

CITATION

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Dr. K. VENKATARAMAN
Director
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Dr. K. VENKATARAMAN
Director
Zoological Survey of India

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

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

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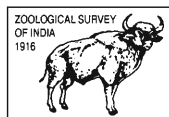
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BASEODISCUS HEMPRICHII (EHRENBERG, 1831) (PHYLUM NEMERTEA) NEW DISTRIBUTIONAL RECORD FROM ANDAMAN AND NICOBAR ISLANDS, INDIA

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INTRODUCTION

Nemerteans or Ribbon worms (previously known as Rhyncocoela and Nemeteni) are soft bodied unsegmented worms. The earliest record of a nemertean worm is probably an general account by Olaus Magnus in 1555 of a long, grayish-blue marine worm. The first formal description of a species of Nemertea did not happen until Gunnerus described the same species (as *Ascaris longissima*) in 1770 (Gibson, 1995). Most of the early information was given by Coe (1901, 1904, 1905, and 1940) which can be found in Hochberg and Luniansky (1998).

A total of 1.149 species were described till today and have grouped into 250 genera (Gibson, 1995) and two classes. Gibson (1953) placed these species under orders : Archinemertea (3 genera, 28 species); Palaeonemertea (11 genera, 70 species); Heteronemertea (79 genera, 401 species); Hoplonemertea, Monostiliferous (91 genera, 500 species); Hoplonemertea, Reptantia-Polystiliferous (22 genera, 45 species); Hoplonemertea, Pelagic-Polystiliferous (40 genera, 97 species); Bdellonemertea (1 genus, 5 species); Monotypic (3 genera).

The fauna of the phylum Nemertea in India is least studied. Earlier record on the occurrence of Nemertean worm *Eupolia hemprichi* (Ehrenberg, 1831) is from coasts of India (Punnett, 1903; Gravely, 1927; Patel *et al.*, 1976). Another record was made stating a similar species of *Gorgonorhynchus repeans* was found in certain coast of India (Coe, 1917). There is also a reference of some unidentified nemertean worms from Gulf of Kutch (Desai, 2010) and Neeleswaram, Kerala

(Nandan, 1998), which, however was identified only to phylum level.

A specimen was obtained from Andaman Nicobar Islands, India during low tides in some intertidal regions, which was readily identified as a Heteronemertean *Baseodiscus hemprichii* (Ehrenberg, 1831) as this species can be easily identified on the basis of external body coloration and pattern alone (Gibson, 1979). The present paper reports the first record of *Baseodiscus hemprichii* (Ehrenberg, 1831) in Andaman and Nicobar Islands, India. A comprehensive synonym list is provided locality information in case of primary reference.

***Baseodiscus hemprichii* (Ehrenberg, 1831)**

- 1831. *Nemertes hemprichii*, Ehrenberg, *Berolina : Officina Academica*, 12.
- 1850. *Borlasia hemprichii* Diesing, *Wien*, 240.
- 1862. *Borlasia hemprichii* Diesing, *Wien math. Naturw. Kl.*, 249.
- 1890. *Eupolia brokii* Burger, *Zeitschr. wiss. Zool.*, **50** : 22.
- 1895a. *Eupolia brokii* Burger, *Zeitschr. wiss. Zool.*, **61** : 26.
- 1893. *Eupolia mediolineata* Burger, *Zool. Jahrb. Syst.*, **7** : 230.
- 1895b. *Eupolia mediolineata* Burger, *Fauna Stat. Neapel*, **22** : 603.
- 1895a. *Eupolia hemprichi* Burger, *Zeitschr. wiss. Zool.*, **61** : 26.
- 1903. *Eupolia hemprichi* Punnett, *University Press, Cambridge*, 104.
- 1927. *Eupolia hemprichi* Gravely, *Bull. Madras Govt. Mus. Nat. Hist.*, **1** : 53.
- 1976. *Eupolia hemprichi* Patel, *et al.*, *J. Mar. Biol. Ass. India*, **18** : 663.

PLATE-I

Whole animal



Head dorsal view



Head ventral view

1905. *Taeniosoma hemprichi* Coe, *Bull. Mus. Comp. Zool. Harvard Coll.*, **47** : 57.
1906. *Taeniosoma hemprichi* Coe, *Bull. U.S. Fish. Comm.*, **23** : 978.
1934. *Baseodiscus edmondsoni* Coe, *Occ. Pap. B.P. Bishop Mus.*, **10** : 1.
1947. *Baseodiscus edmondsoni* Coe, *Occ. Paper. B.P. Bishop Mus.*, **14** : 102.
1939. *Baseodiscus hemprichi* Yamoka, *Denk, Ann. Zool. Jap.*, **18** : 283.
1909. *Baseodiscus hemprichii* Cooper, *Trans. Linn. Soc. Lond. Ser.*, **13** : 7.
1979. *Baseodiscus hemprichii* Gibson, *Zool. J. Linn. Soc.*, **66** : 146.
2001. *Baseodiscus hemprichii* Boyko, *pacif. Sci.*, **55** : 41.
2008. *Baseodiscus hemprichii* Hiroshi Kajihara, *Phuket mar. biol. Cent.*

Materials examined : The nemertean sample was incidentally observed from the intertidal region of Kodyaghat and also from rocky shores of south point, Andaman Nicobar Islands, India, collected in intertidal regions during evening low tides were the tidal amplitude was around 0.4 m. The nemertean was found underneath dead corals and rock crevices. The specimen was collected by the author of this paper in Kodyaghat (11°32'N, 92°43'E) using forceps and brought to lab in sea water where it was examined for length, breadth, coloration patterns in live condition and preserved in 4% formalin. The specimen was deposited in the Pondyicherry University collection at Port Blair, Andaman and Nicobar Islands.

Description : In live condition the length of the nemertean was 3 m, the breadth attained maximum of 6

mm near the fore gut and tapered to 1 mm in the tail region. The head was demarcated from the body by a transverse furrow. The body is slightly laterally compressed. The body color was white. A thick brown line started below the mouth with a 'T' shaped collar and extended the whole length of the body to the posterior end and a comparatively thin line was noticed in the ventral side beginning below the mouth without any 'T' shaped collar. The Snout region was also distinguished with the same brown color patch and only in the dorsal surface.

Habitat : The worm was found inhabiting in certain rocky shores, dead coral reefs and also in some sea grass beds under some boulders and holes.

Distribution : This species have been reported from all over the world. In India, this species shows continuous distribution from Gulf of Mannar to Gulf of Kutchh (Patel *et al.*, 1976). The present record shows the distribution of this nemertean worm in Andaman and Nicobar Islands, India.

Discussion : The Nemertea (Minor phyla) is one of the least studied groups in Indian context. India being a mega biodiversity country lot more species to be identified and reported. Undertaking research in these groups may lead to invention of bioactive compounds as well as ecosystem service they provide.

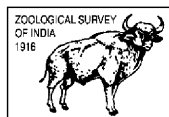
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Rec. zool. Surv. India : 111(Part-1) : 5-9, 2011

REMARKS ON LAMARCKIAN CONCEPT OF ANIMAL EVOLUTION AND PHILOSOPHY OF BIOLOGY

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“Lamarck would be astonished to know that ‘Lamarckism’ has come to mean the inheritance of acquired characters. In the first place, he did not believe that all acquired characters are heritable, and in the second place in saying that some are, he was only repeating that everyone “knew” and had “known” since antiquity” (G.G. Simpson, 1961).

INTRODUCTION

The publication of the theory of natural selection on the origin of species (or descent of species) brought intellectual debate on the idea of evolution. Darwinism (or the theory of natural selection) had to fight with the supporters of biblical ideas of the origin of living beings in one hand and on the other hand on the methods of origin of living ones especially with the supporters of so-called Lamarck’s ideas. Darwinism own. But Lamarckism is still maintaining its influence in some quarters of intellectual and political world; although it has been proved that several explanations on evolution usually labelled as “*Lamarckism*” are not valid.

The object of the present article is to present what Lamarck actually said on evolution of animals and how it was interpreted from time to time and a note on the relationship between Lamarckian philosophy and modern philosophy of biology.

For the above purpose I have taken help of the most popular and dependable English translation, followed by celebrated evolutionists, of Lamarck’s *Philosophie Zoologique* by Hugh Elliot (1914). In addition to this remarks on the subject by celebrated Zoologists have been taken into considerations. In order to present Lamarck’s words, quotations from the English translation by Elliot (1914) have been cited as and when required.

LAMARCK AND EVOLUTION

Some critics of Lamarck believed that he did not propose any genuine mechanism of evolutionary changes. On the contrary Simpson (1961) observed, “Lamarck (1744-1829) was, however, the first to maintain clearly and consistently that all taxa have arisen by evolution and are a phylogenetic continuum”. Mayr (1976) remarked that Lamarck’s master doctrine was that all classes of animals form a unique and graduated series from the simple to the most perfect; and Lamarck could be designated as the founder of the theory of evolution. It is fact that in several pages of *Philosophie Zoologique* ideas on evolution are available, but Lamarck’s discussion of aquatic animals clearly indicate his ideas on evolution. He wrote :

“I do not doubt that mammals originally came from the water, nor that water is the true cradle of entire animal kingdom.”

“We still see, in fact, that the least perfect animals, and they are the most numerous, live only in water, as I shall hereafter mention; that is exclusively in water or very moist places that nature achieved and still achieves in favourable conditions those direct or spontaneous generations which bring into existence the most simple organized animalcules. Whence all other animals have sprung in turn” (pp. 175-176).

“.....After a long succession of generations those individuals, originally belonged to one species, become at length transformed into a new species distinct from the first” (pp. 38-39).

From the above it appears that Elliot (1914) was right to comment.”.....The most fundamental purpose of Lamarck’s Zoological work was to convert the belief in the fixity of species.” Darwin in the sixth edition of his ‘Origin of Species’ (1872) in the chapter entitled, “An Historical Sketch” wrote, “In these works he

upholds the doctrine that all species, including man, are descended from other species. He first did the eminent service of arousing attention to the probability of all change in the organic, as well as in the inorganic world, being the result of law and not of miraculous interposition". Simpson (1953) remarked, "he believed, first of all, that there is some mysterious inherent tendency for life to progress from the simple to the complex from the less to the most perfect". Simpson (*op. cit.*) also commented, "Lamarck was acute enough to observe that life does not really form such a progression. He explained away this inconvenient fact by saying that the course of evolution is perturbed by local adaptation. Adaptation was said to result from the activities and habits of organisms, which modify their anatomy. He assumed as did almost everyone from the dawn of history down to and including Darwin, that such modification would be inherited in like form by offspring."

It is interesting to note that the word "species" was important for Darwin, but for Lamarck it was secondary and he was more concerned with the level of complexity in animals. Moreover, Lamarck considered that environment (? Nature) is an important factor in evolution but he did not explain the role of natural selection as done by Darwin. He said, ".....as changes occur in the environment.....corresponding changes occur" (p. 109). According to Dobzhansky (1951) ".....Lamarck took for granted adaptive modifications following use and disuse of organs and proposed to explain evolution as a result of such modifications. Actually it is the ability of organs to react adaptively to the effects of use and disuse that, must be explained as an evolutionary achievement", but it was not mentioned by Lamarck."

PILLARS OF LAMARCKIAN CONCEPT OF EVOLUTION

Lamarck's belief on the evolution of living beings is now widely accepted. Let us now examine what he considered as the causal factor in evolution. Following ideas are considered pillars of Lamarckian concept of evolution.

1. Direct effect of the environment :

Both anti-Lamarckian and neo-Lamarckians believe that the direct induction of hereditary changes in organisms by the environment is a Lamarckian concept. Simpson (1953) pointed out that this was flatly denied by Lamarck. Hardy (1974), too, contended that Lamarck never supposed that environment influences directly. Fortunately, Lamarck himself put an explanation what

he meant by "influence of environment" in the following statement (p. 107).

"I must now explain what I mean by this statement : The environment affects the shape and organization of animals, that is to say that when the environment becomes very different, it produces in the course of time corresponding modifications in the shape and organization of animals.

"It is true, if this statement were to be taken literally, I should be convicted of an error; for, whatever the environment may do, it does not work any direct modifications whatever in the shape and organization of animals." Mayr (1976), too, considered that Lamarck emphatically rejected the direct effects of the environment on the higher animals which display activities.

2. Evolution through desire of the organism :

The common picture of Lamarckism is the gradual increase of the neck of a giraffe. The whole set of pictures depict that giraffe through its desire to reach an objective and by this desire growing the long neck in succeeding generations. Jones (1953) wrote that although Lamarck denied the voluntary striving of animals, yet his statement, "sentiment interieur" is often interpreted as voluntary striving. Probably this instigated people to draw the cartoon. Actually Lamarck said, ".....If one of the extremities of the order is occupied by the most perfect of living bodies, having the most complex organization, the other extremity of the order must necessarily be occupied by the most imperfect of living bodies, namely those whose organization is the simplest" (p. 60). According to Mayr (1976). T.H. Huxley during his review of the Origin of Species by Darwin, in Times said that according to Lamarck, "the new needs will create new desires, and the attempt to gratify such desires will result in appropriate modification." Mayr (*op. cit.*) comments..... There is great danger that the hurried reader will remember only the word "desire". The cause of this misunderstanding is the mistranslation of the French word "besoin" (need) as wants. It is also the contention of Simpson (1964).

3. Inheritance of acquired characters :

The idea of inheritance of acquired characters is now almost synonym of Lamarckism. The common examples in day to day experience against and in support of the theory of inheritance of acquired characters are (1) the docking of sheep's tails and circumcision of man (of particular faith) have been

carried for thousands of years without producing any heritable effect. The practice causes pains to the subjects which they do not need for their survival. (2) The thickened skin on the sole of human foot and the sternal and allar callosities of the Ostrich, seem to be directly related to pressure arising from the habitual position of these animals. The callosities are also visible in embryos, in which the callosities are not needed at all, but they are hereditarily fixed. In these cases subjects need was for survival on the hard surface. Lamarck believed it, but in restricted sense. According to Lull (1922) Lamarck believed it but never tried to prove. Mayr (1976) observed that Lamarck said about the mechanism by which transmission takes place. Hardy (1974) commented, that Lamarck's contention that changes in the environment can bring about changes in the habit was overlooked. And "he should perhaps be given more credit for having being the first to insist that changes in habit would form an important element in the process". Simpson (1961) refuted the contention that Lamarck believed the importance of inheritance of acquired character in a strong word. He wrote, "Lamarck would be astonished to know that "Lamarckism" has come to mean the inheritance of acquired characters. In the first place, he did not believe that *all* acquired characters are heritable, and in the second place in saying that *some* are, he was only repeating what everyone "knew" and had "known" since antiquity."

Lamarck in the Second Law said, "All acquisitions or losses wrought by nature on individuals.....are preserved by reproduction to the new individuals which arise, provided that the acquired modifications are common to both sexes, or at least to the individuals which produce the young" (P. 113). Again in the page 124 he said, "Now every change that is wrought in an organ through a habit of frequently using it, is subsequently preserved by reproduction, if it is common to individuals who unite together in fertilization for the propagation of their species. Such a change is thus handed on to all succeeding individuals in the same environment, without their having to acquire it in the same way that it was actually created."

From the above it is clear that Lamarck did not try to prove the importance of inheritance of acquired characters in evolution. Repeatedly he tried to point that changes in the environment can bring about changes in the habits of animals and that is those changes of habit which can be so important in bringing about evolutionary changes (Hardy, 1974).

4. Isolation and geographical race formation :

Dobzhansky (1951) pointed out both Lamarck and Darwin believed that the interbreeding of genetically distinct populations result in swamping of the differences. In page 112 Lamarck wrote, "When the observing naturalist travels over large portions of the earth's surface and sees conspicuous changes occurring in the environment, he invariably finds that the characters of species undergo a corresponding change." In the matter of domestication of dog Lamarck wrote in pages 110-111, "No doubt a single, original race, closely resembling the wolf, if indeed it was not actually the wolf, was at some period reduced by man to domestication. That race, of which all the individuals were then alike, was gradually scattered with man in to different countries and climates; and after they had been subjected for sometime to the influences of their environment and of the various habits which had been forced upon them in each country, they underwent remarkable alterations and formed various special races." In these statements Lamarck hinted on isolation as a factor in evolution.

5. Slow and gradualness of evolution :

Lamarck's belief on the slow and gradualness of evolutionary changes is available in the following statements : In page 11 he wrote, "With regard to living bodies, it is no longer possible to doubt that nature has done everything little by little and successively"; in page 70 he wrote about the aquatic animals, ".....nature led them little by little to the habit of living in the air, first by the water's edge and afterwards on all the dry parts of the globe etc." On slow and gradualness and imperceptibility of evolutionary changes in page 30 he said, "These changes only take place with an extreme slowness, which make them always imperceptible." Again in page 50 he wrote, "An enormous time and wide variation in successive conditions must doubtless have been required to enable nature to bring the organization of the animals to that degree of complexity and development in which we see it at its perfection." In page 114 Lamarck remarked for nature, "time has no limits and can be drawn upon to any extent."

Although Lamarck has not said anything on Natural Selection but he mentioned the nature's ability to produce perfect forms. Lamarck said that nature produces the perfect forms; Darwin said nature selects the (?) perfect forms able to survive in the environment.

POLITICS, LAMARCKISM AND MICHURINISM

French Marxists accepted Lamarckism since it contradicted creationists. Russian Marxists accepted Lamarckism in the name of much debated Michurinism (Darlington, 1953). Michurinists, the neo-Lamarckian plant breeders believe, "By selecting the conditions which force a plant to abandon the fixed trend of its adaptability and thus destabilizing abolishing the conservatism of its heredity (either by sharply changing the conditions of cultivation or by enforced fertilization, especially in the distant crosses) it is possible in subsequent generations, by a proper choice of the conditions of training rapidly to create new requirements of the plant, to create new breeds and varieties differing radically from the initial ones" (Lysenko, 1951).

LAMARCK'S VIEWS AND MODERN PHILOSOPHY OF BIOLOGY

Lamarck's hypothesis was practically deductive. He did not cite any evidence of his contentions. His philosophy was based on seventeenth-eighteenth century tradition although he contradicted creationists, and essentialists and developed uniformitarianism and evolutionism. His uniformitarianism rejected the dogma of recency of earth (about 6000 years, as it was believed by most of the earlier philosophers) and hypothesized an extremely high age. This, in fact, led to the idea of the formation of present land scape as a result of gradual and slow process. Mayr (1976) conjectures that this might have influenced Lyell's idea of uniformitarianism and finally Darwin. Lamarck's 'inherent progression', 'sentiment interieur' etc. appear as vitalistic approach to biological principle like that of ancient Greek philosophers. But vitalism as a biological force is now being debated. Moreover, he was deist and used the word creation which is very much against the word evolution.

CAUSES OF LAMARCK'S DEFAMATION

Lamarck's researchers on geology, meteorology, physiology and many other disciplines were proved wrong even during his life time (Simpson, 1964). Most important factor for his defamation was his poor literary style. Hence readings of his works were boring. His *Philosophie Zoologique* contains several repetitions and confusing statements. Unlike Darwin's *Origin of Species*, Lamarck's book was not written with inductive principles and evidences. To know his views one has to read every page and line has to carry out serious research and find out what he meant.

Lamarck left no note book and founded no school, who could explain his views to his contemporaries. Mayr (1976) commented. ".....If Lamarck had the personality to found a school, his theories might have become the starting point of an improved evolutionary interpretation."

