 1878; Tilak *et al.*, 1984; Talwar & Jhingran, 1991). (v) Each scales with oval spots at dorsal side and diamond shaped at the ventral, and lateral line scales with large single spots and a few bilobed spots (*versus* lateral line scales with two spots in *B bendelisis* of Day, 1878; Tilak *et al.*, 1984; Talwar & Jhingran, 1991).

Tilak *et al.* (1984) and Talwar & Jhingran (1991) reported of sexual dimorphism pertaining to coloration of the body, fan shaped paired fins, body size of synonymies of *B. bendelisis*. When compared with the reported species, *B. arunachalensis* it was found to vary in all respect as pointed out in paragraph (1) as above, i.e. barbels totally absent, lateral line incomplete, lateral line scales with single large spots and a few bilobed spots, 'V' shaped band on each side of gill opening, caudal fin with a prominent streak at the bifurcation of caudal lobe and caudal fin unequal.

The diagnostic features purported in Table-1 also distinctly shows that the species under report, *Barilius arunachalensis* could be readily separated from all the reported species as well as the synonymies of the Genus *Barilius* (Day, 1878; Talwar & Jhingran, 1991; Menon, 1999; Jayaram, 1999; Vishwanath & Manoj Kumar, 2002).

The discovery of the new species (*Barilius arunachalensis*) from the D'Ering wildlife Sanctuary of Arunachal Pradesh has thrown a new light that the sanctuary offers a safe habitat and in no way the fish stands threatened from external interferences. Thus the sanctuary is one of the noble examples of in-situ conservation of fauna and flora of the region. The collection of live species within the sanctuary is not legally permitted hence only a few samples of the present species were collected from outside the sanctuary. However, the continuity of the studies shall be kept in progress so that any variability of the new species could be further observed, if any.

Table 2 : Comparative account is showing the distinction between *Barilius arunachalensis* and the allied genera/ species of the sub-family Rasborinae.

Sl. No.	Name of the Species	Characteristic features	Diagnostic features
A.	Species with 2 pairs of barbels		
1	<i>Barilius radiolatus</i>	D.ii 7-8, A.ii.iii 10-11, Pi.16, Vi.8	Tubercles small, poorly developed on snout and lower jaw. Lateral line (L.L) scales 56-62. Vertical bars absent. Dorsal fin inserted anterior to anal fin. Pre-dorsal scales 24.
2	<i>Barilius shacra</i>	D.ii 7, A. ii. iii. 8, Pi.ii 14, Vi.8	Tubercles small and poorly developed on snout & lower jaw. Lateral line scales 59-70. Vertical bars 12, rarely absent. Dorsal inserted advance of Anal. Dorsal fin with black band along its upper third. Pre-dorsal scale 22-25. The fish attains a length of 12.5 cm.
3	<i>Barilius bendelisis</i> Sub-species of <i>Barilius bendelisis</i> (Synonyms of <i>Barilius bendelisis</i> of Menon, 1990) 3 i.* <i>chedra</i> (male) 3 ii.* <i>cocsa</i> (Female)	D.ii 7, A.ii. iii. 7-8, Pi. 14, Vi.8	(i) Tubercles small and poorly developed on snout & lower jaw. Lateral line scales 40-45. Vertical bands 8-12 numbers descending towards lateral line, often becomes indistinct (as spots) in adults. Lateral line scales with two black spots at their base. Dorsal fin ahead of anal nearer to caudal base than snout tip. Pre-dorsal scale 18-20. The species attains a length of 15.5 cm. (i) Males are well built. Paired fins enlarged and fan like. Pectoral fin base muscular and robust. Three pectoral rays extends beyond ventral. Dorsal & anal fins are expanded. (ii) Tip of snout, sides and lower jaw with thick layer of spiny tubercles. Body with fine tubercles on scales. Vertical bands disappear with growth. (iii) Females lack all characters as in sl ii. Fish attains a length of 15.5 cm.
4	<i>Barilius vagra vagra</i>	D.i.ii.7, A.ii. iii. 10-12, Pi.14-15, V. 8	Tubercles poorly developed on snout & lower jaw. Lateral line scales 33-44. Vertical bars 10-14 above lateral line. Dorsal inserted anterior to anal. Dorsal & caudal fin grey edged. Pre-dorsal scales 21-26. Body depth 5.5-7.4 times S.L. Vertical bars reaching lateral line.

Table 2 : Cont'd.

Sl. No.	Name of the Species	Characteristic features	Diagnostic features
4i	<i>Barilius vagra</i> <i>pakistanicus</i> (synonym of <i>Barilius vagra</i> of Talwar & Jhingran 1991)		
5	<i>Barilius ornatus</i> (A synonym of <i>Barilius</i> <i>barnoides</i> of Talwar & Jhingran, 1991)	D. iii.7-8, A.iii.10-11 Pi.13-14, Vi.8	Lateral Line scales 38 – 41, Pre-dorsal scales 14-20
6	<i>Barilius barilia</i>	D.ii.7, A.iii.10-11, Pi.12, Vi.8	Tubercles poorly developed on lower jaw. Lateral Line scales 43-46. Vertical bars 14 or 15 extends up to lateral line. Dorsal placed advance to anal. Fins pinkish, Pre-dorsal scales 22. The Fish attains a length of 10 cm.
7	<i>Barilius barnoides</i>	D.ii.iii.7-8, A. ii. iii.10-11, Pi.13, Vi.8	Tubercles on head poorly developed. Lateral Line scales 42-45. Vertical bars 14-15 above lateral line. Dorsal fin advance of Anal. Fins hayline. Pre-dorsal scale 19-21. The fish attains a length of 8.0 cm.
8	<i>Barilius ngawa</i>	D.ii.iii.7 – 8, A.ii.iii.10-11 Pi.12-13, Vi.7	Lower jaw with a symphysis & upper jaw with a notch Lateral Line scales 42-43. Vertical bars 13- 14 extends to lateral line. Dorsal fin with a dark band and caudal with dark margins.
B.	Species with 1 pair of Barbels :		
9	<i>Barilius gatensis</i>	D.ii.iii.8 – 9, A.iii.12-14, Pi.14, Vi.8	Rostral pair minute. Tubercles large and well developed on snout and lower jaw. L.L scales 39-40, Pre-dorsal scale 15, Vertical bars 13-15, often as oblong spots, become almost broken in adults, Dorsal fin a ahead of anal, extending to 3 rd Anal ray. Dorsal fin & anal with dark base. The fish attains 15 cm in length.
10	<i>Barilius modestus</i>	D. ii. 7, A.ii. 10 – 11, Pi.14, Vi.8	Rostral pair fairly long. Tubercles well developed on snout & lower jaw. L.L scales 42-43, Pre- dorsal scales 15. Body silvery with dark band on dorsal fin. Fins yellowish. The fish attains a length of 12.5 cm.
11	<i>Barilius tileo</i>	D. ii.7, A.iii.10, Pi.13, Vi.8	Maxillary pairs, often absent. Tubercles well developed on snout & lower jaw. L.L scales 65- 75. Pre-dorsal scales 28-30. Body with two-three rows of spots & blotches. Dorsal fin advance to Anal. Dorsal fin dark grey with pinkish edge others yellow. The fish attains a length of 15 cm.

Table 2 : Cont'd.

Sl. No.	Name of the Species	Characteristic features	Diagnostic features
12	<i>Barilius dogarsinghi</i>	D.ii.7, A.iii.9, Pi.12, Vi.8	Short Rostral pair. Tubercles large and well developed on snout & lower jaw and sides of head. L.L scales 38-39. Pre-dorsal scales 20. Transverse bands 9 extending to lateral line. Dorsal inserted nearer to caudal and extending over half of Anal fin. Fins hyaline. The fish attains a length of 8.5 cm.
13	<i>Barilius dimorphicus</i>	—	Lateral line scales 60-66. Lower jaw slightly longer. Pectoral fin longer than head. Body with 2-4 irregular rows of spot.
C.	Barbels absent :		
14	<i>Barilius evezardi</i>	D.ii.7, A.ii.12 – 13, Pi.12., Vi.8	Tubercles large & well developed on head. Lateral line scales 40. A silvery band on flanks. Dorsal fin ahead of anal, its posterior half above anal. Dorsal and caudal fins edges black. Fins yellowish. Pre-dorsal scales 14. The fish attains a length of 11 cm.
15	<i>Barilius bakeri</i>	D.ii.iii.10, A.i.iii.14, Pi.14, Vi.8	Tubercles large and well developed on snout & lower jaw. L.L scales 37-38, Body with a row of large bluish spots along the flanks. Dorsal fin ahead of Anal, extending to 4 th Anal ray. Dorsal, anal and pectoral fins with dark grey bases, edges white. Pre-dorsal scales 16. The fish attains a length of 15 cm.
16	<i>Barilius barna</i>	D.ii.7, A.iii. 10-11, Pi.14, Vi.8	Tubercles large and well developed on snout & lower jaw. L.L scales 39-42. Vertical bars 11. Dorsal advance of Anal fin, often last ray extending to caudal. Dorsal & caudal fin edges black. Pre-dorsal scales 15-16. The fish attains a length of 7.5 cm.
17	<i>Barilius canarensis</i>	D.ii.10-11, A.ii.12-14, Pi.14, Vi.8	Tubercles large on head. L.L scales 37-38. Dorsal with rows of large vertical green spots along body. Fins grey with white margin. Pre-dorsal scales 15. Fish attains a length of 15 cm.
18	<i>Barilius auropurpureus</i> (separated & placed under Genus <i>Inlecyrpris</i> , Howes, 1980a)	D.ii.7, A.iii.15, Pi. 11, Vi.6	L.L scales 39 – 41. Vertical bars 14 with rows of minute dots. Dorsal inserted above anal fin. Ventral keeled.
19	<i>Barilius lairokensis</i> (of Arun Kumar and Tombi Singh, 2000)	—	Dorsal & Anal fins with spines. Body with 14-16 dark lateral bands. (No <i>Barilius</i> species so far reported with spines thus needs to be separated).

Table 2 : Cont'd.

Sl. No.	Name of the Species	Characteristic features	Diagnostic features
20	<i>Barilius nelsoni</i> (of Barman, 1989, a synonym of <i>Barilius radiolatus</i> of Talwar & Jhingran, 1991)		Hence not described.
21	<i>Barilius bola/guttatus</i> (Separated under the genus <i>Raiamus</i> of Howes, 1980)		Hence not described.
22	<i>Barilius arunachalensis</i>	D.i.7, A.i.8, P.ii.11, Vi.8, C.18	Rough tubercles, prominent on snout & lower jaw. Barbels absent. Snout deeply humped. Mouth upturned, gape not reaching orbit. Lips unequal, lower lip slightly longer. Lateral line scales incomplete, ceases at the 35 th scale. Dorsal inserted ahead of anal, but nearer to caudal base. Dorsal fin extends to 3 rd ray of Anal. Scales large, cycloid and with oval spots at the dorsal side & diamond shaped spots at the ventral surface and lateral line scales with single large spots and a few bilobed spots. Pectoral tip just reaching ventral fin base. Two broad band almost 'V' shaped on each side behind gill opening. Caudal fin with prominent streak at the bifurcation of the caudal lobe. Longitudinal streak at the dorsal fin and prominent streak at the bifurcation of caudal. Caudal unequal, lower lobe longer. The length of fish recorded upto 16.8 cm.

*Sub-species

ACKNOWLEDGEMENTS

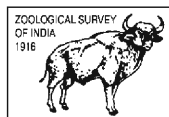
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REFERENCES

Borang, A., Bhatt, B.B., Chaudhury, S.B., Borkotoki, A. and Bhutia, P.T. (2005). Checklist of the snakes of Arunachal Pradesh, Northeast India. *J. Bombay Nat. Hist. Soc.*, **102**(1) : 19-26.

- Borang, A. (2001). Mammalian fauna of Arunachal Pradesh (checklist & distribution in protected areas). *Arunachal Forest News*, **19** (1&2) : 43-82.
- Choudhury, A.U. (2003). *The Mammals of Arunachal Pradesh*. Regency Publications, New Delhi.
- Datta, A., Naniwadekar, R. and Anand, M.O. (2008). Hornbills, hoolocks and hog badgers : long term monitoring of threatened wildlife with local communities in Arunachal Pradesh, north east India. Final report to the Rufford Small Grants Program (UK). Nature Conservation Foundation, Mysore, India. pp. 80.
- Day, F. (1878). *The Fishes of India; being a natural history of the fishes known to inhabit the seas and fresh waters of India, Burma and Ceylon*.
- Editor-Director, (2006a). *Fauna of Arunachal Pradesh, State Fauna series*, **13**(Part-1) : 317-396.
- Editor-Director, (2006b). *Fauna of Arunachal Pradesh. State Fauna Series*, **13**(Part-2) : 1-518. (Published by Director, Zool Surv. India, Kolkata).
- Forest Survey of India (2000). *The State Forest Report, 1999*. FSI, Govt. of India Press, Dehradun, 133.
- Howes, G.J. (1980a). The taxonomy, phylogeny and classification of the Bariline cyprinid fishes. *Bull. Br. Mus. Nat. Hist (Zool)*, **37**(3) : 129-198.
- Jayaram, K.C. (1999). *The Freshwater Fishes of the Indian Region*. Narendra Publishing House, Delhi, India, xxiii. Pp. 551.
- Kalita, S.N. and Haridasan K. (2001). Forest and wildlife management in Arunachal Pradesh. *Arunachal Forest News*, **19**(1&2): 26-31.
- Kaul, R.N. and Haridasan, K. (1987). Forest types of Arunachal Pradesh-A preliminary study. *J. Econ. Tax. Bot.*, **9**(2) : 397-389.
- Kumar, A. (2009). Occurrence of mammals in D'Ering Memorial Wildlife Sanctuary and adjacent areas, Arunachal Pradesh, India. *J. Env. Bio-sci.* vol. **23**(1), 107-111.
- Kumar, A. and Ramakrishna (2010). A review of vertebrate and invertebrate fauna of Arunachal Pradesh. *State Gazetteer of Arunachal Pradesh*. (in Press)
- Kumar, R.S., Mishra, C. and Sinha, A. (2005). Discovery of the Tibetan macaque *Macaca thibetana* in Arunachal Pradesh, India. *Curr. Sci.* **88**(9) : 1387-1388.
- Mishra, C. and Datta, A. (2007). A new bird species from Eastern Himalayan Arunachal Pradesh- India's biological frontier. *Curr. Sci.* **92**(9) : 1205-1206.
- Menon A.G.K., (1999). Checklist Freshwater Fishes of India. *Rec. Zool. Surv. India, Occasional Paper* **175** : 1-366.
- Nath, P. & Dey, S.C. (2000). *Fish and Fisheries of North Eastern India (Arunachal Pradesh)*. Narendra Publishing House, Delhi : 200 pp.
- Talwar, P.K. and Jhingran, A. (1991). *Inland Fishes of India and adjacent countries*, Oxford and IBH publishing Co. Pvt. Ltd., New Delhi, 2 Volumes : xix-1158 pp.
- Tilak, R., Jaffer, Z. and Hussain, A. (1984). Systematic status of *Barilius bendelisis*, Hamilton (Cyprinidae : Pisces). *Rec. Zool. Surv. India*, **81**(3&4) : 279-290.
- Vishwanath and Manoj Kumar, B. (2002). A New Bariliine Cyprinid Fish of the Genus *Barilius* Hamilton from Manipur, India. *Journal of Bombay Natural History Society*, **99**(i) : 86-89.



Rec. zool. Surv. India : 110(Part-3) : 35-36, 2010

FIRST RECORD OF *ERETHISTES HARA* (HAMILTON, 1822) (SILURIFORMES : ERETHISTIDAE) FROM MADHYA PRADESH, INDIA

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INTRODUCTION

Siluriformes is an important order of Pisces, comprising of approximately 2,000 species pertaining to 30 families. They are mostly confined to freshwater, but some are marine. Siluroid fishes are devoid of scales and are popularly termed as Cat-fishes, due to the presence of feelers or long barbels arranged around the mouth. These fishes appear to use their feelers in moving about in muddy places, and consequently have less use for their eyes than forms that reside in clear water. In some freshwater as well as marine forms, the males appear to carry the ova in their mouths perhaps until the young are produced. These fishes are credited with causing poisonous wounds. They are capable of atmospheric respiration also (Day, 1889).

The family Erethistidae are commonly known as the 'Moth Cats' because of their colour pattern of the fins

as being very like moth's wings. Head is osseous above, somewhat depressed. Mouth small, gill opening narrow, eyes small. Nostrils close together, separated by a small barbel. Barbels eight. First dorsal fin arising slightly in front of the ventrals, having a serrated spine and five or six branched rays. Adipose dorsal present. Ventral with six rays. Pectoral with a serrated spine.

While working on the Pisces of Madhya Pradesh, the authors came across two interesting specimens of 'Moth Cats' identified as *Erethistes hara* (Hamilton, 1822) belonging to family Erethistidae. Globally, this family is represented by 6 genera and about 25 species (De Pinna, 1996). However, only 9 species are reported from India (Jayaram, 2006). *Erethistes hara* (Hamilton) is so far reported by Jayaram (1981, 2006); Lipton (1985); Aatur Rahman (1989) and Mamnur Rashid, *et.al.* (1997).



Erethistes hara (Hamilton, 1822)



Head of *Erethistes hara* (Hamilton, 1822)

***Erethistes hara* (Hamilton, 1822)**

Material examined : Madhya Pradesh, Kuanri river, Morena Distt., 05. I. 1995, (1ex.) Coll. H.S.Sharma; Reg, no.V-4446; Mahanadi River, VijayRaghavgarh, Katni Distt., 17. I. 2009, (1ex.), Coll. J.Thilak. Reg, no.V-4771.

Diagnostic Features / Description : The body length of the specimen was measured 2.5 cm and 2.8 cm. Blunt spiny ossicles present in the skin. Pectoral spine shorter (0.5cm.) than head length. Occipital process, cleithral process, scapular process all prominent and naked. Humeral process prominent on ventral side. 4 pairs of barbels. Rayed dorsal fin with 5 rays and a spine. A

combination of brown and cream vertical bands after the posterior dorsal fin. Maxillary and mandibular barbels with alternate black and brown bands.

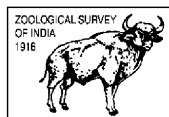
Distribution : Ganges, Brahmaputra & Irrawaddy drainages in northeast India, Bihar, North Bengal, Orissa, Uttar Pradesh, Bangladesh, Nepal and Myanmar.

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REFERENCES

- Ataur Rahman, A.K.A. 1989. *Freshwater Fishes of Bangladesh*. Zoological Society of Bangladesh. Department of Zoology, University of Dhaka. 364 pp.
- Day, F. 1889. *The Fauna of British India, including Ceylon and Burma. Fishes- Vol.I*, 548 pp. London : Taylor and Francis.
- De Pinna, M.C.C. 1996. A phylogenetic analysis of the Asiancatfish families Sisoridae, Akysidae and Amblycipitidae, with a hypothesis on the relationships of the neotropical Asprenidae (Teleostei, Ostariophysi). *Fieldiana (Zool.)*, **84** : 1-82.
- Hamilton, F. 1822. *An account of the fishes found in the river Ganges and its branches*. 1-VII, 1-405, pls. 1-39. Archibald, Constable & Co., Edinburgh Hurst, Robinson & Co., London.
- Jayaram, K.C. 1981. *The Freshwater Fishes of India, Pakistan, Bangladesh, Burma and Sri Lanka*. Zoological Survey of India, Calcutta, 475 pp., pls. 1-13.
- Jayaram, K.C. 2006. *Cat fishes of India*. Narendra Publishing House , New Delhi, 383pp, Plates-XI, Figs. 163.
- Lipton, A.P. 1985. Fish fauna of Tripura. *Matsya*, 9-10, 110-118.
- Mamnur Rashid, M., Aminul Haque, A.K.M. & Rahman, A.K.A. 1997. A checklist of ichthyofauna of the River Dharla of Fulbari (Kurigram). *Bangladesh Journal of Animal Science*, 26, 133-140.



Rec. zool. Surv. India : 110(Part-3) : 37-57, 2010

TRICHOTAXONOMY OF INDIAN SPECIES OF GENUS *RATUFA* GRAY (MAMMALIA : RODENTIA : SCIURIDAE)

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INTRODUCTION

Oriental giant squirrels (Genus *Ratufa*) belong to subfamily Ratufinae and are found in parts of South and South-east Asia. There are four species of oriental giant squirrels : *Ratufa affinis* (Raffles) (Pale Giant Squirrel), *Ratufa bicolor* (Sparrman) (Malaya Giant Squirrel), *Ratufa indica* (Erxleben) (Indian Giant Squirrel) and *Ratufa macroura* (Pennant) (Grizzled Giant Squirrel). *Ratufa affinis* (Raffles) (Pale Giant Squirrel) is found in Brunei, Indonesia, Malaysia, Singapore and Thailand (Krapp 1998).

The Malayan Giant Squirrel, *Ratufa bicolor* (Sparrman) is at home on the Indian subcontinent, north of the Ganges in Nepal, Sikkim, Bhutan and Assam; farther to the east it lives in Burma, Malaya and upto Southern China and on Java. It is deep dark brown, almost black on the back and a light beige on the underside. They are very shy and they live exclusively in forest in the highest trees. They are very agile and jump in great leap from tree to tree, over a distance of almost 22 ft (Krapp 1998). *Ratufa bicolor* (Sparrman) is a Schedule II species under IWPA 1972, and has category Lc IUCN (Kumar and Khanna 2004).

Ratufa indica (Erxleben), Indian Giant Squirrel has been listed as, VU(IUCN Alacd.Cl ver 2.3 ,1994), (CAMP)VU A2c, 3c, 4c, (IWPA) Schedule II, CITES Appendix II, endemic population (Kumar and Khanna 2006). *Ratufa macroura* (Pennant) Grizzled Giant Squirrel, Sri Lankan Giant squirrel is a large species of squirrel found in Sri Lanka and in the forests of southern India. The species is found in patches of riverine forest along the Kaveri river in south India and in hill forests

in peninsular India. and in parts of Sri Lanka. The Sri Lankan race is *R. macroura dandolena* (Menon 2003).

Abbreviations : SP : Scale pattern, SM : Scale margin, DS : distance between scales.

Ratufa macroura (Pennant) Grizzled Giant Squirrel, is listed as IUCN VU Alc ver 2.3 (1994), CAMP VU A2c, 3c,4c; D; IWPA I, CITES Appendix II, population trend indeterminate (Kumar and Khanna 2006).

Very little study so far has been done on the trichotaxonomy of the species of family Sciuridae (Bahuguna, 2007), a group largely being poached throughout world for its skin. Trichotaxonomy is well known for its utility in wildlife forensic science (Anon 1995, Chakraborty and De 1995, De *et al* 1998, Bahuguna and Mukherjee 2000), for ecological study of the animals, in wildlife management and conservation (Mathiak 1938, Nath and Joseph 1981, Bahuguna 2007). Williams in 1938 reported the characteristics of hair of mole and shrew for wildlife management.

The present study describes the characteristic of primary guard hair of different regions of species of genus *Ratufa* i.e. *Ratufa indica* (Erxleben), Indian Giant Squirrel, *Ratufa bicolor* (Sparrman) Malayan Giant Squirrel and *Ratufa macroura* (Pennant) Grizzled Giant Squirrel.

MATERIAL AND METHODS

Hair samples were collected randomly from dorsal, ventral, head and tail regions of the specimens {male *Ratufa indica* (Erxleben) (subspecies *indica*), loc : Devikop, Dharwar, Bombay Prov. 24.xi.1911., Collector. G. C. Shortridge. Collection . No. 166, Reg no 15090;

male *Ratufa bicolor* (Sparman) subspecies *gigantea*, loc : Darjeeling, Bengal, Date 19.viii. 1916., Collector N. A. Baptista Collection no. 2149, Reg no 15163; *Ratufa macroura* (Pennant), Indian Museum, Sri Lanka, Collector : J. L. F. Kelaart, ASBR, Reg no 9472, Date of collection not available) from National Zoological Collection of Mammal and Osteology section, Zoological survey of India, Kolkata. For each type of the study (Medulla type, Cross section, Cuticular and SEM examination) about 10 primary guard hair from dorsal, ventral, head and tail regions of each specimen were examined. The samples were washed in graded series of acetone i.e. 50%, 70%, 80%, 90% and 95% for 30 min. in each grade and finally kept in pure acetone overnight.

Medulla

To study the type of medulla, the cleaned hair was mounted in DePeX (Gurr) for whole mount. When mounting, the hair tuft, it is necessary to ensure that the individual hair is well separated. For temporary mounting Paraffin oil is a most convenient medium (Appleyard, 1960).

Longitudinal sections were also prepared for clear picture of medulla type.

Cross section : For the present study, hair cross sections were obtained by simple hand sectioning after mounting the hair in paraffin wax, the method followed as given in reference guide Bahuguna *et al* 2010. For longitudinal section of medulla, the blocks of hair were prepared in paraffin wax and hand sectioning was done longitudinally. The technique is useful for clear picture of medulla type (Bahuguna 2008) as the presence of pigments generally hides the structure.

Scale casts : Procedures for studying scale pattern usually involve the use of special media to obtain a cast or impression of the actual hair surface. For getting the cast, the cleaned hair was kept with the help of the fine forceps on thin film of the gelatin (3%) medium on slide for some time till the medium was air-dried. After drying of gelatin the hair was removed gently. For very long hair they can be cut into sections to have complete picture of scales at tip, mid and basal region of hair. Another medium polyvinyl acetate (PVA in 50% distilled water) can also be used for this purpose (Appleyard, 1960).

For cuticle studies different parts of hair i.e. distal (tip), mid and proximal part (base) of hair were examined.

Photomicrographs were taken for cross section, medulla type and cuticular studies at x100 to x200 (total magnification) under compound light microscope, Olympus CX41.

Scanning electron microscope study

This was performed for studying details of cuticular pattern. After cleaning the hair, small mid section of hair were kept on adhesive on stub. The stubs were coated with thin film (15-20 Å) of gold and kept in the chamber to view details of scale pattern. The electron micrographs thus obtained from Zeiss EVO40 were used to find out scale index, scales types and scale margins.

Hair measurements : Hair measurements were noted for calculating mean of thickness of medulla and total thickness of hair and their ratios for medullary index. Ratios of length of hair and thickness of hair were also taken into account to get length index. The measurements were shown under observations as mean $\pm$ SD

Nomenclature of medulla type was adopted after Wildman (1954) and the same for cuticular scale pattern and cross section types after Brunner and Coman (1974.)

OBSERVATIONS

Genus *Ratufa* Gray, 1867

Ratufa bicolor (Sparman), Malayan Giant Squirrel

**Status IWPA : Schedule II, Part II, CITES :
Appendix II; CAMP : VU (Nationally), DD
(Globally)**

Dorsal

A Physical characteristics

Colour : Both light brown and dark brown

Total thickness (T) : $86.3 \pm 1.5 \mu\text{m}$

Length index (L/T) : 30.3 ± 0.09

Shape and Nature : Straight and thin

B Cuticular Scale Pattern

At mid : SP regular wave, SM rippled, DS near; at proximal, SP regular wave SM rippled, DS near; At distal : SP regular wave, SM rippled, DS near Scale index: 6.0 ± 0.0

C Medulla

Medullary configuration : Wide Aeriform Lattice

Medulla thickness $60.9 \pm 1.0 \mu\text{m}$ Medullary index (M/T) : 0.70 ± 0.66 **D Cross section**

Type of cross section : Oblong

Medulla size in cross section : Large

Ventral**A Physical characteristics**

Colour : light brown

Total thickness (T) : $49.8 \pm 0.0 \mu\text{m}$ Length index : 24.5 ± 0.0

Shape and Nature : Straight and thin

B Cuticular Scale Pattern

At mid : SP regular wave, SM rippled, DS near; at proximal, SP regular wave SM rippled, DS near; At distal: SP regular wave, SM rippled, DS near

Scale index : 5.3 ± 0.01 **C Medulla**

Medullary configuration : Wide Aeriform Lattice

Medulla thickness : $29.8 \pm 0.06 \mu\text{m}$ Medullary index (M/T) : 0.59 ± 0.0 **D Cross section**

Type of cross section : Oblong

Medulla size in cross section : medium

Head**A Physical characteristics**

Colour : dark brown with light brown tips

Total thickness (T) : $109.0 \pm 1.0 \mu\text{m}$ Length index : 16.88 ± 0.0

Shape and Nature : Straight and thin

B Cuticular Scale Pattern

At mid : SP regular wave, SM scalloped margin, DS near; at proximal, SP regular wave SM scalloped, DS near; At distal : SP regular wave, SM scalloped, DS near, Scale index : 4.17 ± 0.0

C Medulla

Medullary configuration : Wide Aeriform Lattice

Medulla thickness : $89.0 \pm 1.0 \mu\text{m}$ Medullary index : 0.51 ± 0.25 **D Cross section**

Type of cross section : Oblong

Medulla size in cross section : Large

Tail**A Physical characteristics**

Colour : Dark brown

Total thickness (T) : $92.7 \pm 0.4 \mu\text{m}$ Length index : 51.7 ± 0.25

Shape and Nature : Straight and thin

B Cuticular Scale Pattern

At mid : SP Irregular wave, SM rippled, DS near; at proximal, SP Irregular wave SM slightly rippled, DS near; At distal: SP Irregular wave, SM smooth, DS near

Scale index : 2.86 ± 0.01 **C Medulla**

Medullary configuration : Wide Aeriform Lattice

Medulla thickness : $82.7 \pm 0.4 \mu\text{m}$ Medullary index : 0.89 ± 0.01 **D Cross section**

Type of cross section : Oblong

Medulla size in cross section : Large

Ratufa indica (Erxleben, 1777) (Indian Giant Squirrel, Malabar Squirrel)

Status : IWPA : Schedule II, Part II; CITES : Appendix II : CAMP : VU (Nationally), DD (Globally).

Dorsal**A Physical characteristics**

Colour : dark brown or black

Total thickness (T) : $85.4 \pm 0.52 \mu\text{m}$ Length index : 39.22 ± 0.1

Shape and Nature : Straight and thin

B Cuticular Scale Pattern

At mid : SP regular wave, SM rippled, DS near; at proximal, SP regular wave SM rippled, DS near; At distal : SP regular wave, SM rippled, DS near

Scale index : 6.0 ± 0.45 **C Medulla**

Medullary configuration : Simple medulla

Medulla thickness $65.4 \pm 0.52 \mu\text{m}$

Medullary index : 0.76 ± 0.0

D Cross section

Type of cross section : Oblong

Medulla size in cross section : Large

Ventral

A Physical characteristics

Colour : light brown and beige

Total thickness (T) : $84.5 \pm 0.32 \mu\text{m}$

Length index : 14.6 ± 0.16

Shape and Nature : Straight and thin

B Cuticular Scale Pattern

At mid : SP regular wave, SM slightly rippled, DS near; at proximal, SP regular wave SM slightly rippled, DS near; At distal : SP regular wave, SM rippled, DS near Scale index: 6.5 ± 0.01 .

C Medulla

Medullary configuration : Wide Aeriform Lattice

Medulla thickness : $44.5 \pm 0.52 \mu\text{m}$

Medullary index : 0.52 ± 0.01

D Cross section

Type of cross section : Oblong

Medulla size in cross section : Medium

Head

A Physical characteristics

Colour : light brown at tips, mid dark brown and black

Total thickness (T) : $69.6 \pm 0.08 \mu\text{m}$

Length index : 17.81 ± 0.06

Shape and Nature : Straight and thin

B Cuticular Scale Pattern

At mid : SP regular wave, SM rippled, DS near; at proximal, SP regular wave SM rippled, DS near; At distal : SP regular wave, SM rippled, DS near

Scale index : 7.3 ± 0.0

C Medulla

Medullary configuration : Wide Aeriform Lattice

Medulla thickness : $49.2 \pm 0.21 \mu\text{m}$

Medullary index : 0.706 ± 0.026

D Cross section

Type of cross section : Oblong

Medulla size in cross section : Large

Tail

A Physical characteristics

Total thickness (T) : $79.2 \pm 0.16 \mu\text{m}$

Length index : 57.19 ± 0.25

Shape and Nature : Straight and thin

B Cuticular Scale Pattern

At mid : SP regular wave, SM rippled, DS near; at proximal, SP regular wave SM rippled, DS near; At distal : SP regular wave, SM rippled, DS near Scale index : 6.5 ± 0.01

C Medulla

Medullary configuration : Wide Aeriform Lattice

Medulla thickness : $60.7 \pm 0.16 \mu\text{m}$

Medullary index : 0.76 ± 0.01

D Cross section

Type of cross section : Circular, Oblong

Medulla size in cross section : Large

Ratufa macroura (Pennant, 1769) (Grizzled Indian (Giant) Squirrel)

Status : IWPA : Schedule 1, Part 1; RDB : EN; CITES : Appendix II; CAMP : EN (Nationally), DD (Globally)

Dorsal

A Physical characteristics

Colour : Dark brown/black with light brown tips

Total thickness (T) : $69.72 \pm 0.06 \mu\text{m}$

Length index : 46.04 ± 0.05

Shape and Nature : Straight and thin

B Cuticular Scale Pattern

At mid : SP regular wave, SM rippled, DS near; at proximal, SP regular wave SM rippled, DS near; At distal : SP regular wave, SM rippled, DS near

Scale index : 6.24 ± 0.32

C Medulla

Medullary configuration : Wide Aeriform Lattice

Medulla thickness : $60.3 \pm 0.08 \mu\text{m}$

Medullary index : 0.86 ± 0.013

D Cross section

Type of cross section : Oblong

Medulla size in cross section : Large

Ventral

A Physical characteristics

Colour : dark brown/black and light brown

Total thickness (T) : $29.9 \pm 0.03 \mu\text{m}$

Length index : 35.45 ± 0.01

Shape and Nature : Straight and thin

B Cuticular Scale Pattern

At mid : SP regular wave, SM rippled, DS near; at proximal, SP regular wave SM rippled, DS near; At distal : SP regular wave, SM rippled, DS near Scale index : 6.3 ± 0.0

C Medulla

Medullary configuration : Simple medulla

Medulla thickness : $20.0 \pm 0.0 \mu\text{m}$

Medullary index : 0.66 ± 0.0

D Cross section

Type of cross section : Oblong

Medulla size in cross section : Medium

Head

A Physical characteristics

Colour : Slightly light brown at tips, mid is dark

Total thickness (T) : $87.27 \pm 1.0 \mu\text{m}$

Length index : 13.76 ± 0.047

Shape and Nature : Straight and thin

B Cuticular Scale Pattern

At mid : SP regular wave, SM rippled, DS near; at proximal, SP regular wave SM rippled, DS near; At distal : SP regular wave, SM rippled, DS near Scale index : 4.4 ± 0.0

C Medulla

Medullary configuration : Wide Aeriform Lattice

Medulla thickness : $67.2 \pm 1.0 \mu\text{m}$

Medullary index : 0.77 ± 0.01

D Cross section

Type of cross section : Oblong

Medulla size in cross section : Large

Tail

A Physical characteristics

Colour : black/dark brown throughout

Total thickness (T) : $102.7 \pm 0.46 \mu\text{m}$

Length index : 39.4 ± 0.07

Shape and Nature : Straight and thin

B Cuticular Scale Pattern

At mid : SP regular wave, SM smooth, DS distant; at proximal, SP regular wave SM smooth, DS distant; At distal : SP regular wave, SM smooth, DS distant

Scale index : 4.25 ± 0.01

C Medulla

Medullary configuration : Wide Aeriform Lattice

Medulla thickness : $86.3 \pm 0.50 \mu\text{m}$

Medullary index : 0.84 ± 0.01

D Cross section

Type of cross section : Oblong

Medulla size in cross section : Large

RESULTS AND DISCUSSION

Physical characteristics : Coat color is known to vary from juveniles to adults in many mammals. However, it has been reported by Menon (2003), that color of coat varies from different regions of distribution in case of *Ratufa indica* (Erxleben) an endemic squirrel. The dorsal region is a mixture of maroon and black with under parts cream and buff. In the northern Western Ghats this squirrel is brownish-maroon in appearance, with an all brown and white tail. In south it is black and dark maroon with a black and brown tail, whereas in the central and Southeastern Indian forms has brown color coat on the back with black hair on forelegs and have black tail with a pale tip. Malayan or Black Giant squirrel, *Ratufa bicolor* (Sparrman), is deep brown or black on the back and buff beneath. It has large black ears with hairy tufts, a black tail and black marks on its chin. The forelegs are black in front and buff on the back. Grizzled giant squirrel *Ratufa macroura* (Pennant), this endangered squirrel is comparatively smallest and has brownish gray coat with pale hair tips giving it a grizzled look. Its ventral surface is dirty white and tail has white bands. Ears and head are dark brown

or black. Thus the color of hair from all body regions of the species of *Ratufa* although noted for the record in the present study but not taken into consideration for the key for identification of species. However, in case of Indian species of *Ratufa*, the banding is not the characteristic feature of the primary guard hair from all regions examined. But, bandwidth was noted to be characteristics of the genus *Callosciurus* of family Sciuridae and has been utilized in development of the key for identification of the species (Bahuguna 2008) as one of the important physical features. Length indices for all three species for primary guard hair from all body regions were: for *Ratufa bicolor* (Sparrman) 30.3 ± 0.0 (for dorsal), 24.5 ± 0.0 (for ventral), 16.80 ± 0.0 (for head) and 51.7 ± 0.25 (for tail); for *Ratufa indica* (Erxleben) they were 39.2 ± 0.1 (for dorsal), 14.6 ± 0.16 (for ventral), 17.81 ± 0.06 (for head), 57.19 ± 0.25 (for tail). In case of *Ratufa macroura* (Pennant) length indices were 46.04 ± 0.5 (for dorsal), 35.45 ± 0.016 (for ventral), 13.76 ± 0.04 (for head) and 39.4 ± 0.07 (for tail). Length indices were noted to be maximum of *Ratufa macroura* (Pennant) for dorsal hair, of *Ratufa bicolor* (Sparrman) for ventral, of *Ratufa indica* (Erxleben) for head and tail. Length indices were used as an additional physical characteristics of hair (Bahuguna 2008) to know its consistency in identification of the species. In the present study the species of *Ratufa* examined showed the interspecific variability in length indices as noted in case of Indian species of *Callosciurus* (Bahuguna 2008).