Cuvier's personality and oratory made both Geoffroy St. Hillaire dumb and French people could not hear anything about evolution for about a century. According to Simpson (1953) after the publication of Darwin's theory on Origin of Species critics of the theory of natural selection developed a modified version of Lamarck's views now known as neo-Lamarckism. Simpson (1953) said that the neo-Lamarckians contended that materials for evolution were individual modifications caused by reactions of organisms (a point really Lamarckian) and by action of the environment on organisms (a point flatly denied by Lamarck). The neo-Lamarckians "insisted that such modifications were heritable, otherwise they could have no direct influence on evolution (Lamarck believed this, but so did Darwin and most other students from antiquity to about 1900). Simpson (1964) commented, "This is an ironic joke : that the theory to which all Lamarck's name became and still remains attached and to which all his posthumous fame is due fundamentally different from what he himself intended. It would have been bitterly repudiated by him and he might well have preferred the neglect that his lot while giving."

Elliot (1914) commented that 'anyone of those quotes Lamarck have scarcely taken trouble to read his works.'

SUMMARY

1. Lamarck studied botany, zoology, geology, meteorology, physiology; most of them appeared nonsense in his lifetime. His studies on botany and zoology made him famous.

2. He proposed evolution and contradicted the creationists, catastrophists and essentialists and speculated uniformitarianism. His views that all species including man evolved from other species was upheld by Darwin.

3. Lamarck believed that all taxa have arisen by evolution and are a phylogenetic continuum.

4. He believed that evolution took place from the simplest to most perfect forms, species concept was secondary in his philosophy while it was the corner stone for Darwin's theory.

5. Lamarck considered evolution is a slow and gradual process and the needs unlimited time.

6. Lamarck never said that environment influences directly; and evolution through slow willing of animals as a Lamarckian concept was based on mistranslation of the words 'sentiment interieur' and 'besoin' in the works of Lamarck. Similarly the idea of 'inheritance of acquired characters' was not based on his original statements.

7. Neo-Lamarckians believed materials for evolution were individual modifications caused by reactions of organisms (a point really Lamarckian) and by the action of the environment on organisms (a point flatly denied by Lamarck).

8. His philosophy was deductive as well as subjective in the line of ancient Greek Philosophers. Hence he did not provide any evidence in support of his statements. While Darwin's was inductive and more scientific and intelligible.

9. Lamarck's literary style was poor, confusing and repetitive; he left no notebook and could not form any school.

ABSTRACT

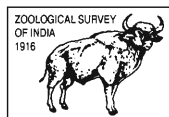
Lamarck's conception of evolution of animals is acknowledged by all. Due to his poor literary style mistranslation of his statements appeared in the literature. Hence the ideas like 'direct effect of the environment', 'inheritance of acquired characters' and 'evolution through slow willing of animals' are being considered as the important factors of evolution as Lamarckian concept. Lamarck believed that in an unlimited time with the change of environment morphology of animals (population) change very slowly and when breeding pairs or individuals have same characters then the changed morphology is inherited.

ACKNOWLEDGEMENTS

The author is thankful to Dr. K. Venkataraman, Director, Dr. Ramakrishna, (Former Director), Zoological Survey of India, Kolkata for providing facilities and also thankful to Dr. R. Babu, Scientist-C, and Mr. I.J. Gupta, Scientist-C (Retd.) of the same department for several courtesies.

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Rec. zool. Surv. India : 111(Part-1) : 11-16, 2011

REDESCRIPTION AND NEW DISTRIBUTIONAL RECORDS OF *OREUMENOIDES EDWARDSII* (DE SAUSSURE) (HYMENOPTERA : VESPIDAE; EUMENINAE) FROM INDIA

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INTRODUCTION

Though relatively more taxonomic works on the potter wasps have been done on the fauna of Palaearctic and Nearctic regions, our information on the fauna of Indian subcontinent is very scanty and fragmentary. Among the species reported from India many need detailed taxonomic revision and redescription. One such species is *Oreumenoides edwardsii* (de Saussure), first described by de Saussure in 1852 as *Eumenes edwardsii* from Bombay. The species was described on the basis of a female (Habite: "Les Indes Orientales; le Bombay"). Original description was very short which is inadequate for the identification at species level. Subsequently Bingham (1897) provided a redescription of it which is also very short and with some errors in description such as : (1). Median segment (= Propodeum) smooth, slightly pubescent (Actually, dorsal side of propodeum closely and densely punctate with small silvery white pubescence and in between moderately large silvery white pubescence and lateral sides of propodeum smooth, almost bare except at lower side with minute pubescence); (2). Clypeus about twice as long as broad (Actually, the minimum width of clypeus is 0.86x its length medially); (3). The description of colour is also not provided in detail.

In 1961 Soika erected a new genus *Oreumenoides* based on *Eumenes edwardsii* as the type. The other diagnostic characters of the genus are : male antennal apex minute, not hooked apically; petiole more than 1.25x the length of mesosoma; second gastral tergum without lamella separated by preapical thickening; pronotum with pretegular carina. This Oriental genus is represented only by the type species *Oreumenoides edwardsii* (de Saussure) till date.

O. edwardsii is so far known from Mumbai (in Maharashtra) (de Saussure, 1852; Bingham, 1897), Dehradun (in Uttarakhand) (Gupta, 1995), Malampuzha (in Kerala) and Karad (in Maharashtra) (Gusenleitner, 2006), North West Province (in Pakistan), Burma (= Myanmar) and Tenasserim (in Myanmar) (Bingham, 1897), Sikkim; Satara district, Bombay Presidency; Calcutta; Kumdhik, Nepal Terai; Pusa; Gorakhpur; Trichinopoly (= Thiruchirapally in Tamil Nadu) (Dover & Rao, 1922) and from Thailand (Zipcodezoo.com Webpage). In the present paper, this species is redescribed and newly recorded from the Indian states Delhi, Jharkhand, Karnataka, Madhya Pradesh and Rajasthan and the Union territory Pondicherry.

MATERIAL AND METHODS

This study is based on a number of unidentified specimens present in the Hymenoptera Section of Zoological Survey of India, Kolkata (NZSI). All the specimens were set-pinned and dried. Male genitalia were dissected from one specimen collected from Namkum, Ranchi. Genitalia were dissected, treated with hot KOH, washed, dehydrated through grades of alcohol and mounted on card. The specimens were studied under a stereozoom microscope (Wild Heerbrugg made in Switzerland) and drawings were made using the drawing tube of microscope.

All the studied specimens were properly registered and kept at the 'National Zoological Collections' of the Hymenoptera Section of the Zoological Survey of India, Kolkata (NZSI).

The following abbreviations are used in the text: F = Female; M = Male; MP = Museum National d'Histoire Naturelle, Paris; NZSI = 'National Zoological Collections' of the Hymenoptera Section, Zoological Survey of India,

Kolkata; OOL = Ocellocular length; POL = Postocellar length.

***Oreumenoides edwardsii* (de Saussure)**

(Figs. 1-21 & Plate I)

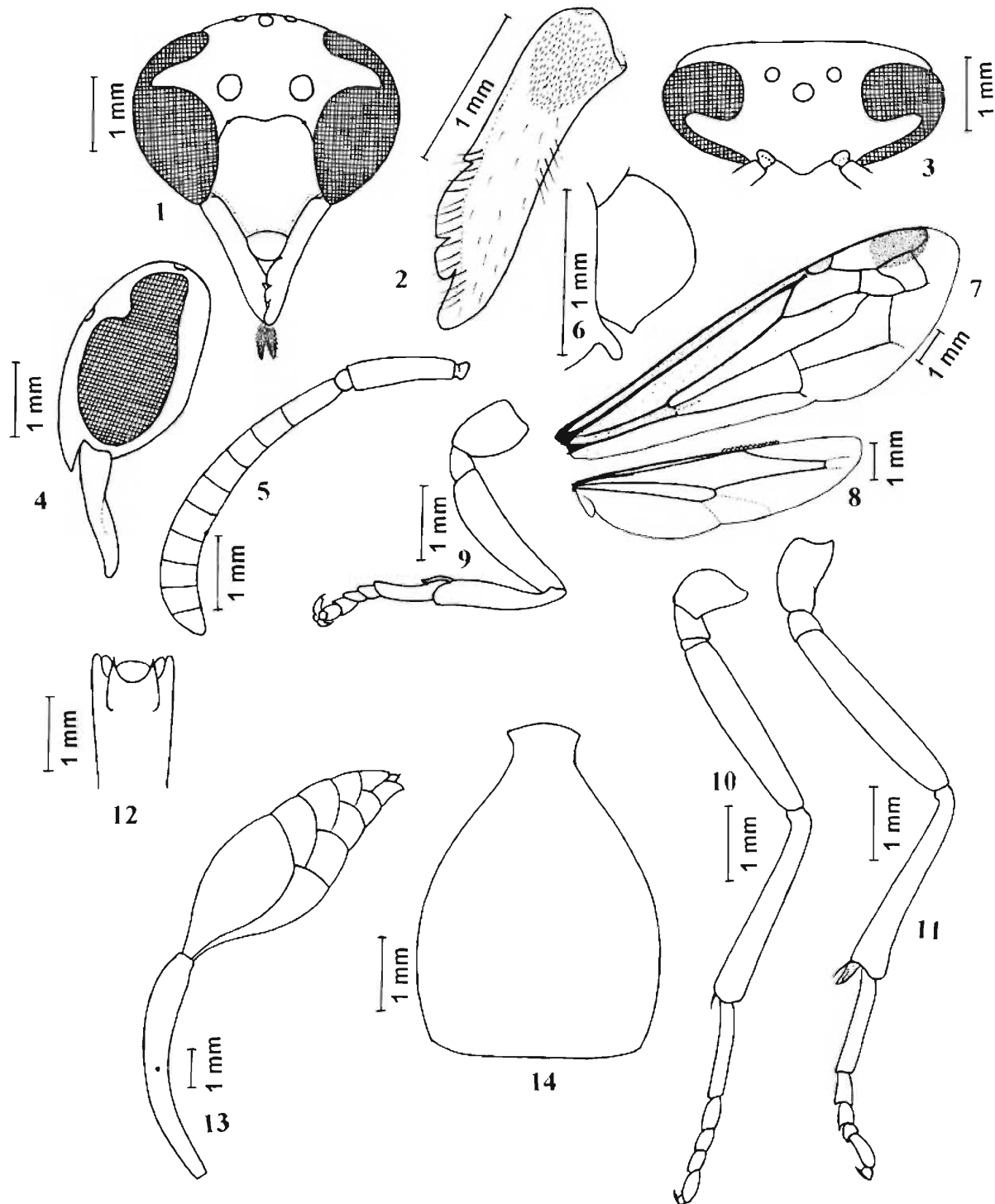
1852. *Eumenes edwardsii* de Saussure, *Mon. Guep. Sol.* P. 60, Female, Syntype, Type loc. Les Indes-Orientales, Bombay (MP). Additional citations: Smith, 1857, *Cat. Hym. Brit. Mus.*, V, p. 22; Bingham, 1897, *Fauna of Brit. India, Hym.*, 1 : 344, Female, Male, des., distr., fig., syn.; Dutt, 1912, *Mem. Dept. Agr. India Ent. Ser.*, 4 : 239, nest; Dover & Rao, 1922, *J. Asia. Soc. Ben.*, N. S. xviii : 238, distr.; Gupta, 1995, *Him. Eco. Series, Hym.*, zool. Surv. India, 83, distr.
1961. *Oreumenoides edwardsii* (de Saussure): Giordani Soika, *Verh. XI Int., Kongr. Entomol. Wien.* 1 : 245, erected new genus *Oreumenoides* with type species *Eumenes edwardsii* de Saussure by original designation. Additional citation: Gusenleitner, 2006, *Linzer boil. Beitr.*, 38(1) : 694, distr.

Redescription : Female: Body length 14-16 mm; forewing length 11 mm. Body ferruginous red with yellow and black markings. Yellow markings as follows: at the clypeus, a triangular mark on interantennal space, inner margin of lower eye extends upto ocular sinus, a narrow line on outer margin of eye (rarely only a spot dorsally), a spot on ventral side of antennal attachment, a short line on middle of the pronotum (rarely the line extends to sides), a spot on tegula apically, parategula (rarely brownish yellow), lower half of metanotum (rarely yellowish brown), a small spot on antero-lateral side of propodeum (rarely absent), a small spot on postero-lateral corner of propodeum, propodeal valvula (rarely yellowish brown), a streak on outer side of tibiae and basitarsi (rarely absent in mid and hind tibiae and mid and hind basitarsi), a yellow mark on outer side of fore, mid and hind femora (rarely absent), a streak on each side just after middle of petiole, two subapical spots and two spots on postero-lateral corner on the same above, two lateral oval spots basally and a broad band apically on second gastral tergite, two spots postero-laterally on third gastral tergite (sometimes fourth also), a narrow band on second gastral sternite apically, a broad band on third and fourth sternite apically (sometimes fifth and sixth also). Black markings are as follows : frons except inner ocular sinus, vertex, temple except ocular margin of eye, occiput, mesoscutum except an M-shaped ferruginous brown marking, apical margin of scutellum, basal half of metanotum (sometimes reduced), axillary fossa, suture between metanotum and propodeum, median groove of propodeum, mesepimeron largely, ventral side of mesosoma, base and middle of

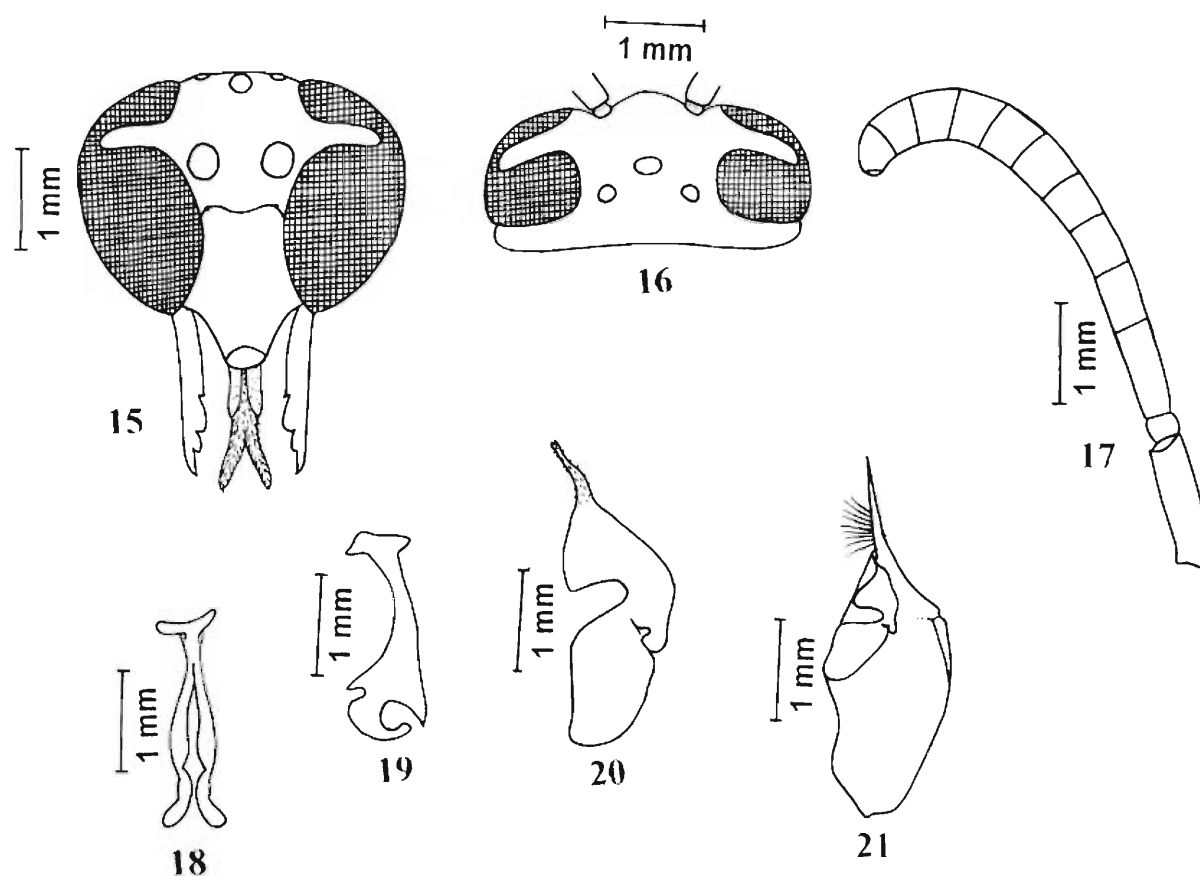
petiole above, middle of second gastral tergite (sometimes faint medially, appears to be blackish brown), a broad longitudinal band from base upto middle of second gastral sternite, two lateral spots on second gastral sternite subapically (sometimes faint, appears to be blackish brown). Forewing (Fig. 7) almost hyaline with some brown infumations anteriorly, a distinct brown infumation on radial cell at distal half; hindwing hyaline. Body covered with minute silvery white pubescence, some moderately large silvery white pubescence in between minute pubescence on frons, vertex, scutellum, metanotum, dorsal side of propodeum and scattered hairs on gastral segments.

Head : Width in front view (Fig. 1) 1.29x as long as distance between front ocellus and clypeal margin medially; width in dorsal view (Fig. 3) 6.7x distance between front ocellus and posterior occipital margin, almost equal to (0.98x) mesosoma along tegula; clypeus convex, minimum width 0.86x its length medially, apex emarginate with two lateral triangular tooth-like projections, almost smooth, upper margin emarginate; mandible (Fig. 2) smooth, with a line of large hairs on inner margin, scattered moderately large hairs on dorsal surface with few scattered large hairs outwards, very small closely set hairs basally; supraclypeal area, interantennal space except anterior portion, inner orbit, ocular sinus, vertex except at middle, temple and occiput almost smooth; frons, anterior portion of interantennal space, vertex at middle near to ocellar triangle with moderately large punctures, interspaces mostly equal to punctures; POL 2.16x OOL; interocular distance more on vertex than at clypeus (23:19); temple distinctly narrower (0.63x) than eye in profile (measured through its ocular sinus) (Fig. 4). Antenna farther from each other than from eyes (9:3); scape length 1.75x length of first flagellar segment (Fig. 5); first flagellar segment 1.71x as long as second flagellar segment, 2.4x as long as wide; flagellar segments widening towards apex as in figure 5; apical antennal segment slightly longer than wide.

Mesosoma : anterior face of pronotum smooth; posterior and lateral portion of pronotum, mesoscutum, scutellum, mesopleuron with moderately strong punctures; metanotum shiny with scattered punctures; dorsal side of propodeum closely and densely punctate except at anterior margin towards metanotum smooth, interspaces mostly less than punctures; metapleuron and lateral sides of propodeum smooth; pronotum with distinct pretegular carina; median length of mesoscutum as long as its maximum width; parategula (Fig. 6)



Figs. 1-14. *Oreumenoides edwardsii* (de Saussure). Female. Fig. 1. Head front view; Fig. 2. Left mandible front view; Fig. 3. Head dorsal view; Fig. 4. Head lateral view; Fig. 5. Antenna; Fig. 6. Tegula and parategula dorsal view; Fig. 7. Forewing; Fig. 8. Hindwing; Fig. 9. Fore leg lateral view; Fig. 10. Mid leg lateral view; Fig. 11. Hind leg lateral view; Fig. 12. Apex of petiole on ventral side; Fig. 13. Metasoma lateral view; Fig. 14. Second gastral tergum dorsal view.



Figs. 15-21. *Oreumenoides edwardsii* (de Saussure). Male. Fig. 15. Head front view; Fig. 16. Head dorsal view; Fig. 17. Antenna; Fig. 18. Aedeagus front view; Fig. 19. Aedeagus lateral view; Fig. 20. Volsella; Fig. 21. Paramere with volsella.

exceeding tegula posteriorly; axillary fossa not slit-like, much broader; metanotum at the same level of scutellum and propodeum, not raised; propodeal valvula rounded. Legs as in figures 9, 10 & 11; midtibia with one spur. Forewing and hindwing as in figures 7 & 8; forewing with prestigma 0.54x less than pterostigma; second submarginal cell acute basally.

Metasoma : Petiole length 1.27x than mesosoma in lateral view, 1.47x second gastral tergite (Fig. 13); apex of petiole on ventral side as in figure 12; petiole and gaster almost smooth, with minute punctures; second gastral tergum (Fig. 14) without lamella separated by preapical thickening, slightly curved inward medially at apex, almost straight, 1.3x as long as broad; posterior apices of third, fourth and fifth tergites and second, third, fourth and fifth sternites distinctly curved inward at middle.

Male : Body length 13.5-18 mm; forewing length 10.5 mm. Colour similar to that of female except in most

of the males labrum yellow and mandible yellowish brown; head width in dorsal view (Fig. 16) 4.7x distance between front ocellus and posterior occipital margin; median length of clypeus (Fig. 15) 1.67x its minimum width; POL 3.6x OOL; Antenna as in figure 17; last antennal segment minute, not coiled apically; aedeagus as in figures 18 & 19; volsellae as in figure 20; paramere with volsellae as in figure 21, parameral spine with moderately large hairs. Other characters almost as in female.

Material examined : India : Delhi : Delhi University Ridge, 1 F, 1.xii.1975, coll. V.K. Gupta, Regd. No. 12377/H3; Delhi University Campus, 1 F, 4.ix.1978, coll. A. Kaur, Regd. No. 12378/H3. Jharkhand : Ranchi dist., Namkum, 2 M, 15&23.v.1956, coll. C. Tirky, Regd. Nos. 12379/H3 & 12380/H3. Karnataka : Dharwad dist., Dharwad, 1 F, 17.i.1982, coll. S.K. Ghosh & party, Regd. No. 12381/H3. Madhya Pradesh : Shivpuri dist., Surwaya, 1 M, 16.v.1975, coll. S.K. Gupta & Party, Regd.

PLATE-I



Oreumenoides edwardsii (de Saussure). Female.

No. 12382/H3. Maharashtra : Satara dist.; Moleshwar, 1 F, 23.iv.1912, coll. F.H. Gravely, Regd. No. 12383/H3. Pondicherry : Karaikal dist., Karaikal, 1 F, x.1963, coll. P.S. Nathan, Regd. No. 12384/H3; Pondicherry dist., Nettapakkam, 1 F, x.1963, Gupta collection, Regd. No. 12391/H3. Rajasthan : Sirohi dist., Mount Abu, 1 M, date of collection unknown, coll. Dudgeon, Regd. No. 12385/H3. Tamil Nadu : Coimbatore dist., Coimbatore, 3 M & 2 F, 20.iii.1957, iv.1963, ix.1963, xii.1963, x.1964, coll. P.S. Nathan, Regd. Nos. 12386/H3 to 12390/H3. Uttar Pradesh : Mirzapur dist., Pipri, near Rihand dam, 1 M, 2.v.1947, coll. H.A. Hafiz, Regd. No. 12392/H3; Azamgarh dist., Azamgarh, 1 F, 29.iv.1990, coll. T.R. Mitra & party, Regd. No. 12393/H3. West Bengal : East Midnapur dist., Daudpur, 1F, 12.viii.1985, coll. B.C. Das & Party, Regd. No. 12394/H3; South 24 Parganas dist., Sunderbans Biosphere Reserve, Sudhanyakhali, 1 F, 1.iv.2008, coll. P. Girish Kumar, Regd. No. 12395/H3 (NZSI).

Distribution : Oriental. India : Delhi (new record), Bihar, Jharkhand (new record), Karnataka (new record), Kerala, Madhya Pradesh (new record), Maharashtra, Pondicherry (new record), Rajasthan (new record), Sikkim, Tamil Nadu, Uttarakhand, Uttar Pradesh, West Bengal.

Elsewhere : Myanmar, Nepal, Pakistan, Thailand.

Behaviour : Nest construction (Dutt, 1912).

SUMMARY

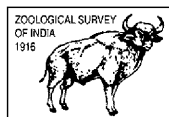
The Oriental potter wasp species *Oreumenoides edwardsii* (de Saussure, 1852) is redescribed here. In this paper, this species is newly recorded from the Indian states Delhi, Jharkhand, Karnataka, Madhya Pradesh and Rajasthan and the Union territory Pondicherry.

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The author is grateful to Dr. K. Venkataraman, Director, Zoological Survey of India, Dr. Kailash Chandra, Additional Director & Officer-in-Charge of Entomology Division (A), Zoological Survey of India, Kolkata and Dr. S.I. Kazmi, Officer-in-Charge of Hymenoptera Section, Zoological Survey of India, Kolkata for providing research facilities and encouragements to carry out this work. The author is also grateful to Dr. J. Gusenleitner, Austria for some valuable reprints of his papers. Sincere thanks are also due to Shri. Mridul Purakayastha, IT Assistant (Data Entry), ENVIS Centre on Faunal Diversity, Zoological Survey of India, Kolkata for editing photo.

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Rec. zool. Surv. India : **111**(Part-1) : 17-24, 2011

A POPULATION SURVEY OF RHESUS MONKEYS AND HANUMAN LANGURS OF PURI AND KHURDA DISTRICTS, ORISSA, INDIA

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INTRODUCTION

Field studies on the non-human primates of Orissa was undertaken by Zoological Survey of India as a part of status survey of non-human primates of India from 1977-81 under a DST Project (Tiwari and Mukherjee, 1992). Other workers studied primates of Orissa and mammals are Behura and Guru (1969) reported wildlife of Orissa; Tiwari *et al.* (1997) published the sightings of monkeys and langurs at Chandaka wildlife sanctuary; Ramakrishna (2006) published faunal account of Simlipal Biosphere Reserve; Chaudhuri *et al.* (2007) reported primates of Nayagarh district; Ramakrishna *et al.* (2008) published hanuman langur population of Balasore district. In 1978 Zoological Survey of India team had surveyed Puri, Bolangir and Sundargarh districts of Orissa. Later the Puri district was divided into 3 districts in 1994 as Puri, Khorda and Nayagarh. Tiwari and Mukherjee (1992) discussed the account of primates in Orissa state as a whole but no separate district wise results were given. Monitoring and estimation of primate population is important for the purpose of management. The status of primates in Nayagarh district was already published (Chaudhuri *et al.*, 2007) and the remaining two districts Puri and Khurda are dealt in this report based on the population of primates over a period of two decades.

This report deals with the information regarding distribution, abundance, social composition of rhesus monkey, (*Macaca mulatta*) and Hanuman langur (*Semnopithecus entellus*) of Puri and Khurda districts, Orissa. In these districts the rhesus monkeys and Hanuman langurs were recorded in the temples, towns, forests and villages.

The rhesus monkeys and hanuman langurs the two widely distributed species in India are found in these two districts. These two monkeys inhabit in diverse habitats from forests to open lands and near human settlements as also in montane arid zone.

STUDY AREAS

Puri district lies between 19°28'–26°35' N and 84°29'–86°25' E with an area of 3479 km² and Khurda district with an area of 2887² km. The districts are divided into dissimilar natural divisions—the littoral tract, an alluvial tract and hilly tract. Areas along river Daya is flat and alluvial with having long ranges of rugged hills at many places. The littoral tract lies between alluvial plain and Bay of Bengal. The land assumes the form of a bare silt of sand, stretches along seashores for full length of the district, which varies from 6 km to few hundred meters in width. Alluvial tract is occupied by villages and cultivated fields. The hilly tract is mainly in Khurda district. Hill ranges at many places break the country into small well cultivated fertile valleys intersected by hill streams. The length of the seacoast of Puri District is about 150 km. The rivers are Mahanadi, Kuakhani, Daya, Bhargavi and Kuakhai. Climate of the district is warm and humid and it enjoys a sub-tropical monsoon climate, with three districts season's viz. winter, summer and monsoon. May is the hottest month with a mean daily temperature of 35°C and January is the coldest having a daily temperature of 14-16°C. The average annual rainfall is about 1443 km.

The forests consisted of dry, semi-evergreen and approximate more to the type met within the agnatic sub-region than to dry deciduous type prevalent in

parts of Bihar and Orissa (Plate-I). The forests contain common species to both the northern and southern tracts and similar to vegetation found in Nayagarh district (Chaudhuri *et al.*, 2007). There are many low hills at many parts of Puri district have good contact grows and raised garden of betel leaf which are the principal cash crop of many villages. Polang tree was seen at many villages whose seeds produced principal illuminant before kerosene came to use.

METHODS

The survey methods applied in Puri and Khurda districts were the same that was adopted in Nayagarh district survey (Chaudhuri *et al.*, 2007). The survey was conducted on road sides, villages, towns and forests. The roadside surveys were made by using a slow moving vehicle while forest roads and trails were surveyed both by vehicle and on foot. Transect and point methods were adopted to locate monkeys in the forests and hills. The transect method in the forest path was accomplished by slow walking and waiting for 5-6 minutes in every 200 m for visual and auditory signals for presence of monkeys (Southwick *et al.*, 1961). The point method was adopted in hills where elevation exceeds 200 m and above. In other areas total count and sweep sampling techniques were used to estimate the primate population.

Four surveys were conducted in these two districts from 2002 to 2004 during summer and winter months and the data collected during summer 2004 survey is presented here, when the two districts were resurveyed so as to avoid any duplication of monkey counts. The survey was conducted in the forenoon (0700-1130 hrs.) and afternoon (1500-1800 hrs.) depending upon available sunlight. A total of 1600 hrs. was conducted for in the field survey. About 2400 km² area was surveyed which was 40% of the total geographical area of the study districts. The monkey groups when located, their social composition, habitat, inter-intra group interactions were recorded. The individuals of a group were broadly classified, for both the monkey species, as adult males, adult females, juveniles and infants. Adult males and adults females were determined depending upon their body size and age. Juveniles were those more than one year or less than three years old and infants were those carried by mothers, pre-weaned and less than one year old.

RESULT

A total of 2400 km² area was surveyed which comprised about 38% of the total geographical area of Puri and Khurda districts. Eighteen groups of rhesus monkey and 110 groups of Hanuman langur were recorded. The Hanuman langurs were mostly sighted in the villages and forests while rhesus monkeys were mainly observed in the forests.

RHESUS MONKEY

Altogether 18 rhesus monkey groups of 501 individuals comprising 61 adult males; 224 adult females; 100 juveniles and 116 infants were observed (Table-1) (Plate-I). The distribution of these monkeys is shown in Fig. 1. The group's size varied from 5 to 52 individuals excluding Jagannath temple group in Puri town, which consisted of 134 monkeys. The Jagannath temple monkeys were distributed in more than one group, but identification of the groups was not possible due to close association and constant overlapping. The mean group size was 27.8 ± 7.06 of which 3.39 ± 0.76 was adult males, 12.44 ± 2.58 was adult females, 5.5 ± 2.23 was juveniles and 6.4 ± 1.73 was infants (Table-1). This provides a population estimate of 0.0075 groups/km² and 0.20 individuals/km².

Out of 501 monkeys, the population composed of 12.18% adult males; 44.71% adult females; 19.96% juveniles and 23.15% infants. About 51.7% adult females were carrying infants. The adult males and adult females ratio was 1 : 3.6 and adult females and juveniles and infants ratios were 1 : 0.44 and 1 : 0.5 respectively. The 18 rhesus groups were observed in 4 habitats—villages, forest, temples and towns. Five temple groups were recorded with 234 monkeys; forests contained 214 individuals in 9 groups; 3 groups with 48 monkeys were counted in the villages and a town group with 5 monkeys was recorded. The mean density of the habitat categories is shown in Fig. 1.

The undivided Puri district was first surveyed by Zoological Survey of India team in 1978 under a DST (Tiwari & Mukherjee, 1992); the said report of the survey did not mention districtwise population. The Nayagarh district primate survey, which was a part of the then Puri district, was published by Chaudhuri *et al.*, 2007.

During 1978 survey 9 groups of rhesus monkey with a total of 178 individuals were recorded. Out of 9 groups one group containing 3 monkeys were recorded at Baruni hill forests where the social composition was not mentioned. The remaining 8 social groups having 175 monkeys of which 29 were adult males; 62 were adult females; 51 were juveniles and 33 were infants. These monkeys were found inhabiting in temples, forests and in villages (Table-2). The mean density of monkeys in these three habitats is shown in Fig. 5. The

average group size excluding the Baruni group was 10.78 ± 8.83 monkeys of which 3.22 ± 1.41 was adult males; 6.89 ± 2.90 were adult females; 5.67 ± 2.64 was juveniles and 3.67 ± 2.13 were infants. The percentage composition consisted of 16.57% adult males, 35.43% adult females, 29.15% juveniles and 18.85% infants. About 53% females were carrying infants. The ratio of adult males to adult females was 1 : 2.13 and adult females to juveniles and infants ratios were 1 : 0.82 and 1 : 0.53 respectively.

Table-1. Distribution and social composition of Rhesus macaque at Puri and Khurda District during–2004.

Habitat	Total	Males	Females	Juveniles	Infants
Temple	234	28	91	54	61
Town	5	1	2	0	2
Forest	214	26	107	38	43
Village	48	6	24	8	10

Table-2. Distribution and social composition of Rhesus macaque at Puri and Khurda district–1978.

Habitat	Total	Males	Females	Juveniles	Infants
Temple	73	14	27	20	12
Forest	74	12	22	20	17
Village	31	3	13	11	4

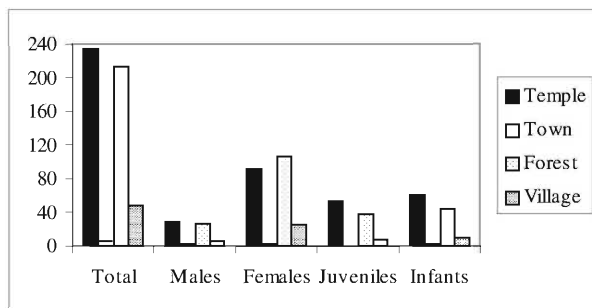


Fig. 1. Distribution & Social composition of Rhesus macaque at Puri & Khurda districts in 2004.

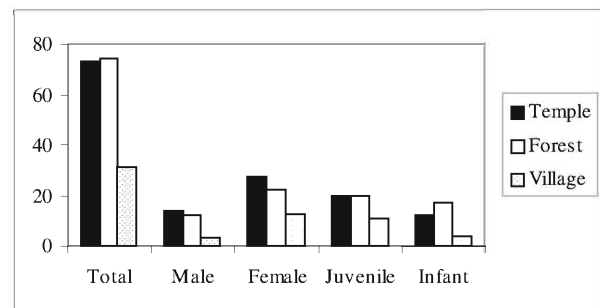


Fig. 2. Distribution & Social composition of Rhesus macaque at Puri & Khurda districts–1978.

HANUMAN LANGURS

Result from the survey revealed the sightings of 110 groups of Hanuman langur, of which 3 were all male bands and 3 solitary males and rest 104 were social groups (Plate-I). The 110 groups consisted of 2114 langurs. The distribution of social langur groups is shown in Fig. 2. This provides a population estimate of 0.045 groups/km² which comprised of 0.88 langurs/km². The group size varied from 4 to 64 individuals. The 3 all male bands consisted of 14 langurs and all these inhabited the villages close to bisexual groups in Puri and Khurda districts.

The 104 social groups consisted of 2097 langurs, which composed of 228 adult males; 1031 adult females; 438 juveniles and 400 infants. The mean group size was 20.16 ± 1.22 individuals (Table-3). The adult males to adult females ratio was 1 : 4.5 and adult females to sub-adults ratio was 1 : 0.81. About 38.7% females were having infants. These 104 social hanuman langur groups were distributed in 4 habitat categories—villages, forests, temples and towns. The mean density of these groups is shown in Fig. 2. The habitatwise distribution of langurs is given in Table-3.

Table-3. Distribution and social composition of Hanuman Langur at Puri and Khurda district–2004.

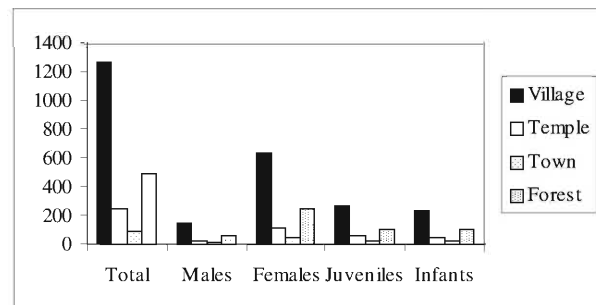
Habitat	Total	Males	Females	Juveniles	Infants
Village	1270	140	628	266	236
Temple	242	26	115	52	49
Town	94	11	46	18	19
Forest	491	51	242	102	96

Village : The 68 bisexual village groups contained 1270 langurs with a mean group size of 18.78 ± 1.4 individuals. The social composition consisted of 140 adult males; 628 adult females; 266 juveniles and 236 infants (Table-3, Fig. 2). The adult male to adult female ratio was 1 : 4.48 and adult females to sub-adults ratio were 1 : 0.79. The percentage composition of population consisted of 11% adult males; 49.45% adult females; 20.95% juveniles and 18.6% infants. The 37.5% females were having infants.

Forests : The second largest population of langur was recorded from the forests. Nineteen forest groups having 491 langurs with a mean group size of 25.84 ± 2.7 individuals. The 491 langurs consisted of 51 adult males; 242 adult females; 102 juveniles and 96 infants (Table-3). The percentage composition revealed 10.38% adult males, 49.3% adult females, 20.77% juveniles and 19.55% infants. The ratio of adult males to adult females was 1 : 4.7, adult females to infant were 1 : 0.39 and adult females to total sub-adults ratio was 1 : 0.81. About 39.6% females found carrying infants.

Temple : Ten temple groups contained 242 langurs with a mean group size of 24.20 ± 5.5 individuals. The social composition of temple groups consisted of 26 adult males; 115 adult females; 52 juveniles and 49 infants (Table-3). The percentage composition in the population consisted of 10.75% adult males, 47.52% adult females; 21.48% juveniles and 20.25% infants. About 42.6% females were having infants and this figure was the highest in terms of infant-female relationship. The adult males to adult females ratio was 1 : 4.4 and adult females to infants' ratio was 1 : 0.42.

Town : Only 7 town groups with 94 langurs were sighted with a mean group size of 13.43 ± 1.0 individuals. The 94 langurs consisted of 11 adult males; 46 adult females; 18 juveniles and 19 infants (Table-3). The adult males to adult females ratio was 1 : 4.18 and adult females to sub-adults ratio was 1 : 0.8. The percentage

**Fig. 3.** Distribution & Social composition of Hanuman langur at Puri & Khurda districts-2004.

composition in the population consisted of 11.7% adult males; 48.94% adult females; 19.15% juveniles and 20.21% infants. About 41.3% females were carrying infants.