Medulla characteristics : In all three species examined for hair characteristics of primary guard hair, medulla type was Wide Aeriform Lattice (figs 1, 6, 11, 17, 28, 33, 38, 43, 53, 58) from all body regions except simple medulla type in ventral guard hair of *Ratufa macroura* (Pennant) and dorsal guard hair of *R. indica* (Erxleben) (fig 23, 49,). Medulla type was also noted to be characteristics of the orders of mammals so far examined with only few variations (Bahuguna *et al* 2007). Medullary indices of the species examined were : for *Ratufa bicolor* (Sparrman) 0.70 ± 0.6 (dorsal), 0.59 ± 0.0 (for ventral), 0.51 ± 0.25 (for head), 0.89 ± 0.01 (for tail); for *Ratufa indica* (Erxleben), 0.76 ± 0.01 (for dorsal), 0.52 ± 0.01 (for ventral), 0.70 ± 0.02 (for head), 0.76 ± 0.01 (for tail); for *Ratufa macroura* (Pennant) $0.86 \pm$

0.01 (for dorsal), 0.66 ± 0.0 (for ventral), 0.77 ± 0.01 (for head), 0.84 ± 0.01 (for tail). The medullary indices, thus recorded were the characteristics of the species for hair of all body regions, hence considered an important characteristic of hair for the identification of species of Genus *Ratufa*.

Cross-section types in all hair examined were oblong with large sized medulla (figs 3, 8, 14, 21, 25, 30, 36, 40, 44, 49, 54, 59) except in case of hair from ventral region, which was medium sized for all the species examined.

Cuticular characteristics : In case of *Ratufa macroura* (Pennant) (figs 45-47, 50-52, 55-57, 60, 61), the pattern was regular wave with rippled margin and near in all dorsal, ventral and head. But in tail region pattern is regular wave with smooth margin and distant.

In case of *Ratufa indica* (Erxleben), the cuticular pattern was regular wave, with rippled margin and near in case of hair from all body regions (figs 23, 24, 26, 27, 29, 31, 32, 34, 35, 37, 39, 41, 42). The cuticular pattern of *Ratufa bicolor* (Sparrman), was regular wave, with rippled margin and near in case of primary guard hair of dorsal, ventral but in tail regions it is irregular wave with rippled margin and near at proximal and mid but at distal it was with smooth margin (figs 2-5, 7, 9, 10, 12-15). However hairs from head showed regular wave pattern with scalloped margin and distance between scales were near (figs 18-20, 22). Cuticular characteristics are known to be species specific in many studies (Chakraborty and De 1995, De *et al* 1998, Bahuguna and Mukherjee 2000, Pradhan *et al* 2005, Bahuguna 2007). Scale indices of dorsal primary guard hair of *R. indica* and *R. bicolor* were noted to be almost same but in *R. macroura* it was noted to be 6.24 ± 0.32 in all species examined for dorsal primary guard hair. However they were noted to be different in case of primary guard hair from other body regions. Scale index of the guard hair of ventral region of *R. bicolor* was noted to be 5.3 ± 0.01 and of *R. indica* was 6.5 ± 0.01 and that of *R. macroura* was 6.3 ± 0.0 . Scale index of primary guard hair of head of *R. bicolor* was 4.17 ± 0.0 and of *R. indica* was 7.3 ± 0.0 and of *R. macroura* was 4.4 ± 0.0 . Scale index of tail of *R. bicolor* was 2.86 ± 0.01 , *R. indica* 6.5 ± 0.01 and of *R. macroura* was 4.25 ± 0.01 .

Same type of results have been obtained by the SEM, so far cuticular pattern, scale margin etc. are concerned.

Dorsal guard hair has been utilized since the history of trichotaxonomy for identification of species and development of key for identification because of the consistency in hair characteristics as reported by Mayer (1952), Appleyard (1960), Brunner and Coman (1974), Chakraborty and De 1995, Pradhan *et al.* (2005). However it has been realized that hair characteristics of primary guard hair from other body regions are equally important and should also be recorded. Since it is difficult to collect hair samples from large number of specimens, (especially for threatened and endangered species), thus it is recommended to have the record of hair characteristics from all body regions for further comparisons from other samples. This is required for dealing with wildlife forensic cases.

Based on characteristics of primary guard hair from all body regions, key was prepared, which is useful in identification of species of Genus *Ratufa* for various biological studies including Wildlife forensic.

Key for identification of Indian species of *Ratufa* based on characteristics of primary guard hair :

Dorsal

- 1 Medulla type : Wide Aeriform Lattice, cross section : oblong , large size medulla; Scale Pattern : regular wave, Scale Margin : rippled, Distance between scales near; mean scale indices range : 6.0 to 6.2
Medullary index : 0.70 ± 0.66 , length index 30.3 ± 0.09 *Ratufa bicolor*; Medullary index > 0.70 , length index : > 30.3 2
- 2a. Medullary index 0.86 ± 0.01 , length index 46.04 ± 0.5 *Ratufa macroura* (Pennant)
- 2b. Medullary index 0.76 ± 0.01 , length index 39.2 ± 0.1 *Ratufa indica* (Erxleben)

Ventral

1. Cross section : Oblong, Medium sized medulla; Scale pattern : regular wave, Scale margin : rippled, Distance between scales : near-,
Medulla Wide Aeriform lattice 2
Medulla simple 3

- 2a Medullary index 0.59 ± 0.0 , Length index 24.5 ± 0.0 , Scale index 5.3 ± 0.01 *Ratufa bicolor* (Sparman)
- 2b Medullary index 0.52 ± 0.01 , Length index 14.6 ± 0.16 , Scale index 6.5 ± 0.01 *Ratufa indica* (Erxleben)
- 3 Medullary index 0.66 ± 0.0 , Length index 35.4 ± 0.0 , Scale index 6.3 ± 0.0 *Ratufa macroura* (Pennant)

Head

1. Cross section : Oblong, Large sized medulla; Medulla : Wide Aeriform Lattice
Scale pattern : regular wave, Scale margin : rippled, Distance between scales : near 2
Scale margin scalloped 3
- 2a. Length index : 13.7 ± 0.0 , Medullary index 0.77 ± 0.04 , Scale index 4.4 ± 0.0 *Ratufa macroura* (Pennant)
- 2b. Medullary index 0.70 ± 0.0 , Length index 17.8 ± 0.0 , Scale index 7.3 ± 0.0 *Ratufa indica* (Erxleben)
3. Medullary index 0.51 ± 0.2 , length index 16.8 ± 0.0 , Scale index 4.17 ± 0.0 *Ratufa bicolor* (Sparman)

Tail

1. Cross section : oblong, large medulla, Medulla : Wide Aeriform Lattice, medullary index < 0.80
..... 2
Medullary index > 0.80 3
- 2a. Scale pattern : regular wave, Scale margin : rippled, Distance between scales near; Medullary index 0.76 ± 0.0 ; Length index 57.2 ± 0.2 , Scale index 6.5 ± 0.01 *Ratufa indica* (Erxleben)
- 2b. at proximal : Scale pattern : Irregular wave, Scale margin : rippled, Distance between scales : near; at mid : Scale pattern : Irregular wave, Scale margin : slightly rippled, Distance between scales : near; at distal : Scale pattern Irregular wave, Scale margin : smooth, Distance between scales near ; Medullary index 0.89 ± 0.01 , Length index 51.7 ± 0.2 ; Scale index 2.86 ± 0.01 *Ratufa bicolor* (Sparman)

3. Scale pattern : regular wave, Scale margin : smooth, Distance between scales : distant; Medullary index: 0.84 ± 0.01 ; Length index: 39.0 ± 0.0 , Scale index 4.25 ± 0.01
..... *Ratufa macroura* (Pennant)

SUMMARY

The paper describes the characteristics of primary guard hair of dorsal, ventral, head and tail regions of Indian species of Genus *Ratufa* Gray namely *Ratufa macroura* (Pennant), *Ratufa indica* (Erxleben) and *Ratufa bicolor* (Sparrman) which have been listed under Indian Wildlife Protection Act (1972 as amended upto 2006). It was noted that medulla of hair was of Wide Aeriform Lattice type for all the species examined except that of primary guard hair of ventral region of *Ratufa macroura* (Pennant), in which it was simple medulla type. Cuticular architecture was same in all species i.e. Scale pattern : regular wave, Scale margin: rippled, Distance between scales: near, except in case of hair of head and tail of *Ratufa bicolor* (Sparrman) and tail of *R. macroura* (Pennant). Hair cross-section types were also same i.e. oblong. Various dimensions studied in case of all the three species indicated interspecific variations in medullary indices (M/T) and length indices (L/T). Scale indices (max. length of scale/

max.width of scale) were noted to be of range 6.0-6.2. The key was prepared for identification of species by utilizing the characteristics of primary guard hair from all body regions.

Key words : Trichotaxonomy, *Ratufa bicolor* (Sparrman), *Ratufa indica* (Erxleben), *Ratufa macroura* (Pennant), light microscopic study, Scanning electron microscopic study.

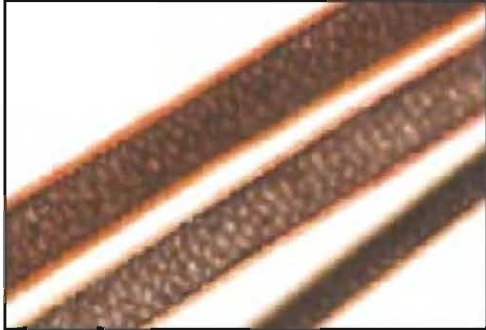
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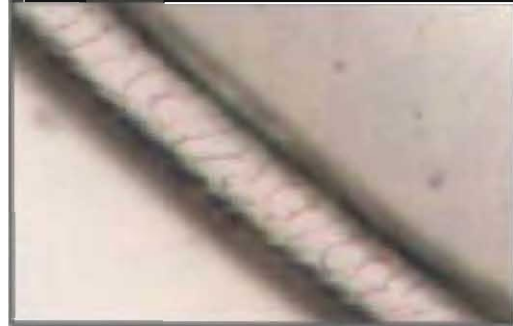
REFERENCES

- Anon 1995. Characterization of *Panthalops hodgsoni* fibers. *Corpo Forestale Dello Stato-Italia, Servizio CITES*, provisional draft.
- Appleyard, H.M. 1960. Guide to the identification of animal fibers. *Wool Industries Research Association* : 118.
- Bahuguna, A and Mukherjee, S.K. 2000. Use of SEM to recognize Tibetan antelope (Chiru) hair and blending in wool products. *Science & Justice* **40**(3) : 177-182.
- Bahuguna, A. 2007. Trichotaxonomy of Red giant flying squirrel, *Pataurista pataurista* (Pallas) and Northern palm squirrel, *Funambulus pannantii* Wroughton (Mammalia : Rodentia : Sciuridae). *Ann. For.*, **15**(2) : 58-69.
- Bahuguna, A. 2008 Identification of Indian species of *Callosciurus* Gray, through dorsal guard hair (Mammalia : Rodentia : Sciuridae), *Biosystematica* **1**(2) : 25-32.
- Bahuguna, A., Shajpal, V., Goyal, S.P., Mukherjee, S.K. and Thakur, V. 2010. Forensic manual, Species Identification from Guard Hair of Selected Indian Mammals. Pub : Wildlife Institute of India, pp : 400.
- Brunner, H. and Coman, B. 1974. The identification of mammalian hair. Shanghai Printing Press Ltd., Hong Kong.
- Chakraborty, S. and De, J.K. 1995. Structure and pattern of Cuticular scales of Mid dorsal guard hair of Marbled Cat, *Felis marmorata charltoni* Rec. Zool. Surv. India, **95**(1-2) : 65-70.

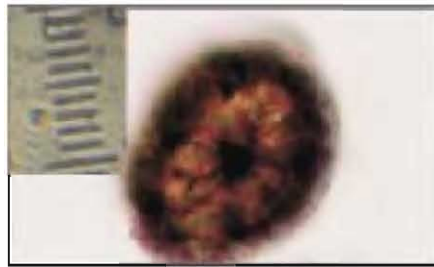
- De, J.K., Chakraborty, S. and Chakraborti, R. 1998. Identification of dorsal guard hairs of five Indian species of MongOOSE-*Herpestes illiger* (Mammalia : Carnivora) *Mammalia*, t. **62**(2) : 285-295.
- Krapp, F. 1998 Squirrels, In : *Grizimek's Encyclopedia*, Mammals McGraw Hill publishing company. **3** : 83-88.
- Kumar, A. & Khanna, V. 2006. Globally Threatened Indian Fauna-Status. Issues and Prospects : 1-104 (Published by the Director, Zool. Surv. India, Kolkata).
- Mathiak, H.A. 1938. A key to the hairs of mammals of Southern Michigan, *J. Wildl. Mgm.* **2** : 251.
- Mayer, W.V.C. 1952. The hair of Californian mammals with keys to the dorsal guard hairs of California mammals. *Amer. Midl. Nat.* **48** : 480.
- Menon, V. 2003. *Squirrels* In : The Field Guide To Indian Mammals, (Eds Daniel, J.C., Johnsingh, A.J.T., Kumar, A, Ommer, N.P. and Choudhury, A.) Pub : Dorling Kindersley (India) Pvt. Ltd. 126-133.
- Nath, S. and Joseph, J. 1981. Preparation of a key for identification of Animal by the structure of their hair. FRI, 16p. 3rd Diploma course.
- Pennant 1769. *Sciurus macrourus*, *Indian Zool.*, 1, pl. 1.
- Pradhan, M.S., Mondal, A.K. and Bhagwat, A.M. 2005. On taxonomic status of *Bandicota bengalensis lordi* (Wroughton) and *Bandicota maxima* (Pradhan, *et al.*) (Subfamily : Murinae; Family : Muridae; Order : Rodentia). *Rec. Zool. Surv. India* : **104**(1&2) : 85-900.
- Sparrman 1778. *Sciurus bicolour*, Samhelle Hand (Wet. Afd.). **1** : 70.
- Wildman, A.B. 1954. The microscopy of animal textile fibers. *Wool Industries Research Association*, Leeds.
- Williams C.S. 1938. Aids to the identification of mole and shrew hairs with general comments on hair structure ad hair determination. *J. Wildl. Mgmt.* **2** : 239.

PLATE 1*Ratufa bicolor* (Sparrman, 1778) (Large Malaya squirrel)**Dorsal**

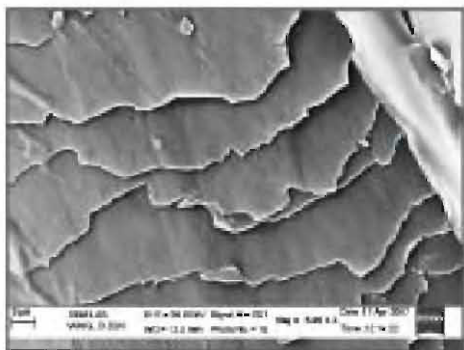
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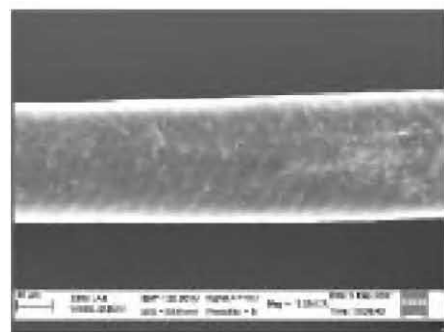
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Figs. 1-3. Photomicrographs using compound light microscope

1 : Medulla type : Wide Aeriform Lattice, x200

2 : Cuticular pattern at distal portion of the hair x200

3 : Cross section : Oblong type with large medulla, x200

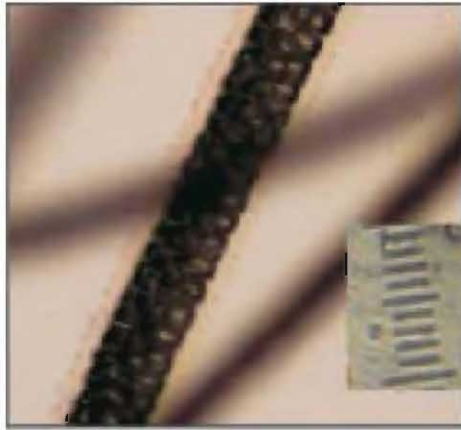
Figs. 4-5. Scanning electron micrographs

4, 5 : Cuticular scale pattern at mid of hair : SP regular wave, DS : near, SM rippled

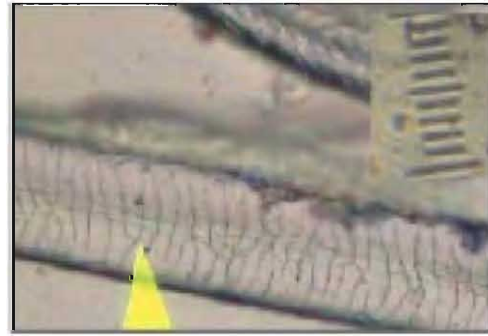
PLATE 2

Ratufa bicolor (Sparman, 1778) (Large Malaya squirrel)

Ventral



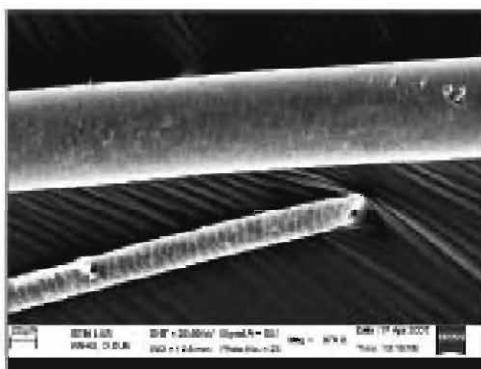
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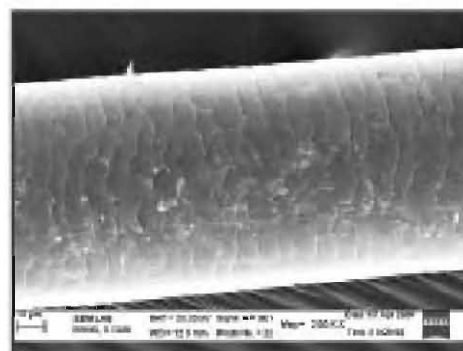
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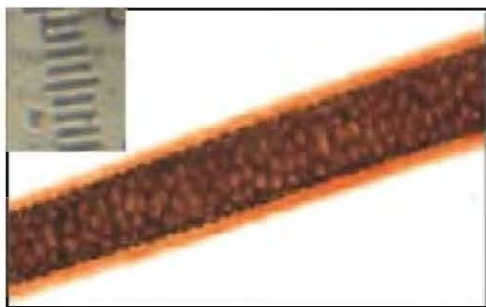
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- Figs. 6-8.** Photomicrographs using compound light microscope
 6 : Medulla type Wide Aeriform Lattice with indentations in cortex x200
 7 : Cuticular pattern : SP : regular wave, DS near, SM : rippled x200
 8 : Cross section type : oblong with medium sized medulla x200
- Figs. 9,10.** Scanning electron micrographs
 9 : Cuticular pattern at mid and proximal portion SP: regular wave, DS near, SM : rippled
 10 : Cuticular pattern towards distal portion

PLATE 3

Ratufa bicolor (Sparman, 1778) (Large Malaya squirrel)

Head



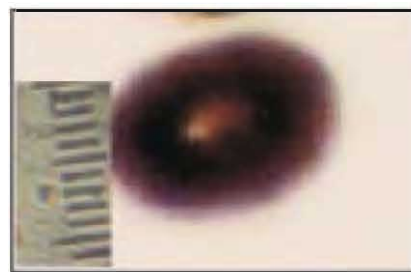
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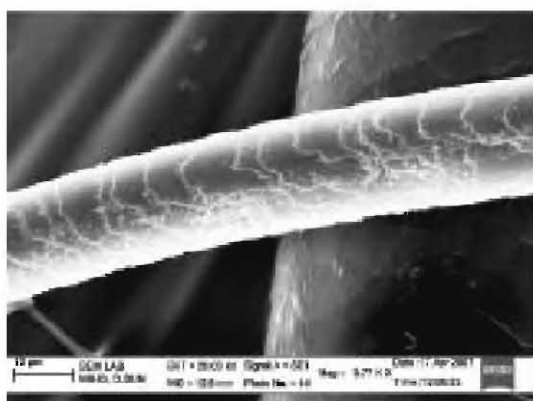
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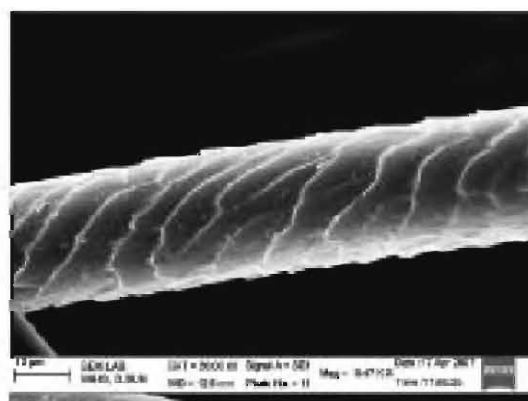
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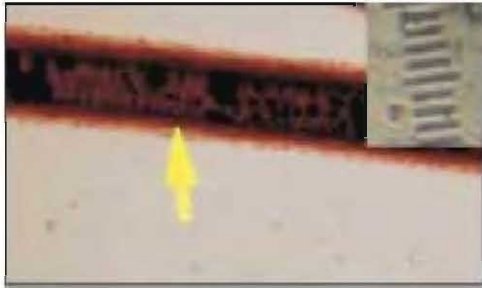
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- Figs. 11-14.** Photomicrographs using compound light microscope
 11 : Medulla type : Wide Aeriform Lattice with indentations in cortex , x200
 12 : Cuticular pattern at proximal portion of hair, x200
 13 : Cuticular pattern at mid of hair x200
 14 : Cross section : oblong, large sized medulla x200
- Figs. 15-16.** Scanning electron micrographs
 15 : at mid and proximal end of hair
 16 : at distal portion

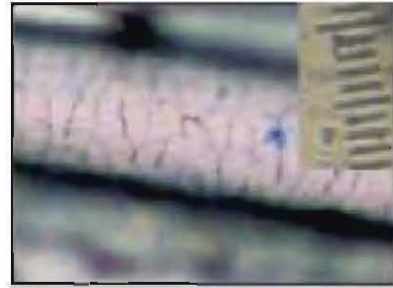
PLATE 4

Ratufa bicolor (Sparman, 1778) (Large Malaya squirrel)

Tail



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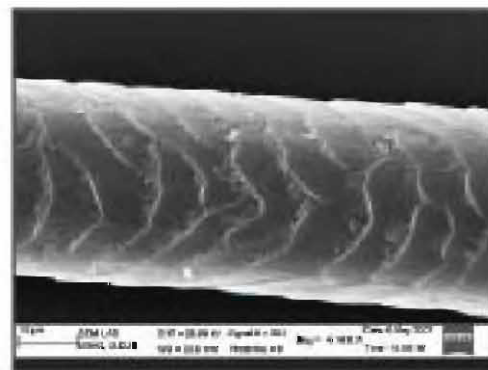
19



20



21



22

Figs. 17-21. Photomicrographs using compound light microscope

17 : Medulla type : Wide Aeriform Lattice without indentations , x200

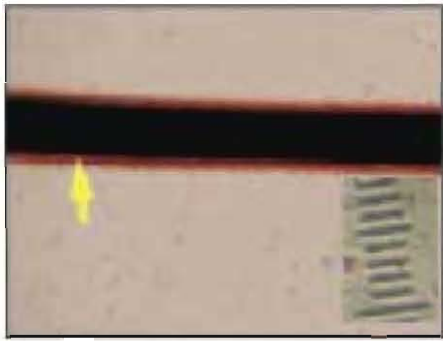
18 : Cuticular pattern at mid SP regular wave, DS near, SM rippled x200

19 : at proximal SP Irregular wave, DS near, SM slightly rippled x200

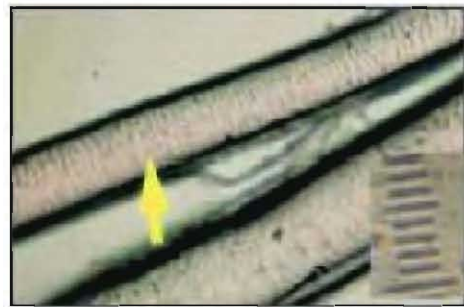
20 : at distal SP Irregular wave, DS near, SM smooth x200

21 : Cross section : oblong type, large medulla x200

Fig. 22. Scanning electron micrograph Cuticular pattern at mid SP Irregular wave, DS near, SM smooth

PLATE 5*Ratufa indica* (Erxleben, 1777) (Indian giant squirrel, Malabar squirrel)**Dorsal**

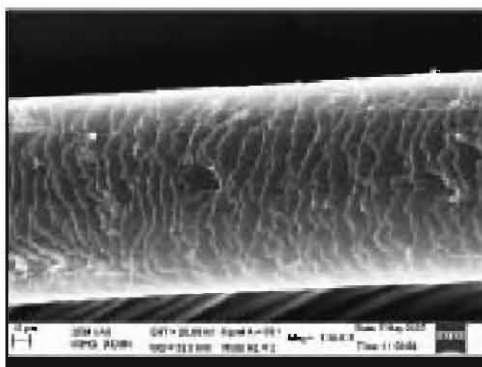
23



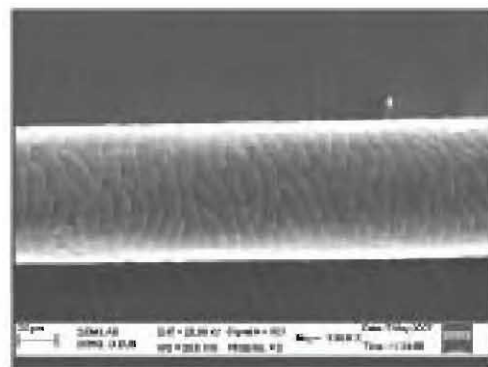
24



25



26



27

Figs. 23-25. Photomicrographs using compound light microscope

23 : Medulla type : Simple medulla (highly pigmented) x200

24 : Cuticular pattern at mid, SP regular wave, SM rippled and DS close x200

25 : Cross section type : oblong, medulla size: large x200

Figs. 26-27. Scanning electron micrograph

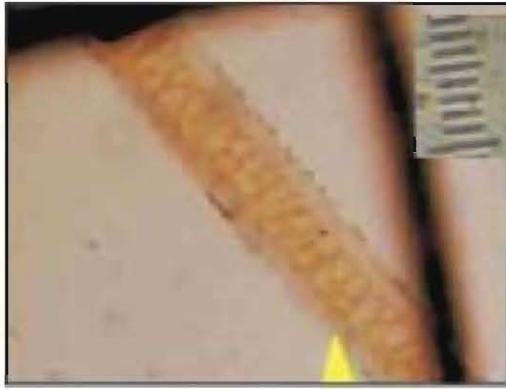
26 : Cuticular pattern at mid of hair

27 : towards proximal portion

PLATE 6

Ratufa indica (Erxleben, 1777)

Ventral



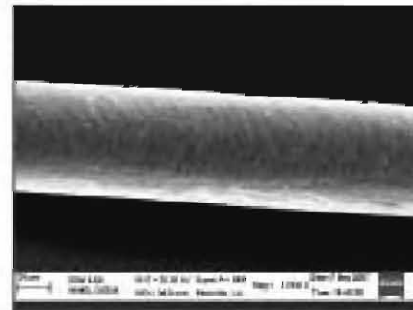
28



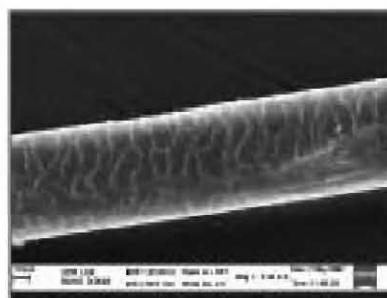
29



30



31



32

Figs. 28-30. Photomicrographs using compound light microscope

28 : Medulla type : Wide Aeriform Lattice x200

29 : Cuticular pattern at proximal end, SP regular wave, SM rippled and DS near x200

30 : Cross section : oblong, medium sized medulla x200

Figs. 31-32. Scanning electron micrographs

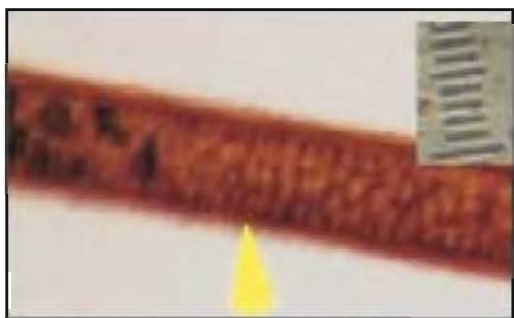
31 : at mid SP regular wave, SM rippled and DS near

32 : at proximal SP regular wave, SM rippled and DS near

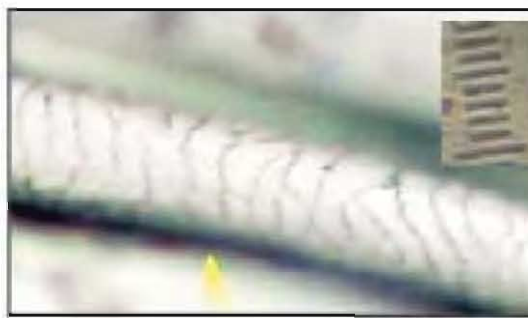
PLATE 7

Ratufa indica (Erxleben, 1777)

Head



33



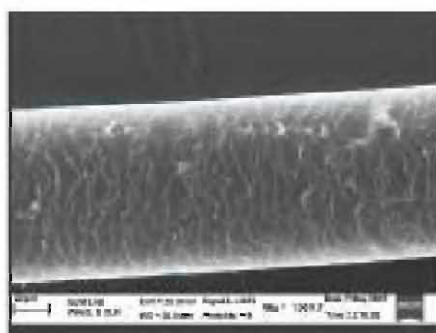
34



35



36



37

Figs. 33-36. Photomicrographs using compound light microscope

33 : Medulla type : Wide Aeriform Lattice x200

34 : Cuticular pattern at distal portion (transitional type) x200

35 : Cuticular pattern at mid of hair x200

36 : cross section oblong, large sized medulla x 200

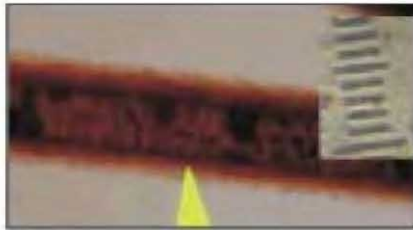
Fig. 37. Scanning electron micrograph

37 : Cuticular pattern at mid of hair: SP regular wave, SM rippled and DS near

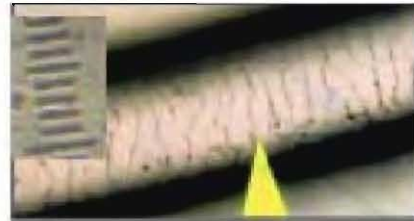
PLATE 8

Ratufa indica (Erxleben, 1777)

Tail



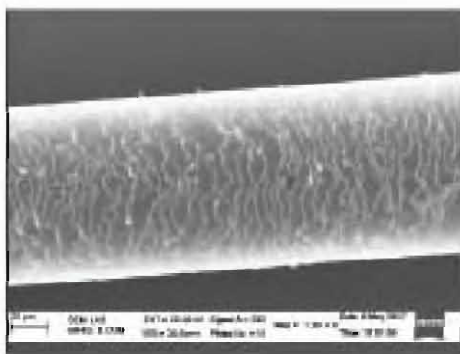
38



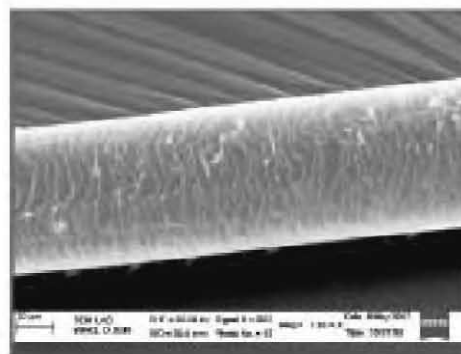
39



40



41



42

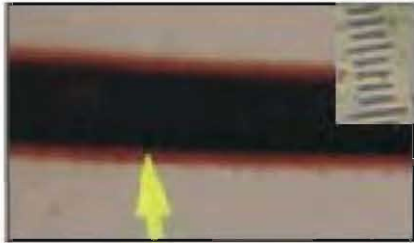
Figs. 38-40. Photomicrographs using compound light microscope

38 : Medulla type Wide Aeriform Lattice x200

39 : Cuticular pattern at mid of hair x200.

40 : Cross section : oblong x200

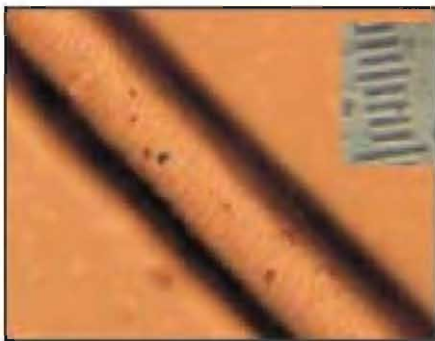
Figs. 41-42. Scanning electron micrographs, 41 at mid, 42 towards proximal

PLATE 9*Ratufa macroura* (Pennant 1769)**Dorsal**

43



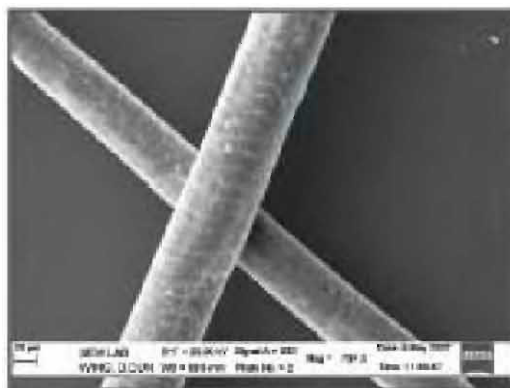
44



45



46



47

Figs. 43-47. Photomicrographs using compound light microscope

43 : medulla type : Wide Aeriform Lattice, with indentations in cortex x200

44 : cross section: oblong, large medulla x200

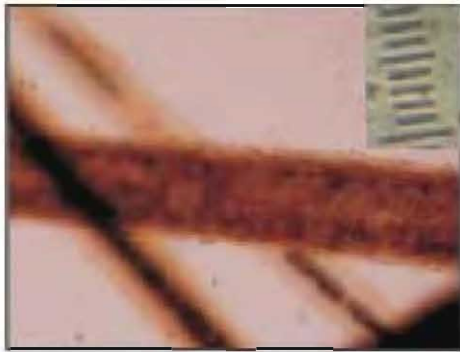
45-46 : cuticular patterns at proximal, 46 at mid SP regular wave, SM rippled DS near x200

Fig. 47. Scanning electron micrograph at mid

PLATE 10

Ratufa macroura (Pennant 1769)

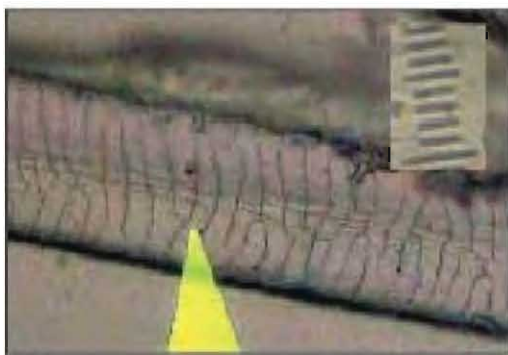
Ventral



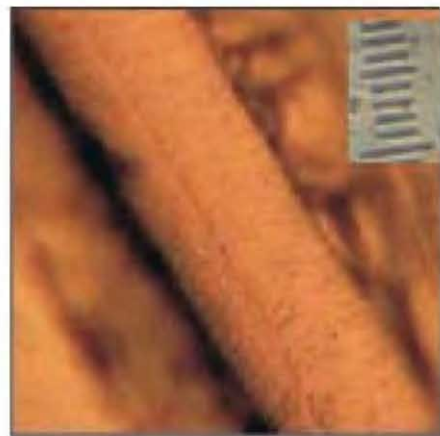
48



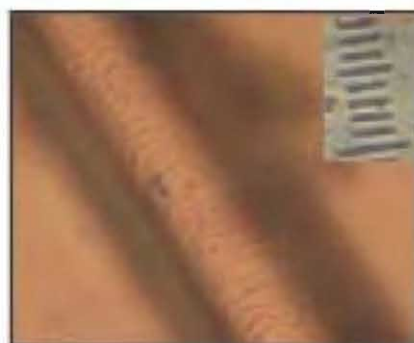
49



50



51



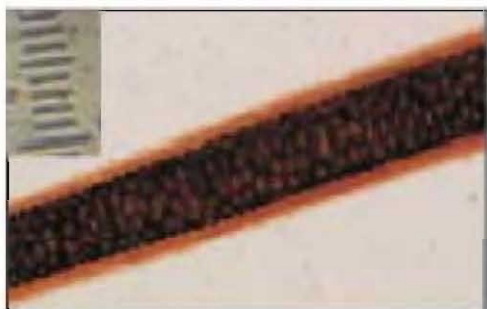
52

Figs. 48-52. Photomicrographs using compound light microscope

48 : Medulla type : Simple medulla x200

49 : Cross section : oblong x 100

50-52 : Cuticular pattern at mid (50), at proximal (51), at distal (52) : SP regular wave, SM rippled, DS near x200.

PLATE 11*Ratufa macroura* (Pennant 1769)**Head**

53



54



55



56



57

Figs. 53-57. Photomicrographs using compound light microscope

53 Medulla type: Wide Aeriform Lattice, with indentations (x200)

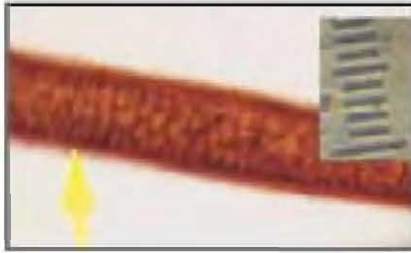
54 cross section: oblong (x200)

55-57 cuticular architecture : distal (55) SP Irregular wave, SM smooth, DS near, proximal (56) SP transitional type, SM smooth (slightly rippled) DS near and mid (57) SP Irregular wave, SM rippled, DS near x200.

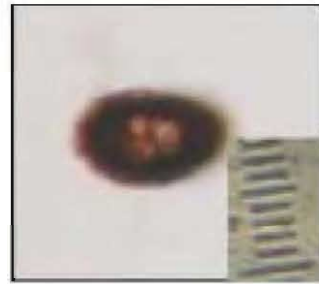
PLATE 12

Ratufa macroura (Pennant 1769)

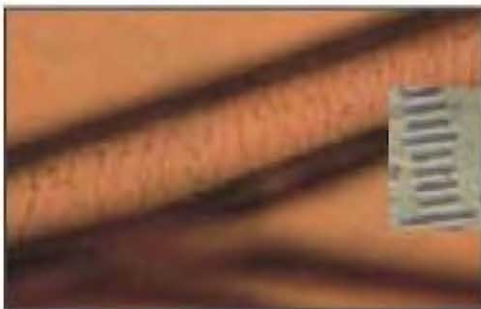
Tail



58



59



60



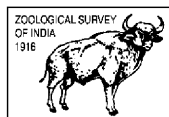
61

Figs. 58-61. Photomicrographs using compound light microscope

58 : Medulla type : Wide Aeriform Lattice with indentations (x200)

59 : Cross section : oblong, large sized medulla (x200)

60-61 : cuticular pattern at mid (Fig 60) SP regular wave, SM rippled, DS near (x200), at distal (Fig 61) SP regular wave, SM rippled, DS near (x200)



Rec. zool. Surv. India : 110(Part-3) : 59-60, 2010

OCCURRENCE OF A REEF FISH, *PARAMONACANTHUS JAPONICUS* (TILESIUS, 1809) IN VELLAR ESTUARY, SOUTH EAST COAST OF INDIA

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INTRODUCTION

Paramonacanthus japonicus is a coral reef fish belonging to the family Monacanthidae of the class Actinopterygii and the order Tetraodontiformes. This species was first reported by Tilesius (1809) from the Japan coast. Even though it occurs in marine waters, its origin is originally from reef region (<http://www.zipcodezoo.com>). Some members of this family are used for aquarium trade also. There are approximately 22 species were reported in this genus (<http://www.zipcodezoo.com>). Among the various group of this family, *P. japonicus* is found to be common in reef regions, lagoons and soft bottom areas of the sea. In the present study, this species was recorded for the first time as shoal in the Vellar estuary and there is no earlier report available for their distribution in Indian estuaries.

In a routine survey of fishes made at the Vellar estuary revealed that a large number of *P. japonicus* (Fig. 1) was recorded. The fishes were found in the upper reaches of the Vellar estuary on 15th March, 2009 and no specimen was found in the subsequent days. The fishes were collected by encircling the net and immediately after collection they were transported to the hatchery and accommodated into a glass tank filled with fresh and filtered estuarine water with artificial aeration. 20 nos. of fishes were collected, in which the largest fish measuring was 63 mm length, 45 mm body depth and 6.85 gm weight. The water sample was also collected from the fishing site and the physicochemical parameters were recorded. The salinity was 25 ppt, D.O. 6 mg/l, temperature 28°C and pH 7.8.

SYSTEMATIC ACCOUNT

Order TETRAODONTIFORMES

Family MONACANTHIDAE

Paramonacanthus japonicus (Tilesius, 1809)

DESCRIPTION

The body was laterally compressed. Head and the body covered with lathery skin, very dark or brown in colour and they had three dark distinct bands on the body in upward direction. The caudal fin was wedge shaped and anal fin had rudimentary spines with 2-3 dark brown vertical bands. The first dorsal fin has one

Table-1 : Morphometric characters.

Characters	Measurements (cm)
Total length	6.3
Standard length	4.9
1 st dorsal fin length	2.1
2 nd dorsal fin length	0.7
Pectoral fin length	0.7
Anal fin length	0.6
Caudal fin length	1.4
Pectoral fin length	0.3
2 nd dorsal fin base length	1.7
Anal fin base length	1.6
Distance from snout to 1 st dorsal	1.9
Distance from snout to gill slit	1.9
Eye diameter	0.4



Fig. 1 : *Paramonacanthus japonicus*.



Fig. 2 : Colour changing behaviour of *Paramonacanthus japonicus* in the rearing tank.

strong spine with invert serration of 8-10 small spines. The dorsal and anal fins were commencing from opposite point to each other and ended near to the caudal fin. Second dorsal and anal fins were modified as rays and ended near to the rounded caudal fin. The snout was piggy shaped and the eyes were distinct which is situated just below the first dorsal spine. Gill slits have very small opening (Table-1). Upper jaw usually with three teeth in outer and two in the inner series on each premaxillary. The colour of the fish was observed to change during rearing in captive condition (Fig. 2). The fishes become fully dark black or faint, if any object come together. This is the peculiar adaptation of these fishes and because of this, the aquarist prefer these fishes.

DISTRIBUTION

The fishes are distributed widely in Bay of Bengal, East and west China, Great Barrier Reef, Gulf of Thailand, Hong Kong, Indian Ocean, Indonesian Sea, Indo-West Pacific, Southern Japan and North West Australia to Papua New Guinea, Malaysia, Taiwan and other parts of the world (<http://www.zipcodezoo.com>).

REMARKS

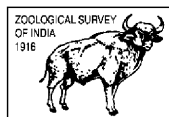
Monacanthidae fishes are very common in coastal and reef waters of Indian and Western Pacific Ocean. *Paramonacanthus japonicus* was reported first time from the Gulf of Mannar region of Indian waters by Senthil Kumar (2001). This species inhabits the vicinity of reef environments, hide themselves among various plants or attached with animals. It feeds on wide variety of benthic invertebrates, corals or zooplankton (<http://www.fishbase.com>). A study conducted by Masuda et al. (1984) reported that the juveniles are some time moving towards the seaweed and seagrass beds in shallow water region. The moderate salinity of the estuarine water and the abundance of coastal vegetation, particularly mangroves may be the possible reason of this fish into the estuary.

ACKNOWLEDGEMENT

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REFERENCES

- Fishbase, 2008. A global information system on fishes. Available at <http://www.fishbase.com/summary/species/summary>. ID = 7977*Paramonacanthus japonicus*.
- Masuda, H., Amaoka, K., Araga, C., Uyeno, T., Yoshino, T., 1984. The fishes of the Japanese Archipelago. Vol. 1 (text). Tokai University Press, Tokyo, Japan. 437 p. (Text), 370 pls.
- Senthilkumar, R., 2001. Systematics, biochemical and toxinology of Tetradontid fishes (Pisces : Tetradontiformis) of Southeast coast of India. PhD thesis CAS in Marine Biology, Annamalai University, India. pp 139.
- Zipcodezoo.2008. [http://www.zipcodezoo.com/animals/Paramonacanthus japonicus](http://www.zipcodezoo.com/animals/Paramonacanthus_japonicus).



Rec. zool. Surv. India : 110(Part-3) : 61-76, 2010

TAXONOMY AND SYSTEMATICS OF CORAL ASSOCIATED BRACHYURAN CRABS IN GULF OF MANNAR MARINE BIOSPHERE RESERVE

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INTRODUCTION

Indian coral reefs are distributed along the entire east and west coasts. The coral reefs acts as a home for several faunal communities. Gulf of Mannar Marine Biosphere Reserve (GoMMBR) islands situated at south east coast of India are known for its rich coral diversity (Venkataraman *et al.*, 2003b, 2004). Crustaceans play a vital role in the symbiotic association with the coral colonies. Studies have been done on the crustacean cryptofaunal diversity and species richness in GoMMBR (Venkataraman *et al.* 2002, 2003a; Nammalwar and Edwin, 2002; Kathirvel and Gokul, 2006). However among the faunal diversity in coral reef areas, the crustaceans perform a better symbiotic association in coral reef ecosystem. According to Garth (1973) both obligatory and facultative symbiotic crustaceans were associated with the coral colonies. In spite of this it was reported that crustaceans were found to be associated more in the dense branched coral colonies covered with algae than in the colonies having surplus mucus (Coles, 1980). Symbiotic brachyuran crabs were abundant in *Pocillopora* coral colonies covered with algae. Jeyabaskaran (1997) reported the abundance of the brachyuran crabs were more in the branching corals comparatively.

Various studies have been conducted on the taxonomy of the crabs in India (Alcock, 1895, 1896, 1898, 1899a, 1899b, 1900; Sankarankutty, 1967;

Jeyabaskaran *et al.* 2000) as well as across the world (Guinot, 1971, 1976; Galil, 1988; Castro, 1999a, b, c).

The present study emphasized 26 species of brachyuran crabs belonging to 10 genera and 8 families. Out of these 4 species are new to GoMMBR and 2 species are new to India. The present study declares the brachyuran crabs along with the other faunal groups were found to be associated more in the branching corals particularly the *Pocillopora* colonies covered with algae. Based on the previous studies and for conservation aspects the crab collection was restricted to *Pocillopora* coral colonies covered with algae in the islands of GoMMBR. Considering its taxonomical and ecological importance the coral crabs symbiotically associated with *Pocillopora* colonies covered with algae were studied in detail.

SYSTEMATIC ACCOUNT

Phylum ARTHROPODA

Super class CRUSTACEA

Sub class MALACOSTRACA

Order DECAPODA

Family PORTUNIDAE

1. *Portunus brockii* (De Man)

Plate-I, Fig.-a

1887. *Neptunus brockii* De Man, *Archiv f. Naturgesch*, p. 328.

1976. *Portunus (Monomia) brockii* Sakai, *Crabs of Japan and adjacent seas*, p. 343.

Materials : 2 Males. The maximum carapace length (CL) 2.5 cm and the minimum carapace length (CL) 1.0 cm. Reg. No. **ZSI/MBS/5219**.

Diagnosis : Front with 4 flat and indistinct lobes, laterals broader; 9 anterolateral teeth, increasing sharpness from first to the last, last one largest; carapace broader than long with conspicuous elevated patches of granulations on its surface; chelipeds moderately stout, granulated and tomentose; anterior border of arm with 2 spines; wrist with an inner sharp spine and an outer one as a lobule; hand with 3 upper inconspicuous carina and a distinct and granulated carina on outer surface; fingers short and stout; third maxilliped with an antero lateral projection of merus; penultimate segment of male abdomen with slightly convex border; first male pleopod curved, stout and bluntly ending.

Habitat : Sand, mud and mangrove flat; from shore to 22 m deep.

Distribution : Reports on previous records of the species from the GoMMBR : No earlier records in GoMMBR, from India: Andamans Alcock (1899) and from the Indo-Pacific region: Indonesia, Singapore, Australia and Japan (Sakai, 1976).

Remarks : It was recorded from the dead *Pocillopora* coral covered with algae from Poomarichan Island. It was recorded for the first time from the islands of GoMMBR.

2. *Thalamita integra* Dana

Plate-I, Fig.-b

1852. *Thalamita integra* Dana, *U. S. Exploration. Expedition*, p. 85., pl.1.

1976. *Thalamita integra* Sakai, *Crabs of Japan and adjacent seas*, p. 377.

Materials : 3 Males and 4 females; the maximum CL is 2.5 cm and the minimum CL is 1.0 cm.

Diagnosis : Front cut into 2 broad lobes exclusive of broad supraorbital tooth; edges of the frontal lobes and of the broad supra orbital tooth almost transverse and straight; no transverse ridge on cardiac and post-branchial region of carapace; chelipeds smooth; propodus with 4 teeth; upper inner border of propodus of walking legs more or less crested; the sixth segment of male abdomen much broader than long.

Habitat : Inter-tidal sandy areas, coral reefs and under dead coral blocks, up to 8 m deep.

Distribution : Reports on previous records of the species from the GoMMBR: Tuticorin (Henderson, 1893), Vedalai (Sankarankutty, 1967) and islands in GoMMBR (Jeyabaskaran *et al.*, 2000), from the Indian waters: Minicoy, Lakshadweep (Sankarankutty, 1961b) and Andamans (Alcock 1899; Sankarankutty 1961a) and from the Indo-Pacific region: Gulf of Mannar off Sri Lanka (Laurie, 1906) and Red Sea, east coast of Africa, Madagascar, Australia, Tahiti, Japan and Hawaii (Sakai, 1976).

Remarks : It was recorded from the dead *Pocillopora* coral covered with algae from Krusadai and Poomarichan Islands.

Family XANTHIDAE

3. *Halimede ochtodes* (Herbst)

Plate-I, Fig.-c

1783. *Cancer ochtodes* Herbst, *Veruch einer Naturgeschichti der krabben und krebse*, p. 158.

1976. *Halimede ochtodes* Sakai, *Crabs of Japan and adjacent seas*, p. 387.

Materials : 3 Males and 2 females; the maximum CL is 3.5 cm and the minimum CL is 2.5 cm.

Diagnosis : Carapace oval-pentagonal with smooth surface; anterolateral border divided into 4 rounded deep-cut lobes, decreasing in size from behind forwards; front projecting horizontally forward beyond the orbits with 2 uniform lobes; the chelipeds unequal, prominently in males; upper border of the arm cut into teeth or pearl-like tubercles; two tubercles on the inner border of wrist; upper and outer surfaces of the wrist covered with pustulous tubercles; upper border of the hand, and of the basal half of the finger with a row of pisiform tubercles; fingers sharp pointed; the legs smooth, but the upper border of the merus of all, or of the first three pairs serrate or spinulous; the dactylus and the neighboring part of the lower border of the propodite furred.

Habitat : Muddy or sandy bottom, 20 to 35 m deep.

Distribution : Reports on previous records of the species from the GoMMBR: Islands of GoMMBR (Jeyabaskaran *et al.*, 2000), from Indian waters: Chennai coast (Alcock, 1898) and Parangipettai coast (Sethuramalingam and Ajmalkhan, 1991) and from the

Indo-Pacific region: Red Sea, Myanmar, Gulf of Thailand, Malaysia, Singapore, Hong Kong and Japan (Sakai, 1976).

Remarks : It was recorded from the dead *Pocillopora* coral covered with algae from Krusadai Island.

4. *Demanita baccalipes* (Alcock)

Plate-I, Fig.-d

1898. *Xantho* (*Lophoxanthus*) *scaberrimus* var. *baccalipes* Alcock, *J. Asiat. Soc. Bengal*, p.117.

1976. *Demanita baccalipes* Sakai, *Crabs of Japan and adjacent seas*, p.421.

Materials : 10 Males and 6 females; the maximum CL is 2.0 cm and the minimum CL is 0.5 cm.

Diagnosis : Carapace longer than broad and moderately convex; regions and sub-regions of carapace defined by broad, deep and smooth channels and covered with well-defined tubercles; characteristic tubercles with a worn-out appearance especially in the middle of carapace and in the chelipeds; front 2-lobed and fronto-orbital border less than half of width of carapace; anterolateral border 4 lobed; chelipeds equal and covered with large depressed tubercles; 2 tubercles at the inner angle of wrist; anterior border of walking legs marked with wart-like tubercles.

Habitat : Found at the bottom of rocks or broken shells, 15 to 35 m deep.

Distribution : Reports on previous records of the species from the GoMMBR : Jeyabaskaran *et al.*, (2000), from the Indian waters : Okha, Mumbai (Chhapgar, 1957) and Parangipettai coasts (Sethuramalingam and Ajmalkhan, 1991) and from the Indo-Pacific region: Sri Lanka (Alcock, 1898), Malacca Strait and Japan (Sakai, 1976).

Remarks : It was recorded from the dead *Pocillopora* coral covered with algae from Shingle and Krusadai Islands.

5. *Leptodius euglyptus* Alcock

Plate-I, Fig.-e

1898. *Xantho* (*Leptodius*) *euglyptus* Alcock, *J. Asiat. Soc. Bengal*, 67, p.121.

1927. *Xantho* (*Leptodius*) *euglyptus* Gravely, *Bull. Madras Govt. Mus (M.S)*, 1, p. 146, pls. 19-26.

Materials : 60 Males and 83 females; the maximum CL is 2.0 cm and the minimum CL is 0.5 cm.

Diagnosis : Carapace broader than long and convex in its two-thirds; front projecting beyond orbit; anterolateral border cut into 5 conical teeth; chelipeds unequal; upper surface of hand nodular; fingers short and hollowed at tip; carpus and propodus of walking legs longitudinally ridged and grooved above; dactylus furred; side wall of carapace, edge of upper surface of arm of chelipeds and edge of legs hairy.

Habitat : Coral reefs, mostly seen in branching corals and sandy beaches.

Distribution : Reports on previous records of the species from the GoMMBR : Krusadai Island (Gravely (1927) and islands in Gulf of Mannar (Jeyabaskaran *et al.*, 2000), from the Indian waters : Okha (Chhapgar, 1957) and from the Indo-Pacific region : Sri Lanka and Mergui Archipelago (Alcock, 1898).

Remarks : It was recorded from the dead *Pocillopora* coral covered with algae from Shingle, Krusadai, Poomarichan, Pullivasal, Mulli, Vaalai and Thalayari, Appa and Anaipar Islands.

6. *Leptodius exaratus* (H. Milne Edwards)

Plate-I, Fig.-f

1834. *Chlorodius exaratus* H. Milne Edwards, *Librairie Encyclopedique de Roret*, p. 402.

1976. *Leptodius exaratus* Sakai, *Crabs of Japan and adjacent seas*, p. 423.

Materials : 63 Males and 74 females; the maximum CL is 3.5 cm and the minimum CL is 0.5 cm.

Diagnosis : Carapace transversely oval, 1.5-1.6 times broader than long, moderately convex in anterior, almost flat in posterior part; surface smooth and glabrous with well defined regions, areolated in anterior, less in posterior third; front projecting beyond inner orbital angle, bilobed with square cut lobes having anterior margin somewhat concave; anterolateral margins with four teeth behind outer orbital angle; chelipeds unequal in both sexes; unarmed except for small acute tubercle at upper inner angle of wrist; hand of larger cheliped swollen, completely smooth, tips of fingers broadened and hollowed-out; walking legs stout, unarmed and smooth.

Habitat : Intertidal and shallow subtidal of rocky coast and also in mangroves or soft sediment shores; not below 2-3 m deep.

Distribution : Reports on previous records of the species from the GoMMBR : Tuticorin (Henderson, 1893), Krusadai Island (Gravely, 1927), Shingle, Pullivasal and Krusadai Islands (Sankarankutty, 1967), islands in Gulf of Mannar (Jeyabaskaran *et al.*, 2000) from the Indian waters: Okha, Mumbai (Alcock 1898; Chhapgar 1957), Rameswaram (Henderson, 1893), Lakshadweep (Sankarankutty, 1962a) and Andamans (Alcock, 1898) and from the Indo-Pacific region: Red Sea, Persian Gulf, south and east coasts of Africa, Seychelles, Maldives, Sri Lanka, Thailand, Indonesia, Malaysia, Polynesia, Australia, China, Japan and Hawaii (Sakai, 1976).

Remarks : It was recorded from the dead *Pocillopora* coral covered with algae from Shingle, Krusadai, Poomarichan, Manauli Putti, Hare, Mulli, Vaalai and Thalayani and Nallathanni Islands.

7. *Leptodius sanguineus* (H. Milne Edwards)

Plate-I, Fig.-g

1834 *Chlorodius sanguineus* H. Milne Edwards, *Lib. Encyclo. de Roret*, 1, p. 207.

1976. *Leptodius sanguineus* Sakai, *Crabs of Japan and adjacent seas*, p. 422.

Materials : 4 Males and 4 females; the maximum CL is 1.5 cm and the minimum CL is 0.5 cm. Reg. No. **ZSI/MBS/5220**.

Diagnosis : Carapace more convex anteriorly and the branchial lobules more convex; 5 teeth on anterolateral margin, not including the external orbital angle; front distinctly narrow; chelipeds unequal in both sexes; upper surface of wrist more or less wrinkled; a strong tubercle on the inner angle of wrist; hands smooth; tips of fingers broadened and hollowed-out; walking legs stout, unarmed and smooth.

Habitat : Rocky or stony beaches, under stones or in crevices of rock.

Distribution : Reports on previous records of the species from the GoMMBR : No earlier records were carried out from GoMMBR, from Indian waters: Lakshadweep (Alcock 1898; Sankarankutty 1961b) and Andaman and Nicobar Islands (Heller, 1868; Alcock, 1898; Sankarankutty, 1962a) and from Indo-Pacific region: Red Sea, Persian Gulf, east coast of Africa, Maldives, Japan and Hawaii (Borradaile 1902; Sakai 1976).

Remarks : It was recorded from the dead *Pocillopora* corals covered with algae from Krusadai, Poomarichan and Nallathani Islands. It was reported for the first time from GoMMBR.

8. *Leptodius crassimanus* (A. Milne Edwards)

Plate-I, Fig.-h

1867. *Xantho crassimanus* A. Milne Edwards, *Ann. Soc. Entomol. France*, 7(4), p. 267.

1967. *Leptodius crassimanus* Sankarankutty, *Proc. Symp. Crustacea.*, 1, p. 351.

Materials : 1 female. The maximum CL is 4.0 cm and the minimum CL is 3.5 cm.

Diagnosis : Front narrow with edges of its lobes deeply concave with the appearance of quadridentate; carapace anteriorly convex and broader than long; anterolateral border cut into 5 teeth; fingers of cheliped black in colour with white tips and not so broad at tip and also not sharply hollowed; first male pleopod curved and its tip flat and arrow-headed covered with long spines.

Habitat : Found among rocks.

Distribution : Reports on previous records of the species from the GoMMBR : Shingle Island (Sankarankutty, 1967), from the Indian waters : Mumbai (Chhapgar, 1957), Parangipettai (Sethuramalingam and Ajmalkhan, 1991) and Andamans (Alcock, 1898) and from the Indo-Pacific region: Karachi, Sri Lanka and Australia (Alcock, 1898).

Remarks : It was recorded from the dead *Pocillopora* corals covered with algae from Krusadai, Poomarichan and Nallathani Islands.

9. *Etisus laevimanus* (Randall)

Plate-II, Fig.-i

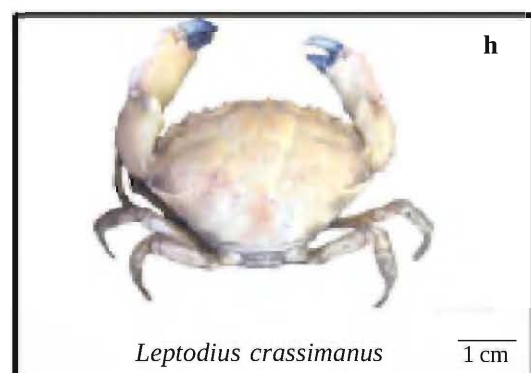
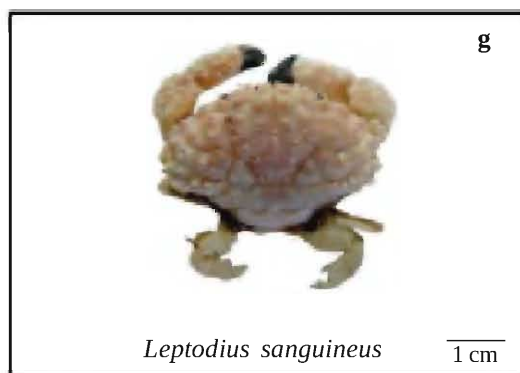
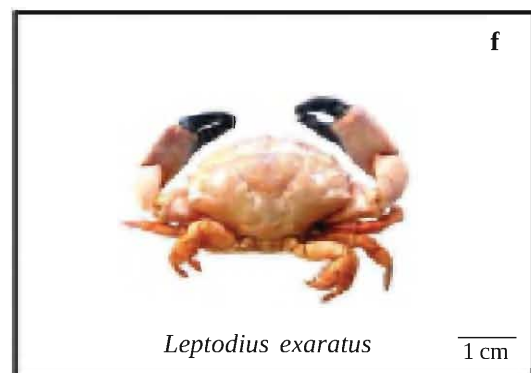
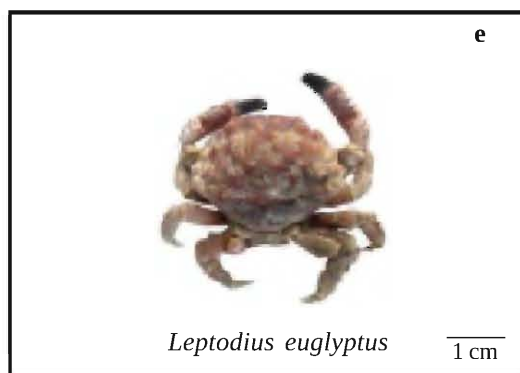
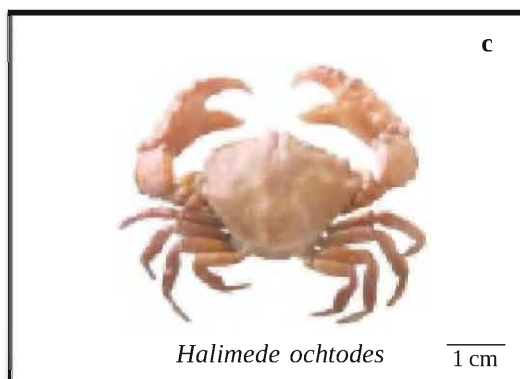
1839. *Etisus laevimanus* Randall, *J. Acad. nat. sci. Phil.*, 8(1), p. 115.

1976. *Etisus laevimanus* Sakai, *Crabs of Japan and adjacent seas*, p. 455.

Materials : 15 Males and 18 females; the maximum CL is 2.0 cm and the minimum CL is 1.5 cm.

Diagnosis : Four teeth (excluding the external angle of orbit) on the anterolateral border; free edge of front bow-shaped; legs not spiny; chelipeds in the adult male two and half of carpace length; the wrist with a blunt spine at the inner angle; walking legs with both edges

PLATE-I



of all long joints hairy, more in the lower edge of the dactylus and the upper edge of the other joints; upper edge of propodus and dactylus strongly granular.

Habitat : Found in live and dead corals.

Distribution : Reports on previous records of the species from the GoMMBR: Tuticorin (Henderson, 1893), Krusadai Island (Gravely, 1927), Kilakkarai (Sankarankutty, 1967) and islands of Gulf of Mannar (Jeyabaskaran *et al.*, 2000), from the Indian waters: Okha and Mumbai (Chhappgar, 1957), Lakshadweep, Andaman and Nicobar Islands (Alcock, 1898) and from the Indo-Pacific region: Red Sea, Persian Gulf, east coast of Africa, Mauritius, Karachi, Sri Lanka, Celebes, Singapore, Reunion Islands, Japan and Hawaii (Alcock 1898; Sankarankutty 1962a; Sakai 1976).

Remarks : It was recorded from the dead *Pocillopora* corals covered with algae from Manauli Putti, Mulli and Anaipar Islands.

10. *Pilodius areolatus* (H. Milne Edwards)

Plate-II, Fig.-j

1834. *Chlorodius areolatus* H. Milne Edwards, *Librairie Encyclopedique de Roret*, 1, p. 400.

1976. *Pilodius areolatus* Sakai, *Crabs of Japan and adjacent seas*, p. 460.

Materials : 6 Males and 10 females; the maximum CL is 1.0 cm and the minimum CL is 0.5 cm.

Diagnosis : Carapace flat and completely lobulated and covered with a coat of very short pubescence; lobules of carapace deeply demarcated and convex; covered with pearly granules of equal size; front deeply and broadly cut into two granular lobe; chelipeds unequal; outer surface of arm, wrist and hand covered with pearly granules; fingers strongly arches; exposed surface of legs covered with a dense spongy fur, from which, the tops of numerous conical shaped granules peep out.

Habitat : Corals reefs in shallow waters.

Distribution : Reports on previous records of the species from the GoMMBR : Islands of Gulf of Mannar (Jeyabaskaran *et al.*, 2000), from the Indian waters: Andaman and Nicobar Islands (Alcock, 1898) and from the Indo-Pacific region : Red Sea, east coast of Africa, Mauritius, Sri Lanka, south seas, Japan and Hawaii (Alcock 1898; Sakai 1976).

Remarks : It was recorded from the dead *Pocillopora* corals covered with algae from Poomarichan and Hare Islands.

11. *Chlorodiella nigra* (Forskål)

Plate-II, Fig.-k

1775. *Cancer niger* Forskål, *Hauniae*, I-XXXIV, p. 89.

1976. *Chlorodiella nigra* Sakai, *Crabs of Japan and adjacent seas*, p. 465.

Materials : 388 Males and 540 females; the maximum CL is 2.0 cm and the minimum CL is 0.3 cm.

Diagnosis : Carapace transversely hexagonal, 1.5-1.6 times as broad as long, slightly convex; surface smooth and glabrous with ill-defined regions; front broad, about 0.4 times the carapace breadth, almost straight with a shallow median notch; anterolateral border with four teeth behind the outer orbital angle, rounded in adult and sharp in juvenile specimens; first tooth often smaller or even indistinct and confluent with outer orbital angle; chelipeds asymmetrical, twice the length of carapace, smooth and unarmed except for a small spine or tubercle on the anterior border of the merus and on the inner margin of the carpus; tips of fingers spoon-shaped. Ambulatory legs stout, smooth with numerous long plumose setae.

Habitat recorded by earlier workers : Found in live and dead corals.

Distribution : Reports on previous records of the species from the GoMMBR: Krusadai Island (Gravely, 1927), Manauli Island (Sankarankutty, 1967) and islands of Gulf of Mannar (Jeyabaskaran *et al.*, 2000), from the Indian waters: Lakshadweep (Borradaile, 1902; 1903), Andaman and Nicobar Islands (Heller 1868; Alcock 1898) and from the Indo-Pacific region: Red Sea, south and east coasts of Africa, Madagascar, Seychelles, Karachi, Mergui Archipelago, Australia, French Polynesia, Japan and Hawaii (Sankarankutty 1962a; Sakai 1976).

Remarks : It was recorded from the dead *Pocillopora* corals covered with algae from Shingle, Krusadai, Poomarichan, Pullivasal, Manauli Putti, Hare, Mulli, Vaalai and Thalayari, Appa, Anaipar, Nallathanni and Upputhanni Islands.