In 1978 Puri district was surveyed by the ZSI team. Khurda district at that time was a part of Puri district. During that period 39 social groups of Hanuman Langur was recorded with a total of 592 langurs and the mean group size was 15.18 ± 1.53 individuals. The social groups composed of 58 adult males (1.48 ± 0.12); 308 adult females (7.90 ± 0.82); 118 juveniles (3.0 ± 0.42) and 108 infants (2.77 ± 0.44) (Table-4). The group size rose from 3 to 42. The adult males to adult female's ratio were 1 : 5.31. Adult females to juveniles and infants ratios were 1 : 0.38 and 1 : 0.35 respectively. The percentage composition of different sexes and age class was 9.8% adult males, 52.0% adult females, 19.95% juveniles and 18.25% infants. The Hanuman langurs those were recorded duringn 1978 survey were distributed in three habitat categories—villages, forests and towns and only one temple group was encountered with 36 langurs at Udaigiri. In earlier survey three town groups with 45 langurs were reported from Puri district whereas during 2004 survey 7 town groups with 94 langurs were recorded. The in earlier survey three villages contained 22 groups, the maximum number recorded at Puri district followed by forests 13 groups. The 22 village groups were having 354 individuals of whom 32 were adult males; 185 were adult females; 78

were juveniles and 59 were infants. The mean density of langurs harboring different habitats is shown in Fig. 4. The two status survey of non-human primates of Puri and Khurda districts revealed a huge change of population over a period of about 26 years.

To find out the changes that occurred, were selected 20 common langur groups were selected from the both surveys inhabiting all categories and distributed at different places throughout the districts. The 1978 survey was conducted in the month of May. A number of surveys were conducted for the study of status of primates in 2003-2004 and 20-langur groups were chosen from the survey carried out during the month of May 2003 so as to make comparative study. These 20 groups contained 332 in 1978 survey and 335 langurs in 2004 survey (Table-5, Fig. 3). The only major changes were noticed in the adult males and adult female's populations. In 1978, 9.3% males and 51.2% females were recorded whereas during 2003 survey it was 12.2% males and 47.7% females were observed. The 't' test of these two population yielded insignificant results ($t = -0.043$, $p \text{ value } Pct < t$).

DISCUSSION

The rhesus monkeys of Puri and Khurda districts were found inhabiting the forests and temples. Out of 18 rhesus groups from 5 groups were recorded from temples and 9 groups from forests. The forest dwelling monkeys represented 42.7% of the total recorded population in these two districts. The forest provides natural food and shelter to these monkeys, whereas provisional food provided by the visitors to the temple monkeys was main factor for their concentration in the temples.

In 1978 survey 3 temple groups were recorded of which 2 groups were from Puri town. The Jagannath temple group was the largest with 64 monkeys, whereas the survey of 2004 recorded 5 temple groups from Puri town. The number of monkeys of Jagannath temple had increased to 134 in number. The Jagannath temple monkeys as observed were not a single group. The area of the temple is nearly 1 km² and we tried time and again to ascertain the sleeping but due to restrictions number of groups of our movement during evening hours it was not possible to trace the night individual

Table-4. Distribution and social composition of Hanuman Langur at Puri and Khurda during the year 1978.

Habitat	Total	Males	Females	Juveniles	Infants
Forest	157	18	80	31	28
Town	45	5	23	5	12
Temple	36	3	20	4	9
Village	354	32	185	78	59

Table-5. Social composition of Hanuman langurs during summer of 1978 & 2004 of Puri & Khurda districts.

Year	Total	Males	Females	Juveniles	Infants
Total (1978)	332	31	170	62	69
Total (2004)	335	41	160	71	63

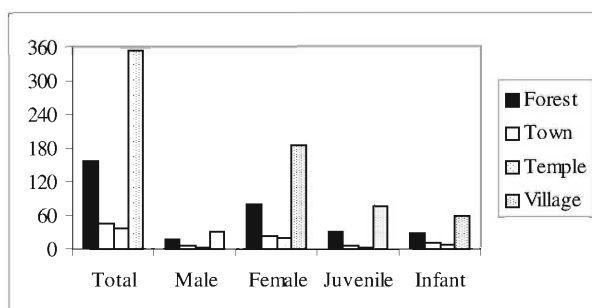


Fig. 4. Distribution & Social composition of Hanuman langur at Puri & Khurda districts-1978.

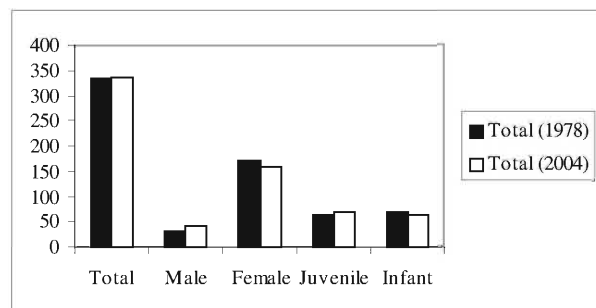
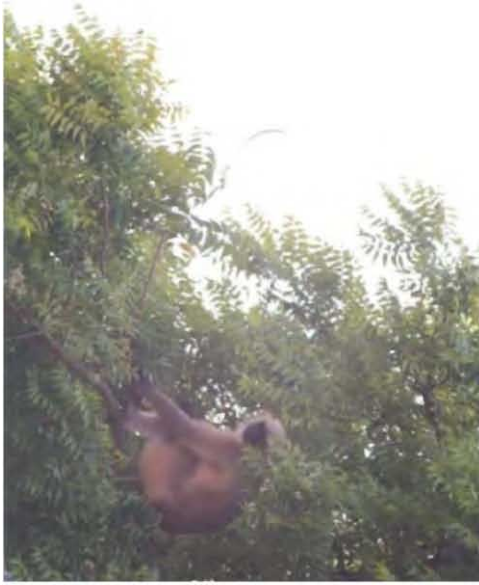


Fig. 5. Distribution & Social composition of Rhesus macaque at Puri & Khurda districts-1978.

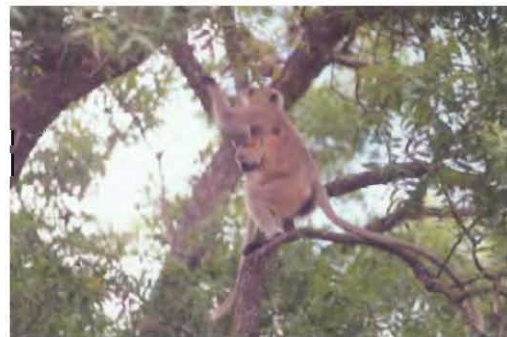
PLATE-I



Hanuman Langur at Balipatra village



Hanuman Langur on Khandagiri-Chandka Road

*Rhesus macaque* at Bara Pukuria village

Hanuman Langur at Nachuni village



Hanuman Langur in agriculture land at Balipatna village



Hanuman Langur at Barunei forest



Forest Type of Balukhand Wildlife Sanctuary, Konark

trees or places for group counts. The monkeys found in other temples at Puri were supposed to be budded off from Jagannath temple groups. The population of rhesus monkeys in these two districts is low in terms of habitable areas and food availability.

The present survey revealed that hanuman langurs are more or less widely distributed in Puri and Khurda districts. The langurs mostly inhabit villages. About 65% of the total langur groups recorded from these two districts is found in villages. The villages provide food and trees for shelter to the langurs. The langurs often raid crops and gardens in the villages. This has become a serious concern to the villagers but still the man-monkey conflicts are less in this part of Orissa. The people of the state are much tolerant towards the monkeys due to their sacred status, which they enjoy from the ancient times, though this attitude has eroded in many parts of the country. The earlier survey of 1978, 39 groups with 592 langurs was reported whereas during present survey 2097 langurs in 110 groups were recorded. Thus the population groups three and half times over a period of 25 years. In both the cases village groups were more in numbers than any other habitat. Twenty two village groups with 354 langurs were sighted in 1978 survey whereas during 2004 census 68 groups with 1270 langurs were encountered. The village groups were increased about five times in 25 years. The 1978 survey was conducted in the month of May, the hottest month; this may be the reason for not

locating all the groups. Analysis of field data of 1978 survey, it was observed that at least 50% of the places where the survey team could not sighted the langurs but local people reported their presence. However, during 2004 survey the langurs were recorded from the places from where the local people reported their presence in the earlier survey.

Nayagarh district, which is part of the then Puri district, was surveyed in 2005 (Chaudhuri *et al.*, 2007) and the field investigation revealed that the rhesus population could not flourish during the last two decades. Only 4 new groups were added from 6 groups that were counted in 1978 survey at Nayagarh, though good forest cover (about 31%) still exists. Hanuman langur, the other primate species, nearly doubled from 16 groups to 30 groups from 1978 to 2005. It is evident from the present study that the rhesus monkeys are less adapted to the habitat of Puri and Khurda than the langurs. The hanuman langur which is regarded as leaf eating monkey and use the upper canopy now found inhabiting all type of habitats and changed the feeding pattern, thus causing great threat to the bottom feeders, the rhesus monkeys.

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Rec. zool. Surv. India : 111(Part-1) : 25-30, 2011

STUDIES ON THE SPHINGID FAUNA (LEPIDOPTERA : HETEROCERA : SPHINGIDAE) OF DALMA WILDLIFE SANCTUARY, JHARKHAND

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INTRODUCTION

Sphingidae is a family of moths (Lepidoptera), commonly called hawk moths, sphinx moths and hornworms, and are known to travel long distances on migration; some species have been encountered at mid-sea by ships (Kehimkar, 1997). They are moderate to large in size and are distinguished among other moths by their rapid, sustained flying ability (Scoble, 1995). The stout and cigar shaped body and long and narrow forewings are clearly adapted for rapid flight. The possession of long proboscis makes them ideal and distinct pollinators for flowers with long tubular corolla (Barlow, 1982). The family comprises of roughly 1,354 species reported worldwide, out of which about 204 species are distributed in India (Bell & Scott, 1937; D' Abrera, 1986).

The earlier studies revealed that little works have been done on the taxonomy, ecology and distribution of sphingidae in India and practically very little information is available from Bihar and Jharkhand (Bell & Scott, 1937; Beeson, 1941; Lefroy & Howlett, 1971). In the present work attempts have been made during 2007 and 2008 to collect and study sphingid moths from Dalma wildlife sanctuary which is one of the important conservation areas in Jharkhand. The studies have revealed the presence of 17 species of sphingid moths under 12 genera which are reported here for the first time from Dalma wildlife sanctuary.

The diagnostic characters, occurrence, distribution etc. dealt in this paper are based on Beeson (1941), Bell and Scott (1937), Mandal and Maulik (1991, 1997) and Chandra and Nema (2007).

DIVISION : ASEMANOPHORAE

Subfamily ACHERONTIINAE

Tribe ACHERONTIINI

Genus *Acherontia* Laspeyres

1. *Acherontia lachesis* (Fabr.)

1798. *Sphinx lachesis* Fabricius, *Syst. Ent. Suppl.*, : 434.

1937. *Acherontia lachesis*, Bell & Scott, *Fauna Brit. India, Moths*, 5 : 55.

Diagnosis : Head and thorax blackish, powdered with white, yellow and blue-grey scales. The skull mark on the dorsum of the thorax more conspicuous. Fore wing blackish, powdered with white, yellow and bluish grey scales. Hind wing upper side with the basal third marked with black. Abdomen black with a broad, interrupted, grey-blue dorsal stripe and small yellow side patches on the four proximal segments.

Material Examined : 2 exx., 5.viii.2008; 2 exx., 6.viii.2008; 2 ex., 7.viii.2008. Pindra pera, Dalma wildlife sanctuary, East Singhbhum, Jharkhand, coll. S. Sambath & Party.

Wingspan : 102-132 mm.

Occurrence : July-September.

Distribution : India : Jharkhand (East Singhbhum), Andaman Islands, Madhya Pradesh (Indore, Seoni), Orissa (Balasore) and West Bengal (Kolkata and North 24-Parganas); almost throughout the rest of the mainland except the North-West Himalaya .

Elsewhere : Bangladesh, Bhutan, China, Java up to Southern Moluccas in the farther east, Malaysia (western), Myanmar, Pakistan and Sri Lanka.

Host Plants : *Erythrina* spp., *Ipomaea* spp., *Jasminum* spp., *Solanus* spp., *Tectona grandis*, *Vitex negundo*, etc.

2. *Acherontia styx styx* (Westwood)

1848. *Sphenx* (*Acherontia*) *styx* Westwood, *Cab. Or. Ent.*, : 88.

1937. *Acherontia styx styx*, Bell & Scott, *Fauna Brit. India, Moths*, 5 : 58.

Diagnosis : Skull mark on thorax is less conspicuous. Fore wing with tawny-russet streaks. The basal third of hind wing upper side being immaculate instead of marked with black. Abdomen bears yellow side-patches well extensive. Fore tibiae with few spines.

Material Examined : 1 ex., 6.viii.1975, Rajendra Nagar, Patna, Bihar. Coll. K.C. Kansal; 2 exx., 5.viii.2008; 2 exx., 6.viii.2008; 1 ex., 7.viii.2008. Pindra pera, Dalma wildlife sanctuary, East Singhbhum, Jharkhand, coll. S. Sambath & Party.

Wingspan : 90-130 mm.

Occurrence : April-August.

Distribution : India : Jharkhand (East Singhbhum), Bihar (Patna), Madhya Pradesh (Indore, Jabalpur, Seoni), Orissa (Sundargarh) and West Bengal (Bankura, Bardhaman, and Kolkata) and throughout the rest of the mainland.

Elsewhere : Bangladesh, Bhutan, Myanmar, Pakistan and Sri Lanka.

Host Plants : *Jasminum* spp., *Nyctanthes*, *Sesamum indicum*, *Vitex negundo*.

Genus *Herse* Oken

3. *Herse convolvuli convolvuli* (Linnaeus)

1758. *Sphinx convolvuli* Linnaeus, *Syst. Nat.*, ed. 10 : 490.

1937. *Herse convolvuli convolvuli*, Bell & Scott, *Fauna Brit. India, Moths*, 5 : 61.

Diagnosis : Fore wing with many narrow whitish lunulate bands, obsolescent on some specimens. Hind wing pale grey with broad subbasal, two median and post median fuscous transverse bands. Abdomen with red lateral transverse spots.

Material Examined : 2 exx., 5.viii.2008, Pindra pera, Dalma wildlife sanctuary, East Singhbhum, Jharkhand, coll. S. Sambath & Party.

Wingspan : 80-120 mm.

Occurrence : August-December

Distribution : India : Jharkhand (East Singhbhum), Orissa (Cuttack), West Bengal and throughout the rest of the mainland.

Elsewhere : Eastern hemisphere except the higher latitudes, Europe and rarely in England, Siberia.

Host Plants : Plants of the family Leguminosae and Convolvulaceae.

Tribe SPHINGINI

Genus *Meganoton* Boisduval

4. *Meganoton nyctiphanes* (Walk)

1856. *Macrosila nyctiphanes* Walker, *List Specimens lepid. Insects Colln Br. Mus.*, 8 : 209.

1937. *Meganoton nyctiphanes*, Bell & Scott, *Fauna Brit. India, Moths*, 5 : 73.

Diagnosis : Upper side dark brown. Fore wing variegated with various shades of brown and grey scales and crossed by numerous waved dark lines. Hind wing dark brown with a series of pale spots across the disc. Head, thorax and abdomen white below ; abdomen with white segmental streaks at sides.

Material Examined : 1 ex., 6.viii.2008; 3 exx., 27.ix.2008; 2 exx., 4.xii.2008, Pindra pera, Dalma wildlife sanctuary, East Singhbhum, Jharkhand, coll. S. Sambath & Party.

Wingspan : 105-125 mm.

Occurrence : August-December.

Distribution : India : Jharkhand (East Singhbhum), Andaman Islands, East Himalaya and Southern peninsula.

Elsewhere : Malaya, Myanmar and Sri Lanka.

Host Plants : *Symphorema involucrellum*.

Genus *Psilogramma* Rothschild & Jordan

5. *Psilogramma menephron menephron* (Cramer)

1780. *Sphinx menephron* Cramer, *Pap. Exot.*, 3 : 164.

1937. *Psilogramma menephron menephron*, Bell & Scott, *Fauna Brit. India, Moths*, 5 : 77.

Diagnosis : Head, thorax and abdomen and fore wing grey; dark brown bands along sides of palpi and thorax meeting on metathorax, where there are blue and yellow scales; abdomen with a blackish dorsal stripe and brown subdorsal segmental patches. Fore wing with dark oblique lines from costa; hind wing brown, with a

black patch at anal angle. Rainy season specimens are usually dark.

Material Examined : 1 ex., 5.viii.2008; 1 ex., 6.viii.2008; Pindra pera, Dalma wildlife sanctuary, East Singhbhum, Jharkhand, coll. S. Sambath & Party.

Wingspan : 82-138 mm.

Occurrence : August to December.

Distribution : India : Jharkhand (East Singhbhum), Orissa (Keonjhar) Madhya Pradesh (Seoni, Sidhi, Umari), West Bengal and rest of the mainland.

Elsewhere : China and eastwards to the Solomon Islands.

Host Plants : *Clerodendron infortunatum*, *Tectona grandis*, *Vitex negundo*.

Subfamily AMBULICINAE

Genus *Polyptychus* Hubner

6. *Polyptychus dentatus* (Cramer)

1777. *Sphinx dentatus* Cramer, *Pap. Exot.*, 2 : 42.

1937. *Polyptychus dentatus*, Bell & Scott, *Fauna Brit. India, Moths*, 5 : 169.

Diagnosis : Whitish-cinereous. The post-discal and discal lines of fore wing parallel, straight, the former not curved dista beyond R₂; the dentate line between them distinct.

Material Examined : 1 ex., 27.ix.2008, Pindra pera, Dalma wildlife sanctuary, East Singhbhum, Jharkhand, coll. S. Sambath & Party.

Wingspan : 110 mm.

Occurrence : September-December.

Distribution : India : Jharkhand East Singhbhum), Madhya Pradesh (Indore, Seoni), West Bengal, Eastern and Northwest Himalaya, Maharashtra (Bombay), Southern peninsula and Uttar Pradesh (Allahabad).

Elsewhere : China, Pakistan and Sri Lanka.

Host Plants : *Cordia oblique*.

Genus *Oxyambulyx* Rothschild & Jordan

7. *Oxyambulyx subocellata* (Feld.)

1874. *Ambulyx subocellata* Felder, *Reise Ost. Fregatte Novara*, Lep. t. 76.

1937. *Oxyambulyx subocellata*, Bell & Scott, *Fauna Brit. India, Moths*, 5 : 136.

Diagnosis : Can be distinguished from all others of the genus by the thinness of the thoracic stripe over the tegula and by the series of subbasal spots on fore

wing upper side. Body reddish brown, thoracic stripe very thin. The fore wing with a series of four subbasal spots, green edged with white. Hind wing yellow pale or reddish brown.

Material Examined : 3 exx., 22.viii.2007; 3 exx., 27.ix.2008, Pindra pera, Dalma wildlife sanctuary, East Singhbhum, Jharkhand, coll. S. Sambath & Party.

Wingspan : 90-110 mm.

Occurrence : August-September.

Distribution : Adaman Islands, Southern peninsula.

Elsewhere : China (south), Malaya and Sri Lanka.

Host Plants : *Odina odier* and *Buchanania latifolia*.

8. *Oxyambulyx substrigilis aglaia* Jord.

1923. *Oxyambulyx substrigilis aglaia* Jordan, *Novit. Zool.*, 26 (1) : 190-192.

1937. *Oxyambulyx substrigilis aglaia*, Bell & Scott, *Fauna Brit. India, Moths*, 5 : 128.

Diagnosis : This species is easily distinguished by the large black or tawny basal patch of hind wing upper side. Dorsal line of abdomen distinct.

Material examined : 5 exx., 27.ix.2008, Pindra pera, Dalma wildlife sanctuary, East Singhbhum, Jharkhand, coll. S. Sambath & Party.

Wingspan : 105-120 mm.

Occurrence : September-October.

Distribution : Southern Part of India.

Host Plants : *Algaia littoralis*.