12. *Cymo andreossyi* (Audouin)

Plate-II, Fig.-I

1826. *Pilumnus andreossyi* Audouin, *Des. de l'Egypte, Hist. Nat, Paris*. 1(4), p. 86.1976 *Cymo andreossyi* Sakai, *Crabs of Japan and adjacent seas*, p.467.**Materials** : 11 Males and 6 females; the maximum CL is 1.5 cm and the minimum CL is 0.5 cm.**Diagnosis** : Carapace almost circular, slightly broader than long, surface flat, covered with a short pubescence; front somewhat deflexed, bilobed with wide V-shaped incision; anterolateral margin evenly convex, composed of three lobes covered with granules; chelipeds markedly unequal, covered with tomentum and granules; fingers of larger cheliped stout, truncated, blunt-pointed and deeply hollowed at tip, those of smaller cheliped, though also hollowed, thin, slender and pointed; ambulatory legs stout, thickly covered with long pubescence, dorsal margins of merus finely granular, those of following segments with more acuminate granules.**Habitat** : Coral reefs in shallow waters.**Distribution** : Reports on previous records of the species from the GoMMBR: Tuticorin (Henderson, 1893), Krusadai Island (Gravelly, 1927), Manauli Island (Sankarankutty, 1967) and islands of Gulf of Mannar (Jeyabaskaran *et al.*, 2000), from the Indian waters: Lakshadweep (Borradaile, 1902; 1903) and Andaman and Nicobar Islands (Alcock, 1898) and from the Indo-Pacific region: Red Sea, Persian Gulf, east coast of Africa, Madagascar, Seychelles, Karachi, Mergui Archipelago, Australia, French Polynesia, Japan and Hawaii (Sankarankutty, 1962a).**Remarks** : It was recorded from the dead *Pocillopora* corals covered with algae from Vaalai and Thalayari, Anaipar and Nallathanni Islands.**13. *Actaea cavipes* (Dana)**

Plate-II, Fig.-m

1852. *Actaeodes cavipes* Dana, *U. S. exploration Expedition*, 13 , pl. 1, p. 78.1976. *Actaea cavipes* Sakai, *Crabs of Japan and adjacent seas*, p. 447.**Materials** : 32 Males and 73 females; the maximum CL is 2.5 cm and the minimum CL is 0.4 cm. Reg. No. **ZSI/MBS/5221**.**Diagnosis** : Carapace broader than long, completely lobulated; the lobules covered with military granules and separated by broad grooves; front obliquely depressed with cupid's bow-shaped edge; anterolateral border with 4 or 5 lobes; lobes granular and uneven but not pitted; outer surface of wrist with numerous pits and craters; carpus and propodus of legs with a double longitudinal crest; fingers long, pointed and slightly hollow at tip.**Habitat** : Coral reefs in shallow waters.**Distribution** : Reports on previous records of the species from the GoMMBR: No previous reports were carried out from GoMMBR, from the Indian waters: Lakshadweep (Borradaile 1903; Sankarankutty 1961b) and Andaman and Nicobar Islands (Alcock 1898; Sankarankutty 1961a) and from the Indo-Pacific region: Red Sea, east coast of Africa, Mauritius, Samoa, Fiji, Tahiti, New Caledonia, New Guinea and Japan (Alcock 1898; Sankarankutty 1961b; Sakai 1976).**Remarks** : It was recorded from the dead *Pocillopora* corals covered with algae from Shingle, Krusadai, Poomarichan, Pullivasal, Manauli Putti, Hare and Appa Islands. It was reported for the first time from GoMMBR.**14. *Actaea calculosa* (A. Milne Edwards)**

Plate-II, Fig.-n

1834. *Cancer calculosa* H. Milne Edwards, *Librairie Encyclopedique deRoret*, 1, p. 371.1976. *Actaea tuberculosus* Guinot, *Mem. Mus. Nat. D' hist*, p. 221.**Materials** : 1 Male and 3 females; the maximum CL is 2.0 cm and the minimum CL is 1.0 cm. Reg. No. **ZSI/MBS/5222**.**Diagnosis** : Carapace shorter and broader its length is being only about two thirds of its breadth; the regions and lobules much more distinctly delimited; front sharply bilobed; tubercles on the carapace and chelipeds much smoother and hardly faceted; 4-lobulation of the anterolateral borders more distinct; fingers in chelipeds short, blunt pointed, hardly hollow at tip; the tubercles on the legs never spiny (Plate-II N).**Habitat** : Coral reefs in shallow waters.**Distribution** : Reports on previous records of the species from the GoMMBR : No earlier records were

carried out from both the GoMMBR and the Indian waters, from the Indo-Pacific region: Persian Gulf, Karachi and Mergui Archipelago (Alcock, 1898), Sri Lankan side of Gulf of Mannar (Laurie, 1906), Gulf of Thailand, China Sea, Tahiti, Australia, Kei Islands and Japan (Sakai, 1976).

Remarks : It was recorded from the dead *Pocillopora* corals covered with algae from Krusadai and Manauli Putti Islands. Since there is no earlier record of this species, this record is the first from the Indian waters.

Family PILUMNIDAE

15. *Pilumnus vespertilio* (Fabricius)

Plate-II, Fig.-o

1793. *Cancer vespertilio* Fabricius, *Emendata et aucta*, 2, p. 463, pls.1-8.

1976. *Pilumnus vespertilio* Sakai, *Crabs of Japan and adjacent seas*, p. 484.

Materials : 10 Males and 13 females; the maximum CL is 1.5 cm and the minimum CL is 0.5 cm.

Diagnosis : Carapace, legs and chelipeds (with the exception of the fingers and the lower corner and lower border of the hand, which are bare) entirely concealed by a thick, dark, shaggy coat of coarse, tufted and somewhat matted hairs; two kinds of two hairs, longer and shorter; the longer being most numerous on the legs and on the borders of the carapace; when denuded, carapace transversely oval, nearly 3/4 as long as broad, the regions fairly distinctly delimited and areolated and the surface studded with small well-separated clusters of granules, from which the hairs spring; front obliquely deflexed; the orbital margins, like the edge of the front smooth or obscurely crenulate; the antero-lateral border a little shorter than the posterolateral cut into three spiniform teeth; the chelipeds unequal; inner angle of the wrist sharp, but never spiniform; the upper and outer surfaces of the wrists, of the smaller hand, and of all but the lower border and lower outer corner of the larger hand (which is quite bare and usually quite smooth) covered with clusters of granules; the carpus and propodus of all the legs, and the merus also of the last pair of legs with granular on the anterior and dorsal aspects.

Habitat : Coral reefs and rocky beach in shallow waters.

Distribution : Reports on previous records of the species from the GoMMBR: Tuticorin (Henderson, 1893), Krusadai Island (Gravely, 1927), Manauli Island (Sankarankutty, 1967) and islands of Gulf of Mannar (Jeyabaskaran *et al.*, 2000), from the Indian waters : Okha and Mumbai (Chhapgar, 1957), Lakshadweep (Borrdale 1903; Sankarankutty 1961b), Palk Bay and Andamans (Alcock, 1898), and from the Indo-Pacific region: Red Sea, east coast of Africa, Mauritius, Sri Lanka, Japan and Hawaii (Sakai, 1976).

Remarks : It was recorded from the dead *Pocillopora* coral covered with algae from Shingle, Hare and Vaalai and Thalayari Islands.

16. *Pilumnus tomentosus* Latreille

Plate-II, Fig.-p

1825. *Pilumnus tomentosus* Latreille, *exposées succinctement et dans un ordre analytique, avec l'indication de leurs genres*, Bailliere, 2, p. 125.

1976. *Pilumnus tomentosus* Sakai, *Crabs of Japan and adjacent seas*, p. 485.

Materials : 4 Males and 6 females; the maximum CL is 2.0 cm and the minimum CL is 0.5 cm.

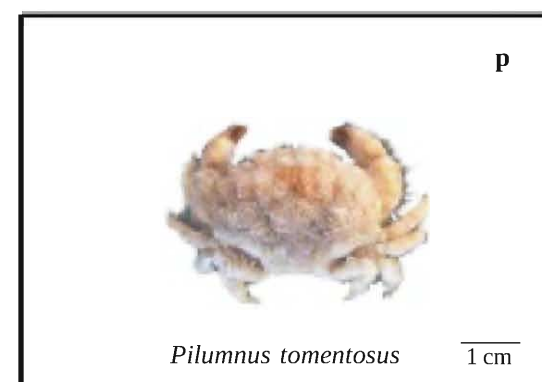
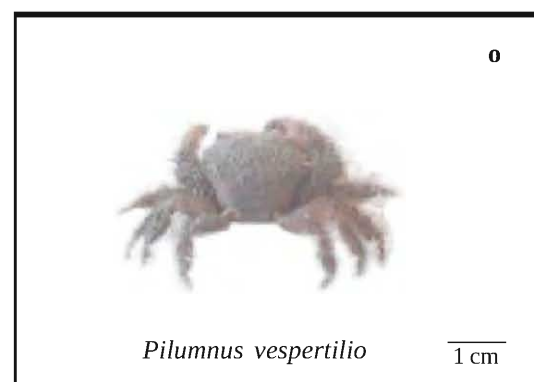
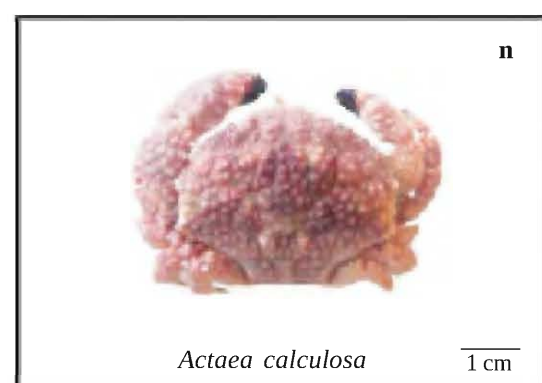
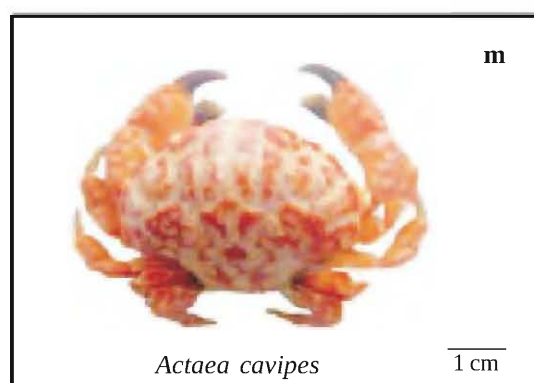
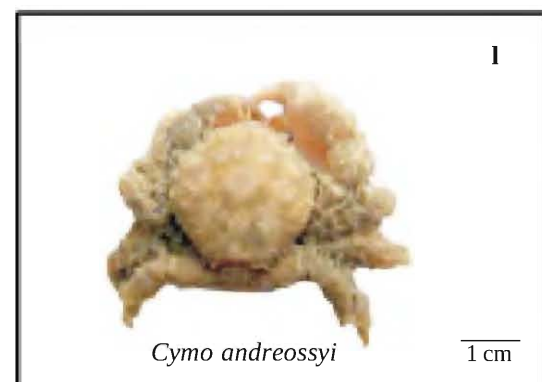
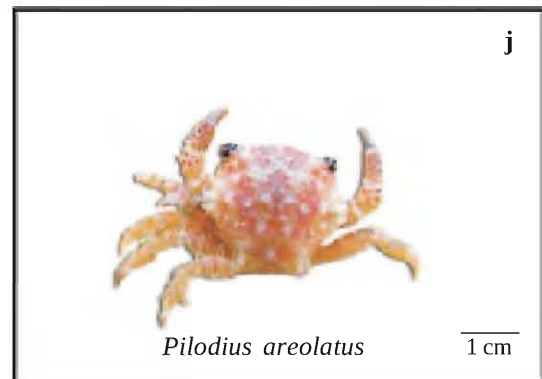
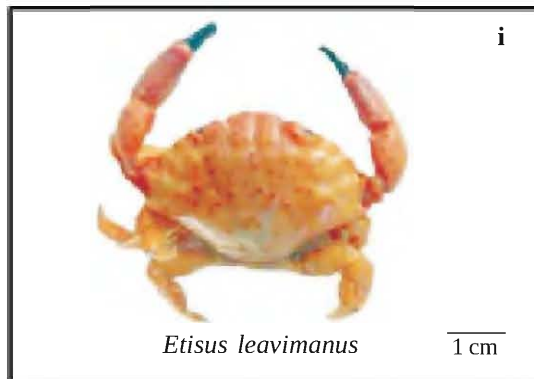
Diagnosis : Carapace and appendages with long hairs; regions of carapace moderately defined; carapace moderately convex; antero-lateral borders armed with sharp teeth; posterolateral border not concave; front bilobed; preorbital tooth distinct; external orbital tooth with no accessory tooth; entire animal covered with yellowish hair but outline of carapace and appendages perceptible in natural condition; hairs uniformly distributed on carapace and chelipeds.

Habitat : Rocky beaches, up to 25 m deep.

Distribution : Reports on previous records of the species from the GoMMBR : Islands of Gulf of Mannar (Jeyabaskaran *et al.*, 2000), from the Indian waters : No previous records and from the Indo-Pacific region : South and West Australia and Japan (Sakai, 1976).

Remarks : It was recorded from the dead *Pocillopora* corals covered with algae from Krusadai, Pullivasal and Manauli Putti Islands.

PLATE-II



Family TRAPEZIIDAE

17. *Tetralia rubridactyla* Garth

Plate-III, Fig.-q

1902. *Tetralia glaberrima* Borradaile, *The fauna and geography of the Maldive and Laccadive Archipelagoes*, 1(3), p. 265, Figs. 41–60.

1999b. *Tetralia rubridactyla* Castro, *Zoosystema*, 21(1), 102.

Materials : 1 Male and 1 female; the maximum CL is 1.0 cm and the minimum CL is 0.5 cm. Reg. No. **ZSI/MBS/5223**.

Diagnosis : Anterior border of carapace with relatively small lobes or no lobes. Carapace trapezoidal or oval, its posterior border shorter than anterior border; chelipeds unequal in size; surface of chelipeds smooth or with microscopic granules; setae on dorsal surface of the propodus of larger cheliped; thoracic sternum with median suture; walking legs not distinctly banded; anterior distal border of merus of cheliped with prominent dentate crest; distal portion of dactylus of chelipeds orange red endopod of first maxilliped with straight or slightly concave edge.

Habitat : From *Acropora* corals.

Distribution : There was no earlier record of occurrence of the species from GoMMBR and Indian region. It was recorded previously from the Indo-Pacific region from Indonesia, western Indian oceans far north as Somalia to the Pacific Ocean (Japan to French Polynesia) except Hawaiian Islands (Castro, 1999b).

Remarks : It was recorded from the dead *Pocillopora* corals covered with algae from Manauli Putti and Vaalai and Thalayari Islands. Since there is no previous record from Indian waters, this is the first record of the species.

18. *Trapezia areolata* Dana

Plate-III, Fig.-r

1852. *Trapezia areolata* Dana, *U. S. exploration. expedition*, p. 13, pt.1.

1907. *Trapezia cymodoce areolata* Rathbun, *Mem. Mus. Comp. Zool. Harvard*, 35, p. 59, Pl. 1–9.

Materials : 3 Males and 2 females; the maximum CL is 1.5 cm and the minimum CL is 0.5 cm.

Diagnosis : A distinct spine at the junction of anterolateral and posterolateral borders of carapace;

lower border of hand cristate and entire; frontal border rather undulate; frontal teeth being not deeply separated; outer surface of hand smooth and bold; no transverse series of red spots on carapace; carapace and chelipeds covered with an elegant meshwork of deep reddish lines.

Habitat : From *Pocillopora* corals (Castro *et al.*, 2004).

Distribution : Reports on previous records of the species from the GoMMBR : Islands in Gulf of Mannar (Jeyabaskaran *et al.*, 2000) from the Indian waters: Andaman and Nicobar Islands (Alcock, 1898) and from the Indo-Pacific region : Sri Lanka, Mergui Archileago, New Guinea, Australia, Tahiti, Fiji, Samoa and New Caledonia (Alcock 1898; Jeyabaskaran *et al.*, 2000).

Remarks : It was recorded from dead *Pocillopora* corals covered with algae from Upputhanni Island.

Family MAJIDAE

19. *Tylocarcinus styx* (Herbst)

Plate-III, Fig.-s

1803 *Cancer styx* Herbst, *Veruch einer Naturgeschichti der krabben und krebse*, 3, p.53.

1976 *Tylocarcinus styx* Sakai, *Crabs of Japan and adjacent seas*, p. 221.

Materials : 69 Males and 97 females; the maximum CL is 2.5 cm and the minimum CL is 1.1 cm.

Diagnosis : Carapace elongate pyriform, dorsal surface covered with rounded tubercles; rostrum 1/3rd to 1/4th of postrostral carapace length; rostral spines fused at base and ; diverged at distal part; preocular spine sharp, upcurved; lateral margins tuberculate, but lacking spines; chelipeds shorter and more slender than first ambulatory legs; ambulatory legs very stout, decreasing in size from the very long first one to the last; merus with 5-6 spines on anterior border; carpus with sharp distal spine; dactylus claw-shaped.

Habitat : Rocky beaches and coral reefs.

Distribution : Reports on previous records of the species from the GoMMBR : Tuticorin (Henderson, 1893), Krusadai island (Gravelly, 1927), Manuli Island (Sankarankutty, 1967) and islands of Gulf of Mannar (Jeyabaskaran *et al.*, 2000), from the Indian waters : Lakshadweep (Sankarankutty, 1961b) and Andamans

(Alcock, 1898) and from the Indo-Pacific region : Red Sea, east coast of Africa, Maldives, Sri Lanka, Mergui Archipelago, Samoa and Japan (Sakai, 1976).

Remarks : It was recorded from the dead *Pocillopora* corals covered with algae from Krusadai, Manauli Putti, Hare, Mulli and Nallathanni Islands.

20. *Schizophrys aspera* (H. Milne Edwards)

Plate-III, Fig.-t

1834. *Mithrax asper* H. Milne Edwards, *Librairie Encyclopedique de Rore*, 1, p. 320.

1976. *Schizophrys aspera* Sakai, *Crabs of Japan and adjacent seas*, p. 246.

Materials : 16 Males and 30 females; the maximum CL is 2.5 cm and the minimum CL is 2.0 cm.

Diagnosis : Carapace broadly pyriform, depressed or moderately convex, surface unevenly granular and setose; gastric region with a transverse row of 4 tubercles or spines; rostrum prominent, consisting of two stout divergent spines of about 1/6th to 1/9th of postrostral carapace length; each bearing one lateral accessory spine of variable length; lateral margins of carapace with 6 well developed acute spines behind postorbital tooth; chelipeds not much stouter than first pair of legs in females, much longer and more stout in males; walking legs with cylindrical setose.

Habitat : Rocky areas.

Distribution : Reports on previous records of the species from the GoMMBR : Tuticorin (Henderson, 1893), Krusadai Island (Gravely, 1927), Manauli Island (Sankarankutty, 1967) and islands in Gulf of Mannar (Jeyabaskaran *et al.*, 2000), from the Indian waters: Lakshadweep (Sankarankutty, 1961b), Okha, Mumbai (Chhapgar, 1957) and Nicobar (Sankarankutty, 1962b) and from the Indo-Pacific region : Red Sea, Persian Gulf, east coast of Africa, Maldives, Sri Lanka, Karachi, Mergui Archipelago, Samoa, New Caledonia, Hawaii and Japan (Sakai, 1976).

Remarks : It was recorded from the dead *Pocillopora* corals covered with algae from Hare Island.

Family LEUCOSIIDAE

21. *Arcania heptacantha* (De Haan)

Plate-III, Fig.-u

1850. *Iphis heptacantha* De Haan, *Lugduni Batavorum*, fasc, p. 27.

1976. *Iphis heptacantha* Sakai, *Crabs of Japan and adjacent seas*, p. 94.

Materials : 4 Males and 4 females; the maximum CL is 2.5 cm and the minimum CL is 1.5 cm.

Diagnosis : Carapace circular in outline; dactylus of chelipeds as long as palm fingers and slender; margins of carapace armed with 7 spines, of which lateral 2 most prominent; colouration uniformly pale vermillion.

Habitat : Sandy or muddy bottom.

Distribution : Reports on previous records of the species from the GoMMBR : Islands in GoMMBR (Jeyabaskaran *et al.*, 2000). No other records from the Indian waters. From the Indo-Pacific region : Gulf of Thailand, Singapore and Japan (Sakai, 1976).

Remarks : It was recorded from the dead *Pocillopora* corals covered with algae from Poomarichan and Manauli Putti Islands.

22. *Arcania erinaceus* (Fabricius)

Plate-III, Fig.-v

1798. *Leucosia erinaceus* Fabricius, *Hafniae*, p. 352.

1976. *Arcania erinaceus* Sakai, *Crabs of Japan and adjacent seas*, p. 92.

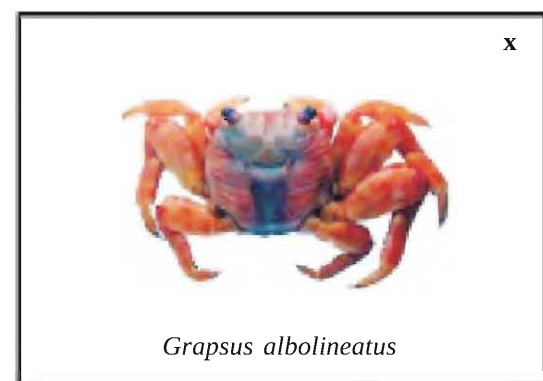
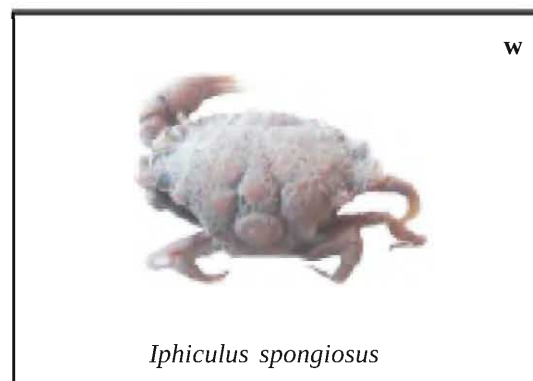
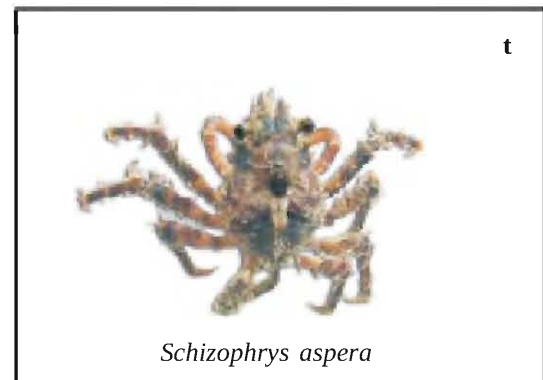
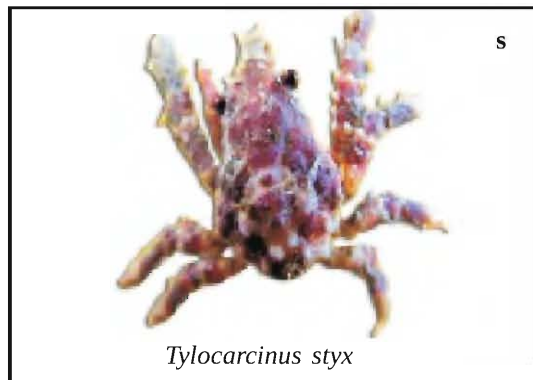
Materials : 3 Males and 2 females; the maximum CL is 2.0 cm and the minimum CL is 1.1 cm.

Diagnosis : Carapace globular, thickly covered with thorns and spine-like granules, among which the smooth shallow sulci that defining the branchial and hepatic regions visible; around the margin of the carapace, eleven large spines, covered with secondary spinelets; ventral surface of the external maxillipeds, thoracic sterna, and abdominal terga also covered with sharply granular; front ending in two prominent sharp spines; merus of chelipeds and legs covered with thorns, and the other joints, except the dactyli, the distal half of the hand, and the fingers sharply granular; the fingers a little shorter than the palm; the first pair of true legs exceeding the arms in length by their last 2 1/2 joints.

Habitat : Sandy or muddy substrate.

Distribution : Reports on previous records of the species from the GoMMBR : Trawl catches from GoMMBR (Jeyabaskaran *et al.*, 2000), from the Indian

PLATE-III



waters : Pondicherry and mouth of Hooghly river (Alcock, 1895) and from the Indo-Pacific region : Sri Lanka, Singapore and Japan (Sakai, 1976).

Remarks : It was recorded from the dead *Pocillopora* corals covered with algae from Manauli Putti Island.

23. *Iphiculus spongiosus* Adams and White

Plate-III, Fig.-w

1849. *Iphiculus spongiosus* Adams and White, *Zoology of the voyage, H.M.S. Samarang*, 1843–46, p 57, pls. I–XIII.

1976. *Iphiculus spongiosus* Sakai, *Crabs of Japan and adjacent seas*, p.105.

Materials : 5 Males and 2 females; the maximum CL is 2.0 cm and the minimum CL is 1.0 cm. Reg. No. **ZSI/MBS/5224**.

Diagnosis : Carapace convex, transversely ovoidal, much broader than long; the surface when denuded of its wooly covering, granulose with numerous larger pustulus tubercles, and showing the cardiac and intestinal regions tumid and very well demarcated by grooves; on the anterolateral margins, four large coarse spines, increasing in size from backwards; on the postero- lateral margins, two coarser dentiform tubercles present, separated by a wide interval; front coarsely bilobed; a strong tooth at the outer angle of the orbit; another at the outer angle of the buccal cavern; the chelipeds densely tomentose up to the base of the fingers; the fingers are more slender.

Habitat : Muddy substrate.

Distribution : No earlier records were made from GoMMBR. Records from the Indian waters : Andamans (Alcock, 1896) and from the Indo-Pacific region : Red Sea, Bay of Bengal, Singapore, Gulf of Thailand, the Philippines, Hong Kong and Japan (Sakai, 1976).

Remarks : It was recorded from the dead *Pocillopora* corals covered with algae from Anaipar Island. It was reported for the first time from GoMMBR.

Family GRAPSIDAE

24. *Grapsus albolineatus* Lamarck

Plate-III, Fig.-x

1818. *Grapsus albo-lineatus* Lamarck, *Exposition des principes fondamentaux de la Zoologie*, 5, p. 249.

1976. *Grapsus albolineatus* Sakai, *Crabs of Japan and adjacent seas*, p. 630.

Materials : 2 Males and 4 females; the maximum CL is 3.0 cm and the minimum CL is 2.5 cm.

Diagnosis : Carapace subcircular, slightly broader than long; depressed, dorsal surface smooth in median, with transverse and oblique striae in lateral part; front broad, about 1/3rd of total carapace width, deflexed; lateral margins strongly arched with a single sharp tooth behind the orbital tooth; chelipeds subequal, anterior margin of arm (merus) with sharp spines; inner corner of carpus with long spine; hand with upper surface granular, fingers with corneous spooned tip; walking legs stout, depressed, meri with subdistal spine; dactyli with strong brownish spines).

Habitat : Rocky beach or coral reefs.

Distribution : Reports on previous records of the species from the GoMMBR: Tuticorin (Henderson, 1893), from the Indian waters : Malabar and Coromandel coasts (Alcock, 1900), Trivandrum (Pillai, 1951), Okha (Chhapgar, 1957) and Andaman and Nicobar Islands (Alcock 1900; Sankarankutty, 1961a) and from the Indo-Pacific region: Red Sea, east coast of Africa, Sind coast, Sri Lanka, Polynesia, Hawaii and Japan (Sakai, 1976).

Remarks : It was recorded from the dead *Pocillopora* corals covered with algae from Shingle and Poomarichan Islands.

25. *Metapograpsus messor* (Forskål)

Plate-IV, Fig.-y

1775. *Cancer messor* Forskål, *Hauniae.*, I–XXXIV, p. 88.

1976. *Metapograpsus messor* Sakai, *Crabs of Japan and adjacent seas*, p. 630.

Materials : 4 females; the maximum CL is 2.5 cm and the minimum CL is 2.1 cm.

Diagnosis : Carapace trapezoidal, 1.25-1.35 times broader than long, with strongly converging lateral margins; surface smooth and slightly convex; front very broad, about 3/5th of greatest carapace width; lateral margins entire, without tooth behind the outer orbital angle; chelipeds unequal, larger one about 1.5 times the length of the carapace, strong and stout; palm inflated, outer surface smooth; fingers with blunt tips; walking legs with broad, flattened merus and strongly spinose dactyli.

PLATE-IV



Fig. 1 : *Paramonacanthus japonicus*.

Habitat : Mangroves, sub-tidal region, rocks, oyster beds and muddy substratum.

Distribution : Reports on previous records of the species from the GoMMBR : Tuticorin (Henderson, 1893) and Krusadai Island (Gravely, 1927), from the Indian waters : Okha and Mumbai (Chhapgar, 1957), Trivandram (Pillai, 1951), Parangipettai (Sethuramalingam and Ajmalkhan, 1991), Orissa, Gangetic delta and Andamans (Alcock, 1900) and from the Indo-Pacific region: Red Sea, east coast of Africa, Seychelles, Persian Gulf, Pakistan, Australia, Hawaii and Japan (Sakai, 1976).

Remarks : It was recorded from the dead *Pocillopora* corals covered with algae from Upputhanni Island.

Family OCYPODIDAE

26. *Ocypode cordimana* Desmarest

Plate-IV, Fig.-z

1825. *Ocypode cordimana* Desmarest, *Sur les cotes ou dans les eaux douces de la France*. Paris., p. 121.

1976. *Ocypode cordimana* Sakai, *Crabs of Japan and adjacent seas*, p. 599.

Materials : 2 Males and 1 female; the maximum CL is 2.0 cm and the minimum CL is 1.5 cm.

Diagnosis : Carapace deep, quadrilateral, strongly convex fore and aft, its length about seven-eighth of its greatest breadth; antero-lateral angles coinciding with the outer orbital angles, and point acutely forwards; orbits deep; no terminal style to the eyes; chelipeds and legs rough and squamiform; no serration of their edges, except in the case of the lower borders of the arms, the inner edge of the wrists, and the lower border of the hands; palm of the larger hand, though deep, not particularly compressed, and no stridulating ridge.

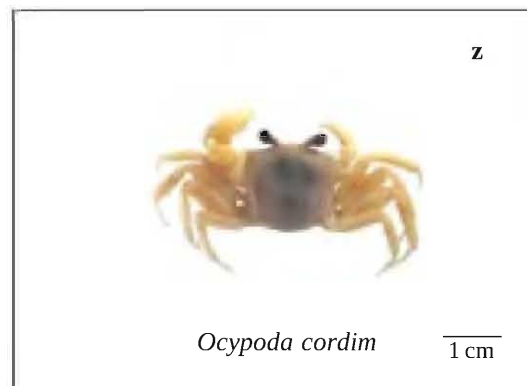


Fig. 2 : Colour changing behaviour of fish *Paramonacanthus japonicus* in the rearing tank.

Habitat recorded by earlier workers : Sandy beach.

Distribution : Reports on previous records of the species from the GoMMBR : Tuticorin (Henderson, 1893) and Krusadai island (Gravely, 1927), from the Indian waters : Lakshadweep (Borradaile 1903; Sankarankutty 1961b), Mumbai (Chhapgar, 1957), Trivandrum (Pillai, 1951), Chennai (Alcock, 1900) and Andaman and Nicobar Islands (Heller 1868; Alcock 1900) and from the Indo-Pacific region: Red Sea, east coast of Africa, Mauritius, Maldives, Tahiti and Japan (Sakai, 1976).

Remarks : It was recorded from the dead *Pocillopora* corals covered with algae from Shingle Island.

SUMMARY

A total of 26 species were collected from the *Pocillopora* coral colonies covered with algae from the present study. The present study emphasized 26 species of brachyuran crabs belonging to 10 genera and 8 families. Out of these 4 species are new to GoMMBR and 2 species are new to India. Alcock (1895-1900) examined 601 Species from the collections of Indian Museum. His collections were not specifically pertaining to GoMMBR but it represents all over the coasts also some outside waters. 208 species of crabs were reported by Laurie (1906) from the Gulf of Mannar waters. However his samplings were mainly based in both Indian and Sri Lankan waters. Sankarankutty (1967) reported 88 species of brachyuran crabs from the biosphere reserve. Recently Jeyabaskaran *et al.* (2000) updated the checklist of brachyuran crabs in GoMMBR

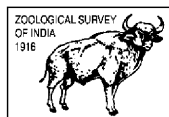
which records 106 species. The earlier studies on the brachyuran crabs in GoMMBR revealed a greater number of species. However the crabs examined from the earlier studies were collected from the coral reef areas. The previous studies were not restricted to the coral colonies. An attempt was made in the present

study in which the samplings of the cryptic brachyuran crabs are restricted only to the dense branched *Pocillopora* colonies. Periodical and long term studies should be encouraged on the taxonomy and ecology of brachyuran crabs which will definitely focus light on the coral associated crustaceans in GoMMBR.

REFERENCES

- Alcock, A. (1895). Materials for the carcinological fauna of India, No. 1, The Brachyura Oxyrhyncha. *J. Asiat. Soc. Bengal*, **64** : 157-291.
- Alcock, A. (1896). Materials for the carcinological fauna of India, No. 2, The Brachyura Oxystomata. *J. Asiat. Soc. Bengal*, **65** : 134-296.
- Alcock, A. (1898). Materials for the carcinological fauna of India, No. 3, The Brachyura Cyclometopa. I. The family Xanthidae. *J. Asiat. Soc. Bengal*, **67** : 67-233.
- Alcock, A. (1899a). Materials for the carcinological fauna of India, No. 4, The Brachyura Cyclometopa, Part-II, a revision of the Cyclometopa with an account of the families portunidae, Cancridae and Corystidae. *J. Asiat. Soc. Bengal*, **68** : 1-104.
- Alcock, A. (1899b). Materials for the carcinological fauna of India, No. 5, The Brachyura Priniginea or Dromiacea. *J. Asiat. Soc. Bengal*, **68** : 123-169.
- Alcock, A. (1900). Materials for the carcinological fauna of India, No. 6, The Brachyura Catometopa or Grapsoidea. *J. Asiat. Soc. Bengal*, **69** : 279-456.
- Borradaile, L.A. (1902). Marine Crustaceas. III. The Xanthidae and some other crabs. In : Gardiner J.S. (ed.) The fauna and geography of the Maldive and Laccadive Archipelagoes, Vol. **1**(3) : 237-271, Figs. 41-60.
- Borradaile, L.A. (1903). Marine Crustaceas. IV. Some remarks on the classification of the crabs. In : Gardiner J.S. (ed.) The fauna and geography of the Maldive and Laccadive Archipelagoes, **1**(4) : 424-429, Fig. 140.
- Castro, P. 1999a. The Trapeziidae (crustacea: Brachyura : Xanthoidea) of Indonesia. *Zool. med. Leiden*. **73** : 27-61.
- Castro, P. 1999b. Trapeziid Crabs (Crustacea, Brachyura, Xanthoidea, Trapeziidae) of the Indian ocean and the Red Sea. *Zoosystema*, **21**(1) : 93-119.
- Castro, P. 1999c. The Trapeziidae (Crustacea : Brachyura : Xanthoidea) of Indonesia. Results of the Rumphius Biohistorical Expedition to Ambon (1990), part-7. *Zool. Med. Leiden*. **73**(3) : 27-61.
- Chhapgar, B.F. (1957). Marine crabs of Bombay state. *Taraporevala Mar. biol. stn, Contr. No.*, **1**. 1-89.
- Coles, S.L. (1980). Species diversity of decapods associated with living and dead reef coral *Pocillopora meandrina*. *Mar. Ecol. Prog. Ser.*, **2** : 281-291.
- Galil, B. 1988. Further notes on species of *Tetralia* (Decapoda, Trapeziidae). *Crustaceana*, **54** (1) : 57-68.
- Garth, J.S. (1973). Decapod crustacea inhabiting reef building corals of Ceylon and Maldives. *J. Mar. biol. Ass. India*, **15**(1) : 195-212.
- Gravely, F.H. (1927). Crustacea In : The Littoral fauna of Krusadai Island in the Gulf of Mannar. *Bull. Madras Govt. Mus (M.S.)*, **(1)** : 141-155, pls 19-26.
- Guinot, D. (1971). Recherches preliminaires sur les groupements naturels chez les Crustaces Decapodes Brachyours. VIII. Synthese et bibliographie. *Bull. Mus. Natn. Hist. nat., Paris*, 2^e ser., **42**(5) : 1063-1090.
- Guinot, D. (1976). Constitution de quelques groupes naturels chez les crustaces decapods brachyours. I. La superfamille des Bellioidea et trios sous-familles de Xanthidae (Polydectinae Dana, Trichiinae de Haan, Actaeinae Alcock). *Mem. Mus. nat. D'his. nat., Paris*, pp. 308.

- Heller, C. (1868). Crustacean. Reise der oesterreichischen fregatte Novara um die erde in den Jahren. *Reise der Novara Zool.*, **11**(3) : 1-280.
- Henderson, J.R. (1893). A Contribution to Indian Carcinology. *Trans. Linn. Soc., Zool.* (2), vol. 5, pp. 325-458, pls. 36-40.
- Jeyabaskaran, R. (1997). Studies on biodiversity of brachyuran crabs of Gulf of Mannar (south east coast of India). Ph. D. Thesis, Annamalai University, India. 1-147.
- Jeyabaskaran, R., Ajmalkhan, S. and Ramaiyan, V. (2000). Brachyuran crabs of Gulf of Mannar. CAS in Marine Biology. Annamalai University. pp. 154.
- Kathirvel, M. and Gokul, A. 2006. A Check list of brachyuran crabs from the Gulf of Mannar Marine Biosphere reserve. *Fisheries Technocrats Forum, Tech. Bull.*, **4** : 1-10.
- Laurie, R.D. (1906). Report on the brachyura collected by Prof. Herdman, at Ceylon, in 1902. In : Herdman, W.A. (ed.), Report to the Government of Ceylon on the pearl oyster fisheries of the Gulf of Mannar. V. *Suppl. Rep.*, **40** : 349-432.
- Nammalwar, P. and Edwin, V.J. (2002). Bibliography of the Gulf of Mannar, *Cent. Mar. Fish. Res. Inst. spl. publ.*, **74** : 1-204.
- Pillai, N.K. (1951). Decapoda (Brachyuran) from Travancore. Bulletin of Central research Institute, university of Travancore, Trivandrum ii, no. 1, ser 'C' : 1-46.
- Sakai, T. (1976). *Crabs of Japan and adjacent seas*. Tokyo, Kodansha. pp. 1-725.
- Sankarankutty, C. (1961a). On Decapoda Brachyura from the Andaman and Nicobar Islands. 1. Families Portunidae, Ocypodidae, Grapsidae and Mictyridae. *J. Mar. biol. Ass. India.*, **3** : 101-119.
- Sankarankutty, C. (1961b). On some crabs (Decapoda Brachyura) from the Laccadive Archipelago. *J. Mar. biol. Ass. India.*, **3** : 120-136.
- Sankarankutty, C. (1962a). On Decapoda Brachyura from the Andaman and Nicobar Island-2. Family: Xanthidae. *J. Mar. biol. Ass. India*, **4** : 121-150.
- Sankarankutty, C. (1962b). On Decapoda Brachyura from the Andaman and Nicobar Island-3. Family, Calappidae, Leucosidae, Parthenopidae, Madae, and Gecarcinidae. *J. Mar. biol. Ass. India*, **4** : 151-164.
- Sankarankutty, C. (1967). On Decapoda Brachyura from the Gulf of Mannar and Palk Bay. *Proc. Symp. Crustacea.*, **I**. 347-362.
- Sethuramalingam, S. and Ajmalkhan, S. (1991). Brachyuran crabs of parangipettai coast. CAS in Marine biology, Annamalai University, 1-47, Pls. 1-28.
- Venkataraman, K., Srinivasan, M., Satyanarayana, Ch. and Prabakar, D. (2002). Faunal diversity of Gulf of Mannar Biosphere Reserve. Zoological Survey of India. *Con. Area Ser.*, **15** : 1-77.
- Venkataraman, K., Jeyabaskaran, R., Satyanarayana, Ch. and Raghuram, K.P. (2003a). Status of coral reefs in Gulf of Mannar Biosphere Reserve. *Rec. Zool. Surv. India*, **103** : 1-15.
- Venkataraman, K., Sathyanarayana, Ch., Alfred, J.R.B. and Wolstenholme, J. (2003b). Handbook on hard corals of India. Zoological Survey of India, Kolkata, India, pp. 1-266.
- Venkataraman, K., Jeyabaskaran, R., Raghuram, K.P. and Alfred, J.R.B. (2004). Bibliography and Checklist of coral reef and coral reef associated fauna of India. Zoological Survey India, Kolkata, India, pp. 1-420.



Rec. zool. Surv. India : 110(Part-3) : 77-92, 2010

NEW RECORDS OF *SCLERACTINIANS* FROM ANDAMAN ISLANDS.

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INTRODUCTION

Andaman Nicobar Islands located between 6°-14° N and 91°-94° E, hosts fringing reefs encircling almost the entire coast. These reefs being touted as the less impacted, and could serve as reserves of Biodiversity in the Indian Ocean are the least investigated of the Indian Ocean, concerning Biodiversity. On zooxanthellate *scleractinians*, there have been very few extensive surveys, is apparent in the description of so far 177 species of hard corals under 57 genera, which is a mere 22.29% of the total reported species from the World. There was an international initiative, from UNDP-GEF, to confirm the global significance of biodiversity of the Andaman region. The report of which indicated a possible occurrence of 400 species of corals (Turner *et al.* 2001). The new records [111 Nos, later verified to be 94 Nos, which includes some non-scleractinians as well (Venkataraman *et al.* 2003)] of this study, however, have not been described. In spite of many organizations now working on coral reefs in India, no significant strides in taxonomic investigations of corals have been made since the last compilation by Pillai (1983). Venkataraman *et al.* (2003) were one exception : 42 species were added to the list of coral of the Andaman Nicobar islands and 13 to the Laskhadweep islands in the Arabian Sea—though, for the whole of Indian reefs the addition was a meager 9 Nos, since Pillai (1983). Raghuram & Venkataraman (2005) added two more species from Gulf of Mannar and Andaman waters.

Extensive surveys have been carried out since 2004 by the first author of this paper in South Andaman reefs for assessment scleractinian diversity in these

reefs and changes with regard to climatic and local impacts; The list of new records the UNDP-GEF (Turner *et al.* 2001). report too needed to be verified for their occurrence or non-occurrence demanding description through taxonomic investigation of specimens. The present paper is the outcome of this effort. 7 new records to Andaman Nicobar waters are described, which include 4 species from the list of new records in the UNDP-GEF report (Turner *et al.* 2001). With the exception of one species which has previous records from Gulf of Mannar, all the described species are new records to Indian waters.

It may be noted that this is the first clear cut record of these species with descriptions of specimens from Indian waters. Earlier listings (other than Turner *et al.*, 2001) if available were ambiguous without the specimen descriptions, as the species described in this paper have closer affinities with many species and have many related species which makes their *in-situ* identification (definite) nearly impossible, and hence called for detailed taxonomic study of the specimens.

MATERIALS AND METHODS

Study area and sampling locations are shown in the map (Fig. I. a & b). Corals have been photographed *in-situ* with Sony cyber shot camera with underwater housing, and were tried to be identified at the first instance. Later, species which required detailed observations of skeletal structures were sampled, without causing un-due damage to the colony. SCUBA was employed for the observation and collection. The specimens were labeled and stored in freshwater for

rotting the tissue, while periodically replacing the water. They were then cleaned with a strong water jet to remove any sticking gelatinous tissue. The rotting procedure was continued if necessary.

Detailed skeletal structures were studied under Nikon SMZ 1500, trinocular, stereoscopic zoom microscope, and photographed with the affixed Nikon 8.0 megapixel ED camera. Whole corallum photographs were taken using Nikon D 300 using 60 mm macro lens provided with sufficient artificial lighting. The specimens after identification were submitted at the National Zoological Collections (NZC), Museum of Zoological Survey of India (ZSI), Andaman Nicobar Regional Centre (ANRC), Port Blair, and registered in the Named Register of ZSI, ANRC.

RESULTS

Family ACROPORIDAE Verrill, 1901

Genus *Montipora* de Blainville, 1830

Montipora danae Edwards & Haime, 1851

Material examined : Corallum 10.5 × 10 cm, India, Andaman Nicobar Islands, Ritchies Archipelago, stn. 4, 12° 03.128' N; 093° 00.236' E (Fig. I. b), Depth 4 m, 6.VII.2009, coll. Rajkumar Rajan, R. Raghuraman, & C.R. Sreeraj, Reg. No. 4656–NZC–ANRC. (PLATE-I).

Description : Colonies are thin plates which are often found inwardly wounding, may give the appearance of inverted conical folds. The surface is covered with dome shaped, verrucae of 1.5-2.4 mm (thickness in perpendicular to the ridges). The verrucae are often fused and forming radiating ridges near the laminar edges. Verrucae are arranged in line to the radiating ridges in the laminar sheet. The spinules in the coenosteal valleys are very fine, however they are more finer in verrucae, both types have elaborate ends. Corallites are immersed and arranged between the verrucae and in the valleys between the ridges in the laminar plate. They are never present on the verrucae. The calices are 0.5-0.7 mm in diameter. Theca is distinguishable in some corallites. The primary septa <3/4 R, are complete and do not taper towards the center. The secondaries, <1/2 R are incomplete.

Colonies are 15-40 cm wide and are dirty cream or pale brown in color. Observed at reef slope of 4-6 m depth. Not very common.

Affinities : *Montipora danae* resembles *M. verruculosus* and *M. verrucosa*. It is differentiated from *M. verruculosus* by (1) the finer reticula, whereas the latter has glabrous verrucae and coenosteum. (2) bigger sized verrucae; in *M. verruculosus*, the size of the verrucae are small i.e. less than 1mm. (3) by the arrangement of verrucae in line to the radiating ridges in the laminar sheet. Differentiated from *M. verrucosa* by having smaller calices and irregular sized verrucae.

Distribution : Reported for the first time from Andaman Nicobar Islands and India. Widely reported from reefs World-wide.

Family FUNGIIDAE Dana, 1846

Genus *Fungia* Lamarck, 1801

Fungia granulosa Klunzinger, 1879

Material examined : 1. Corallum 10.2 cm in diameter, India Andaman Nicobar Islands, North Bay reef, stn. 3, 11° 42' 12.3" N; 092° 45' 06.4" E (Fig. I. a), Depth 6 m, 27.VIII.2008, Coll. Rajkumar Rajan & Murugeson, Reg. No. 4657–NZC–ANRC, (PLATE-II. a-d.).

2. Corallum 9.2 cm in diameter, India, Andaman Nicobar Islands, Ritchies Archipelago, stn. 4, 12° 03.128' N; 093° 00.236' E (Fig. I. b), Depth 5 m, 6.VII.2009, Coll. Rajkumar Rajan, R. Raghuraman, & C.R. Sreeraj, Reg. No. 4658–NZC–ANRC (PLATE-II. e-h.).

Descriptions : Colonies are circular and in average 10 cm diameter. The disc is slightly convex. The area around the central fossa is slightly arched. The septa are distinctively wavy, more pronounced in the lower orders. The margins of the septa are comparatively thickened mostly due to the granular margins which gives a blunt appearance. Towards the periphery however small denticles in the margin are visible. At least the first two orders of septa are uniformly thickened, except near the fossa where tentacular lobes are formed of the higher orders. Coralla size in the present specimens ranged from 9.5-12.5 cm. The central fossa is narrow, elongate and columella spongy. The costae are clearly seen until the center, with the higher order very distinct. They have fine papillae in the costal margins which give a granulose appearance and a thicker margin as that of the septa. Small sized and slit like perforations are observed more towards the outer margin of the corallum.

Observed at the depths of 6-10 m in reef slopes and beds of the protected bays. Not common.

Affinities : By studying the specimens, this species is easily differentiated by the granular nature of the blunt septal margin and the fine costal papillae which are numerous. Some affinities it may show at a first look with *F. scabra*, *F. concinna* and *F. repanda* are readily differentiable: In *F. scabra*, the septa of the higher order only was observed to be wavy, the waviness not extended till the periphery and not very pronounced; In *F. concinna* the higher orders of septa more exert and the margins are spinulose or lobate than granulose margins of *F. granulosa*; The coralla of *Fungia repanda* are comparatively bigger, and the septal margins have triangular dentations.

Distribution : Though included in the list of corals identified by Turner et al. (2001), is described for the first time from Andaman Nicobar Islands and India. According to Veron & Smith (2000) this species is usually uncommon. Other distributional records in Veron & Pichon (1980).

Genus ***Herpolitha*** Eschscholtz, 1825

Herpolitha weberi (van der Horst, 1921)

Material Examined : Corallum 14 × 4.5 cm, India, Andaman Nicobar Islands, Ritchies Archipelago, stn. 4, 12° 03.128' N; 093° 00.236' E (Fig. I. b), Depth 6 m, 6.VII.2009, Coll. Rajkumar Rajan, R. Raghuraman, & C. R. Sreeraj, Reg. No. 4659–NZC–ANRC, (PLATE-III).

Description : Coralla are elongate with pointed tips. They are arched in the middle. The axial furrow reaches both the extremities. Septa are markedly alternating in height near the axial fossa. There are at least 3 groups of Septa. Fusion of septa across the axial furrow is observed with the first and 3rd orders of septa there by demarcating the linear series of centres. Lateral secondary centres are not observed. Columella in the axial furrow are elongate and papillate. The septal teeth present are small and cup shaped. The first group of septa numbering 49 + 49, on either side, originate from the axial fossa. They abruptly ends little short of the periphery (in aberration to the description of specimens by Veron & Pichon, 1980), except near the extremities where they reach the peripheries without interruption and may project outside the septal margin. The second group, equal in thickness and height to that of the first

order, originate away by at least 4 mm away from the axial furrow, extend up to the periphery and projects outside the corallum margin. The 3rd group of septa (96 + 96 on either side) on the sides of the first order are very fine and markedly smaller in height that of the first order. This group of septa which also originate from the axial furrow encircles the first order a little short of periphery by forming loop. This loop formation of the 3rd order septa is observed where the first order does not extend to the periphery. The lower surface is perforate except in the central part. The spinulose spines arranged in rows are well defined towards the corallum perimeter.

Observed at depths of 3-4 m in gradually sloping reef slopes. Not very common.

Affinities : This species has resemblance to *H. limax*, but could be differentiated from the latter by the absence of secondary centres, and having higher length width ratio, usually > 4. Moreover, in *H. limax* the primary septa are heavily truncated and never reach the periphery.

Distribution : Recorded for the first time from Andaman Nicobar Islands and India. According to Veron & Smith (2000) this species is uncommon. Other distributional records in Veron & Pichon (1980).

Family MERULINIDAE Verril, 1866

Genus ***Hydnophora*** Fischer de Waldheim 1807

Hydnophora grandis Gardiner, 1904

Material examined : Coralla branching 7-16 cm tall, 6 pieces, India, Andaman Nicobar Islands, Ritchies Archipelago, stn. 4, 12° 03.128' N; 093° 00.236' E (Fig. I. b), Depth 4 m, 6.VII.2009, Coll. Rajkumar Rajan, R. Raghuraman, & C.R. Sreeraj, Reg. No. 4660–NZC–ANRC, (PLATE-IV).

Descriptions : Colonies are ramose without an encrusting base. Branches are cylindrical along the whole coralla except near the tip where they may taper. They are 0.8 mm at the tip to 10-15 mm in the middle and up to 18 mm at the base. Monticules appear separated and individually projected. Fusion of monticules, thereby forming ridges, is observed only at branch tips, i.e. at branch thicknesses of 9 mm and below. However, matured specimens, even at the branch tips do not show fusion of monticules. There

are about 8-10 primary septa radiating from the monticules. They, on reaching the columella centers are slightly thickened and have small dentations. A row of secondary septa alternating the primaries are present but never reach the columella centers.

Colonies are up to 0.5 m across. Colouration is mostly brownish pink, tending to be bluish down the branches. At localities where this species is present, they form a reasonably good cover (an average of 12.7%). Not commonly observed.

Affinities : This species has resemblance only to *H. rigida*. Differentiated easily from it by the cylindrical branches, and by the presence of individual monticules. *H. rigida* on the other hand has finer branches and the monticules usually fused into ridges down the branch sides.

Distribution : Though included in the list of corals identified by Turner et al. (2001), is described for the first time from Andaman Nicobar Islands and India. According to Veron & Smith (2000) this species is usually uncommon. Not widely reported.

Family PORITIDAE Gray, 1842

Genus *Porites* Link, 1807

Porites stephensoni Crossland, 1952

Material Examined : Corallum 5 × 3.7 cm, India, Andaman Nicobar Islands, North Bay reef, stn. 2, 11° 42.231' N; 092° 45.100' E, (Fig. I. a), Depth 3 m, 27.VIII.2008, Coll. Rajkumar Rajan & Murugeson, Reg. No. 4661–NZC–ANRC, (PLATE-V).

Description : Coralla are encrusting or massive. In the latter case are at the size range of 5-10 cm in diameter. The encrusting ones may grow up to 20 cm in diameter. The surface is humped at most instances. Calices are 0.9-1.1 mm in diameter. The walls are thin. Denticles over the wall, if present, are corresponding to the septa. The septa are thin and short (1/2 R). The septa bear a row of denticles near the theca. Both the septal and thecal denticles are fine and have an arrangement of small spines at the top. The triplet is not fused and the lateral pairs are larger than the dorsal and ventrals. Pali are prominent. 8 pali are present and the ones corresponding to the lateral pairs are bigger than the dorsal and the three ventrals. Columella is deeply seated

and small. Three radii connecting the columella are distinctly noticed.

Colonies are observed in the colors of Pale brown, brown and grayish green. Usually the encrusting ones are brownish in color.

Affinities : From other species of *Porites*, this species is first distinguishable by its smaller sized colony. The closest resembling species in corallite structures is *P. murrayensis*, which also has smaller coralla. However, *P. stephensoni* has thin corallite wall and prominent pali, which differentiate from *P. murrayensis*'s thick walls and the relatively inconspicuous pali (may be absent in the dorsal directive and ventral triplet).

Distribution : Recorded for the first time from Andaman Nicobar Islands and India. According to Veron & Smith (2000) this species is uncommon. Other distributional records in Veron & Pichon (1980).

Porites annae Crossland, 1952

Material Examined : Corallum 7 × 5.4 cm, India, Andaman Nicobar Islands, North Bay reef, stn. 3, 11° 42' 12.3" N; 092° 45' 06.4" E, (Fig. I. a), Depth 5 m, 27.VIII.2008, Coll. Rajkumar Rajan & Murugeson, Reg. No. 4663–NZC–ANRC, North (PLATE-VI).

Description : Colonies form nodular columns, rarely anastomosing, however, normally found to have fused column heads. The height of the columns usually does not exceed 8 cm. They have a thick encrusting base. The corallites appear little excavated. Calices are 1.2-1.6 mm in diameter. Paliiform lobes are distinctly seen. Pali number is usually variable from corallite to corallite. As per Veron & Pichon (1982) matured corallites have an open triplet, therefore each septum having a small palus, in addition to the 5 big pali, thereby making the total number 8. It is usually 6 pali in other cases, where the triplet is fused, and the longer ventral directive has only one palus. At least two rows of denticles are present and one near the wall is slightly exsert. Columella is present and is like a small pali.

Colonies form large stands of 0.5 to several meters across. Smaller colonies are observed at shallower depths and are extremely tolerant to sedimentation. Large stands are commonly occurring at depths of 4-8 m in protected bays. They may be pale brown to deep grey with white heads.

Affinities : This species is easily separated *in-situ* by its distinctive growth form. *P. lichen*, however has a similar growth form is distinguished from *P. annae* by the former's thicker walls, small sized calices and relatively less developed pali.

Distribution : Though included in the list of corals identified by Turner *et al.* (2001), is described for the first time from Andaman Nicobar Islands. Previous records in Indian waters are from Gulf of Mannar reefs, South East Coast of India (Raghuram & Venkataraman, 2005). Other distributional records in Veron & Smith (2000).

***Porites monticulosa* Dana, 1846**

Material Examined : Corallum 12.5 × 12 cm, India, Andaman Nicobar Islands, Ritchies Archipelago, stn. 4, 12° 03.128' N; 093° 00.236' E (Fig. I. b), Depth 4 m, 6.VII.2009, Coll. Rajkumar Rajan, R. Raghuraman, & C.R. Sreeraj, Reg. No. 4662–NZC–ANRC, (PLATE-VII).

Descriptions : Colonies are laminar or encrusting and in both the cases with nodular upward projections, which sometimes develop into slender columns of 3-4 cm height. Ridges are formed on the laminae as well as columns which seem to separate the corallites. Ridges are observed to be devoid of corallites over them. Corallites are 0.5-0.7 mm in dia. Triplet is fused by the inner margins, and makes a perfect cone. 6 pali are very distinct. The dorsal palus is smaller than the 4 lateral pali and that of the ventral. Columella is very small, deeply seated and is absent in some corallites. Only one row of denticles is arranged near the theca.

Colonies are dark brown. While encrusting colonies are 20-50 cm across, the laminar ones are comparatively smaller. Commonly occur at shallower depths (2-3 m) and in protected reef slopes.

Affinities : The growth forms may resemble those of *P. lichen* and *P. anne*, but differentiated from them by the smaller corallites and the columns usually remaining short.

Distribution : Though included in the list of corals identified by Turner *et al.* (2001), is described for the first time from Andaman Nicobar Islands and India. Other distributional records in Veron & Smith (2000).

***Porites latistella* Quelch, 1886**

Material Examined : Coralla laminar to encrusting base with short branches—3 pieces, 7.1 × 6.2 cm, 5.8 ×

4.8 cm, 6.4 × 6 cm, India, Andaman Nicobar Islands, North Bay reef, stn. 2, 11° 42.231' N; 092° 45.100' E (Fig. I. a), Depth 3 m, 27.VIII.2008, Coll. Rajkumar Rajan & S. Murugeson, Reg. No. 4664–NZC–ANRC, (PLATE-VIII).

Description : Colonies are encrusting to thin basal laminae with upwardly arising, cylindrical, irregular sized branches of 4-5 cm height and 8-13 mm thick. The branches are flattened at their tips where they tend to divide. Corallites appear excavated. The walls are irregular in outline. Calices are 1.2-1.4 mm in diameter. 5 pali are usually present. The dorsal directive has no palus. Triplet is usually free; however it may be fused in some corallites. Columella is small and in some corallites it may be absent. One row of denticles is present in the septa.

Colonies are 5-13 cm across and occur in reef flats of protected bays. Normal colouration is pale brown. They are uncommon in reefs.

Affinities : Similar species are *P. sillimania*, *P. cylindrica* and *P. eridani*. *P. sillimania* has similar growth form, however, does not have excavated corallites. In *P. cylindrica*, the corallites are shallow, branches long, cylindrical and taper uniformly till the branch tips as against the flattened tips of *P. latistella*. *P. eridani* has large plates, branches contorted and tips un-flattened.

Distribution : Recorded for the first time from Andaman Nicobar Islands and India. Other distributional records in Veron & Smith (2000).

DISCUSSION

The new records described are of the commonly occurring genera in Andaman Nicobar Islands. In *Montipora* there are so far 10 species described from Andaman Nicobar Islands (20 from the whole of India), and six more listed (with one doubtful identification) as new records (Turner *et al.*, 2001). Veron and Smith (2000) report 73 species of this genus world over. As observed by them, there are several groups of similar species in this genus. This may be one reason why many species have been overlooked and easily concluded as previously reported of this genera.

Though *Hydnophora* are easily distinguishable, the new record *H. grandis* described here could so far may

have been superficially identified as *H. rigida*, from these islands, because of the similarity in growth form. So far 3 species are described from Andaman Nicobar Islands; 2 listed as new records (Turner *et al.*, 2001). With the present description, the total described species will be 4, leaving only two species un-described from the World total. These species are inconspicuous in a reef explains them not being recorded in this reef area.

The family Fungiidae has 20 species, under 8 genera, described so far from Andaman Nicobar Islands (22 species under 10 genera for the whole of India) and 7 species listed as new records by Turner *et al.* (2001). Veron and Smith (2000) reports 57 species of this family, under 13 genera from World over. Though the species described in this study have uncommon occurrence, many species, including one genus of common occurrence (*Heliofungia*) are not recorded for this reef area, in addition to the remaining rare genera and species from the World list.

Of the 4 species of *Porites* described in the present study, 2 species (*Porites stephensoni* & *P. latistella*) have uncommon occurrence and remaining 2 were commonly reported World over. So far 13 species of *Porites* have been described from India and only 7 from Andaman Nicobar Islands, excluding the 5 species listed as new records in the UNDP-GEF report. This number is very low as against the total 52 species reported from World reefs (Veron & Smith, 2000). The difficulties in identification of this species stem from little variation in corallite characters between species and the requirement of *in-situ* investigations of colony structure as well.

Overall, the new records described in this paper—all are not of uncommon occurrence, shows that reef areas in Andaman Nicobar Islands require extensive investigations for Scleractinian diversity. Moreover, the very low records so far of species of *Montipora*, *Porites* and Family Fungiidae indicate that these genus and family are under-represented in this area.

SUMMARY

Coral species described from Andaman Nicobar Islands remains a dismal 177 Nos (Venkataraman *et al.*

2003), despite the indication by Turner *et al.* (2001) that coral diversity in these islands could accrue to 80% of the global maximum. Though, Turner *et al.* (2001) by a rapid survey to investigate the coral diversity, listed 94 new records (out of the total 197 identified in the underwater survey), the new records were not described. A total of 8 species (1. *Montipora danae*, 2. *Fungia granulosa*, 3. *Herpolitha weberi*, 4. *Hydnophora grandis*, 5. *Porites stephensoni*, 6. *P. annae*, 7. *P. monticulosa*, and 8. *P. latistella*) have been described in the present study, which includes 4 species (Nos. 2, 4, 6 & 7) listed as new records in the report by Turner *et al.* (2001). Except for *Porites annae* which has one previous record from Gulf of Mannar (Raghuram & Venkataraman, 2005)—all species described in this paper are new records from Indian waters.

Key words : Scleractinia, new records, India, Andaman Nicobar Islands.

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REFERENCES

- Blainville, H.M. de 1830. Zoophytes. In : *Dictionnaire des Sciences naturelles, Paris*. **60** : 295-364.
- Crossland, C. 1952. Madreporaria, Hydrocorallinae, Heliopora and Tubipora. *Scientific Report of the Great Barrier Reef Expedition, 1928-29* **VI**(3) : 85-257.
- Dana, J.D. 1846. Zoophytes. *United States Exploring Expedition, 1838-1842*, **7** : 740 pp.
- Edwards, H.M. and Haime, J. 1851. Recherches sur les polypiers. Mém. 7 Monographie des Poritides. *Ann. Sci. Nat. Zool. 3e Ser.*, **16** : 21-70.
- Eschscholtz von, J.F. 1825. Bericht über die zoologiesche Ausbeute während der Reise von Kronstadt bis St. Peter und St. Paul. Zoophyten. *Isis (Jena)*, **6** : 734-47, pl. 5.
- Fischer de, W. 1807. Description du Museum Demidoff. **III** : 295-296.
- Gardiner, J.S. 1904. Madreporaria, I Introduction, II Astreaeidae. *Fauna and Geography of the Maldives and Laccadives Archipelagoes. Cambridge*, **2** : 756-790, pl. 59-64.
- Gray, J.E. 1842. Pocilloporidae, *Synopsis Br. Mus.*, (44 ed.).
- Horst van der, C.J. 1921. The Madreporaria of the Siboga Expedition. II Madreporaria Fungida. *Siboga-Expeditie* **XVIIb**, 53-98, pl. 1-6.
- Klunzinger, C.B. 1879. *Die Korallenthier des Rothen Meeres*. Gutmann, Berlin, 188 pp.
- Lamarck de, J.B.P. 1801. *Système des animaux sans vertèbres*. Paris. 1-432.
- Pillai, C.S.G. 1983. Structure and genetic diversity of recent Scleractinia of India. *J. Mar. Biol. Assoc. India.*, **25** : **1** & **2** : 78-90.
- Quelch, J.J. 1886. Report on the reef coral collected by HMS Challenger during the years 1873-1876. *Rept Sci Results Voyage of HMS Challenger, Zoology*, **3** : 203 pp.
- Raghuram, K.P. and Venkataraman, K. 2005. New record of *Porites annae* Crossland and *Porites cylindrica* Dana from Gulf of Mannar and Andaman waters. *Rec. zool. Surv. India*, **105** (Part 1-2) : 133-138.
- Turner, J.R., Vousden, D., Klaus, R., Satyanarayana, Ch. Fenner, D., Venkataraman, K., Rajan P.T. and Subba Rao. 2001. Report of the phase 1 : Remote sensing and Rapid Site Assessment Survey, April 2001. *Coral Reef Systems of the Andaman Islands, GOI/UNDP GEF*. 76 p, with 8 appendices and 55 figs. & pls.
- Venkataraman, K., Satyanarayana, Ch., Alfred, J.R.B. and Wolstenhome, J. 2003. *Handbook on Hard corals of India*, 1-266. Published by Zool. Surv. India.
- Veron, J.E.N. and Pichon, M. 1982. Scleractinia of Eastern Australia. Part IV. Family Poritidae. *Australian Institute of Marine Science Monograph Series*, **V** : 159 pp.
- Veron, J.E.N. and Pichon, M. 1980. Scleractinia of Eastern Australia. Part 3, Families Agaricidae, Siderasreidae, Fungiidae, Oculinidae, Merulinidae, Mussidae, Pectiniidae, Caryophyllidae, Dendrophyllidae. *Australian Institute of Marine Science Monogr Ser.*, **IV** : 471 pp.
- Veron, J.E.N. and Smith, M.S. 2000. *Corals of the World*. Vol. **I**, **II** & **III**. Australian Institute of Marine Science.
- Verrill, A.E. 1866. Synopsis of the polyps and corals of the North Pacific Exploring Expedition, 1853-1856, with descriptions of some additional species from the west coast of North America. *Commun. Essex. Inst.*, **5** : 17-50.
- Verrill, A.E. 1901. Variations and nomenclature of Bermudian, West Indian and Brazilian reef corals with notes on various Indo-Pacific corals. *Trans. Conn. Acad. Arts Sci.*, **11** : 63-168, pl, 10-36.