DIVISION-SEMANOPHORAE

Subfamily PHILAMPELINAE

Tribe NEPHELINI

Genus *Acosmeryx* Boisduval

9. *Acosmeryx anceus subdentata*

Rothschild & Jordan.

1903. *Acosmeryx anceus subdentata* Rothschild & Jordan, *Revision of Sphingidae*, p. 528.

1937. *Acosmeryx anceus subdentata*, Bell & Scott, *Fauna Brit. India, Moths*, 5 : 294.

Diagnosis : The smallest species of the genus, and markings different from those of all the other species. Fore wing distinctly angulate at R³, often with traces of teeth. Upper side tawny cinnamon to chestnut-brown; an oblique distal band diffuse posteriorly. Hind wing fuscous.

Material examined : 1 ex., 24.ix.2008, Pindra pera, Dalma wildlife sanctuary, East Singhbhum, Jharkhand, coll. S. Sambath & Party.

Wingspan : 70-88 mm.

Occurrence : September.

Distribution : India : Jharkhand (East Singhbhum), West Bengal, Sikkim, Southern peninsula.

Elsewhere : Bangladesh, Bhutan and Malay.

Host Plants : *Vitis indica*.

Genus ***Deilephila*** Laspeyres

10. ***Deilephila hypothous hypothous*** (Cramer)

1780. *Sphinx hypothous* Cramer, *Pap. Exot.*, **3** : 165.

1937. *Deilephila hypothous hypothous*, Bell & Scott, *Fauna Brit. India, Moths*, **5** : 271.

Diagnosis : Head and collar of thorax being uniformly dark purplish-brown; thorax and two segments of a abdomen dark olive-green with a white fringe to the first segment. Fore wing with a white spot at apex on upper side and at end of cell on underside.

Material examined : 2 ex., 5.viii.2008; 2 exx., 6.viii.2008; 1 ex., 7.viii.2008, Pindra pera, Dalma wildlife sanctuary, East Singhbhum, Jharkhand, coll. S. Sambath & Party.

Wingspan : 110-124 mm.

Occurrence : August – September.

Distribution : India: Jharkhand (East Singhbhum), Andaman Islands, Assam, Meghalaya, Sikkim, Southern Peninsula and West Bengal (Kolkata).

Elsewhere : Bhutan, China, Malaya, Myanmar and Sri Lanka.

Host Plants : *Uncharia*, *Cinchona*, etc.

Subfamily CHOEROCAMPINAE

Genus ***Hippotion*** Hubner

11. ***Hippotion boerhaviae*** (Fabricius)

1775. *Sphinx boerhaviae* Fabricius, *Syst. Ent.*, : 542.

1937. *Hippotion boerhaviae*, Bell & Scott, *Fauna Brit. India, Moths*, **5** : 424.

Diagnosis : Hind wing red, base not black; a clayish subanal patch.

Material examined : 8 exx., 5.viii.2008; 2 exx., 6.viii.2008; 2 exx., 7.viii.2008; 3 exx., 27.ix.2008, Pindra pera, Dalma wildlife sanctuary, East Singhbhum, Jharkhand, coll. S. Sambath & Party.

Wingspan : 57- 60 mm.

Occurrence : August-September.

Distribution : India : Jharkhand (East Singhbhum), Andhra Pradesh, Gujarat, Madhya Pradesh (Indore, Seoni, Umaria), Maharashtra, Orissa (Bolangir, Dhenkanol, Sundargarh), Sikkim, Southern Peninsula, West Himalaya and West Bengal (Birbhum, Darjiling, Kolkata).

Elsewhere : Bhutan, China (south), Malaya, Pakistan, Philippines and Sri Lanka.

Host Plants : The food-plants belong to Geraniaceae, Nyctaginaceae, Rubiaceae, Scrophulariaceae, etc.

12. ***Pergesa acteus*** (Cramer)

1779. *Sphinx acteus* Cramer, *Pap. Exot.*, **3** : 93.

1937. *Rhyncholaba acteus*, Bell & Scott, *Fauna Brit. India, Moths*, **5** : 462.

Diagnosis : Head, thorax and abdomen purplish grey; vertex of head and a dorso-lateral stripe on thorax and abdomen green. Fore wing purplish grey; a green oblique central area from apex to inner margin. Hind wing fuscous with an anal patch and submarginal band ochreous.

Material examined : 1 ex., 22.viii.2007; 1 ex., 27.ix.2008, Pindra pera, Dalma wildlife sanctuary, East Singhbhum, Jharkhand, coll. S. Sambath & Party.

Wingspan : 64-70 mm.

Occurrence : August-September.

Distribution : Indian : Jharkhand (East Singhbhum), West Bengal (Bardhaman, Kolkata), East and West Himalaya, almost throughout the Peninsula.

Elsewhere : Bhutan, China (south), Myanmar to Moluccas and Sri Lanka.

Host Plants : *Vitis* spp. and plants of the family Aroideae, etc.

Genus ***Theretra*** Hubner

13. ***Theretra alecto alecto*** (Linnaeus)

1758. *Sphinx alecto* Linnaeus, *Syst. Nat.*, ed. **10** : 492.

1937. *Theretra alecto alecto*, Bell & Scott, *Fauna Brit. India, Moths*, **5** : 440.

Diagnosis : Head and thorax dark brown, abdomen pale brown; antennae and side of head and thorax whitish; abdomen with a black side batch on first

segment and three dorsal lines. Fore wing pale brown with a dark speck at end of cell. Hind wing pink, black at base, anal angle flesh colour. Under side flush colour.

Material examined : 3 exx., 22.viii.2007; 7 exx., 27.ix.2008, Pindra pera, Dalma wildlife sanctuary, East Singhbhum, Jharkhand, coll. S. Sambath & Party.

Wingspan : 85 mm.

Occurrence : August-September.

Distribution : India : Jharkhand (East Singhbhum), Madhya Pradesh (Indore, Jabalpur, Hoshangabad, Umari), South India, Western and Eastern Himalaya and West Bengal (Bankura, Kolkata).

Elsewhere : Afghanistan, Bhutan, Java, Malaysia, Myanmar, Northward to Formosa and eastward to the key Islands, Pakistan, Sulawesi and Taiwan.

Host Plants : *Dillenia pentagyna*, *vitis* and *Leea* spp.

14. *Theretra clotho clotho* (Drury)

1773. *Sphinx clotho* Drury, *Illustr. Ins.*, 2 : 48.

1937. *Theretra clotho clotho*, Bell & Scott, *Fauna Brit. India, Moths*, 5 : 434.

Diagnosis : Head and thorax greenish brown, with a white lateral stripe from palpus to end of thorax. Fore wing brown with an apical line joining a discal line with which it forms a single dark line from apex to inner margin. Abdomen brown with a black side patch at base. Hind wing black, shading to brown at apex. Under side ochreous.

Material examined : 3 exx., 5.viii.2008; 1 ex., 6.viii.2008; 2 exx., 7.viii.2008, Pindra pera, Dalma wildlife sanctuary, East Singhbhum, Jharkhand, coll. S. Sambath & Party.

Wingspan : 80-100 mm.

Occurrence : June-September.

Distribution : India: Jharkhand (East Singhbhum), Orissa (Dhenkanol), West Bengal (Darjiling, Kolkata, Medinipur), almost throughout the mainland except North-West Himalaya and Andaman Islands.

Elsewhere : Bhutan, China, Malaya, Myanmar, Philippines and Sri Lanka.

Host Plants : *Dillenia* spp., *vitis* spp., etc.

15. *Theretra nessus* (Drury)

1773. *Sphinx nessus* Drury, *Illustr. Exot. Ins.*, 2 : 46.

1937. *Theretra nessus*, Bell & Scott, *Fauna Brit. India, Moths*, 5 : 434.

Diagnosis : A very large; head and thorax olive green, thorax suffused with ferruginous; a deep orange dorso-lateral streak; abdomen with a broad, shining golden stripe. Costa of fore wing green up to SC¹, the green spreading over front half of the base of wing. Hind wing base black, shading to dusky brown at apex. Underside suffused with reddish ochreous.

Material examined : 4 exx., 27.ix.2008; 1 ex., 28.ix.2008; 4 exx., 30.ix.2008, 2 exx., 1.xi.2008, Maculakocha; 2 exx., 7.xii.2008, Pindra pera, ; Dalma wildlife sanctuary, East Singhbhum, Jharkhand, coll. S. Sambath & Party.

Wingspan : 90 – 132 mm.

Occurrence : September-December.

Distribution : India: Jharkhand (East Singhbhum), Madhya Pradesh (Jabalpur), South India, West and East Himalaya and West Bengal (Kolkata).

Elsewhere : Aden, Australia, Bangladesh, Bhutan, Hong Kong, Japan, Malay, Myanmar, Pakistan, Papuaia and Sri Lanka.

Host Plants : *Pongamia glabra*, *Passiflora* spp., etc.

16. *Theretra oldenlandiae oldenlandiae* (Fabricius)

1775. *Sphinx oldenlandiae* Fabricius, *Syst. Ent.*, : 542.

1937. *Theretra oldenlandiae oldenlandiae*, Bell & Scott, *Fauna Brit. India, Moths*, 5 : 448.

Diagnosis : Head and thorax brown; a pale lateral stripe from palpus to end of thorax. Fore wing greyish-brown. Hind wing dusky with a pale submarginal band not reaching apex. Abdomen with double white dorsal lines.

Material examined : 2 exx., 5.viii.2008; 1 ex., 6.viii.2008; 2 exx., 7.viii.2008, Pindra pera, ; Dalma wildlife sanctuary, East Singhbhum, Jharkhand, coll. S. Sambath & Party.

Wingspan : 54-70 mm.

Occurrence : June-August.

Distribution : India : Jharkhand (East Singhbhum), Madhya Pradesh (Indore, Hoshangabad, Umaria), South India, West and East Himalaya and West Bengal (Bankura, Kolkata).

Elsewhere : Bhutan, Japan, Myanmar, Pakistan, Papua and Sri Lanka.

Host Plants : The food-plants belong to the family Ampelidae, Aroidae, Convolvulaceae, Geraniaceae, Myrtaceae, Ongraceae, Rubiaceae and Tiliaceae.

Tribe SPHINGULINI

Genus *Dolbina* Stgr.

17. *Dolbina inexacta* Walker

1856. *Dolbina inexacta* Walker, *List Spec. Lepid. Insects Colln Br. Mus.*, **8** : 208.

1937. *Dolbina inexacta*, Bell & Scott, *Fauna Brit. India, Moths*, **5** : 95.

Diagnosis : Head and thorax dark brown grizzled with white; thorax with some white marks at sides and round vertex; abdomen golden-brown above brown at sides, a black streak on the dorsum of each segment. Fore wing variegated with grey, dark brown and golden-brown. Hind wing brown. Underside of abdomen with large black and white mesial patches.

Material examined : 2 exx., 24.ix.2008; 3 exx., 25.ix.2008; 2 exx., 26.ix.2008, Pindra pera ; Dalma wildlife

sanctuary, East Singhbhum, Jharkhand, coll. S. Sambath & Party.

Wingspan : 68-75 mm.

Occurrence : August-September.

Distribution : India : Jharkhand (East Singhbhum), East and West Himalayas, South India.

Elsewhere : China.

Host Plants : *Olea dioica*, *Linociera malabarica*, *Lingustrum robustum*.

SUMMARY

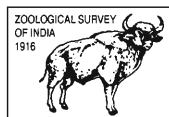
The paper incorporates the accounts of 17 species under 12 genera of the family sphingidae recorded for the first time from Dalma Wildlife Sanctuary, Jharkhand.

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Rec. zool. Surv. India : 111(Part-1) : 31-35, 2011

REDESCRIPTION OF *BARILUS HOWESI* BARMAN, 1986, A VALID CYPRINID SPECIES (PISCES : CYPRINIFORMES : CYPRINIDAE) FROM NORTH BENGAL, INDIA

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INTRODUCTION

The cyprinid fishes of the genus *Barilius* Hamilton are known to inhabit freshwater systems and occurring throughout Southeast Asia. It is known to comprise 29 species (Froese and Pauly, 2010) in Asia and Menon (1999) recognized only 15 species from India. During the studies on the Cyprinid fishes belonging to the genus *Barilius* from India, three specimens of *Barilius* were found lying unidentified in the National Zoological Collections in the Fish Division of Zoological Survey of India, Kolkata. On critical examination it was found that these specimens represent a distinct species and was described as a new species of bariline fishes *Barilius howesi* by Barman (1986). Subsequently, Talwar and Jhingran (1991), Husain *et al.* (1992), Menon (1999) and Jayaram (1999) considered *B. howesi* as conspecific with *B. bendelisis* (Hamilton, 1807). Although, the species was diagnosed as being allied to *Barilus bendelisis* (Hamilton), the later species can easily be separated by presence of black spots on all body scales at their bases and two spots on either side of lateral line in all lateral line scales.

Recently, the first author collected a number of specimens belonging to the genus *Barilius* from North Bengal (West Bengal). The specimens were identified as *B. bendelisis* and during the course of determination it was strongly felt that *B. bendelisis* and *B. howesi* are two distinct species represented in North Bengal. The present communication serves to resurrect *Barilus howesi* as valid species with its re-description to set aside errors committed in the original description and

discusses the differences between *B. howesi* and *B. bendelisis*.

Barilus howesi Barman, 1986

1986. *Barilius howesi* Barman, *J. Bombay nat. Hist. Soc.*, **83**(1) : 171-173 (type locality : Stream near Sulka para, Jalpaiguri district, North Bengal in West Bengal).

Material examined : Holotype : ZSI FF 2235, 70 mm SL, Locality : stream near Sulka para, Jalpaiguri district, North Bengal, Collector : Dr. H.K. Bhowmick, Date of Collection : 27.08.1975; Paratypes : 2 ex., 61-66 mm SL. Reg. No. ZSI FF 2236. Locality, Collector and date of collection same as in holotype.

Description : Body moderately elongate, compressed. Abdomen rounded with vent placed in posterior half of body. Snout pointed, devoid of tubercles; mouth terminal, oblique, large but not protractile. Maxilla extends to below middle of eye. Symphyseal process of lower jaw poorly developed. Barbels two pairs, distinctly smaller than eye diameter. Suborbital bones are wide, the third one not covering cheek. Head length 4.32 to 4.62, body depth 3.15 to 3.33, predorsal distance 1.72 to 1.74 and preanal distance 1.29 to 1.41 in standard length. Depth of head 1.12 to 1.16, eye diameter 3.98 to 4.18, snout length 2.99 to 3.31 in head length. Ratio of interorbital width and eye diameter is 1.36 to 1.59. Gill rakers are 8 or 9 on lower arm of first arch.

Dorsal fin rays ii, 7; anal fin rays ii-iii, 7-8; pectoral fin rays i, 13; pelvic fin rays i, 8; caudal fin rays 19. Height of dorsal fin is 5.79 to 6.01, height of anal fin 6.91 to 7.21, pectoral fin length 4.89 to 5.21 and pelvic

fin length 7.45 to 7.92 in standard length. Origin of dorsal fin is nearer to base of caudal fin than to tip of snout. Caudal fin deeply forked with lower lobe slightly longer than upper.

Lateral line complete with 42 or 43 scales. Lateral transverse scales 12; $8\frac{1}{2}$ scales between origin of dorsal fin and lateral line, $3\frac{1}{2}$ scales between origin of anal fin and lateral line. Predorsal scales 17 or 18 and circumpeduncular scales 12 to 14. Axillary scales, elongate with a fleshy border, present at base of pectoral and pelvic fins.

Colour : Dorsal surface brown, sides and ventral surface silvery white. Upper sides of body with 14 or 15 vertical dark bands, that does not reach lateral line. Fins are hyaline.

DISCUSSIONS

Menon (1999) recognized 15 species from India but considered *B. howesi* Barman as conspecific with *B. bendelisis* (Hamilton). Talwar and Jhingran (1991) have relegated *B. howesi* to the synonymy of *B. bendelisis* without assigning any reason. Husain *et al.* (1992) compared several characters given in original description with that of *B. bendelisis* as described by other authors to conclude that both the species are conspecific. Menon (1999) and Jayaram (1999) followed the same to retain *B. howesi* under the synonymy of *B. bendelisis*. But, Kar (2002) studied the *Barilius* species of India and could compare all species belonging to this genus to distinguish *B. howesi* from *B. bendelisis*.

In the original description (Barman, 1986), *B. howesi* was compared with *B. barna* (Hamilton) and *B. barila* (Hamilton), which were stated to be unrelated (Husain *et al.*, 1992). Among the *Barilius* species known from India, *B. dimorphicus* Tilak and Husain, *B. nelsoni* Barman, *B. radiolatus* Gunther, *B. shacra* (Hamilton) and *B. telio* (Hamilton) are having higher lateral line scale count (55 to 75 vs. 35 to 50 in others). Body is uniform in colour with no vertical bars or spots in *B. everzadi* Day and *B. modestus* Day. *B. bakeri* Day and *B. canarensis* (Jerdon) are characterized in having one or more rows of large spots on sides. In having bars on sides, the described species closely resemble but differs from *B. barila* (Hamilton), *B. barna* (Hamilton), *B. gatensis* (Valenciennes) and *B. vagra* (Hamilton),

which have higher anal fin elements (13 to 17 rays). *B. dogarsinghi* Hora is known to have lower lateral line scale count (less than 40). A comparative chart of meristic and morphometric characters based on the materials examined are given (table 1) hereunder to distinguish *B. howesi* from *B. bendelisis*, both similar in having lower anal fin rays (7 or 8 branched rays), 40 to 43 lateral line scales and bars on sides of body.

Further, in terms of posterior extension of maxilla these fishes can be placed under three distinct groups (Kar, 2002). In *B. everzadi*, *B. radiolatus* and *B. shacra*, maxilla reaches at most to anterior margin of eye. Posterior extension of maxilla reaches to below anterior one-third of eye in *B. barila*, *B. barna*, *B. bendelisis*, *B. canarensis* and *B. nelsoni*. In case of rest of the *Barilius* species including *B. howesi*, maxilla extends to below middle of eye. At this point, *B. howesi* is unrelated not only to *B. barila* and *B. barna*, but also to *B. bendelisis*. It is rather closely allied to *B. modestus* in having lower jaw with a poorly developed symphyseal process but differs in having vertical dark bands (no band or spot in *B. modestus*). In *Barilius* species, number of barbels seems to differ within the species itself and size of the barbels is not a constant character (e.g., *B. bendelisis*, in Day, 1878). Hence, presence or absence or rudimentary nature of barbels (as used in Talwar and Jhingran, 1991; Jayaram, 1999) can not be considered as a differentiating structure to distinguish various species of the genus.

Four species, viz., *Cyprinus bendelisis*, *C. cocsa*, *C. chedra* and *C. tila*, described in Hamilton (1822) as from northern rivers of Bengal are clubbed together under the name *Barilius bendelisis* (Hamilton) (Day, 1878; Menon, 1999). All these species are distinct in having a spot on each scale but last two are said to devoid of barbels and *C. cocsa* with four barbels. The *Cocsa* type specimens are also known to bear a spot on the middle of each scale and a row of small oblong spots on each side of lateral line (Hamilton, 1822; Day, 1878; Shaw and Shebbeare, 1937). The argument in Husain *et al.* (1992) for *B. howesi* being 'a female or immature male of *Cocsa* type specimens of *B. bendelisis* Hamilton' does not hold good as the characteristic black spots on each scale at bases are absent. *B. bendelisis* can easily be distinguished from all other congener in



Outline drawing of *Barilius howesi* Barman



Barilius howesi Barman (Holotype)



Barilius bendelisis (Hamilton) Lataguri, Jalpaiguri Dist. North Bengal



Barilius bendelisis (Hamilton) Rajabhatkhawa, Alipurduar Jn., North Bengal

Table-1. Comparison of meristic and morphometric characters of *B. bendelisis* and *B. howesi*.