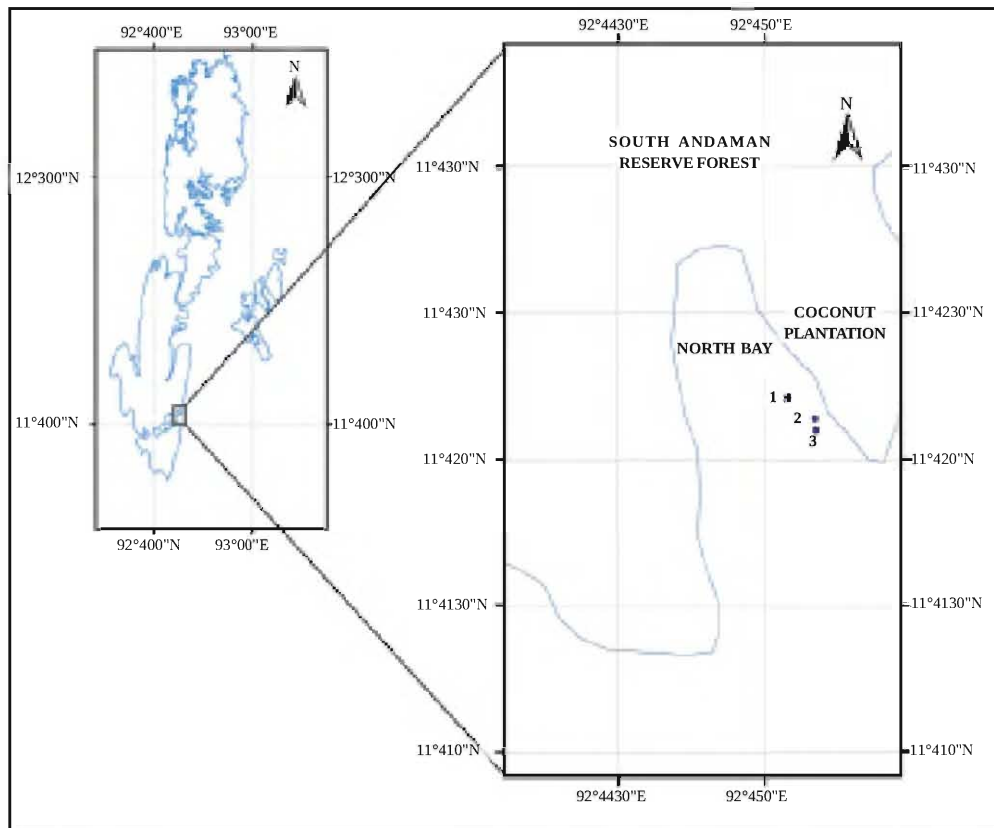


Fig. 1. a) Study area and sampling location in North Bay reef, South Andaman

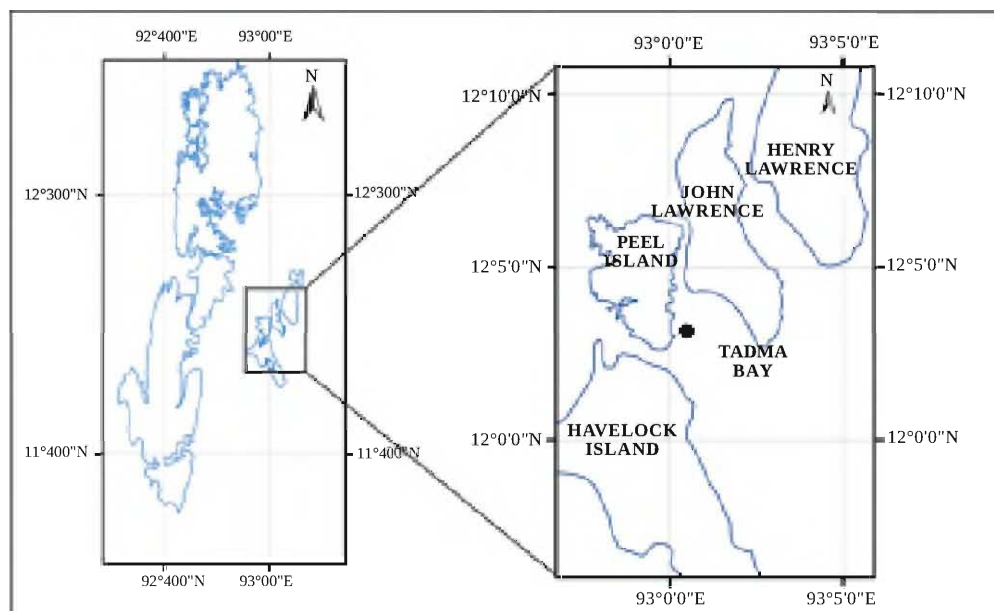
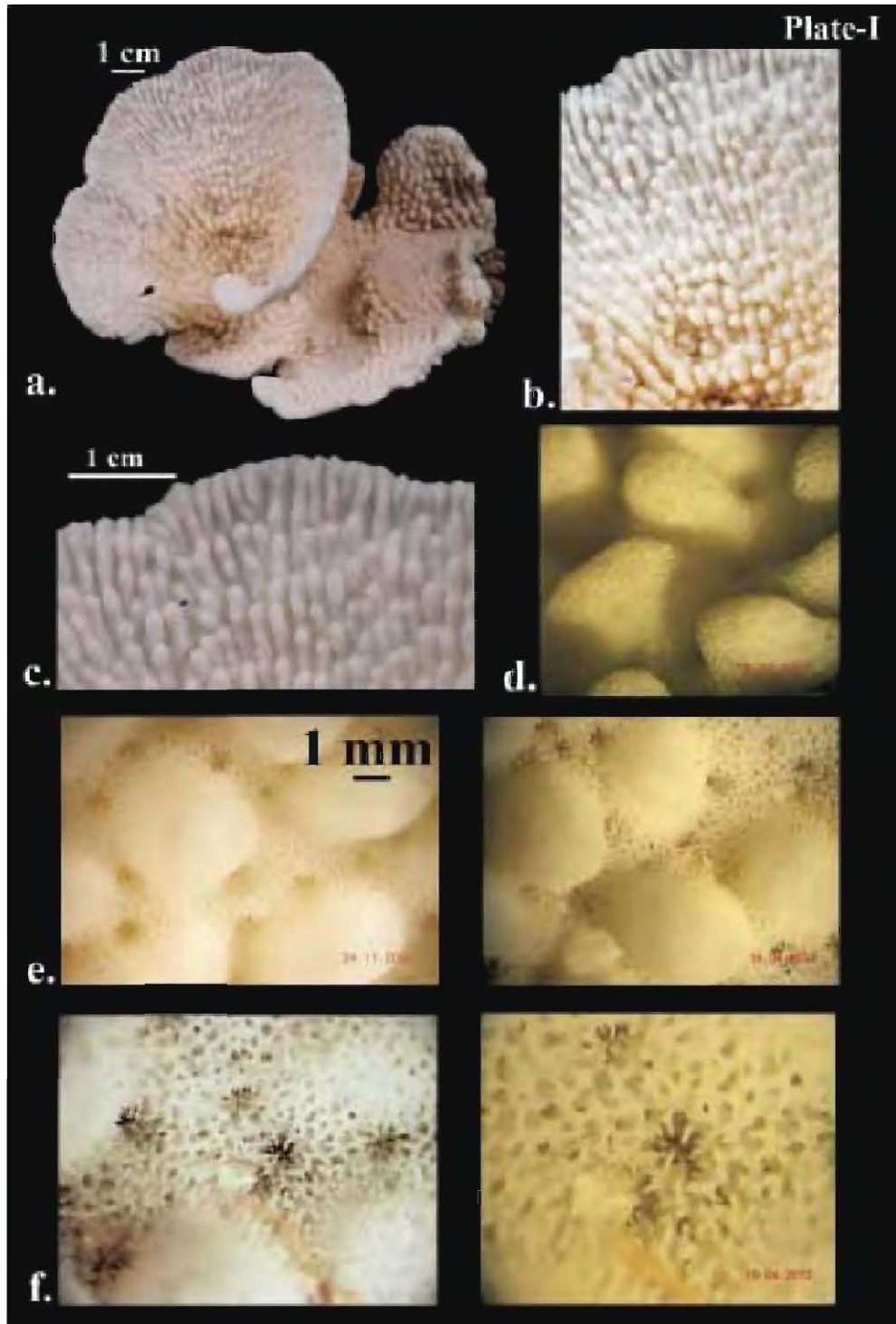
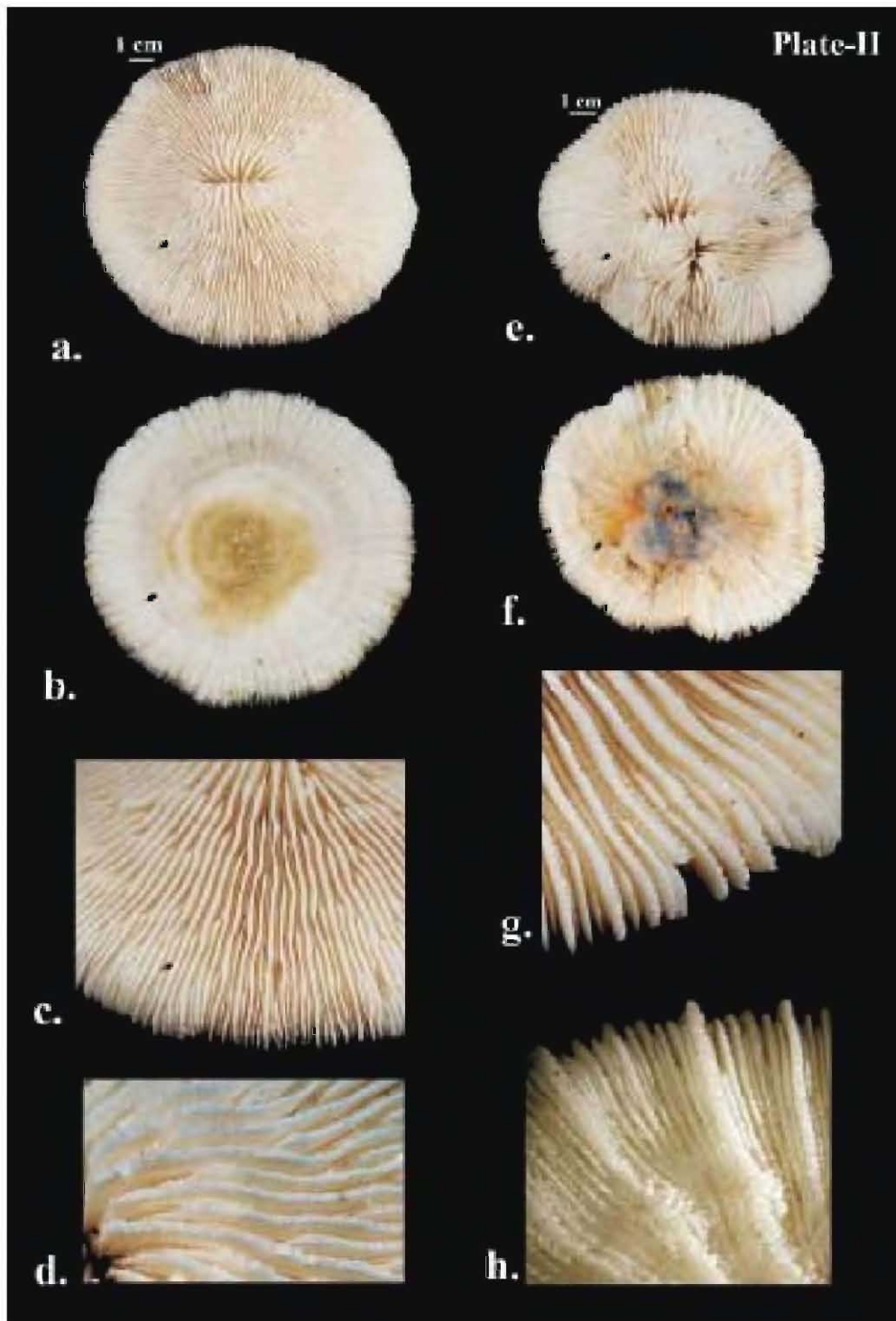


Fig. 1. b) Study area and sampling location in Ritchie's Archipelago, South Andaman

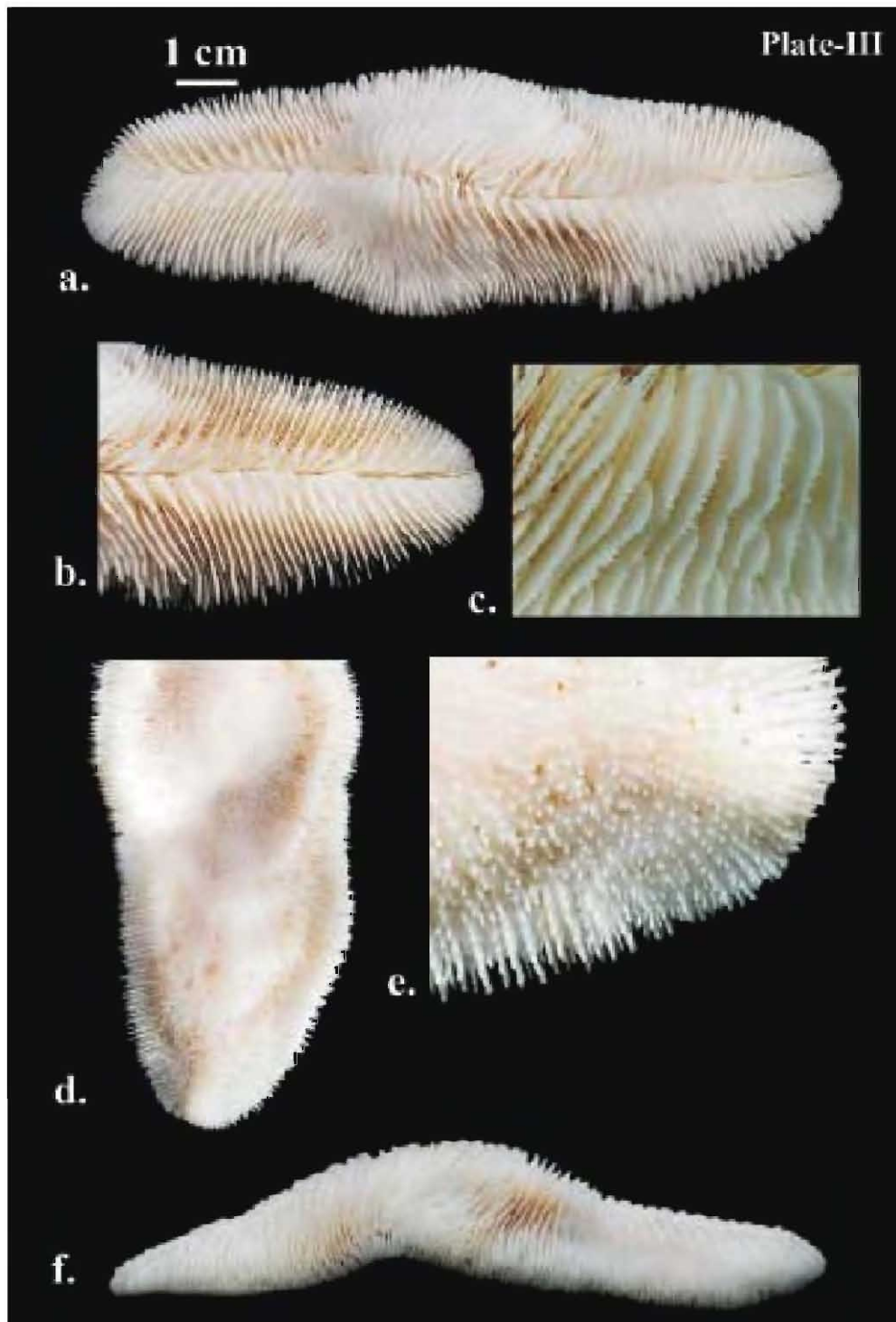
PLATE-I


a. *Montipora danae*, material examined; **b.** Verrucae arranged in line to the peripheral radiating ridges; **c.** Radiating ridges at the periphery; **d.** Verrucae showing finer reticula; **e.** Arrangement of verrucae and corallites in the laminar sheet; **f.** Details of corallite structures

PLATE-II

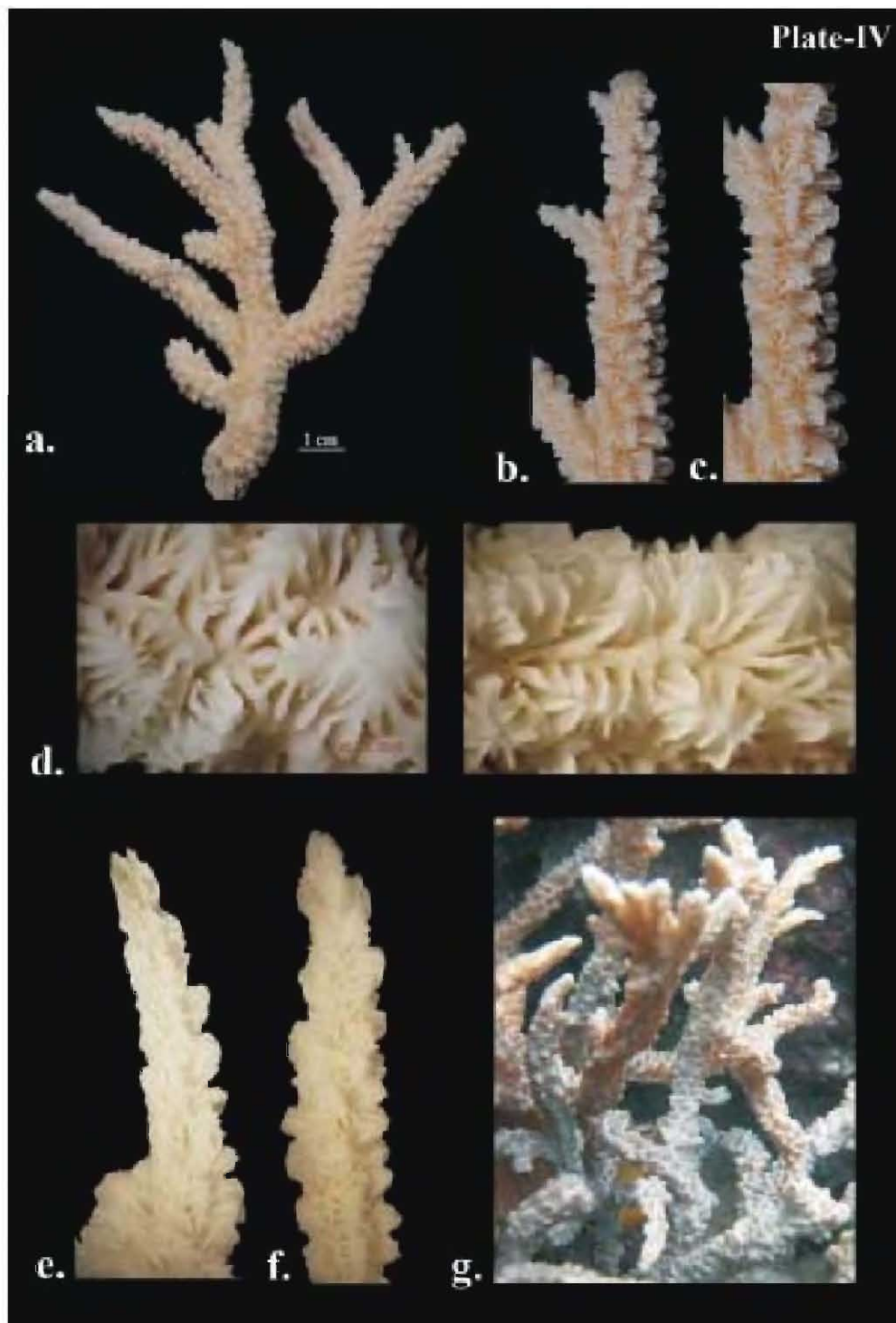


a. & e. *Fungia granulosa*, coralla showing dorsal view; **b. & f.** Ventral view of the coralla; **c.** Septa showing waviness, observed also in higher orders; **g.** Small denticles in the septa at the corallum periphery; **d.** Granular margins of the septa; **h.** Granular costae

PLATE-III


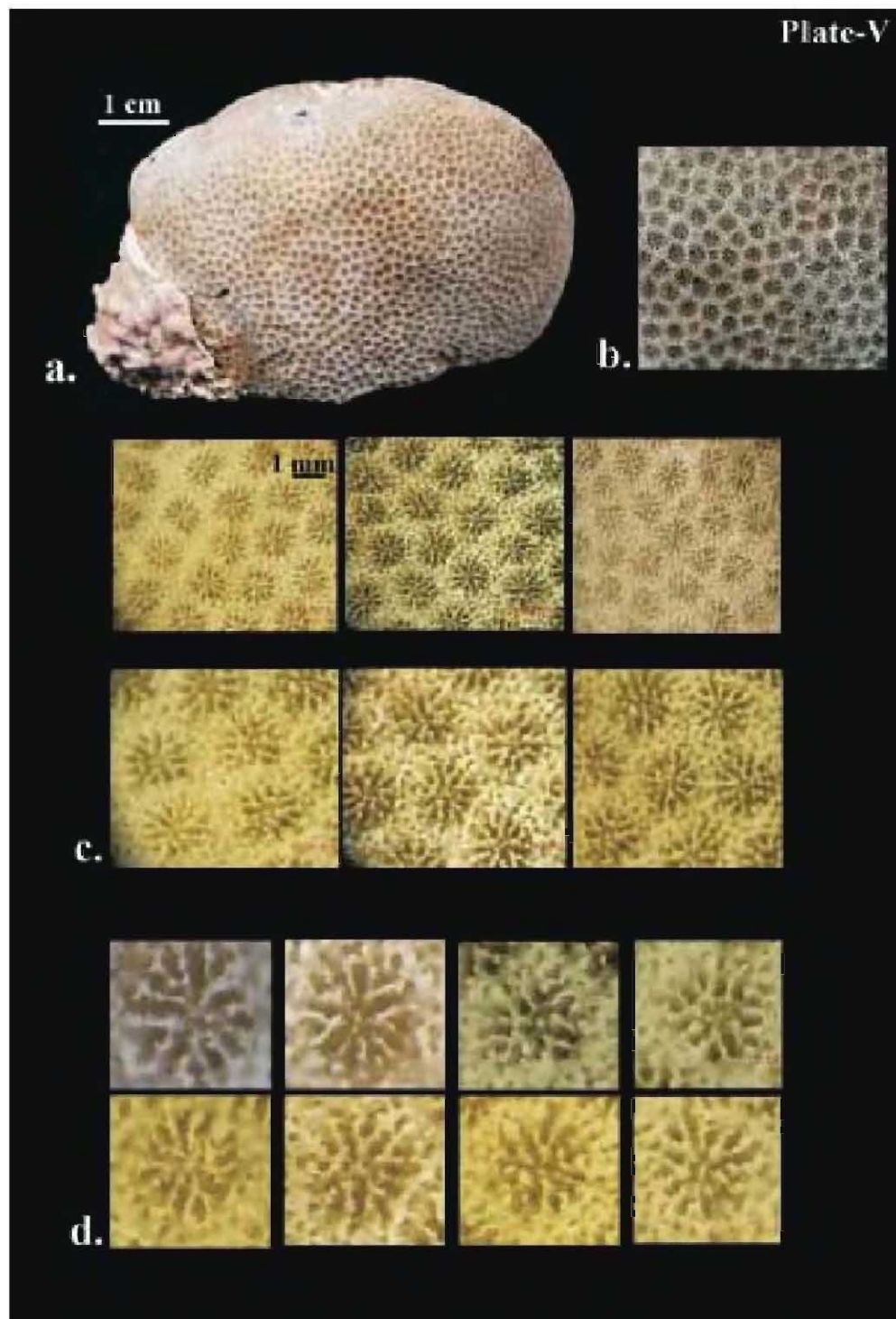
a. *Herpolitha weberi*, dorsal view of the corallum; **b.** Primary septa at the extremities reaching the peripheries, others encircled by a loop of the 3rd group of septa; **c.** Small cup shaped septal teeth; **d.** Arrangement of costae; **e.** Spinulose spines of the costa; **f.** Corallum showing arch

PLATE-IV



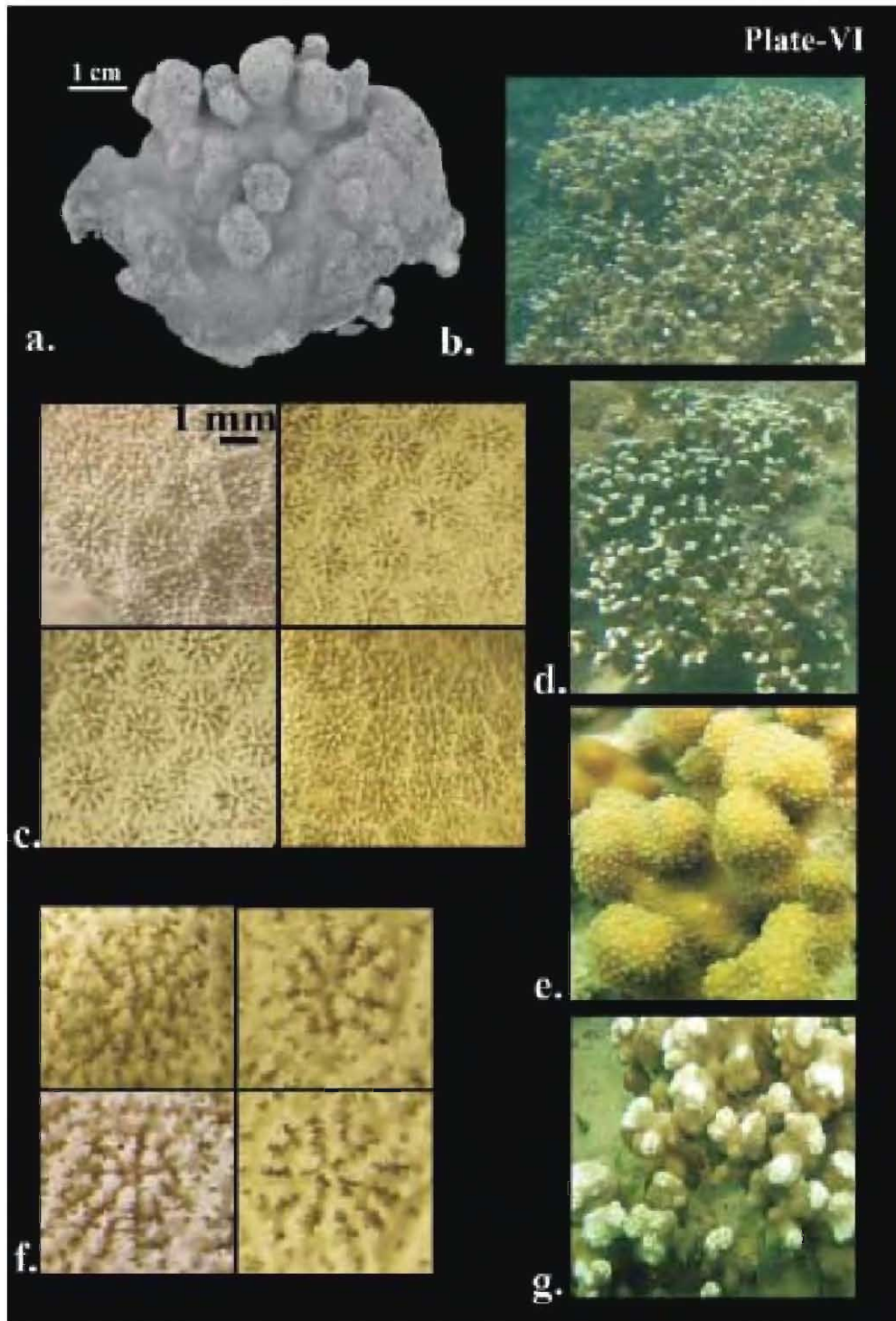
a. *Hydnophora grandis*, corallum; **b. & c.** Branches showing individually projected monticules; **d.** Arrangement of septa; **e.** Monticules appear fused at younger branch tips; **f.** Matured branch tips showing individual monticules; **g.** *In-situ* photograph of a ramose colony.

PLATE-V

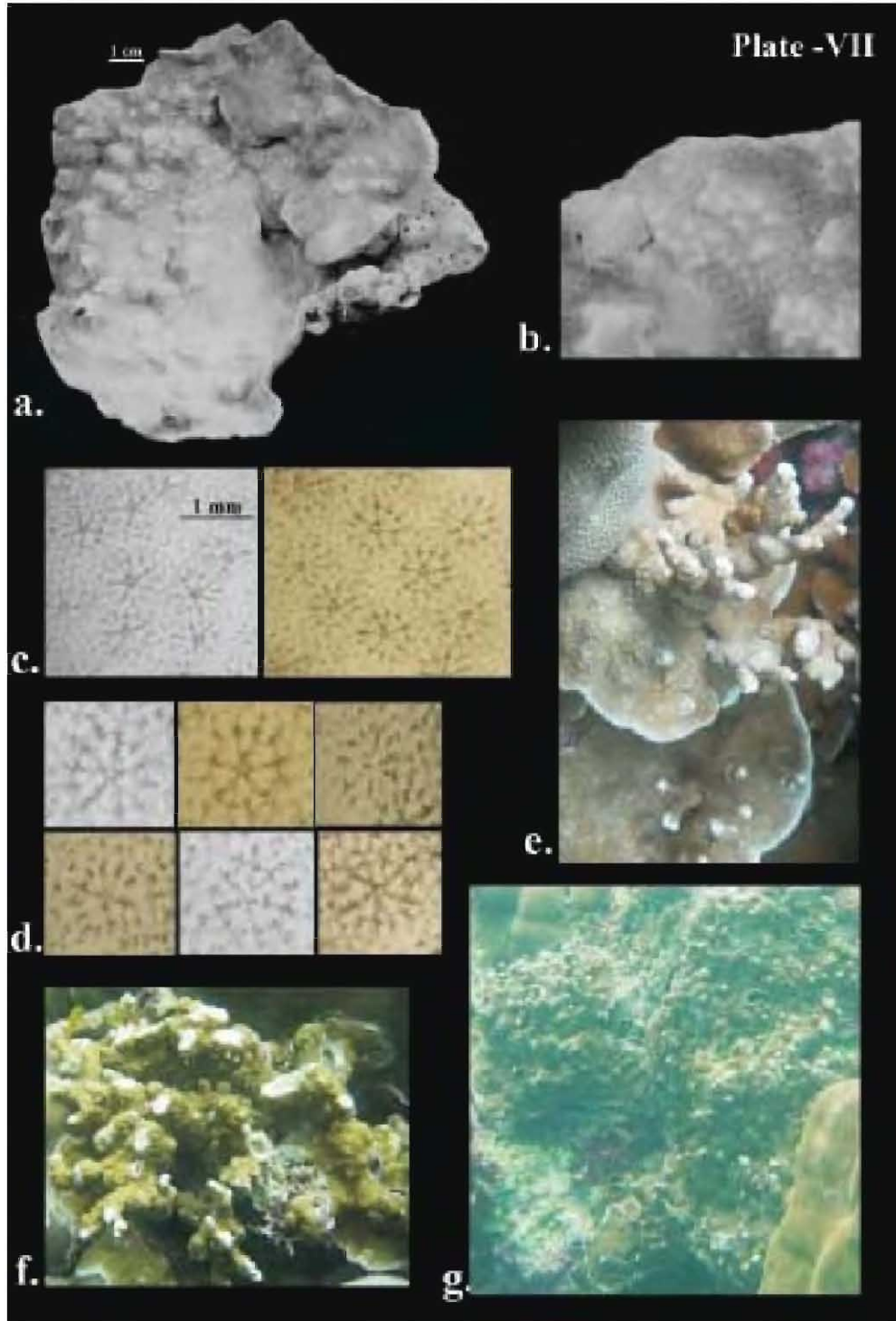


a. *Porites stephensoni*, material examined; **b.** Arrangement of corallites; **c. & d.** Details of corallite structures

PLATE-VI

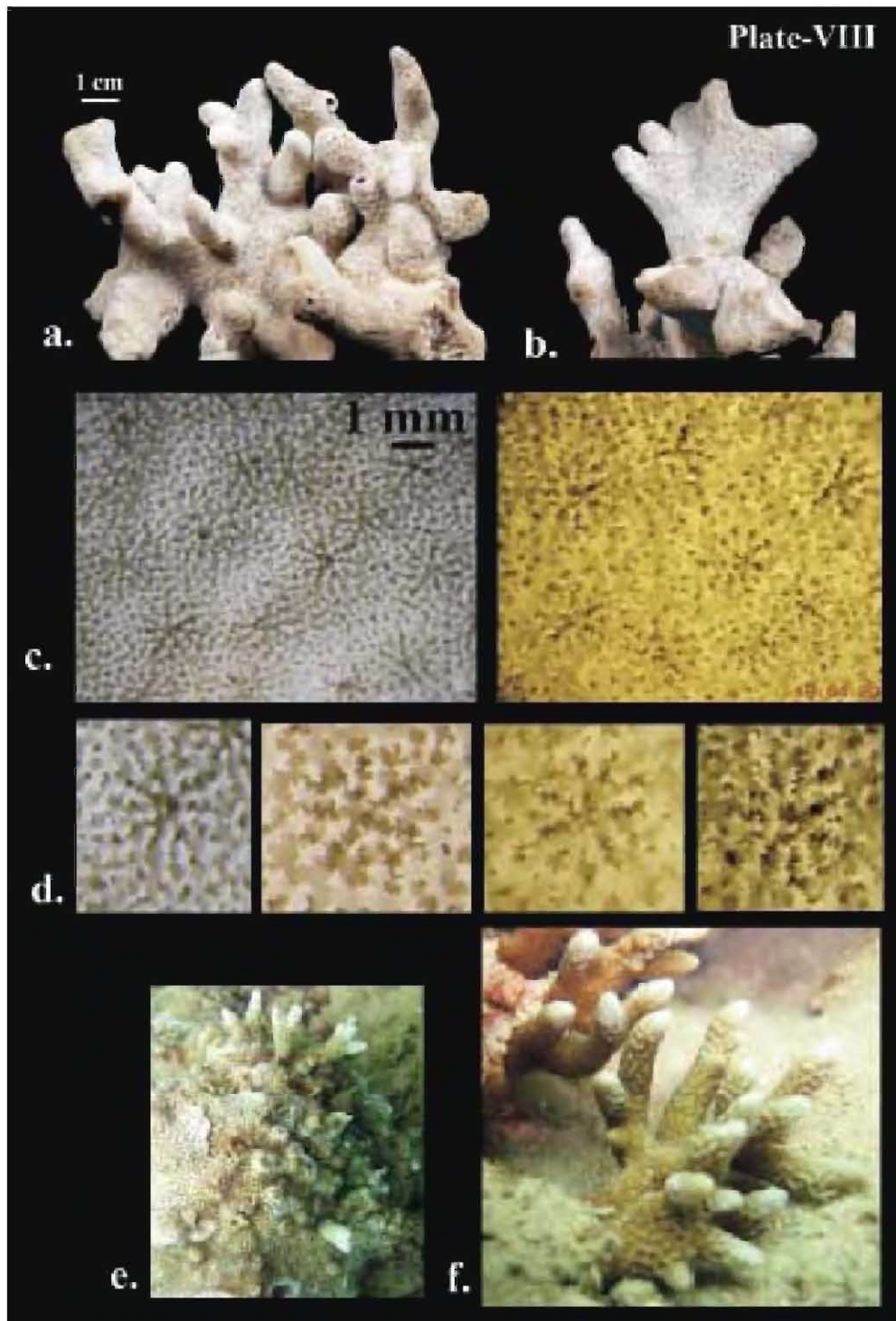


a. *Porites annae*, corallum showing nodular growth; **b.** A large colony at 6 m depth; **d.** Colony at a very shallow depth; **e.** & **g.** Colonies at shallower depths with polyps extended; **c.** Arrangement of corallites; **f.** Details of corallite structures

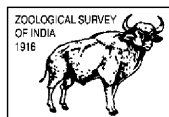
PLATE-VII


a. *Porites monticulosa*, laminar corallum; **b.** Laminar sheet showing ridges; **c.** Arrangement of corallites; **d.** Details of corallite structures; **e.** A laminar colony with upward projections developing into a slender column; **f.** Encrusting colony with slender columns; **g.** Encrusting colony with nodular projections

PLATE-VIII



a. *Porites latistella*, corallum showing excavated corallites; **b.** Branches with flattened tips; **c.** Arrangement of corallites; **d.** Details of corallite structures; **e. & f.** Smaller colonies at shallower depths



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STATUS AND DISTRIBUTION OF FOUR SPECIES OF HORNBILLS FROM NORTH AND CENTRAL WESTERN GHAT—A REPORT

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INTRODUCTION

The Western Ghats is one of the globally recognized “Hot Spots” for biodiversity in India (Mayers, 1990). It lies between 20° 12' N in the north of Navpur or somewhat north of river Tapati and Kanyakumari (8° 06' N, 77° 35' E) in the south and spread over six states. The Western Ghats complex encompasses southern Gujarat, western Maharashtra, Goa, western Karnataka, Kerala and part of Tamil Nadu (Fig. 1). It is located between the Tropical African (Ethiopian) and the Indo-Malayan biogeographic regions. Physiographically the area is somewhat flattened or flat-topped range of hills rise from the Arabian Sea and runs more or less parallel with it. The major hill ranges are the Nilgiri, Annamalai, Palanis and Cardamom hills.

The Western Ghats, being an important part of the monsoon land, is typically characterized by the development of the luxuriant tropical rainforests. The vegetation is influenced more by the abundance of seasonal rainfall than atmospheric temperature. This important biogeographic zone offers most suitable niche to the avifauna and it contains about 59% of Indian forms. Out of which 3 genera and 4 species of hornbills inhabit in Western Ghats. Hornbill is a large bird with considerably huge curved bills surmounted by casque in most of the species. It harbours in the semi-evergreen forests. The avifauna of Western Ghats and South India was studied by Davison (1883), Dewar (1904), Ali (1942-43), Ali (1969), Ali and Ripley (1970), Nicholas (1937). In recent years the birds are studied by Mahabal and Vasanth (2001), Pande *et al* (2003). This report deals with the distribution and abundance

of our species of hornbills namely Malabar Grey Hornbill, Indian Grey Hornbill, Malabar Pied Hornbill and Great Pied Hornbill (Family Bucerodidae) in some areas of Western Ghats.

STUDY AREAS

Chatterjee (1940) classified the Western Ghats in four broad phytogeographic regions. The regions are (i) River Tapti to Goa; (ii) River Kalinadi to Coorg; (iii) the Nilgiris; (iv) The Anamalai, Palanis and Cardomum hills. The present studies on hornbills were carried out in two regions—(i) River Tapti to Goa, covering southern Gujarat, parts of Maharashtra and Goa and (ii) River Kalinadi to Coorg, which included part of Karnataka. The states and districts that are included in these two complexes of Western Ghats fall in north Western Ghats and central Western Ghats (Fig. 2). The physiography of the northern Western Ghats consisted of ravines and canyons, flattopped spurs intereseected by valleys on the easter side and the central Western Ghats regions having valleys surrounded by deep gorges 3-5 km across and 30 m deep. At Maharashtra state many hills have terrace sides and flat tops and great Marathas have built forts in some hilltops. the average elevation of the hills is about 500 m and some peaks arise up to 1000 m. The rainfall is heavy, may go up to 5000 mm in a year. The average maximum and minimum temperature are 30° c and 9.5° c respectively and at higher elevation the temperature goes down up to 5° c.

The major rivers in the study areas are Tapti, Krishna, Savitri, Koyna, Bhima, Kalinadi etc. High atmosphere humidity, warm temperature and high

Table-1 : Selected characters to identify the hornbills in field.

Species	Status	Characters
Malabar Grey Hornbill (<i>Ocyrceros griseus</i>)	Endemic	Bill with no casque, bill colour yellow with brownish re-tinge at the tip. Plumage slaty grey.
Indian Grey Hornbill (<i>Ocyrceros birostris</i>)	-	Bill with small feel-shaped casque, bill almost wholly yellow. Plumage brownish grey.
Malabar Pied Hornbill (<i>Anthracoceros coronatus</i>)	NT (IUCN)	Casque compressed, ridge-like and ending in a simple point, bill is black. White underparts, black neck.
Great Pied Hornbill (<i>Buceros bicornis</i>)	NT (IUCN)	Bill large high casque, ending anteriorly in two points. Underparts and wings black, tail with a broad black subterminal band. White neck.

Table-2 : Description and distribution of hornbills in Western Ghats.

Species	Characters	Distribution
Malabar Grey Hornbill (<i>Ocyrceros griseus</i>)	Slaty grey hornbill. Head, throat and breast streaked with whitish, wings and tail black with white tipped. No casque on bill, Sexes alike.	Mumbai, Khandala south through southern Maharashtra, Goa, western Karnataka, western Tamil Nadu and Kerala. (Ali & Ripley, 1970).
Indian Grey Hornbill (<i>Ocyrceros birostris</i>)	Brownish grey with black and white tipped graduated tail. Heavy curved bill surmounted by a pointed casque. Sexes alike.	Maharashtra, Karnataka, Kerala, Gujarat. Absent in the arid parts of Gujarat and also in the heavy rainfall areas of Kerala. (Ali & Ripley, 1970).
Malabar Pied Hornbill (<i>Anthracoceros coronatus</i>)	Large pied hornbill with black neck and white under parts. A huge yellow and black bill surmounted by a ridgelike casque ending in front in a single point. Female smaller.	Ratnagiri of Maharashtra through Goa, western Karnataka, western Tamil Nadu and Kerala. (Ali & Ripley, 1970).
Great Pied Hornbill (<i>Buceros bicornis</i>)	A large black and white bird with neck, abdomen and tail white in colour. Face, wings and under parts black. A large yellow bill surmounted by a concave topped casque. Female smaller.	Khandala (18°N, 74°E) of Maharashtra south through Goa, western Karnataka, western Tamil Nadu and Kerala. (Ali & Ripley, 1970).

precipitation of southeast monsoon favours deep forests with dense undergrowth. The flora recorded are *Tectona grandis*, *Terminalis tomentosa*, *T. arjuna*, *T. peniculata*, *Ixora parviflora*, *Adina cordifolia*, *Butea frondosa*, *Ziziphus rugosa*, *Anogeissus laifolia*, *Ficus bengalensis*, *Eugenia janbolana*. Bamboo (*Bambusa arundinacea*, *Dendrocalamus strictus*) and medicinal plants are much common in these areas.

METHODOLOGY

Initially available literatures were consulted and before the field survey was initiated, information was gathered from forest personnel associated in the field, local people and tribal communities of the forests. The

hornbills are frugivorous birds and used the upper canopy of the trees, thus the forest types and areas were selected depending upon roosting sites and feeding trees. A slow moving vehicle surveyed the entire areas with three observers. The forests tracts and trials were surveyed on foot. The study was conducted by adopting random sampling technique. Nearly 50 km stretch was covered in each day survey and presence of hornbills either sighted or reported was being recorded. As the habitable areas of the hornbills spill over to a number of states/districts, a multiple field trips were conducted. A total of 90 days was spent in the field for locating these birds and at about 500 hours were spent. During 2001-2003,

altogether six surveys were conducted covering Narmada district of Gujarat south through Jog Falls of Karnataka. The mechanical aid used in the field was binoculars (7 × 50). During field survey minute and careful observation could only distinguish the four different species of hornbills. There were some characters, so close in the four species of hornbills; therefore some major criteria were chosen to identify the species in the field shown in Table-1.

A total of 228 hornbills were sighted comprising of all four species in the surveyed areas of Western Ghats (Table-3). About 132 reported information of hornbills other than the observed data was collected except Malabar Grey Hornbill (Table-4). During the entire period of survey in Western Ghats we could fail to gather any information on the presence of this species of bird in other areas.

Malabar Grey Hornbill *Ocyrceros griseus*

There were 21 birds sighted during the course of survey in Western Ghats (north and central), out of which 8 birds were from Karnataka and 13 birds from Maharashtra (Table-3). Malabar Grey Hornbills were located from localities in Western Ghats 13 birds were

sighted in Amboli Ghats in Sindhudurg district of Maharashtra of which 7 birds were seen in a mixed flock of Malabar Pied Hornbills. 3 birds were sighted from Karnataka and 5 from near Molem, Goa. In the National Zoological Collection, Kolkata, it was recorded that majority of Malabar grey hornbills were collected from Goa part of Western Ghats. The 14 examples that were collected, of which 12 birds were represented from Goa during 1968-1981 periods. It was also surprising that no report was available for the presence of this species in other areas of Western Ghats except only very few places in Goa. Ali and Ripley (1970) recorded distribution range of Malabar Grey Hornbill in Western Ghats from Mumbai and Khandala south through southern Maharashtra, Goa, western Karnataka, western Tamil Nadu and Kerala. The present study revealed that this species no longer exists in Mumbai, Khandala up to Kolhapur and Ratnagiri district of Maharashtra. The Malabar Grey Hornbill not even found in the Dharwar and Shimoga district of Karnataka and it is replaced by another species of hornbill, the Indian Grey Hornbill. The Malabar Grey Hornbill is now restricted in its distribution in some parts of Maharashtra and Goa in Western Ghats (Fig. 3).

Table-3 : The distribution of hornbills in north and central Western Ghats.

Sl. No.	Species	State/District	Locality	Habitat	Total No. bird
1	Malabar Grey Hornbill (<i>Ocyrceros griseus</i>)	Sindhudurg Maharashtra	Amboli Ghat	F	6
2		Sindhudurg Maharashtra	Amboli Ghat	F	7
3		Molem, Goa	Molem	F	5
4		Belgaum, Karnataka	Narden	V	5
5		Karnataka	Jog Falls	F	3
Total					26
6	Indian Grey Hornbill (<i>Ocyrceros birostris</i>)	Narmada/ Gujarat	Sorsi, Mandvi range	F	6
7		Narmada/ Gujarat	Kevdi, Vansda N.P.	F	7
8		Sholapur, Maharashtra	Villages near Nannaj Sancuary	V	8
9		Pune, Maharashtra	Dhebewadi	T	5

Sl. No.	Species	State/District	Locality	Habitat	Total No. bird
10		Purne, Maharashtra	Dhebewadi	T	3
11		Satara, Maharashtra	Pune-Kholapur	V	1
12		Raigad, Maharashtra	Karnala Bird Sanctuary	F	8
13		Dharward/ Karnataka	Dandeli	T	5
14		Shimoga/ Karnataka	Yarmukh village	V	6
15		Shimoga, Karnataka	Shimoga	T	30
Total					79
16	Malabar Pied Hornbill (<i>Anthraceroceros coronatus</i>)	Satara, Maharashtra	Pratapgarh	V	3
17		Kolhapur, Maharashtra	Fanasgaon	V	4
18					
19		Kolhapur, Maharashtra	Velgive	V	2
20		Ratnagiri, Maharashtra	Jaitapur	F	6
21		Ratnagiri, Maharashtra	Devrukh	V	3
22		Ratnagiri, Maharashtra	Kundi	V	2
23		Ratnagiri, Maharashtra	Sakharpa	V	4
24		Ratnagiri, Maharashtra	Hatkhamba	V	4
25		Ratnagiri, Maharashtra	Ujgaon	V	3
26		Ratnagiri, Maharashtra	Talekanta	V	3
27		Ratnagiri, Maharashtra	Pangri	V	4
28		Sindhudurg, Maharashtra	Majgaon	F	2
29		Sindhudurg, Maharashtra	Amboli Ghat	F	6
30		Daraward, Karnataka	Dandeli	F	53

Sl. No.	Species	State/District	Locality	Habitat	Total No. bird
31		Shimoga, Karnataka	Bhadra WLS	F	1
32		Shimoga, Karnataka	Sharavati WLS	F	7
Total					111
33	Great Pied Hornbill (<i>Buceros bicornis</i>)	Satara, Maharashtra	Pratapgarh	V	2
34		Satara, Maharashtra	Pratapgarh	T	2
35		Satara, Maharashtra	Dhudosi	V	2
36		Darward, Karnataka	Gund range, Dandeli div.	F	4
37		Shimoga, Karnataka	Sharavati	F	2
Total					12
Grand Total					228

Abbreviation : V-Village; F-Forest; T-Town

Indian Grey Hornbill *Ocyeros birostris*

79 Indian grey hornbills were recorded from north and central Western Ghats during the surveys; of which 13 from Gujarat, 25 birds were sighted in Maharashtra, and 41 from Karnataka parts. The Gujarat population was recorded from the forests. Maharashtra and Karnataka population were observed in forests, villages and towns (Table-3). the highest concentration of Indian Grey Hornbills in a single spot was recorded from Shimoga town, Karnataka and it was 30 in number. The Indian Grey Hornbills' collection in the Zoological Survey of India from Western Ghats was only from

Pune district, Maharashtra. During the course of survey in Western Ghats, this species was reported from 10 localities comprising forest, village and town areas. Altogether 12 birds were reported on enquiry at various levels in the large areas that were surveyed. The population of Indian Grey Hornbill recorded from Western Ghats was very low and distributed in some pockets. It was observed that this species harbour from Narmada district of Gujarat to Satara district of Maharashtra and in the Shimoga district of Karnataka. The left out stretch from Kolhapur district, Maharashtra through Goa and Belgaum district, Karnataka now occupied by the Malabar Grey Hornbill (Fig. 3).

Table-4 : The distribution of hornbills in north and central Western Ghats (Reported).

Sl. No.	Species	State/District	Locality	Habitat	Total No. bird
1	Malabar Grey Hornbill (<i>Ocyeros griseus</i>)		None		
2	Indian Grey Hornbill (<i>Ocyeros birostris</i>)	Gujarat/ Narmada	Nenai Falls Sagai range Shoolpaneswar WLS	F	3
3		”	Saribar beat, Pipalod Range	F	3

Sl. No.	Species	State/District	Locality	Habitat	Total No. bird
4		Gujarat/ Narmada	Vaghmar beat Dumakhhal,	F	2
5		”	Namgir, Dediapada	F	2
6		Maharashtra, Dhule	Valpai Range, Dev River	F	2
Total					12
7	Malabar Pied Hornbill (<i>Anthracoceros coronatus</i>)	Goa	Codra village (Ponda)	V	10+
8		Maharashtra Sindhudurg	Madkol & Danoli village	V	8+
9		”	Parula (Vengurla)	V	2+
10		”	Otawana (Sawanwadi)	V	2+
11		”	Talera & Vidaydurg	V	10+
		”	Darum (Kankavali)	V	2+
12		Maharashtra, Ratnagiri	Dongar (Rajapur)	F	6+
13		”	Kundi (Devrukh)	V	15+
14		”	Tulsani (Sangameswar)	V	10+
15		”	Hansgaon (Dajipur)	V	2+
16		Maharashtra, Raigarh	Khandas	V	2+
17		Karnataka, Dandeli	Kulig, Nature Camp	F	2+
18		”	Konappa (Dandeli)	V	3+
19		”	Gunda Range	F	4+
20		”	Kadagani (Anshi)	V	2+
21		”	Kudagadi (Anshi)	V	3+
22		Karnataka, Shimoga	Haihole (Saithyali)	F	2
Total					85
23	Great Pied Hornbill (<i>Buceros bicornis</i>)	Dandeli WLS, Karnataka	Yarmuchh- Karemae, Gond Range	F	35
Grand Total					132

Abbreviation : V-Village; F-Forest; T-Town

Malabar Pied Hornbill *Anthracoceros coronatus**

A total of 111 Malabar Pied Hornbills were recorded from Western Ghats, of which 50 birds were sighted in Maharashtra part and remaining 61 from Karnataka part (Table-3). No birds were recorded from Goa. Enquiry from the local people revealed that this bird paid regular visit in the Codra village, near Molem, Goa during fruiting season and the number was between 8 and 10. The largest flock of 53 Malabar Pied Hornbills was recorded from Dandeli, Karnataka. These birds were roosting in the trees in the afternoon after feeding. the entire population of Malabar Pied Hornbill of Karnataka harbour in the forests, whereas only 18 birds were found in the forests of Maharashtra. The remaining 32 birds recorded from Maharashtra were inhabited in the villages, of which 23 birds were observed in the villages of Ratnagiri district. During the surveys 111 birds were reported from the Western Ghats and it spread over from Satara and Kolhapur through Sindhudurg districts of Maharashtra south to Jog Falls of Karnataka (Fig. 3). The survey also revealed that Malabar Pied Hornbills were found more in the villages, of Maharashtra with a good population. Local enquiry in the villages also

confirmed that the many a times villagers noticed this large bird flying across.

Great Pied Hornbill *Buceros bicornis***

The population of this bird is very low in these parts of Western Ghats. Altogether only 12 birds were recorded from the entire surveyed areas of which 6 birds were seen from Satara district of Maharashtra and equal number from Karnataka (Table-3) All Great Pied Hornbills were observed in the forests of the two states. Local people of Velgire village, Kankavali taluka, Sindhudurg district, Maharashtra reported to see this bird during fruiting season (April-May) of every year. Villagers of Kundi village, c. 20 km. from Devrukh, Sangameswar taluka, Ratnagiri district, reported 6-7 birds during April-May 2002. Reported Information revealed that the villagers and forest personnel at Yarmuckh-Karemane areas near Gund Range of Dandeli Wildlife Sanctuary of Karnataka sighted nearly 30-35 birds. This bird visits this place during September-October every year when Ciddar fruits are available. So, the Great Pied Hornbill found in Satara districts of Maharashtra is a disjunctive isolated population (Fig. 3).

Negative Areas :

Table-5 : Negative areas of the North and Central Western Ghats (surveys were undertaken but hornbills were not found).

Sl. No.	Surveyed Area	Period of Survey
1	Samot, Dediapada Taluka, Narmada district, Gujarat (Fig. 4)	19.07.2003-22.07.2003
2	Bardipada, Purna WLS, North Dang Division, Ahwa district, Gujarat	23.07.2003-25.07.2003
3	Pimpri, South Dang Division, Vansda NP, Navsari district, Gujarat	26.07.2003-29.07.2003
4	Mahabaleswar & Pratabgarh, Satara district, Maharashtra (Fig. 5 & 6)	07.08.2002-09.08.2002
5	Khadala, Raigad district, Maharashtra (Fig. 7)	10.08.2002-11.08.2002
6	Pen and Alibag Maharashtra (Fig. 8)	12.08.2002
7	Panvel, Karmala Bird Sanctuary, Raigad, Maharashtra (Fig. 9)	13.08.2002
8	Poi, Karjat, Raigad, Maharashtra	14.08.2002-16.08.2002
9	Koyna WLS, Karad, Satara district, Maharashtra	10.11.2001
10	Chinchini, Pune district, Maharashtra	6.11.2001
11	Sagareswar WLS, Islampur, Sangli district, Maharashtra	17.11.2001
12	Panhala, Kolhapur district, Maharashtra	10.11.2001
13	Waranabad Dam, Chandoli WLS, Kolhapur district	15.11.2001
14	Radhanagri WLS, Kolhapur district, Maharashtra	15.11.2001

*2♂ 1♀ were observed from Hyderabad, Andhra Pradesh (Pittie, A 2003); 4 examples on 30.07.2003 and a flock on 09.03.2003 were observed from Sanjay Gandhi National Park, Mumbai, Maharashtra (Andheria *et al* 2003).

**2 examples on 30.07.200 and 1♀ on 09.03.2003 were observed from Sanjay Gandhi National Park, Maharashtra (Andheria *et al* 2003).

DISCUSSION

Surveys of north and central parts of Western Ghats revealed an approximate estimation harbouring localities but not the population density of the hornbills. The four species of hornbills that were found in Western Ghats at present, observed patchy distribution at certain pockets fallen under Maharashtra, Goa and part of Karnataka (Fig. 3). The distribution is not continuous one as referred by Ali and Ripley (1970) nearly 30 years back. Out of four species of hornbills that are inhabited in Western Ghats, the Indian Grey Hornbills and Malabar Pied Hornbills were more in numbers. the Indian Grey Hornbills now found in good concentration in Karnala Bird Sanctuary, Raigad district, Dhebewadi, Pune district, Maharashtra and Shimoga district of Karnataka. The birds were recorded in forests, villages and towns of the surveyed areas. The Malabar Pied Hornbills were recorded in the forests and a good number were located all along the forests tracts of Konkan Railway running from north to south. The highest concentration of this bird was observed in Dandeli forest of Karnataka consisting of 53+ birds. The Malabar Pied Hornbill prefers high trees with thick foliage to hide them. They also prefer villages near the forested areas. The population of Malabar Grey Hornbills and Great Pied Hornbills were very poor as compared to Indian Grey Hornbill and Malabar Pied Hornbill in Western Ghats as observed during the study. Only 21 birds of Malabar Grey Hornbills and 12 birds of Great Pied Hornbills were recorded in large areas of Western Ghats. It is evident from earlier records that Malabar Grey Hornbills were plenty in numbers about thirty years back in Goa (Ali & Ripley 1970 and National Zoological Collections, Kolkata). Now a days due to rapid urbanization, forest cutting, habitat loss, the population of Malabar Grey Hornbill had declined in 2001-2002 in these areas. It was observed that now a days Malabar Grey Hornbills are not found in Dharwar and Shimoga districts of Karnataka, once they were found in good numbers. It seems that they are being replaced by the Indian Grey Hornbills.

RECOMMENDATIONS FOR CONSERVATION

Hornbill, a small family of frugivorous birds, consists of five genera and nine species in the Indian forms, of which the Western Ghat Complex shares three genera

and four species. The hornbills whatsoever found in Maharashtra and Goa is well protected due to religious belief. According to Hindu mythology, it is called "Guard Pakshi", means the carrier of Lord Vishnu. The population of hornbills is more in the plains rather than in the hills where tribal people kill them for flesh and feathers. They also used the head with casque of the hornbills for decorative purposes. Moreover, hornbills are mostly dweller of evergreen forest which is decreasing day by day. So the hornbills are concurrently decreasing mainly due to loss of habitats. It is well presumed that coming days are not rosy for hornbills.

It was observed from this study that population of Malabar Grey Hornbill and Great Pied Hornbill is very less. Moreover Malabar Grey Hornbill *Ocyrceros griseus* is an endemic bird species and restricted to Western Ghats only (Jathar and Rahmani, 2006). So, it requires full protection. Further, both Malabar Pied Hornbill *Anthraceroceros coronatus* and Great Pied Hornbill *Buceros bicornis* are included in Schedule-I, part-III (Birds) of Indian Wildlife (Protection) Act, 1972 (as amended up to 2002) and are also categorized as Near Threatened species as per Red List species of Birds from India as per Bird Life International 2004. Hence they also need a protection. So in this context, before all these hornbill species silently disappear, a positive action should be taken to protect the remaining population of hornbills from north and central Western Ghats.

1. Steps should be taken to preserve forest patches of Maharashtra and Karnataka, particularly where Great Pied Hornbill and Malabar Grey Hornbill are found.
2. Forest patch of Molem, Goa, is steadily decreasing. This patch should also keep aloof from speedy urbanization.
3. Human association is preferred by hornbills, as it was seen in whole of Maharashtra; Dandeli and Shimoga towns of Karnataka where both Indian Grey Hornbill and Malabar Pied Hornbill keeps human association for their safety. So it is need of the day to be friend with hornbills and not to disturb them at their roosting and nesting places. Hence, there is a need to educate the local people and School children; make them aware through newspaper, radio, television programmes and



Fig. 1 : Map of Western Ghats (above)



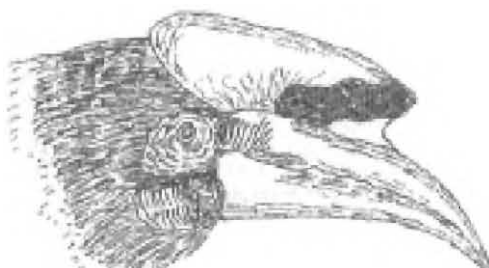
Fig. 2 : Map of surveyed and non surveyed parts of Western Ghats during the study period



1. Indian Grey Hornbill



2. Malabat Grey Hornbill



3. Malabar Pied Hornbill



4. Great Pied Hornbill



Pict. 1. Indian Grey Hornbill



Pict. 2. Malabar Grey Hornbill



Pict. 3. Flock of Malabar Pied Hornbill



Pict. 4. Malabar Pied Hornbill



Pict. 5. Great Pied Hornbill

Four species of Hornbills in North and Central Western Ghats



Fig. 3 : Present and past (Ali & Ripley 1970) distribution of Hornbills in north and central Western Ghats

N.B. : Red line across the sketches is the demarcation line in between northern (surveyed) and southern (not surveyed) portion of the Western ghats.

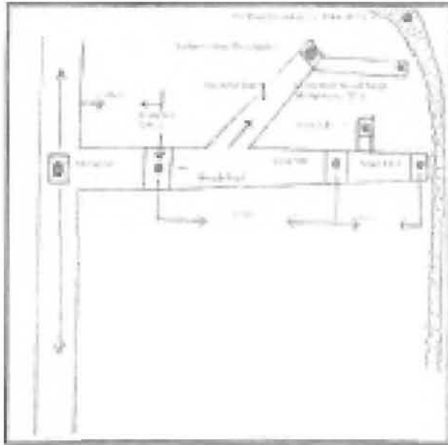


Fig. 4. Camp : Samot, Taluka : Dediapada,
Dist. : Narmada, Gujarat

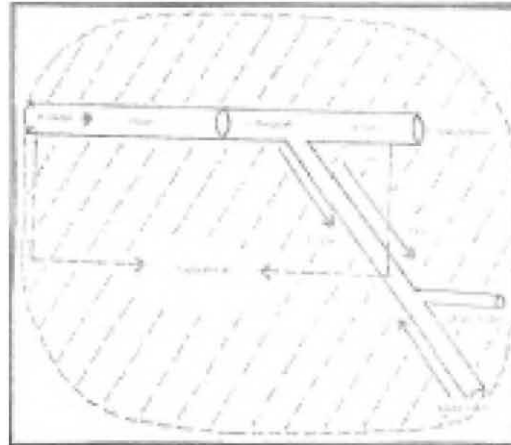


Fig. 5. Camp : Pratapgarh, Dist. Satara, Maharashtra

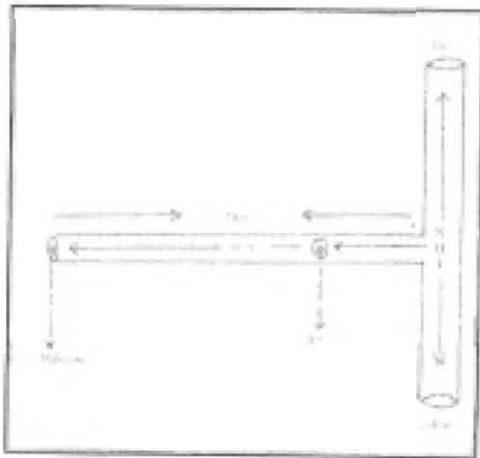


Fig. 6. Camp : Mahabaleswar, Dist. : Satara,
Maharashtra

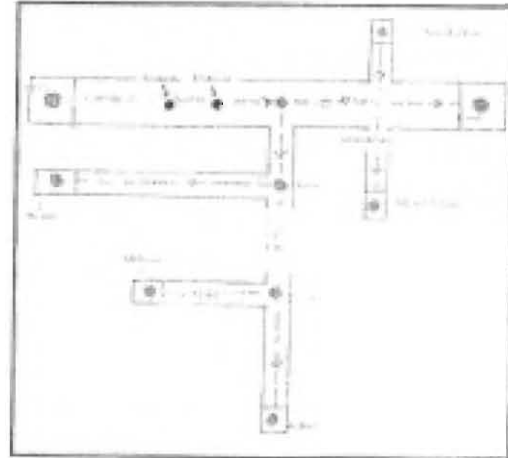


Fig. 7. Camp : Khandala, Dist. : Raigad, Maharashtra



Fig. 8. Camp : Khandala, Dist. : Raigad,
Maharashtra

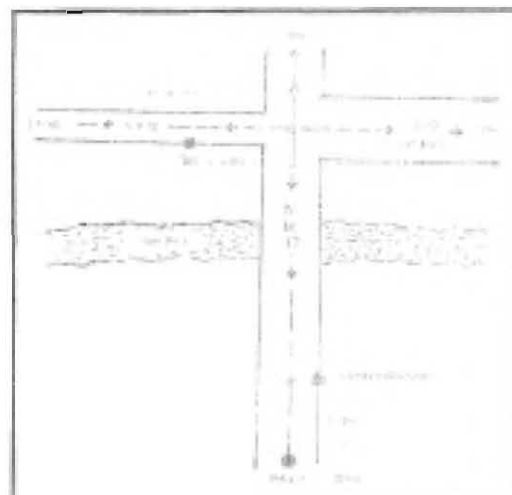
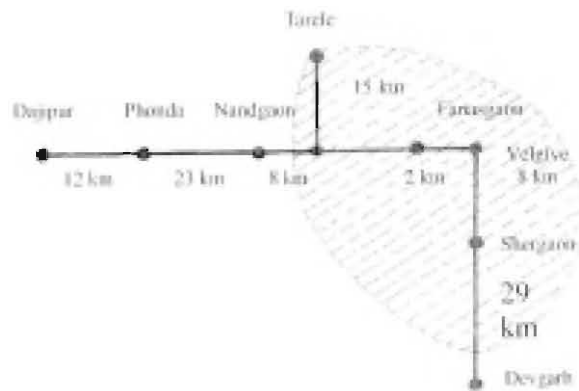
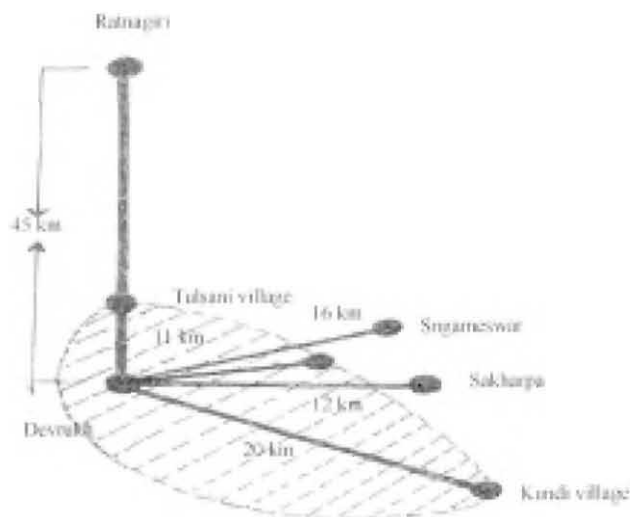


Fig. 9. Camp : Panvel, Dist. : raigad, Maharashtra

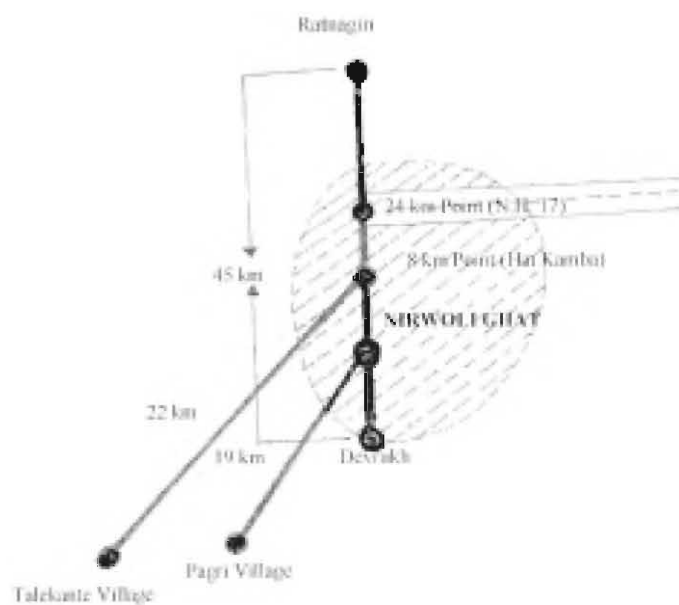
Fig. 4-9 : Imaginary sketches of surveyed areas of North and Central Western Ghats where hornbills were not found.



The whole stretch of hills starting from Tarele to Shergaon under Devgarh Taluka, sindhudurg district is the homeland of Malabar Pied Hornbill along with Great Indian Pied Hornbill.



Whole stretch has a very good population of Malabar Pied Hornbill



This stretch has a concentration of Malabar Pied Hornbill

Fig. 10 : Distribution sketch of Malabar Pied Hornbill in Maharashtra.

involve them along with NGOs, Forest Department in conservation activities.

4. Enforcement Authorities like Forest and Police departments of these states should take legal action against the poaching activities, illegal shooting of hornbills for flesh, feathers and bill with casque.

SUMMARY

Altogether 6 surveys were conducted during, 2001-2003 in north and central Western Ghats for four species of hornbills that are distributed in the Western Ghats complex. A total of 223 hornbills were sighted and about 132 $\pm$ reported information other than observed data were collected except Malabar Grey Hornbill. The population of all four species appeared to be declining and the worst affected is Great Pied Hornbill of which two isolated thin population were observed in the study area. Indian Grey Hornbill and Malabar Pied Hornbill have steady population in comparison with other two

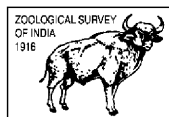
species. Malabar Grey Hornbill at present limits its distribution in some pocket of Goa State. To provide thin lifeline on the four species of hornbills in north and central Western Ghats, habitat so far remains till date, should be kept intact in order to check elimination of hornbills in future.

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REFERENCES

- Ali, Salim (1942-43). The birds of Mysore, parts, *J. Bombay nat. Hist. Soc.* **43** : 318-34.
- Ali, Salim (1969). Birds of Kerala 2nd Edition, Oxford University Press, Bombay.
- Ali, Salim and Ripley, S. Dhillon (1987) Compact Edition of the Handbook of the Birds of India and Pakistan, Oxford University Press, Bombay.
- Chatterjee, D. (1940) Studies on the endemic Flora of India and Burma. *J. Asiat. Soc. Bengali.* **5** : 19-67.
- Davidson, W. (1883). Notes on some birds collected the Nilgiri and parts of Wynaad and southern Mysore. *Stray Feather*, **10** : 329-419.
- Dewar, Douglas (1904). Some notes on the birds taken at Coonoor, Nilgiris, In the May 1904. *J. Bombay nat. Hist. Soc.*, **16** : 153-154.
- Jathar, G.A. and Rahmani, A.R. (2006) Endemic Birds of India. *Buceros*, **11**(2 & 3) : 1-53.
- Kannan, R. and James, D.A. (1997). Breeding Biology of the Great Pied Hornbill (*Buceros bicornis*) in the Anaimalai Hills of Southern India. *Journal of Bombay Natural History Society.* **94** : 451-465.
- Mahabal, Anil and Vasanth, M. (2001). Fauna of Nilgiri Biosphere Reserve, Aves. *Zool. Sur. India, Fauna of Conservation Area Series 11 : Fauna of Nilgiri Biosphere Resrve* : 245-310.
- Manakadan, R. and Pittie, A. (2001). Standardised common and scientific names of the birds of the Indian Subcontinent. *Buceros* **6**(1) : 1-37.
- Mudappa, D. (2000). Breeding biology of the Malabar Grey Hornbill (*Ocyrceros griseus*) in southern Western Ghats, India. *Journal of Bombay Natural History Society* **97**(1) : 15-24.
- Mudappa, D.C. and Kannan, R. (1997). Nest site characteristics and nesting success of Malabar Grey Hornbill in southern Western Ghats, India, *Wilson Bulletin.* **109** : 102-111.
- Nicholas, E.G. (1937). The Kodaikanal birds and how to name them. *Journal of Bombay Natural History Society*, **39** : 812-830.
- Pande, Satish, S. Tambe, Clement Francis M. and Niranjana, Sant (2003). Birds of Western Ghats, Konkan and Malabar (including Birds of Goa). Bombay Natural History society and Oxford University Press.



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NOTES ON THE ZOO-GEOGRAPHICAL DISTRIBUTION OF ANTARCTIC BIRDS BASED ON THE SIGHTING OF ZSI SCIENTISTS DURING 15TH AND 22ND INDIAN ANTARCTIC EXPEDITIONS

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**Member of the 22nd Expedition, **Member of the 15th Expedition*

INTRODUCTION

The Southern Ocean is oceanographically defined as an ocean productive connected with the Antarctic Circumpolar Current, which circulates around Antarctica. This is the aquatic zone in the face of earth where marine birds come in the austral spring and summer to incubate their eggs and to care for their young. During these few months there are sufficient nutrients in the surface of ocean waters to support tremendous blooms of marine plants and the birds spend much of their time in this nutrient rich ocean.

The chapter of Indian Antarctic Programme opened way back in 1981, when the first Indian Scientific Expedition to Antarctica was flagged off from Goa, India. The first scientist from Zoological Survey of India joined 9th expedition during 1989-1990. Since then a continuing monitoring programme was taken up specially on birds and mammals of Antarctic Ocean and moss-inhabiting invertebrate fauna of Schirmacher Oasis, by the ZSI scientists. Daily watch by the scientists was recorded en-route from the ship on sighting of birds and mammals (Fig. 1).

Information on the occurrence and distribution of sea birds of the Indian Ocean sector is meager. Parulekar (1983) published first paper on the occurrence of sea birds in Indian Ocean. Afterwards, Mathew (1994), Chattopadhyay (1995), Sathyakumar (1998) and Bhatnagar and Sathyakumar (1999) published reports on the observation of Antarctic birds. This present communication reveals a comparative study on the zoo-

geographical distribution of Antarctic birds in two different routes of Indian Antarctic expedition (15th from Goa and 22nd from Cape Town, South Africa). Attempts have also been made to find out the variation of distributional ranges and occurrence of marine birds since the 11th Indian Antarctic Scientific Expedition.

This communication is dedicated in the memory of Late Srikumar Chattopadhyay, a great Ornithologist and a member of 11th Indian Antarctic Expedition, who deeply inspired us and left an everlasting influence on us.

STUDY AREA

The 15th expedition route started from Goa (15° 24' N, 73° 48' E) to Indian Bay (69° 56' S, 11° 54' E) in Antarctica via Mauritius and almost 11,000 km stretch of the Indian Ocean was traversed during the onward journey and same during the return journey. The member of the 22nd expedition reached Cape Town from Goa by Air and landed at Indian Bay by ship through the Atlantic Ocean. While return to India the same route was followed. Observations of marine birds were carried out over a vast area from 36°S to 69°S and 30° E to 48° E and from 34°S to 70°S and 12° E to 39° E of Antarctic and sub-Antarctic region during 15th and 22nd expeditions respectively (Fig. 5). These areas were comprised of open sea, floating ice, pack ice, polynia, ice shaft and continental ice. We have considered here only latitude-wise distribution of birds on sightings in both the expeditions. For easy understandings the zoo-geographical distribution of the birds, the study areas

have been divided into three broad divisions i.e., Temperate zone (36°S to 49°S) where cool sub-Antarctic and the warmer sub-tropical surface water is mixing up. Sub-Antarctic or sub-polar zone (50°S to 59°S) where surface layer with slightly warmer Sub-antarctic water and deeper layer with cold denser Antarctic water and the last and third zone is Antarctic or polar zone (60°S to 69°S) which is cooled by ice and wind and more biologically rich.

MATERIALS AND METHODS

Birds were Observed from ship with the help of high power field binocular (One 8×40B Luminar and one 10×50 extra wide Bushnell). Besides recording of bird species, their abundance and distributional range were also recorded on voyage during both the onward and return journeys. Photographs were taken with a still 35 mm camera. The position of each sighting place was recorded by using the Magellan GPS 5000 NAV PRO equipment.

RESULTS

1. **Wandering Albatross** : *Diomedea exulans exulans* Linnaeus : This species is highly pelagic in Antarctic and Sub-Antarctic water but rarely occurs near pack ice (Watson, 1975). This species was sighted in both the voyages. Distributions of the bird in lower latitude are same in the two voyages (Temperate zone) but in 22nd expedition the bird has been found at much higher latitude (Sub-polar zone) than 15th expedition. Parulekar (1983) reported this bird during the 1st Antarctic expedition almost in the Antarctic or Polar region (in between 59°-69° S).

2. **Grey Headed Albatross** : *Diomedea chrysostoma* Forster : Usually this bird is found in Antarctic and Sub-Antarctic waters but its tendency is to occur in higher latitudes where land masses are absent (Watson, 1975). During the 15th expedition this species was recorded only from the Sub-Antarctic or Sub-Polar region, but in 22nd expedition this species was sighted in both temperate and Sub-Antarctic zones.