Characters	<i>B. bendelisis</i>	<i>B. howesi</i>
Head length in SL	3.87-4.00	4.32-4.62
Body depth in SL	3.36-3.84	3.15-3.33
Pre-dorsal length in SL	1.60-1.66	1.72-1.74
Pre-anal length in SL	1.43-1.49	1.29-1.41
Dorsal fin height in SL	4.93-5.47	5.79-6.01
Pelvic fin length in SL	6.85-7.35	7.45-7.92
Head depth in HL	1.33-1.35	1.12-1.16
Eye diameter in HL	4.75-4.80	3.98-4.18
Snout length in HL	2.66-2.71	2.99-3.31
Lateral line scales	40-41	42-43
Pre-dorsal scales	19-21	17-18
Posterior extension of maxilla	To below anterior 1/3 of eye	To below middle of eye

(Source : Kar, 2002)

having all the body scales with black spots at their bases and two spots on either side of lateral line in all the lateral line scales. Presence of black dots in each scale of even younger specimens of *B. bendelisis* is also observed (Tilak, 1967; Jayaram and Singh, 1977; Talwar and Jhingran, 1991), which is not present in *B. howesi* specimens.

In view of the objections raised in Husain *et al.* (1992) meticulous examination of type materials (no other material collected since then) were made and compared with a number of examples of *B. bendelisis* including that of North Bengal. The specimens of *B. howesi* in fact bear dorsal fin rays 8 (not 9), anal fin rays 10 (not 12) and predorsal scales 17-18 (not 20-21). Considering the differences in characters (table-1), especially smaller head, deeper body, shorter pre-dorsal length, longer pre-anal distance, larger eye, shorter snout and absence of black spots on each scale, it is concluded that *B. howesi* is a distinct species and can not be considered conspecific with *B. bendelisis*.

COMPARATIVE MATERIALS

Barilus bendelisis : ZSI F 2437, 1 ex., 95 mm SL, Almorah, no date, purchased from F. Day; ZSI F 2438, 1 ex., 88 mm SL, Orissa, no date, purchased from F. Day; ZSI F 2448-49, 2 exs., 78-85 mm SL, Assam, no date, purchased from F. Day; ZSI F 1629-30/1, 2 exs.,

81-83 mm SL, Purulia, no date, Bengal Fisheries; ZSI F 1856/1, 5 exs., 95-105 mm SL, Maldhum, Uttar Pradesh, no date, Museum Collection; ZSI F 10844/1, 3 exs., 77-82 mm SL, Subarnarekha R., Ranchi, Jharkhand, Dec. 1927, I. Mukherjee; ZSI F 2443/2, 1 ex., 110 mm SL, Belairi R. at foothills, Kameng Frontier Division, 27.11.1961, K.C. Jayaram (Indo-Swiss Expt.); ZSI F 9712/1, 2 exs., 94-98 mm SL, Medha, Satara Dist., Yenna Valley, Bombay Presidency, no date, N. Annandale; ZSI F 9950/1, 4 exs., 65-77 mm SL, Senapati Stream, Kairong, Nagahills, no date, S.L. Hora; ZSI F 10292/1, 2 exs., 48-55 mm SL, Siju Cave, Garo hills, Assam, no date, S.W. Kemp & B.N. Chopra; ZSI F 7078/1, 2 exs., 85-88 mm SL, Rowta river, Assam-Bhutan Frontier, 13.12.1910, S.W. Kemp; ZSI F 1243/1, 4 exs., 44-49 mm SL, Tunga River at Shimago, 20.05.1937, B.S. Bhimachar; ZSI F 11191/1, 10 exs., 92-108 mm SL, Tributaries of Sutlej River, no date, Acad. Nat. Sci. Phil. (exch.); ZSI F 11192/1, 2 exs., 55-58 mm SL, Branch of Sutlej River, no date, Acad. Nat. Sci. Phil. (exch.); ZSI F 11193/1, 5 exs., 88-91 mm SL, northern India, no date, Acad. Nat. Sci. Phil. (exch.); ZSI F 11194/1, 2 exs., 77-79 mm SL, Sutlej river, no date, Acad. Nat. Sci. Phil. (exch.); ZSI F 11195/1, 1 ex., 105 mm SL, Gugger river, no date, Acad. Nat. Sci. Phil. (exch.); ZSI F 11421/1, 28 exs., 83-90 mm SL, R. of Terai and Duars, no date, G.E. Shaw & E.O. Shebbeare; ZSI F 11953/1, 25 exs., 88-92 mm SL, Lachhiwala, Dehra

Dun, no date, S.L. Hora; ZSI F 12117/1, 1 ex., 78 mm SL, Moola Mutha R., Poona, no date, Dept. of Fisheries, Bombay; ZSI F 12159/1, 1 ex., 86 mm SL, Nandhaser river, Nainital, U.P., no date, Bhola & Shebbeare; ZSI F 12217/1, 6 exs., 38-46 mm SL, Tribeni, Nepal, 05.12.1935, F.M. Baily; ZSI F 12499/1, 2 exs., 113-117 mm SL, Waldivi river, Pimpalgaon, 17.08.1935, A.G.L. Fraser; ZSI F 12502/1, 25 exs., 97-120 mm SL, Waldivi river, villages of Deolali and Edgaon, 14.11.1935, A.G.L. Fraser; ZSI F 2592/1, 7 exs., 50-91 mm SL, Rajputna, 06.03.1961, M.L. Bhatia; Unregistered, 1 ex., 86 mm SL, Chinnar river, 13 km east of Mariyoor, Iduki Dist., Kerala, 09.10.1990, A.G.K. Menon & party; ZSI FF 4269, 1 ex., 120 mm SL, Torsa

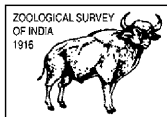
River, Coochbehar, North Bengal, 22.08.2008, R.P. Barman and party; ZSI FF 4270, 6 exs., 37-80 mm. SL, Lataguri, Jalpaiguri district, North Bengal, 27.01.2010, R.P. Barman and party; ZSI FF 4271, 3 exs., 45-63 mm SL, Rajabhatkhawa, Alipurduar Jn., North Bengal, 24.01.2010, R.P. Barman and party.

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THE JACKALS OF TOLLYGUNGE CLUB, KOLKATA

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INTRODUCTION

Since ancient times, our philosophy has held that the harmony of development rests on its relationship with conservation of the environment. Humankind cannot progress without a healthy and diverse natural environment. Connections between nature and society and between biological diversity and humans are critical for achieving the goals of conservation. Recently, we have an opportunity to study such circumstances in a century old club in southern part of Kolkata surrounded by dense human population where a healthy and breeding population of jackals is thriving since last many years. We would like to share our experience with the readers and also caution not to term always such assemblages as man animal conflicts.

The wild Golden jackals (*Canis aureus*) in the premises of Tollygunge Club Ltd., Kolkata have been studied during Nov.-Dec. 2008. Though it was difficult to draw any dividing line between the groups, the total population of 40-45 individuals of jackals may be grouped into approximately seven-to-eight family groups. Most of them are confined to southern part of the club, except two groups roaming in the northern part. Altogether seven abandoned dens were sighted mostly located in the bushes in the eastern periphery of the club while one active den with two cubs in the centre of southern half of the club.

Primarily, what we find is that the jackal population of Tollygunge Club has adapted to their surroundings and display quite different behavior from their cousins found in the wild. The most important adaptation is their diurnal habits and uncared attitude towards human beings. Their feeding, breeding social and inter specific

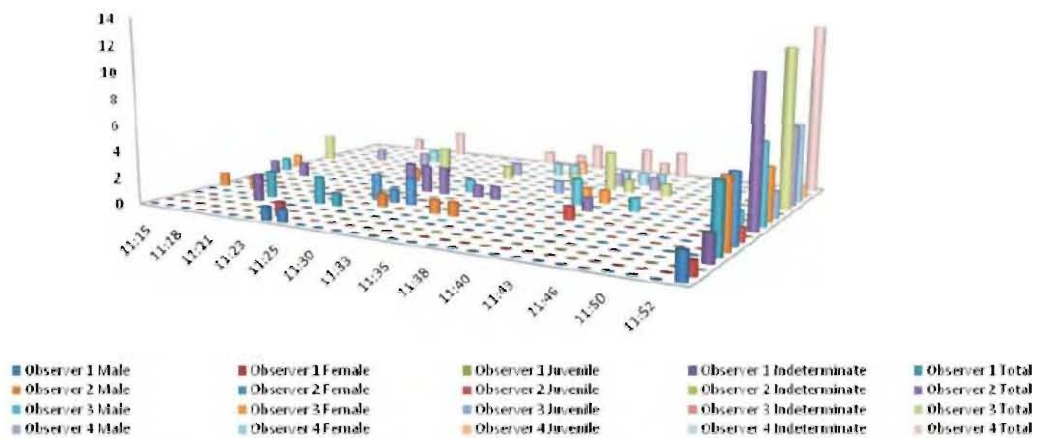
behavior was also studied in the club environment and was discussed in terms of availability of food as well as carrying-capacity of the club in terms of jackal population.

STUDY AREA

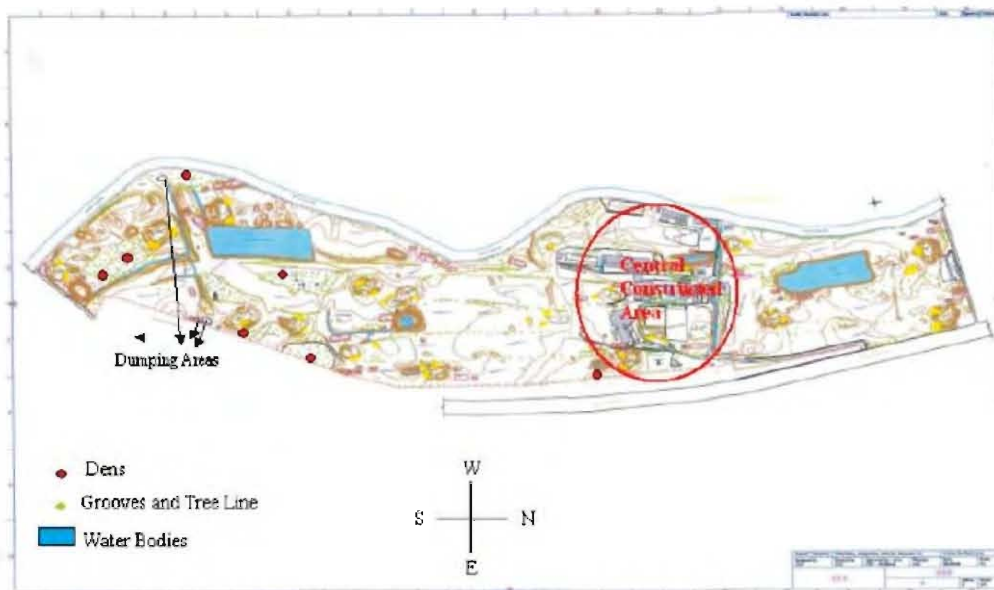
The Tollygunge club (about 100 acres) lies along eastern bank of Tolly's *Nullah* which was the earlier path of a river known as Adi Ganga. Hence, the soil of the club consists of the silt brought down by the erstwhile river. This nutrient rich soil and generous rainfall supported luxuriant vegetation. During colonization many exotic and indigenous plants have been systematically planted in the area which is now the abode of 118 species of plants, 93 species of birds, 12 species of mammals, 7 species of reptiles and 5 species of amphibians (Mookherjee, 1995) along with many fishes, mollusks and butterflies.

The vegetation of the area has been thoroughly altered as per requirement of fairways and removal of vegetation along the boundary wall where the animals take shelter. There are a number of small water bodies with thriving aquatic life especially mollusks and fishes. Apart from these visibly greener areas there are number of depression areas which have been converted into dumping grounds of lopped branches and leaves. These dumping points and few grooves (Map-1) are the shelter places for animal species found in the club.

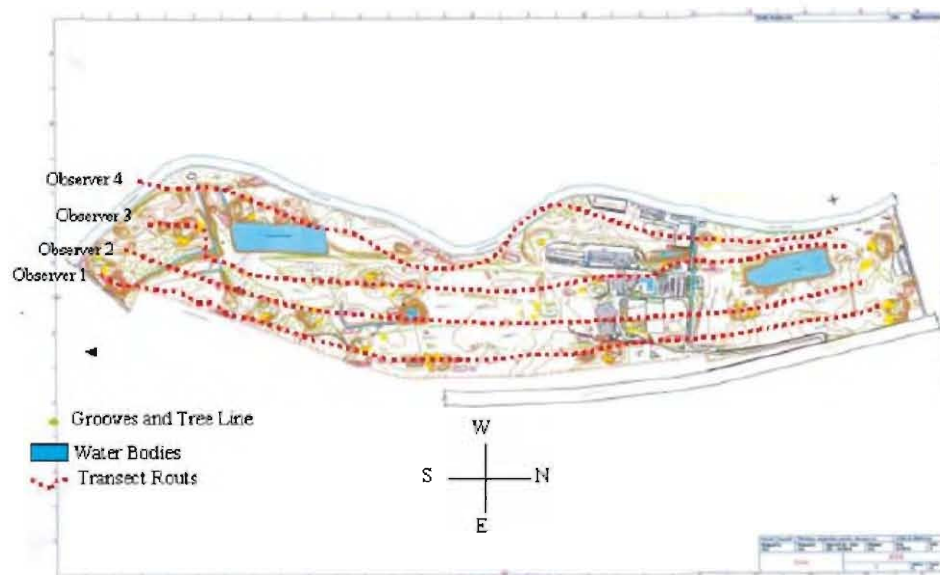
The club activities are mostly confined to the centrally constructed area (Map-1) which is about 15% of the total area of the club. Only golfers, horse riders and a few walkers visit the peripheral areas of the club inhabited by jackals.



Figs. 1. Frequency and age-sex clustering of Jackals along four Transect Routes in Tollygunge Club.



Map 1. Tollygunge Club Showing Location of Dens



Map 2. Tollygunge Club Showing Approximate Transect Routes



A Golden Jackal (*Canis aureus*) in the Tollygunge Club Premises.



There are number of such water bodies in the Club. The wet slopes of such areas are often visited by the Jackals for their food like mollusks, frogs, insects etc.



The Jackal and the Club members accept each other in their social space.



Number of locations has such Bamboo thicket, provide shelter to jackals and idle habitat for rodents a preferred food for jackals.

Apart from many wild animals there is a good population of dogs, inside the club in the central constructed area, who are enjoying the protection from club authorities, and acting as guard against the surrounding jackal population mostly confined to northern and southern part of the club.

THE GOLDEN JACKAL (*Canis aureus*)

a) Distribution

The Golden Jackal also called Asiatic, Oriental or Common Jackal are native to north and east Africa, southeastern Europe and south Asia up to Myanmar. It is the largest of the jackals with three Indian subspecies recognized. In India, they are found almost throughout the country (Alfred *et al.* 2006).

b) Morphology

The Golden Jackal's short, coarse fur is usually yellow to pale golden and brown-tipped, though the color may vary with season and region. The underside, throat and areas around eyes and lips have whitish hair. The Golden Jackal is generally 71-107 cm. in length, with a tail length of about 25 cm. Its standing height is approximately 40-50 cm. at the shoulder. Average weight is 7-15 kg, with males tending to be about 15% heavier than the females. Scent glands are present on the face, the anus and genital regions. Females have 4-8 pairs of mammae. The dental formula is $I \frac{3}{3} C \frac{1}{1} Pm \frac{4}{4} M \frac{2}{3} = 42$. Golden jackals live from eight to nine years in the wild and up to sixteen in captivity.

c) Habitat

In India, the preferred habitat of the jackal consists of periphery of protected areas, a mosaic of small cultivations and dense scrub as well as lowland wetlands, with adequately dense vegetation cover. The Jackals seem to do well in moderately modified agro-systems with non-invasive human activities. Barriers for jackal expansion and population recovery seems to be, large intensively cultivated areas without cover, urbanization and established wolf populations. Agro-pastoral changes during recent past resulted in habitat loss and hunting have largely contributed to decline in jackal population.

d) Behavior

i) Feeding Behavior and Hunting

The Golden Jackal is an opportunistic feeder and not a persistent hunter, with a diet which consists of 54% animal food and 46% plant food (Animal Diversity Web). It is a very capable hunter of small to medium-sized prey such as rabbits, monkeys, rodents, birds, fish and insects. The Golden Jackal uses its highly acute hearing to identify small prey hiding in vegetation. In the Serengeti, the Golden Jackal is a major predator of gazelle fawns, while in India, the Golden Jackal often kills Blackbuck calves. Although it is common for jackals to hunt alone, they occasionally do so in small groups, usually consisting of 2-5 individuals. Working in a pack greatly increases the chances of making a successful kill. During the harvest season in India, the jackal feeds predominantly on fruits. They like easy human-produced food, hence in areas near human habitation they subsist almost entirely on garbage and human wastes.

ii) Breeding Behavior

Golden jackals live in mated pairs and are strictly monogamous. In most jackal families, there are one or two adult members called "helpers." Helpers stay with the parents for a year after reaching sexual maturity, without breeding, to help in taking care of the next litter. Within the family, helpers are subordinate to parents. The female golden jackal initiates all den changes. Though the males are predominantly monogamous, females reserve their aggression for female intruders, preventing the sharing of the male and his paternal investment.

They behave in a manner similar to domesticated dogs and wolves. Male raises one of its hind legs when spraying their urine, and females squat at the site they wish to spray. Males and females alike mark their territory by spraying, primarily during the mating season.

Young are born in a den within the parents' marked territory after a 63 day gestation period. Litters usually contain 2-4 pups which are weaned after 50 to 90 days. Cubs at birth weigh 200-250 grams, and open their eyes after about ten days. The young are fed on milk, and then by regurgitation when they begin to take solid

food at about three months. Though they are sexually mature in about eleven months yet most likely postpone reproduction and stay with the parental pair as helpers for at least a year (Moehlman, 1981 and 1983).

iii) *Social Behavior*

Each jackal species communicates through its own repertoire of calls. Golden jackals use a wide inventory of howls to locate one another. By howling together, a pair shows that there is a bond between them, and thus the choral howling can be considered a kind of betrothal.

e) *Legal Status*

The Golden jackal is a protected species under Schedule II Part II of Wildlife (Protection) Act 1972, Appendix III of CITES and LRlc (Nationally) of CAMP.

METHODS

Since the study areas was relatively an open terrain the transect method was used to come up to conclusions about the estimated population of jackals in the premises of the club. The club was traversed along its length from south to north during day light hours by four persons at a time, keeping visual contact with each other, following four transect routes as marked on the Map 2 so as to cover entire length and breadth of the club. Each observer was advised to count and record the jackals he encountered only on his right side except the person who was travelling along western most transect to see his both sides, so that there is no repetition of count and no area left un-surveyed. The services of staff of the club were also utilized to trouble the jackal, if any, hiding in the bushes along the transects so that they do not escape counting. Each encounter with jackals was recorded on pre-designed data sheet along with age-sex, as far as possible, and also time of sighting.

Apart from the above exercise the area was searched for active and abandoned dens of jackals in the hill of depression areas, dumping grounds, bushes and grooves. Their locations were recorded using GPS.

Since jackals was a familiar with the activities of the club and their members it was easy to observe them during daylight hours when their food and feeding habits and inter-specific behavior were recorded. However, attempts were also made to observe them

during night when the animals were located with the use of powerful spotlight, operating on 12 Volt car batteries, to supplement information on their food habits and foraging grounds.

A Nikon camera DS 60, Garmin 12 channel GPS, 10x50 field binoculars and a map of the club provided by the club authorities were used during field survey.

RESULTS

i) *Feeding Habits*

It was observed that during most of the day time they spent resting while a few of them were observed feeding. Most of the feeding activities were confined to night when they were observed foraging on wet beds of the lowland areas like drainage channels and depression areas digging for mollusks, soil arthropods, annelids, frogs and some times dead fishes. Moreover, feeding on eggs of ground breeding birds can not be ruled out.

In the dryer parts of the club, number of rodent holes were observed mostly in association with dumping areas. The rodents are reported to constitute one of their important foods. They were also observed visiting refuge dumping areas mostly in neighborhood of human dwellings inside the club premises. Apart from animals they were also observed / reported feeding on vegetative matters which mostly constituted dropped fruit of *Ficus* sp. and Jungle jalebi (*Inga dulcis*)

ii) *Population Dynamics*

Considering that the effectiveness of the sampled area during sighting and counting depended on the landscape relief and the vegetation cover, to estimate the population of jackals, as explained above, the club was traversed along its length from south to north by four persons during day light hours. The results of the animal sighted and count are presented in a table along with time of sighting and their sex-age categories where ever possible. During the process a total of 43 jackals were counted consisting of 19 males, 16 females, 4 juvenile, 2 indeterminate and 2 pups. The cumulative instances of sightings were 27 while 16 jackals were counted as single (Table 1 & 2 and Fig 1.).

Apart from above exercise the area was also searched for active as well as abandoned dens of jackals. Altogether seven abandoned dens were sighted

Table 1. Jackal count along four Transect Routes in Tollygunge Club.

Observer 1						Observer 2					Observer 3					Observer 4				
Time	Male	Female	Juvenile	Indeter minate	Total	Male	Female	Juvenile	Indeter minate	Total	Male	Female	Juvenile	Indeter minate	Total	Male	Female	Juvenile	Indeter minate	Total
11:15	0	0	0	0	0	1	0	0	0	1	1	1	0	0	2	0	0	0	0	0
11:18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:19	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
11:20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
11:21	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2
11:24	1	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:25	1	0	0	0	1	0	0	0	0	0	0	1	1	0	2	0	0	0	0	0
11:28	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0
11:30	0	0	0	0	0	1	1	0	0	2	0	0	0	0	0	0	0	0	0	0
11:32	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0
11:33	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	1
11:34	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
11:35	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	1
11:36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	2
11:38	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0
11:39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:40	0	0	0	0	0	0	0	0	0	0	2	1	0	0	3	1	1	0	0	2
11:42	0	0	0	0	0	0	0	1	0	1	0	1	0	0	1	0	1	0	0	1
11:43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2
11:44	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0
11:46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
11:51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:52	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0
Total	2	1	0	2	5	5	5	1	0	11	6	4	2	0	12	6	6	1	0	13

Table 2. Statistical details of Jackals counted in Tollygunge Club.

Observer	Male	Female	Juvenile	Indeterminate	Total	Instance	Single
1	2	1	0	2	5	3	1
2	5	5	1		11	8	5
3	6	4	2	2 pups	14	8	5
4	6	6	1		13	8	5
	19	16	4	2 + 2	43	27	16

mostly located in the bushes in the eastern periphery of the club while one active den with two cubs was observed in the centre of southern half of the club. Their locations are marked in the Map 1.

iii) *Carrying Capacity*

In a natural environment the hunting families hold territories of two to three square kilometers throughout the year, portions of which are marked with urine, either by the male or the female jackal, to ward off intruders. However, the study area (Tollygunge club) with only 100 hact. (1 sq km.) in area holding a handsome, healthy and breeding population of jackals is an indication that the carrying capacity of the club in terms of its food supply is still in favor of jackals. During the period no fighting was observed, demonstrating defending of territory.

iv) *Interspecific Behavior*

It was observed that the basic social unit of the golden jackal is a mated pair or a mated pair and its young. The jackals were observed to forage and rest together. While in natural conditions pairs/pack are more likely to be successful in hunting in comparison to individuals they have been observed foraging on small animals in a group despite the fact that in current case hunting larger prey is out of question.

Most jackal families were observed to have helpers which are subordinate to parents. In the wild habitat these helpers are probably responsible for reports of large packs hunting together but in present case, in absence of such purpose, these associations are, it seems part of their habits.

DISCUSSION

The jackal population of Tollygunge Club has been studied earlier by Dr. A. K. Ghosh and others (unpublished report) and a few students from

Vivekananda College, Kolkata. However, the current assignment was given to us to principally study population, food habits, inter-specific behavior and health of the occupants.

Primarily, what we find is that the jackal population of Tollygunge Club has adapted to their surroundings and display quite a different behavior from their cousins found in the wild. The most important adaptation is their diurnal habits and uncared attitude towards human beings. The most suitable explanation to it, seems, that both man and animal has accepted each other as they are there since last so many years. Historically also, there are no records of jackals posing any threat to humans except perhaps in the rare occasion when it is affected by rabies.

The transect method of census, applied for area is most appropriate method with relatively open terrain of the club, yielded reliable results. The present population of jackal in the club may be in the range of 40-45 individuals. This is not the total count and only an estimate. However, it requires more time and equipments, like capture and marking devices, to know the exact number of jackals in the club premises. The party conducted survey earlier (Ghosh, *et al* 2008) has sighted only 14 jackals. The recording of as high as 30% of the population (16 animals) as singles' is the indication that the jackal groups in the Club area are not as cohesive as in the wild. The possible explanation to this may be that they consider more secured within the premises and consistent groups are formed during breeding and rearing period.

The basic social unit of the golden jackal is a mated pair or a mated pair and their young (helpers). They forage and rest together. Though it was difficult to draw any dividing line between the groups the total

population of jackals may be grouped in to approximately seven-to-eight loose family groups. Most of them are confined to southern part of the club, except two groups roaming in the northern part. In a natural environment the hunting families hold territories of two to three square kilometers throughout the year, portions of which are marked with urine, either by the male or the female jackal, to ward off intruders. However, the study area (Tollygunge club), which is an artificial environment, with an area of only 100 hact. (1 sq km.) and holding a handsome, healthy and breeding population of jackals is an indication that carrying capacity of club is still in favor of jackals especially when no fighting were observed for defending the territory. But such incidents have been reported by local staff during breeding period.

In the wild both male and female members of a golden jackal pair have important roles in maintaining their territory and in raising the young. When one parent dies, it is unlikely that the rest of the family will survive (Moehlman, 1983). Members of the same family also cooperate in sharing larger food items and transport food in their stomachs for later regurgitation to pups or to a lactating mother.

As far as their reproductive success is concerned there are records of six pups in 2007 and three pups in early 2008 as reported by Dr. Ghosh (unpublished report) and two pups in Dec., 2008 during our study. These reporting indicate that the jackals are continuously and successfully breeding in the Club. It is known that once the population of the canids' reaches to its saturation *i.e.* carrying capacity, they control their own number (unpublished report by Dr. Ghosh), therefore, we can conclude that the jackal population of the Club is yet to reach its point of saturation.

The jackals are known to consume approximately 54% animal food and 46% plant food with a very varied diet (Animal Diversity Web). This is one of the important habits that are contributing to their successful survival in spite of various actions taken by the Club Authorities to see that Club refuge is not accessible to jackals. The findings of another study conducted in agro-ecosystem of Bangladesh also

indicate that rodents were the principal food type (56%) as measured by incidence of occurrence, birds were the second most common food type (30%) and plant material, mostly sugarcane stem or panicles of rice or wheat, was found in 17% of the scat samples, while invertebrates, mostly insects, occurred in 9% of scats analyzed (Michael M. Jaeger, *et al.*, 2007). The most common rodent remains were those of *R. rattus*, *B. bengalensis*, and *Mus. spp.* The latter two species have been reported to occur in the club (Mookherjee, 1995).

The rodents, birds and their eggs, reptiles, frogs, fish, mollusks, soil arthropods and fruits are available in plenty in the club to sustain themselves. If average good health and breeding population is any indication then food and food habits are not at all the limiting factors as far as jackals of the Club are concerned.

There is a good population of dogs in the central part of the club enjoying the protection from club authorities. It seems that purpose of keeping them is probably to protect central-activity-area out of bound for jackals. This practice is working well and a number of times dogs were observed chasing the jackals especially in the parking and tennis court areas. These dogs in spite of getting protection from authorities are not keeping good health and can be a potential source for spreading diseases, among jackals, especially rabies.

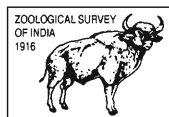
During the study a number of visiting club members were interviewed especially in term of whether they prefer jackals to stay in the area or otherwise. The response was mixed. Some of the members favor, but a few of them had shown their displeasure over their presence.

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CRABS AND PRAWNS (CRUSTACEA : DECAPODA) OF BAHUDA ESTUARY, GANJAM, ORISSA

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INTRODUCTION

River Bahuda is one of the major rivers in Orissa. It originates from Andanda which is between Ramgiri and Mahendragiri hills of Gajapati District of the state. After running for a short distance in Gajapati District it enters Ganjam District at Berhampur; then it runs within Ganjam District and takes a strong diversion at Nuapadapentha. Near Patrapur it crosses the border of Orissa and enters Andhra Pradesh. It crosses Icchhapuram, takes a strong diversion, then again enters the state of Orissa and opens to Bay of Bengal at Village Sunapur, of Ganjam. Bahuda basin is characterized by silt and clay dominated sediments in the upper and mid reaches as against sand dominated sediment in the lower reaches.

Information on malacostracan fauna of Indian estuaries is very scanty (Balasubramanyan (1962) on Vellar Estuary; Subrahmanyam (1969) on Godavari Estuary; Selvakumar and Ajmal Khan (1993) on Parangipettai coast). Only recently, this aspect is being studied by Bairagi (1995), Bhadra (1995), Ghosh (1995) and Reddy (1995) on Hugli Matla, Deb (1998) on Mahanadi Estuary, Dev Roy and Bhadra, (2001) on Godavari Estuary, Dev Roy and Nandi (2007, 2009) on East Coast, Rath and Dev Roy (2008), on Krishna Estuary and Rath and Dev Roy (2010a, b). Even then, information is lacking especially for many estuaries. As nothing is known on crustacean resources of Bahuda estuary, the present study has been taken up for a period of three years from 2004-2006 to inventorize the prawn and crab diversity. In the present communication, materials deposited by earlier survey parties from this estuary have been identified and included. A total of

212 examples of prawns (both penaeid and non-penaeid) and 850 examples of crabs were examined and studied. These belong to 11 species under 4 genera and 2 families of prawns and 22 species under 16 genera and 4 families of crabs respectively. Key to genera and species has been provided for quick recognition.

MATERIAL AND METHODS

All materials for the present study were collected around Sunapur and Sorala mainly covering Ganjam district. As the mangrove ecosystem is very poorly developed in these areas only a few variety of mangrove inhabiting crabs were collected from this region. In the present paper, measurements of crabs were taken following the standard methods. In case of prawns, total length was measured from tip of the rostrum to the tip of the telson.

The abbreviations L and W are used here to indicate carapace length and carapace width respectively. Other abbreviations used in this text are as under :

AM-A. Mohapatra , CANR-Dr. C.A.N. Rao, CR-Crustacea, PMS-Dr. P.M. Sureshan, SR-S. Rath, SZS-Dr. S.Z. Siddiqi.

All collections pertaining to the present investigation has been deposited with the National Zoological Collections of Zoological Survey of India, Gopalpur, Orissa.

SYSTEMATIC LIST OF PRAWNS AND CRABS FROM BAHUDA ESTUARY, GANJAM DISTRICT, ORISSA

Subphylum	CRUSTACEA
Class	MALACOSTRACA
Subclass	EUMALACOSTRACA

- Superorder EUCARIDA
 Order DECAPODA
 Suborder DENDROBRANCHIATA
 Family PENAEIDAE
1. *Penaeus (Penaeus) monodon* Fabricius, 1798
 2. *Penaeus (Penaeus) semisulactus* De Haan, 1844
 3. *Penaeus (Fenneropenaeus) indicus* (H. Milne Edwards, 1837)
 4. *Penaeus (Marsupenaeus) japonicus* Bate, 1888
 5. *Penaeus (Melicertus) canaliculatus* (Olivier, 1811)
 6. *Metapenaeus monoceros* (Fabricius, 1798)
 7. *Metapenacus dobsoni* (Miers, 1878)
 8. *Parapenaeopsis aclivirostris* Alcock, 1905
 Suborder PLEOCYEMATA
 Infraorder CARIDEA
 Family PALAEMONIDAE
 9. *Macrobrachium malcolmsonii* (H. Milne Edwards, 1844)
 10. *Macrobrachium equidens* (Dana, 1852)
 11. *Macrobrachium rude* (Heller, 1862)
 Infraorder BRACHYURA
 Section EUBRACHYURA
 Family MATUTIDAE
 12. *Ashtoret lunaris* (Forskål, 1775)
 13. *Ashtoret miersi* (Henderson, 1887)
 14. *Matuta planipes* Fabricius, 1798
 Section BRACHYRHYNCHA
 Superfamily PORTUNOIDEA
 Family PORTUNIDAE
 Subfamily PORTUNINAE
 15. *Scylla serrata* (Forskål, 1775)
 16. *Portunus pelagicus* (Linnaeus, 1758)
 17. *Portunus sanguinolentus* (Herbst, 1790)
 Subfamily THALAMITINAE
 18. *Charybdis (Charybdis) helleri* (A. Milne Edwards, 1867)
 19. *Charybdis (Charybdis) affinis* Dana, 1852
 20. *Thalamita crenata* (Latreille, 1829)
 Family GRAPSIDAE
 21. *Metopograpsus messor* (Forskål, 1775)

- Family SESARMIDAE
22. *Parasesarma plicatum* (Latreille, 1803)
 23. *Perisesarma bidens* (De Haan, 1835)
 24. *Episesarma nederi* (H. Milne Edwards, 1853)
 25. *Muradium tetragonum* (Fabricius, 1798)
 26. *Metasesarma obesum* (Dana, 1851)
 Family VARUNIDAE
 27. *Metaplex distincta* (H. Milne Edwards, 1852)
 28. *Varuna litterata* (Fabricius, 1798)
 Superfamily OCYPODOIDEA
 Family OCYPODIDAE
 Subfamily OCYPODINAE
 29. *Ocypode macrocera* A. Milne Edwards, 1837
 30. *Ocypode ceratophthalma* (Pallas, 1772)
 Subfamily UCINAE
 31. *Uca lactea* (De Haan, 1835)
 32. *Uca triangularis* A. Milne Edwards, 1873
 Family MACROPHTHALMIDAE
 33. *Macrophthalmus (Mareotis) tomentosus* Souleyet, 1841

SYSTEMATIC ACCOUNT

Family PENAEIDAE

Key to the genera of family PENAEIDAE from Bahuda estuary

1. Dentition present on both side of rostrum
 *Penaeus*
 Dentition present only on dorsal side of rostrum
 2
2. Pleurobranchiae on 3rd to 7th thoracic somites, exopodites on the last pair of thoracic legs only
 *Metapenaeus*
 Pleurobranchiae on 3rd to 6th thoracic somites, thoracic legs with exopodites *Parapenaeopsis*
 Genus *Penaeus* Fabricius, 1798

Key to subgenera of the genus *Penaeus* from Bahuda estuary

1. Gastrofrontal carina present 2
 Gastrofrontal carina absent 3

2. Thelycum bearing a sub-triangular plate on 7th thoracic sternite and 2 lateral sub-circular plates on 8th thoracic sternites *Melicertus*
Thelycum with a triangular plate on 7th thoracic and a pouch like square plate on 8th thoracic sternites *Marsupenaeus*
3. Hepatic carina prominent *Penaeus*
Hepatic carina ill defined or absent
..... *Fenneropenaeus*

Sub-genus ***Penaeus*** Fabricius, 1798

**Key to the species of subgenus *Penaeus* from
Bahuda estuary**

- Fifth pereopod without exopod, petasma with distomedian projections slightly overhanging distal margin of costae; anterior process of thelycum concave rounded distally, posterior process sub triangular *P. (P.) monodon*
- Fifth pereopod with small exopod, petasma with distomedian projections reaching costae; anterior process of thelycum with raised edges delimiting a depressed area, posterior process convex
..... *P. (P.) semisulcatus*

1. *Penaeus (Penaeus) monodon* Fabricius, 1798

(Pl. 1, fig. 1)

1798. *Penaeus monodon* Fabricius, *Ent. Syst. Suppl.* : 408.
1969. *Penaeus monodon* : George, *Bull. Cent. Mar. Fish Res. Inst.*, **14** : 22.
1991. *Penaeus (Penaeus) monodon* : Paulpandian and Ramasamy, *Guide to the Prawns of Portonovo*. : 36, pl. 29, fig. 4.

Material examined : 10 ex., Sorala, 14.12.2006, Coll. : SR, Reg. No. CR-5685; 7 ex., Sorala, 15.12.2006, Coll. : SR, Reg. No. CR-5689; 4 ex., Antareipur, 22.01.2007, Coll. : SR, Reg. No. CR-5701.

Measurements : L-55.0-107.0.

Distribution : India : East and West coasts, Andaman and Nicobar Island and Lakshadweep.

Elsewhere : East Africa, Gulf of Aden, Red Sea, West coast of Madagascar, Mauritius, Pakistan, Sri Lanka, Philippines, China, Japan, New Guinea and Australia.

Remarks : This species is not abundant in commercial catches. This species was earlier reported

from Gautami-Godavari (Subramanyam, 1969) and Matla estuaries (Reddy, 1995).

2. *Penaeus (Penaeus) semisulcatus* De Haan, 1844
(Pl. 1, fig. 2)

1844. *Penaeus semisulcatus* De Haan, In : Von Siebold, *Fauna Japon. (Crust.)* (6/7) : 46 fig. 1.
1969. *Penaeus semisulcatus* : George, *Bull. Cent. Mar. Fish. Res. Inst.* **14** : 23.
1991. *Penaeus (Penaeus) semisulcatus* : Paulpandian and Ramasamy, *Guide to the Prawns of Portonovo*. : 36 pl. 29, fig. 4.

Material examined : 2 ex., Sorala, 14.12.2006, Coll. : SR, Reg. No. CR-5686; 3 ex., Sorala, 22.01.2004, Coll. : SR, Reg. No. CR-5696; 1 ex., Sunapur, 13.12.2006, Coll. : SR, Reg. No. CR-5726.

Measurements : L-60.0-107.0.

Distribution : India : East and West coasts. Elsewhere: East Africa, Red Sea, Western Madagascar, Mauritius, Sri Lanka, Philippines, Japan, Korea, New Guinea, Northern Australia and Eastern Mediterranean.

Remarks : Closely resembles *P. (P.) monodon*. In size and weight, the female appear to attain larger size than male.

Subgenus ***Fenneropenaeus*** Pérez Faafante, 1969

3. *Penaeus (Fenneropenaeus) indicus* (H. Milne

Edwards, 1837)

(Pl. 1, fig. 3)

1837. *Penaeus indicus* H. Milne Edwards, *Hist. Nat. Crust., Paris*, **2** : 415.
1906. *Penaeus indicus* : Alcock, *Cat. Indian Decapod Crust.*, **3**(1) : 12.
1991. *Penaeus (Fenneropenaeus) indicus* : Paulpandian and Ramasamy, *Guide to the Prawns of Portonovo* : 35, pt. 28, fig. 2.