3. **Yellow-Nosed Albatross** : *Diomedea chlorohychnos* Gmelin : This species is pelagic in nature and is found largely in sub-tropical and warmer Sub-Antarctic waters (Watson, 1975). This bird was only

sighted in 22nd expedition and from sub-Antarctic zone. Parulekar (1983) also reported this bird in between temperate and sub-Antarctic zones.

4. **Sooty Albatross** : *Phoebetria fusca* Hilsenberg : This species is mostly found in temperate and sub-Antarctic waters and highly pelagic in nature (Watson, 1975). This species was sighted only during the 15th expedition. It was observed that this species is distributed in all the three zones of Southern Ocean i.e., Temperate, sub-Antarctic and Antarctic.

5. **Laysan Albatross** : *Diomedea immutabilis* Rothschild : This bird is very rare and only sighted during the 15th expedition. The distributional range of this species was found upto sub-Antarctic zone from temperate zone.

6. **Black-Browed Albatross** : *Diomedea melanophris* Temminck : Generally this bird is found in Antarctic and sub-Antarctic waters. It occurs both offshore and far out to sea but tends to favour the seas near the continental landmasses (Watson, 1975). Like the Laysan Albatross this bird was also found in both the temperate and sub-Antarctic zones and sighted only in 15th expedition.

7. **Royal Albatross** : *Diomedea epomophora* Lesson : This bird is very common in Antarctic water. This bird was sighted in the temperate zone only during the 15th expedition.

8. **Light mantled Sooty Albatross** : *Phoebetria palpebrata* Forster : This bird is highly pelagic and distributed all along the Antarctic waters; its southern limit seems to be heavy pack ice at the edge of the Antarctic continent (Watson, 1975). During the 15th expedition this bird was recorded from both the temperate and sub-Antarctic zones. But it was never sighted in 22nd expedition.

9. **White Chinned Petrel** : *Procellaria aequinoctialis aequinoctialis* Linnaeus : Widespread in pelagic and offshore waters of the Sub-Antarctic and uncommon in south of the Antarctic convergence (Watson, 1975). This species was recorded in both the expeditions. In both the voyages the bird was recorded from the temperate zone but in the 15th expedition the distributional range extended up to the sub-Antarctic zone.

10. **Southern Giant Fulmer/Southern Giant Petrel** : *Macronectes giganteus* (Gmelin) : They are pelagic in Antarctic and sub Antarctic waters throughout the year (Watson, 1975). The distributional range of this bird was recorded in all the three zones by the 22nd expedition member whereas it was only reported from temperate zone during 15th expedition.

11. **Fairy Prion** : *Pachyptila turtur turtur* (Kuhl) : According to Watson (1975) this bird is very common in sub-tropical and sub-Antarctic waters. This bird was sighted in the temperate zone in both the expeditions.

12. **Blue Petrel** : *Holobaena caerulea* (Gmelin) : This species was reported from the cold sub-Antarctic and Antarctic waters (Watson, 1975). But during the 15th expedition this species was reported from both temperate and sub-Antarctic zones, whereas in 22nd expedition this bird was only sighted in sub-Antarctic zone.

13. **Cape Pegion/Cape Petrel** : *Daption capensis capensis* Linnaeus (Figs.3&4). This bird is generally pelagic in sub-Antarctic and Antarctic waters but it avoids the pack ice. Sometimes they are found in cooler tropical waters (Watson, 1975). This bird was sighted in the sub-Antarctic zone (15th expedition) but is observed much higher latitudinal distribution (in between 59°S to 69°S) in 22nd expedition. Parulekar (1983) also reported its wide distributional range during 1st Indian expedition.

14. **Antarctic Petrel** : *Thalassoica antarctica* (Gmelin) : This bird is most frequent in open water with scattered ice bergs and ice floes, also found in open pack ice (Watson, 1975). This bird was sighted in both the expeditions and almost from the same zone (Antarctic zone).

15. **Antarctic Prion** : *Pachyptila desolata desolata* (Gmelin) : This species is highly pelagic in Antarctic and sub-Antarctic waters (Watson, 1975). The bird was sighted in temperate as well as in sub-Antarctic zones during 15th expedition. The bird was recorded at much lower latitude during 22nd expedition (Temperate zone).

16. **Kerguelen Petrel** : *Pterodroma brevirostris* (Lesson) : This species is highly pelagic in sub-Antarctic and Antarctic waters north of the pack ice (Watson, 1975). This species was sighted from

temperate zone and recorded only during 15th expedition.

17. **Great Winged Petrel** : *Pterodroma macroptera macroptera* (A. Smith) : Generally occurs well out to sea, where it is largely confined to the sub-tropical surface water zone. Occasionally, the Great Winged Petrel stays into the sub-Antarctic and Antarctic zones during summer (Watson, 1975). This species was sighted from temperate zone and recorded only during 15th expedition.

18. **Northern Giant Fulmer** : *Macronectes giganteus halli* Mathews : This bird occurs almost exclusively north of the convergence, and pelagic in Antarctic and sub-Antarctic waters (Watson, 1975). This species was sighted from temperate zone and recorded only during 15th expedition.

19. **Soft Plumaged Petrel** : *Pterodroma mollis mollis* (Gould) : This petrel is reported from mostly sub-tropical and sub-Antarctic waters but occasionally entering the Antarctic zone during the summer (Watson, 1975). This species was sighted from temperate zone and recorded only during 15th expedition.

20. **Short Tailed Shear Water** : *Puffinus tenuirostris tenuirostris* (Temminck) : This species was sighted from temperate zone and recorded only during 15th expedition.

21. **Wilson's Storm Petrel** : *Oceanites oceanicus oceanicus* (Kuhl) : Although this species is confined to colder pelagic and offshore Antarctic and sub-Antarctic waters during the breeding seasons but migrate to climatically similar northern hemisphere waters in the off season (Watson, 1975). During both the expeditions, this bird was sighted in temperate zone.

22. **Grey Backed Strom Petrel** : *Garrodia nereis* (Gould) : This bird is highly pelagic, and found largely in the sub-Antarctic zone (Watson, 1975). This bird was sighted by the 15th expedition member form temperate zone.

23. **Snow Petrel** : *Pagodroma nivea* (Forster) : This species is almost entirely restricted to the colder Antarctic waters with pack ice or icebergs and ice floes (Watson, 1975). During both the expeditions, this bird was sighted near the shelf in Anatarctic zone.

24. **Antarctic Tern** : *Sterna vittata Gmelia* : This bird was sighted only in 22nd expedition and recorded its wide zoo-geographical distribution from 48°S to 61°S latitude. But during the 1st expedition, the bird was reported only from temperate zone (Parulekar, 1983).

25. **South Polar Skua** : *Catharacta skua macormicki* (Saunders) : (Fig. 2). Adults stay near breeding colonies in the Antarctic zone during the summer, but during the off-season it may range north to sub-tropical waters (Watson, 1975). This bird was sighted only in Antarctic zone during both the expeditions.

26. **Adelie Penguin** : *Pygoscelis adelia* (Hombron and Jacquinot) : These are the most common penguin species in the East Antarctica. In both the expeditions a good number of birds were sighted from 60° to 70° S latitude and 10° – 40° E longitude.

27. **King Penguin** : *Aptenodytes patagonicus patagonicus* Miller : The bird was sighted in the 15th expedition near the Prince Edward Island (45°S and 69° E). The bird is known to breed in South Georgia.

28. **Emperor Penguin** : *Aptenodytes forsteri* Gray : Earlier report says that Emperor penguins breed regularly during winter in more than 30 colonies around the shores of the Continent and adjacent islands. Mostly the birds were sighted in between 66°S to 71°S latitude during 15th and 22nd expeditions.

DISCUSSION

The studies made separately on occurrence and distribution of different bird species sighted in 15th and 22nd Indian Antarctic expeditions during voyage through Indian and Atlantic Oceans Recorded 28 species including 14 species as common in occurrence in both the expeditions. Among different bird groups Petrels were dominant in number of species followed by Albatrosses. Record of Lesser number (14 spp.) of bird species during 22nd expedition than the 15th expedition (23 spp.) may be due to shorter travel time and for shorter route and also for lower temperature in Atlantic Ocean. These may have some impact on species make-up and distribution. This was evident by

absence of some birds species in the 22nd expedition (Table-1).

The result also showed that except Wandering Albatross which was recorded in Antarctic zone all other Albatross species were found to occur between temperate to Sub-Antarctic zones. Two species of Penguins, Adelie and Emperor were observed in all the three zones, being maximum in Sub-Antarctic and Antarctic zones. Only King Penguin sighted in 15th expedition were found to distribute in Sub-Antarctic Islands. Among the Petrels, Cape Petrel, Antarctic Petrel, Giant Winged Petrel and Snow Petrel were found to tolerate much lower temperature as they mostly live in Sub-Antarctic and Antarctic zones. Many of the other birds recorded in this study are known to occur in Antarctic zone but they are here observed to live in temperate and Sub-Antarctic zones.

But it is very early to say, whether these changes are occurred due to the climatic changes of Southern Ocean, or non-availability of food in the Southern Ocean or insufficient data of Avifauna of Southern Ocean.

Present day Polar Regions experience greater rates of climate change than elsewhere on the planet. The fauna of these regions is uniquely adapted to the extreme environments in which they exist, and may be vulnerable to shifts in climate. Climate change is having impacts on both marine, and terrestrial, and limnetic systems, and hence will influence future biological diversity.

In view to above, it has been clearly understood that the Antarctic research in future will not be the mere listing of species but also essential to develop the long-term monitoring programme to have a better understanding the causes of changes.

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Table-1 : List of bird species encountered during the voyages in both 15th and 22nd Indian Antarctic Expedition (Latitude wise).

Sl. No.	Common Name	Latitude	
		1995-1996	2002-2003
1	Wandering Albatross	36°S to 49°S	34°S to 58°S
2	Grey Headed Albatross	50°S to 59°S	46°S to 55°S
3	Yellow-Nosed Albatross	NOT SIGHTED	55° S
4	Sooty Albatross	36°S to 69°S	NOT SIGHTED
5	Laysan Albatross	36°S to 59°S	NOT SIGHTED
6	Black-Browed Albatross	36°S to 59°S	NOT SIGHTED
7	Royal Albatross	36°S to 49°S	NOT SIGHTED
8	Light Mantled Sooty Albatross	36°S to 69°S	NOT SIGHTED
9	White Chinned Petrel	35°S to 69°S	34°S to 51°S
10	Southern Giant Fulmer/ Southern Giant Petrel	60°S to 69°S	34°S to 70°S
11	Fairy Prion	36°S to 49°S	45°S to 50°S
12	Blue Petrel	36°S to 69°S	51°S
13	Cape Pegin/Cape Petrel	50°S to 59°S	59°S to 69°S
14	Antarctic Petrel	50°S to 69°S	68°S to 70°S
15	Antarctic Prion	39°S to 59°S	38°S
16	Kerguelen Petrel	36°S to 49°S	NOT SIGHTED
17	Great Winged Petrel	36°S to 49°S	NOT SIGHTED
18	Northern Giant Fulmer	36°S to 49°S	NOT SIGHTED
19	Soft Plumaged Petrel	36°S to 49°S	NOT SIGHTED
20	Short Tailed Shear Water	36°S to 49°S	NOT SIGHTED
21	Wilson's storm Petrel	36°S to 49°S	38°S
22	Grey Backed Strom Petrel	36°S to 49°S	NOT SIGHTED
23	Snow Petrel	60°S to 69°S	63°S to 69°S
24	Antarctic Tern	NOT SIGHTED	48°S to 61°S
25	South Polar Skua	59°S to 69°S	63°S to 69°S
26	Adelie Penguin	60° to 70° S	69° to 70° S
27	King Penguin	45°S to 69°S	NOT SIGHTED
28	Emperor Penguin	66°S to 69°S	69°S to 71°S

REFERENCES

- Bhatnagar, Y. and Sathyakumar, S. 1999. Developing a long-term monitoring programme for birds and mammals in the Indian Ocean and Antarctica. Tech pub.no.13 : 131-164.
- Chattopadhyay, S. 1995. On the Avian forms encountered during the eleventh Indian scientific expedition to Antarctica. Tech pub. no. 9 : 163-197.
- Mathew, K.J. 1994. Observation made during the third Indian Antarctic Expedition on sea birds of the Southern hemisphere. Preliminary Scientific Report 1983-1984 D.O.D. : 61-64.
- Parulekar, A.H. 1983. Sea birds and marine mammals of the first Indian Antarctic expedition (Scientific Report) Tech report. D.O.D., : 224-231.
- Sathyakumar, S. 1998. Developing a long-term monitoring programme for birds and mammals in the Indian Ocean and Antarctica using GPS and GIS technologies. Tech pub.no.13 : 131-164.
- Watson, G.E. 1975. Birds of the Antarctic and sub Antarctic. Pp. 1-350. American Geophysical Union, Washington, D.C.



Fig. 1. Monitoring of the birds from the Ship in Pack ice zone



Fig. 2. Antarctic Skua in Schirmacher oasis



Fig. 3. Cape-Pigeon (Ventral view)



Fig. 4. Cape Pigeon (Dorsal view)

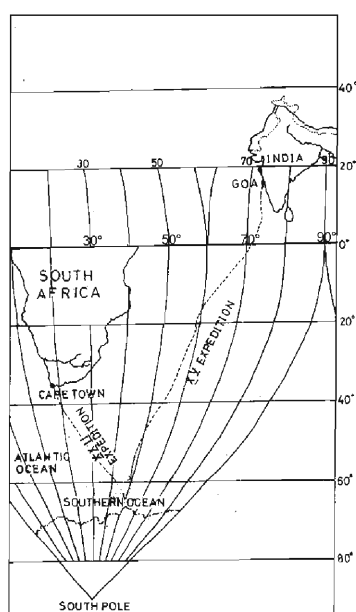
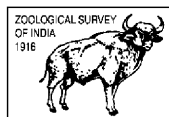


Fig. 5. Root map of Expedition



Rec. zool. Surv. India : **110**(Part-3) : 113-114, 2010

Short Communication

FIRST RECORD OF THE CLOUDED GROUND GECKO, *GECKOELLA NEBULOSA* (BEDDOME, 1870) FROM JHARKHAND (ERSTWHILE BIHAR)

INTRODUCTION

While examining the collection of gekkonid lizards available in National Zoological Collection of the Zoological Survey of India, it was found that the lot contained a species of the genus *Geckoella*, which was later identified as that of *Geckoella nebulosa* (Beddome). Also our studies revealed that this solitary specimen of the species is the first authentic record from the State of Jharkhand, which formed till recently as an integral part of the State of Bihar.

The brief description of the species under report is as follows :

A terrestrial gecko, found hiding under stones during the day; head moderate; body cylindrical and stout, covered with enlarged tubercles above and imbricate scales below; tail short, tapering to point, swollen at base; dorsum grayish-brown with transversely arranged dark brown spots bordered by a

sinuous white line extended up to the tail. Total length 82 mm (Reg. No. ZSI 24528).

This specimen under discussion has been collected by Sri. S.S. Saha, ZSI, from Meghatuburu, Saranda Forest in the hilly region of West Singhbhum district of Jharkhand.

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REFERENCES

- Beddome, R.H. 1870. Descriptions of new reptiles from the *Madras Presidency Monthly J. Med. Sci.*, : 169-176.
Dutta, S.K. 1997. A record of *Geckoella nebulosa* (Beddome, 1870) From Orissa, India, *Hamadryad*. 22 (1) : 49-50.
Kluge, A.G. 1993. Gekkonid lizard taxonomy, International Gecko Society, San Diego. 245 pg.
Sanyal, D.P. 1993. Reptilia In: Fauna of Orissa. State Fauna Series 1 pg : 1-55. Zoological Survey of India.
Smith, M.A. 1935. The fauna of British India, including Ceylon and Burma. Reptilia and Amphibia. Vol. II, Sauria. Taylor and Francis, London. xiii + 440 pg + 1 Pl.

B.H.C.K. MURTHY

AND

GOURI DASGUPTA

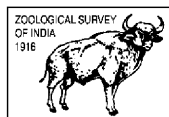
*Zoological Survey of India,
Kolkata-700016*



Fig. 1 : *Geckoella nebulosa* (Beddome, 1870) ZSI. Reg. No. 25428



Fig. 2 : *Geckoella nebulosa* (Beddome, 1870) from Jharkhand (Erstwhile Bihar).



Rec. zool. Surv. India : 110(Part-3) : 115-117, 2010

Short Communication

ON A COLLECTION OF THE FLIES OF FORENSIC IMPORTANCE

INTRODUCTION

The decomposition of a dead body starts firstly through the action of micro organisms such as fungi and bacteria, followed by the action of a series of arthropods, with the predominance of the sarcosaprophagous insects (Nuorteva, 1977).

Flies are the most important organisms for forensic study because most of them develop in the bodies of dead vertebrates, and several species leave behind a heavily sclerotized (hardened) puparial case that may persist for centuries which help to determine the time of death etc. But its use in India is meagre because of the lack of base line knowledge on carrion fauna. The scientists of Diptera section, Zoological Survey of India, have initiated a study with an aim to generate the basic data on these carrion feeding flies.

Our objective is to identify the flies those visit the corpse or carcass in the adult form and also breed on these substrates. This communication reports 2 species of family Muscidae and 1 species each of families Stratiomyidae, Calliphoridae, Ulididae and Sarcophagidae from the carcasses of Rhino, Rat and Frog.

MATERIALS AND METHODS

The study was done in two different environments : in the Laboratory of National Museum of Natural History, Bhubaneswar, and in a natural forest area of a semi urban area. The rats and frogs were killed through head injury and immediately placed in the natural forest under a shaded tree. The adult flies were collected by sweeping insect net and larvae were collected through hand picking methods. Mostly collection was made in between 11 A.M. to 12 P.M. in the month of August' 2007 & February, 2008. Observations and collections were continued until the entire carcass had been consumed.

KEY TO THE FAMILIES OF FLIES ASSOCIATED WITH CARCASSES

1. Third antennal segment with rings Stratiomyidae
- Third antennal segment with bristles 2
2. Second antennal segment lacking longitudinal seam; inner calypter small or absent; thorax typically lacking complete transverse suture Ulididae
- Second antennal segment with longitudinal seam; inner calypter usually large; thorax usually with transverse suture 3
3. Hypopleura usually lacking stiff bristles and without setae, or if hypopleural setae present, then pteropleural bristles absent or cell P₁ not narrowing towards wing tip Muscidae
- Hypopleura and pteropleura with stiff bristles; cell P₁ narrowing or closed toward wing tip 4
4. Antennal aristae usually plumose throughout, 2 notopleural bristles; body often metallic green or blue Calliphoridae
- Antennal aristae typically plumose only on basal half, 3-4 notopleural bristles; body not-metallic . Sarcophagidae

Family STRATIOMYIDAE

Hermatia illucens (Linnaeus)

1758. *Musca illucens* Linnaeus, Syst. Nat. Ed. 10, 1 : 589.
Type-locality : South America

1975. *Hermatia illucens* : Delfinado & Hardy, A catalog of Diptera of the Oriental Region, 2 : 31

Material examined : 1♂, NMNH, Bhubaneswar, 4.ix.2005, coll. P. Roy, from semi dried flesh of Rhino.

Remarks : This black-colored fly is easily recognized, having two translucent "windows" on the first abdominal segment. Larvae are occasionally found

indoors, particularly in bathrooms, latrines and kitchens. In the pupal stage, this insect resembles the larvae. Larval forms have also been extracted from human carrion, and there are reports that the larvae have been accidentally swallowed with contaminated food, causing myiasis. According to published records the species also breeds in old carrion (Bohart & Gressitt, 1951). But nothing has been known of its development inside the flesh of Rhino. So, this is the first report of development of *Hermatia illucens* (Linnaeus) inside the flesh of Rhino.

Family ULIDIDAE (=Family Otitidae)

***Physiphora aenea* (Fabricius)**

1794. *Musca aenea* Fabricius, *Ent. Syst.* 4 : 335. Type-locality : "in India Orientali".

1977. *Physiphora aenea* : Delfinado & Hardy, *A catalog of Diptera of the Oriental Region*, 3 : 167.

Material examined : 2 ♀♀, Shyamnagar, North 24 Parganas dist, West Bengal, 03.viii.2007, coll. S. Banerjee, ex. frog.

Remarks : Medium sized (6-9 mm), fairly stout, brilliant metallic blue green; eyes iridescent, multicoloured, epistome, proboscis and palpi black; frontal stripe green or blue; legs ochraceous; wings colourless, not pictured; abdomen unicolorous, green, hairs on anterior corners yellowish.

Adults of the specimens are found in many situations walking on the surfaces of rotting fruits, garbage, rotting vegetation, carrion or faeces, including human excrement. During the present study, a large number of specimens were collected from the rotten flesh of the frog.

Family MUSCIDAE

***Musca (Musca) domestica* Linnaeus**

1758. *Musca domestica* Linnaeus, *Syst. Nat. Ed.* 10, 1 : 596. Type-locality : Europe, America.

1977. *Musca (Musca) domestica* : Delfinado & Hardy, *A catalog of Diptera of the Oriental Region*, 3 : 459.

Material examined : 2 ♀♀, NMNH, Bhubaneswar, 21.v.2006, coll. P.Roy, ex. semidried flesh of Rhino, 1 ♂, 2 ♀♀, Shyamnagar, North 24 Parganas dist, West Bengal, 27.iii.2008, coll. S. Banerjee, ex. carcasses of rat.

Remarks : The common Housefly is easily distinguishable from the other known species of *Musca* with hairy propleura (sometimes only few setae are

visible). Females are usually larger and can extend the tip of the abdomen to form an ovipositor which is used to lay eggs. Sometimes males have enlarged eyes which meet on top of the head.

The house fly is 6 to 7 mm long. The eyes are reddish and the mouth parts are sponging. The thorax is greyish to olive pollinose, bears four narrow black stripes and there is a sharp upward bend in the fourth longitudinal wing vein. The abdomen is gray or yellowish with dark midline and irregular dark markings on the sides. The underside of the male is yellowish. The larvae are not normally found in carcasses, but the adults are attracted to tainted meat (Zumpt & Patterson, 1952). There is nothing known about the muscid development inside the flesh of Rhino in India. So, this is the first report of *Musca (Musca) domestica* Linnaeus from the flesh of Rhino.

***Atherigona (Acritochaeta) orientalis* Schiner**

1868. *Atherigona orientalis* Schiner, *Reise der osterreichischen Fregatte Novara, Dipt.* : 295. Type-locality : Nicobar Islands.

1977. *Atherigona (Acritochaeta) orientalis* : Delfinado & Hardy, *A catalog of Diptera of the Oriental Region*, 3 : 491.

Material examined : 8 ♀♀, Shyamnagar, North 24 Parganas dist, West Bengal, ex. carcasses of rat.

Remarks : Flies are small (3-4 mm), yellowish grey pruinose, with a pair of sublateral black spots on third, fourth and fifth abdominal tergites; leg bristles short; arista bare. The adult feeds on an exceptionally wide variety of substances, including all sorts of carrion, spoiling fruits and vegetables, table food of nearly all kinds, and human excrement in fresh, isolated deposits. These small flies were observed in large numbers on the dead body after three days of the death of the rat.

Family CALLIPHORIDAE

***Chrysomya megacephala* (Fabricius)**

1794. *Musca megacephala* Fabricius, *Syst. Ent.* 4 : 317. Type-locality : Guinea.

1977. *Chrysomya megacephala* : Delfinado & Hardy, *A catalog of Diptera of the Oriental Region*, 3 : 542.

Material examined : 2 ♂♂, 5 ♀♀, NMNH, Bhubaneswar, 21.v.2006, coll. P.Roy, ex. On semi dried flesh of Rhino, 7 ♀♀, Shyamnagar, North 24 Parganas dist, West Bengal, 27.ii.2008, coll. S. Banerjee, ex. carcasses of rat, 1 ♂♂, 5 ♀♀, Shyamnagar, North 24

Parganas dist, West Bengal, 03.viii.2007, coll. S. Banerjee, ex. frog.

Remarks : Moderate in size (8-11 mm). Adults are large, metallic blue to blue green, with purple reflections, dark reddish frontal stripe and antennae, face, cheek and palpi are orange with orange pubescence but frons predominantly black. Mesonotum with two short and narrow longitudinal black stripes anteriorly, and a small dark triangle situated in a postero-medial position to each humeral callus. Second and third abdominal segments black-banded on posterior margins. Wings hyaline, slightly darkened at base; legs black. Head in male with the eyes touching in the middle of the frons. In the female the eyes are separated by a broad frons.

Adults are strongly attracted to carrion, human excrement and sweats. It is reported that dead rats and large masses of excrement were most powerful attractant. The larvae of this species breed equally well in carrion and human excrement, but not in faeces of herbivores. In this study this species was collected from the three dead animals i.e. Rhino, rat and frog. In the field, this species was observed from the second day of our study on the carcass of the rat.

Family SARCOPHAGIDAE

***Parasarcophaga (s. str.) albiceps* (Meigen)**

1826. *Parasarcophaga albiceps* Meigen, *Syst. Besch. zweifl. Insekt.*, 5 : 22. Type-locality : Europe.

1992. *Parasarcophaga (s. str.) albiceps* : Nandi, *J. Beng. Nat. Hist. Soc.*, 11(2) : 38.

Material examined : 7 ♀♀, Shyamnagar, North 24 Parganas dist, West Bengal, 03.viii.2007, coll. S. Banerjee, ex. frog.

Remarks : Large flies (11 to 17 mm), frontal vitta black, arista long plumose; thorax greyish with silvery pollen and with three black longitudinal stripes; wings hyaline with brown veins, halter brown; legs black, hind tibia with bristles on antero-ventral surface in addition to long villosity; abdomen with silvery grey checkered pattern. This is a fairly common species which is attracted to excrement and dead bodies of different animals. The larvae breed from meat, beef, animals dung, human excrement, dead rabbit, human carcasses and garbage.

This species was observed and collected very soon after the death of the frog on the day 1 and till day 2.

ACKNOWLEDGEMENTS

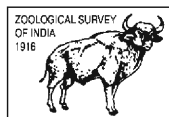
The authors would like to thank Dr. Ramakrishna, Director, Dr. A. K. Sanyal, Addl. Director and Dr. A. Bal, Scientist-E, and in-charge of entomology division (B), Zoological Survey of India for their kind support and help. Thanks are also due to Dr. P. Roy, Sr. Scientific Officer, NMNH, Bhubaneswar for giving us opportunity to study the materials.

REFERENCES

- Bohart, G.E and Gressitt, J.L. 1951. Filth-inhabiting flies of Guam. *Bulletin Bishop Museum*, 4 : 1-151, Honolulu.
- Delfinado, M.D and Hardy, D.E (1975). (eds.). *A Catalog of Diptera of the Oriental Region*. 2 : 1-459, University of Hawaii Press, Honolulu.
- Delfinado, M.D and Hardy, D.E (1977). (eds.). *A Catalog of Diptera of the Oriental Region*. 3 : 1-854, University of Hawaii Press, Honolulu.
- Nandi, B.C. (1992). Note on rearing of *Parasarcophaga (Liopygia) ruficornis* (Fabricius), a sarcophagid fly from dead *Calotes versicolor* (Daudin). *Proc. zool. Soc. Calcutta*, 45 (2); 137-140.
- Nuorteva, P. 1977. Sarcosaprophagous insects as forensic indicators. In CG Tedeschi, WG Eckert & LG Tedeschi (eds.), *Forensic Medicine : a study in Trauma and Environmental Hazards*, Vol.II.WB Saunders, New York, p.1072-1095.
- Zumpt, F. and Patterson, H.E. (1952). Flies visiting human faeces and carcasses in Johannesburg. *S. Afr. J. clin. Sci.* 3 : 92.

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Short Communication

OCCURRENCE OF HIMALAYAN RUBYTHROAT, *LUSCINIA PECTORALIS* *TSCHEBAIEWI* (PRZEVALSKI), PASSERIFORMES : TURDINAE IN CHHATTISGARH, INDIA

INTRODUCTION

During the avifaunal survey of Madhya Pradesh & Chhattisgarh the present authors undertook a field trip to Achanakmar Wildlife Sanctuary during the last part of October, 2000. In the sanctuary three camps were put up—Achanakmar, Lamni and Surhi. On 16.10.2000 in the afternoon the survey team left Lamni for the last camp at Surhi. It was about ten kilometers from Achanakmar on the Bilaspur road when the survey team encountered a few tribal boys hunting birds and squirrels with gullel. Two birds and one five striped palm squirrel, *Funambulus pennanti* Wroughton were found in their kitty. After great persuasion the authors were successful in managing those two birds and proceeded to Surhi. It was evening when the team reached the field camp. Of the two birds one was common of the area—the Eurasian Golden Oriole, *Oriolus oriolus* (Linnaeus). Problem started with the other small bird, though all the characters needed for identification were present and the bird was not heavily damaged either, the authors could not believe their eyes. The bird was identified in the field as the Himalayan Rubythroat, *Luscinia pectoralis tschebaiewi* (Przevalski), which was confirmed after reaching Zoological Survey of India Head Quarter in Kolkata. The most striking feature about the bird is that this was never been recorded in Chhattisgarh like here (D' Abreu 1931), Ali 1939 & 1940, Chandra & Singh 2004) and that too from such a lower elevation, as Himalayan Rubythroat is basically a bird of the high altitude areas (Ali & Ripley, 1987).

Field character : Forehead narrowly white, the narrow white supercilium extends to the back of the ear coverts, moustachial streak white, back olive brown,

wings brown, tail blackish brown with white base, outer rectrices with white tips. Chin and throat scarlet, sides of throat and breast deep black, belly and undertail coverts whitish.

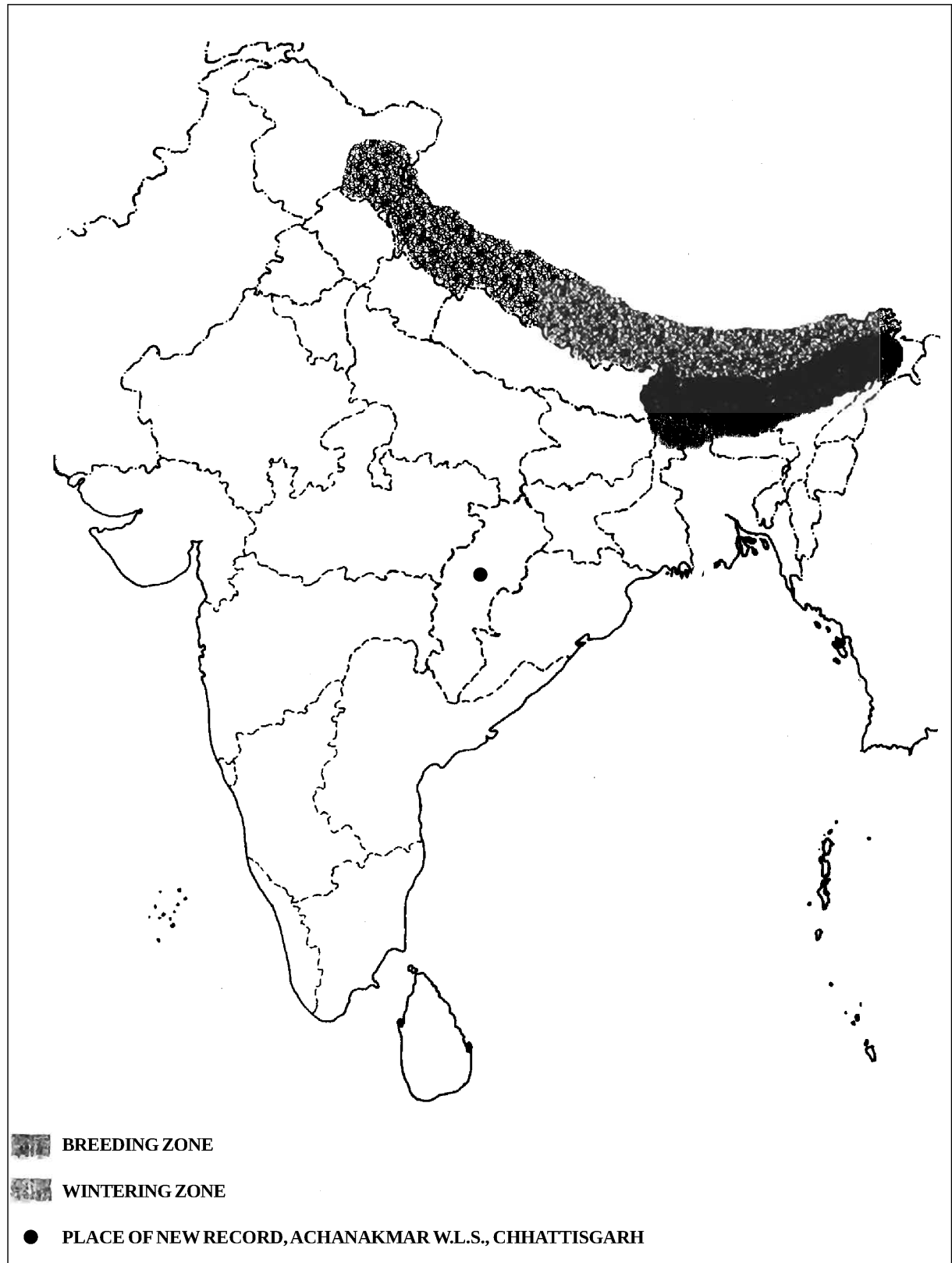


Material examined : Chhattisgarh : Bilaspur district : 1 male; Surhi, Coll. S. Ghosh, Dt. 16.10.2000, Registration No. 41291.

Measurements :

Collected specimen	Measurements given by Ali & Ripley (1987)
Wing – 74 mm	74 – 83 mm
Tail – 59 mm	58 – 66 mm
Bill from skull – 17 mm	15 – 17 mm
Total length – 14.5 cm	15 cm

Distribution : Breeds in Ladakh, Tibet, northern Bhutan, and northern Arunachal Pradesh between 3900 – 4500 m. Winters from the foothills of eastern Nepal,



Map

northern Bengal, Bhutan, Arunachal Pradesh to the Mishmi hills south through Assam and Bangladesh (Ali & Ripley, 1987). Hence the present specimen constitutes the first record of the sub species wintering to further south and west ward in Chhattisgarh.

However, there are two winter records of Himalayan Ruby throat *Luscinia pectoralis pectoralis* (Gould) from the Peninsula; Sultanpur, U.P. (Hume coll.) and Londa, Karnataka (Koelz, JBNHS 43 : 14) as mentioned by Ali & Ripley (1987).

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REFERENCES

- Ali, S. (1939). The Birds of Central India, Part-I. *J. Bombay nat. Hist. Soc.*, **41**(1) : 82-106.
- Ali, S. (1940). The Birds of Central India, Part-II. *J. Bombay nat. Hist. Soc.*, **41**(3) : 470-488.
- Ali, S. & Ripley, S. D. (1987). Handbook of the Birds of India and Pakistan (Compact), Oxford University Press, New Delhi.
- Baker, E. C. S. (1822-30) The fauna of British India. Birds 2nd Ed. 1-8 vols. Taylor & Francis, London.
- Chandra, K. and Singh, R. K. (2004). Avifauna of Madhya Pradesh and Chhattisgarh. *Zoo's Print Journal*, **19**(7) : 1534-1539.
- D' Abreu, E. A. (1931) Notes of the Fauna of British India. Birds, chiefly with reference to the Central provinces. *J. Bombay. Nat. Hist. Soc.*, **35** : 217-219.
- Manakandan, R. and Pittie, A., (2001). Standardised Common and scientific names of the Birds of the Indian Subcontinent. *Buceros*, **Vol. 6**, No. 1 : 1-37.

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