Material examined : 39 ex., Sorala, 14.12.2006, Coll. : SR, Reg. No. CR-5687; 6 ex., Sorala, 15.12.2006, Coll. : SR, Reg. No. CR-5690; 1 ex., Antareipur, 22.01.2006, Coll. : SR, Reg. No. CR-5703; 3 ex., Sunapur, 08.01.2006, Coll. : SR, Reg. No. CR-5727.

Measurements : L-50.0-112.0.

Distribution : India : East and West coasts, Andaman and Nicobar Island, Lakshadweep.

Elsewhere : Sri Lanka, China, East African coast, Madagascar, Red Sea, Philippines and Northern Australia.

Remarks : Found abundantly in Bahuda Estuary. This prawn is also reported from Gautami-Godavari (Subramanyam, 1969) and Matla estuaries (Reddy, 1995).

Subgenus **Marsupenaeus** Tirmizi, 1971

4. *Penaeus (Marsupenaeus) japonicus* Bate, 1888

1888. *Penaeus canaliculatus* var. *japonicus* Bate, Rep. Sci. Res., "Challenger" **24** : 245.

1969. *Penaeus Japonicus* : George, Bull. cent. mar. Fish. Res. Inst., **14** : 21.

1991. *Penaeus (Marsupenaeus) japonicus* : Paulpandian and Ramasamy, *Guide to the Prawns of Portonovo* : 36, pl. 29, fig 1.

Material examined : 4 ex., Sorala, 22.01.2004, Coll. : SR, Reg. No. CR-5697; 8 ex., Antareipur, 22.01.2004, Coll. : SR, Reg. No. CR-5702.

Measurements : L-77.0-102.0.

Distribution : India : East and West coast.

Elsewhere : South East Africa, Red Sea, Gulf of Madagascar, Mauritius, Korea, Japan, New Guinea and Australia.

Remarks : Occasionally found in Bahuda Estuary. This species is recorded from Matla estuary (Reddy, 1995).

Subgenus **Melicertus** Rafinesque, 1814

5. *Penaeus (Melicertus) canaliculatus* (Olivier, 1811)

1811. *Palaemon canaliculatus*, Olivier, *Encycl. Method. Hist. Nat. (Ins)*, **8** : 660.

1969. *Penaeus canaliculatus*: George, Bull. Cent. Mar. Fish. Res. Inst., **14** : 21.

1991. *Penaeus (Melicertus) canaliculatus* : Paulpandian and Ramasamy, *Guide to the Prawns of Portonovo*,: 35, pl 29, fig. 4.

Material examined : 1 ex., Sorala, 22.01.2004, Coll. : SR, Reg. No. CR-5698; 1 ex., Keutasunapur, 22.01.2004, Coll. : SR, Reg. No. CR-5707; 1 ex., Sorala, 14.12.2006, Coll. : SR, Reg. No. CR-5790.

Measurements : L-70.0-172.0.

Distribution : India : East and West coast.

Elsewhere : South East Africa, Red Sea, Mauritius, Sri Lanka, Taiwan, New Guinea and Polynesia.

Remarks : This species appears to be quite rare in this estuary and is often confused with *P. (M.) japonicus*.

Genus **Metapenaeus** Wood Mason and Alcock, 1891

Key to the species of Genus *Metapenaeus* from Bahuda estuary

- Rostrum elevated and toothless along its distal half; distomedian petasml projection with filaments not readily visible; thelycum of impregnated females usually with white conjoined pads *M. dobsoni*
- Rostrum straight and toothed along entire dorsal margin; distomedian petasml projection without apical filament; thelycum of impregnated females without white conjoined pads *M. monoceros*

6. *Metapenaeus monoceros* (Fabricius, 1798)

(Pl. 1, fig. 4)

1798. *Penaeus monoceros* Fabricius, *Ent. Syst. Suppl.* : 409.

1906. *Metapenaeus monoceros* : Alcock, *Cat. India Decapod Crust.*, **3**(1) :18.

1998. *Metapenaeus monoceros* : Deb, *Estuarine Ecosystem Series*, **3** : Mahanadi Estuary Crust : 137.

Material examined : 20 ex., Sorala, 14.12.2006, Coll. : SR, Reg. No. CR-5688; 3 ex., Sorala, 15.12.2006, Coll. : SR, Reg. No. CR-5691; 32 ex., Sorala, 22.01.2004, Coll. : SR, Reg. No. CR-5695; 23 ex., Antareipur, 22.01.2004, Coll. : SR, Reg. No. CR-5700; 12 ex., Sunapur, 22.01.2004, Coll. : SR, Reg. No. CR-5706.

Measurements : L-45.0-98.0.

Distribution : India : East and West coasts. Elsewhere: Sri Lanka, South Africa, Malay Peninsula, Red Sea, Madagascar, Mauritius and Mediterranean.

Remarks : Closely resembles *M. ensis*. This species occurs abundantly in Bahuda Estuary. Reported from Mahanadi (Deb, 1998) and Gautami-Godavari (Subramanyam, 1969) estuaries also.

7. *Metapenaeus dobsoni* (Miers, 1878)

(Pl. 2, fig. 1)

1878. *Penaeus dobsoni* Miers, *Proc. Zool. Soc. London* : 302.

1906. *Metapenaeus dobsoni* : Alcock, *Cat. Indian Decapod Crust.*, **3**(1) : 21.

1995. *Metapenaeus dobsoni* : Reddy, *Estuarine Ecosystem series, Part 2* : Hugli, Matla Estuary : 294.

Material examined : 1 ex., Sorala, 15.12.2006, Coll. : SR, Reg. No. CR-5692; 2 ex., Sorala, 22.01.2004, Coll. : SR, Reg. No. CR-5699; 2 ex., Antereipur, 22.01.2004,

Coll. : SR, Reg. No. CR-5704; 2 ex., Sunapur, 22.01.2004,
Coll. : SR, Reg. No. CR-5705.

Measurements : L-35.0-64.0.

Distribution : India : South-West coast.

Elsewhere : Sri Lanka, Gulf of Thailand, Philippines and Indonesia.

Remarks : Abundant in Bahuda estuary. Recorded from Gautami-Godavari (Subramanyam, 1969) and Matla estuaries (Reddy, 1995) also.

Genus ***Parapenaeopsis*** Alcock, 1901

8. ***Parapenaeopsis acclivirostris*** Alcock, 1905
(Pl. 2, fig. 2)

1905. *Parapenaeopsis acclivirostris* Alcock, *Ann. Mag. nat. Hist.*, ser. 7, **16** : 522.

1992. *Parapenaeopsis acclivirostris* : Goswami, *J. mar. biol. Ass. India*, **34**(1&2) : 121.

Material examined : 3 ex., Sunapur, 22.01.04, Coll. : SR, Reg. No. CR-5980.

Mesurements : L-85-90.

Distribution : India : West Bengal.

Elsewhere : Indo-West Pacific from South and East Africa to India.

Remarks : This species occurs both in marine and estuarine habitats.

Family PALAEMONIDAE Rafinesque, 1815

Genus ***Macrobrachium*** Bate, 1868

Key to species of the genus *Macrobrachium* from Bahuda estuary

1. Rostrum with 3 post-orbital teeth on carapace, podomeres tuberculate 2
- Rostrum with 2 post-orbital teeth on carapace, podomeres pubescent *M. rude*
2. Carapace smooth *M. malcolmsonii*
- Carapace scabrous in the anterior part
..... *M. equidens*

9. ***Macrobrachium malcolmsonii***

(H. Milne Edwards, 1844)

(Pl. 2, fig. 3)

1844. *Palaemon malcolmsonii* H. Milne Edwards, *Voy Inde Jacquemont*, **4**(2) : 8.

1950. *Macrobrachium malcolmsonii* : Holthuis, *Siboga Exped.*, **39** a(9) : 121.

1995. *Macrobrachium malcolmsonii* : Reddy, *Wetland Ecosystem Series 1 : Fauna of Chilika Lake* : 380.

Material examined : 2 ex., Sorala, 22.01.2004, Coll. : SR, Reg. No. CR-5794.

Measurements : L-100.0.

Distribution : India : Southern India.

Elsewhere : Pakistan, Sri Lanka and Bangladesh.

Remarks : This species inhabits both estuarine and fresh waters. As early in 1844, H. Milne Edwards reported it as the commonest species in South India. However, this species appears to be rare in this estuary.

10. ***Macrobrachium equidens*** (Dana, 1852)
(Pl. 2, fig. 4)

1852. *Palaemon equidens* Dana, *Proc. Acad. Nat. Sci. Philad.*, **6** : 26.

1950. *Macrobrachium equidens* : Holthusis, *Siboga Exped.*, **39** (a-9) : 162.

1995. *Macrobrachium equidens* : Reddy, *Estuarine Ecosystem series, Part 2 Hugli Matla Estuary* : 310.

Material examined : 14 ex., Sorala, 14.12.2006, Coll. : SR, Reg. No. CR-5789; 5 ex., Sorala, 22.01.2004, Coll. : SR, Reg. No. CR-5795.

Measurements : L-45.0-108.0.

Distribution : India : South-West coast, Kerala.

Elsewhere : Pakistan, Sri Lanka, China, East coast of Africa, Madagascar, Philippines and New Caledonia.

Remarks : This species is found in large numbers in this estuary. *M. equidens* has earlier been reported from Matla estuary by Reddy (1995).

11. ***Macrobrachium rude*** (Heller, 1862)

1862. *Palaemon rudis* Heller, *Verh. Zool. -bot. Ges. Wien*, **12** : 525.

1950. *Macrobrachium rude* : Holthuis, *Siboga Exped.*, pt. X, **39** : 150.

1998. *Macrobrachium rude* : Deb, *Estuarine Ecosystem Series, 3 : Mahanadi Estuary* : 133.

Material examined : 3 ex., Sorala, 22.01.2004, Coll. : SR, Reg. No. CR-5793.

Measurements : L- 68.0.

Distribution : India : East coast.

Elsewhere : Sri Lanka, Bangladesh, Natal East coast of Africa, Madagascar and South Somalia.

Remarks : This species is found both in riverine and estuarine in habitats. It also occurs in Matla estuary (Reddy, 1995).

Family MATUTIDAE De Haan, 1833

Key to the genera of the family Matutidae from Bahuda estuary

- Mid-palmar ridge granular, dactylar ridge smooth, carpus of penultimate periopod bicarinate *Ashtoret*
- Mid-palmar ridge smooth, dactylar ridge milled, carpus of last pair of leg unicarinate *Matuta*

Genus *Ashtoret* Galil and Clark, 1994**Key to species of the genus Ashtoret from Bahuda estuary**

- A finely milled ridge on outer surface of dactylus in male, absent in female, plastron coarsely granular *A. lunaris*
- No milled ridge on outer surface of dactylus in both sexes, plastron finely granular *A. miersi*

12. Ashtoret lunaris (Forskål, 1775)

1775. *Cancer lunaris* Forskål, *Desc. Anim.*, : 91.
 1896. *Matuta banski* : Alcock, *J. Asiat. Soc. Bengal*, **65** (2) : 158.
 1994. *Ashtoret lunaris* : Galil and Clark, *Zool. Verh. Leiden*, **294** : 5, figs a-b, pl. 1a-b.
 2005. *Ashtoret lunaris* : Dev Roy and Bhadra, *State Fauna Series, 5: Fauna of Andhra Pradesh* (Part 5) : 382, pl.1, fig. 2.

Material examined : 1 ex., Mouth, 07.01.2005, Coll. : PMS, Reg. No. CR-5759; 1 ex., Mouth, 12.05.2004, Coll. : AM, Reg. No. CR-5774; 1 ex., Keutasunapur, 22.07.2003, Coll. : SZS, Reg. No. CR-5779; 1 ex., Antareipur, 22.01.2004, Coll. : SR, Reg. No. CR-5780.

Measurements : L-39.0-44.0, W-42.0-46.0.*Distribution* : India : Orissa, Andhra Pradesh.*Elsewhere* : Aden, Red Sea, Singapore, Malaysia, Philippines, Indonesia, New Guinea and Australia.

Remarks : Earlier reported from Hugli, Mahanadi (Deb, 1998), Godavari (Dev Roy and Bhadra, 2001), Krishna (Rath and Dev Roy, 2009) and Vamsadhara Estuaries (Rath and Dev Roy, 2010), it is now recorded from Bahuda estuary.

13. Ashtoret miersi Henderson, 1887

1775. *Cancer lunaris* Forskål, *Desc. Anim.*, : 91.
 1896. *Matuta banski* : Alcock, *J. Asiat. Soc. Bengal*, **65** (2) : 158.

1994. *Ashtoret lunaris* : Galil and Clark, *Zool. Verh. Leiden*, **294** : 5, figs a-b, pl. 1a-b.

2005. *Ashtoret lunaris* : Dev Roy and Bhadra, *State Fauna Series 5 : Fauna of Andhra Pradesh* (Part 5) : **382** : pl.1, fig. 2.

Material examined : 2 ex., Keutasunapur, 10.08.2005, Coll. : SR, Reg. No. CR-5723.

Measurements : L-20.0, W-21.0.*Distribution* : India : Orissa, Andhra Pradesh.*Elsewhere* : Aden, Red Sea, Singapore, Malaysia, Philippines, Indonesia, New Guinea and Australia.

Remarks : This species has been reported earlier from Mahanadi estuary (Deb, 1998).

Genus *Matuta* Weber, 1795**14. Matuta planipes** Fabricius, 1798

(Pl. 3, Fig. 1)

1798. *Matuta planipes* Fabricius, *Ent. Syst. Suppl.*, : 369.
 1994. *Matuta planipes* : Galil and Clark, *Zool. Verh. Leiden*, **294** : 5, figs a-b, pl. 1a-b.
 1998. *Matuta planipes* : Deb., *State Fauna Series, 3 : Fauna of West Bengal part 10* : 365.

Material examined : 2 ex., Keutasunapur, 10.08.2005, Coll. : SR, Reg. No. CR-5722.

Measurements : L-18.0-20.0, W-18.5-21.0.*Distribution* : India : West Bengal, Orissa, Andhra Pradesh, Tamil Nadu, Maharashtra.*Elsewhere* : Pakistan, Myanmar, Thailand, Java, China, Japan and Australia.

Remarks : This species was encountered near the confluence area of Bahuda estuary. Also reported from Hugli, Matla, Mahanadi and Krishna estuaries (Deb, 1998; Rath and Dev Roy, 2008).

Family PORTUNIDAE Rafinesque, 1815

Subfamily PORTUNINAE Rafinesque, 1815

Key to genera of the subfamily Portuninae from Bahuda estuary

- Carapace smooth, regions ill defined propodus of chelipeds smooth and inflated *Scylla*
- Carapace not smooth, regions well defined, propodus of chelipeds prismatic and costate *Portunus*

Genus **Scylla** De Haan, 1833

15. **Scylla serrata** (Forskål, 1775)

1775. *Cancer serratus* Forskål. *Desc. Anim.* : 90.

2005. *Scylla serrata* : Dev Roy and Bhadra, *State Fauna Series*, 5 : *Fauna of Andhra Pradesh* (Part 5) : 420.

Material examined : 2 ex., Antareipur, 29.10.2003, Coll. : AM, Reg. No. CR-5708; 10 ex., Keutasunapur, 22.01.2004, Coll. : SR, Reg. No. CR-5710; 1 ex., Keutasunapur, 22.01.2004, Coll. : SR, Reg. No. CR-5712; 54 ex., Sorala, 14.12.2006, Coll. : SR, Reg. No. CR-5731; 1 ex., Sunapur, 14.12.2006, Coll. : SR, Reg. No. CR-5732; 13 ex., Antareipur, 22.01.2004, Coll. : SR, Reg. No. CR-5737; 3 ex., Sunapur, 12.12.2006, Coll. : SR, Reg. No. CR-5739; 1 ex., Sunapur, 12.12.2006, Coll. : SR, Reg. No. CR-5746; 15 ex., Sorala, 13.12.2006, Coll. : SR, Reg. No. CR-5751; 2 ex., Antareipur, 22.01.2004, Coll. : SR, Reg. No. CR-5752; 1 ex., Antareipur, 29.10.2003, Coll. : AM, Reg. No. CR-5753; 1 ex., Keutasunapur, 22.07.2003, Coll. : SZS, Reg. No. CR-5781; 1 ex., Sorala, 22.01.2004, Coll. : SR, Reg. No. CR-5782.

Measurements : L-11.0-56.0, W-14.0-84.0.

Distribution : India : West Bengal, Orissa, Andhra Pradesh, Tamil Nadu, Karnataka, Goa, Maharashtra, Gujarat and Andaman and Nicobar Islands.

Elsewhere : Africa, Red Sea, Pakistan, Mergui, Formosa, Japan, Australia and Tahiti.

Remarks : This crab inhabits muddy bottoms along the estuarine waters. It is the most important edible crab of the region and is exploited in large quantities.

Genus **Portunus** Weber, 1795

Key to species of the genus **Portunus** from
Bahuda Estuary

- Carapace marked with three large blood red spots, posterior border of merus of chelipeds devoid of any spine *P. sanguinolentus*
- No such spots on carapace, but surface studded with miliary granules, posterior border of merus of chelipeds armed with a spine at its distal end *P. pelagicus*

16. **Portunus pelagicus** (Linnaeus, 1758)

1758. *Cancer pelagicus* Linnaeus, *Syst. Nat.*, 10th ed., 1 : 626.

1899. *Neptunus pelagicus*: Alcock, *J. Asiat. Soc. Bengal*, 68 (2) : 34.

2000. *Portunus pelagicus* : Dev Roy and Das, *Rec. Zool. Surv. India, Occ. Paper No.* 185 : 41.

Material examined : 2 ex., Sunapur, 14.12.2006, Coll. : SR, Reg. No. CR-5734; 1 ex., Antareipur, 22.01.2004, Coll. : SR, Reg. No. CR-5738; 3 ex., Sunapur, 13.12.2006, Coll. : SR, Reg. No. CR-5748; 1 ex., Keutasunapur, 22.01.2004, Coll. : AM, Reg. No. CR-5754; 1 ex., Mouth, 07.01.2005, Coll. : PMS, Reg. No. CR-5755; 1 ex., Keutasunapur, 22.07.2003, Coll. : SZS, Reg. No. CR-5760; 2 ex., Mouth, 07.01.2005, Coll. : PMS, Reg. No. CR-5761; 1 ex., Mouth, 12.05.2004, Coll. : AM, Reg. No. CR-5772; 1 ex., Mouth, 01.09.2004, Coll. : AM, Reg. No. CR-5778; 2 ex., Sorala, 22.01.2004, Coll. : SR, Reg. No. CR-5783.

Measurements : L-14.0-45.0, W-23.0-81.0.

Distribution : India : West Bengal, Orissa, Andhra Pradesh, Tamil Nadu, Gujarat, Kerala, Karnataka, Maharashtra and Andamans.

Elsewhere : East and South coasts of Africa, Red Sea, Persian Gulf, Karachi, Mergui Archipelago, Singapore, Philippines, Hong Kong, China, Japan, Australia, New Zealand, Tahiti and as far as Hawaiian Islands.

Remarks : This species is fished regularly for its commercial value. It is recorded from Hughli, Matla, Mahanadi, Godavari, Krishna, Vamsadhara, Nagavali and Ennore estuaries (Dev Roy and Nandi, 2009).

17. **Portunus sanguinolentus** (Herbst, 1796)

1796. *Cancer sanguinolentus* Herbst, *Krabben und Krebse*, 1 (2) : 161. pl. 8 figs. 56-57.

1899. *Neptunus sanguinolentus* : Alock, *J. Asiat. Soc. Bengal*, 68 (2) : 32.

2000. *Portunus sanguinolentus* : Dev Roy and Das, *Rec. Zool. Surv. India, Occ. Paper No.*, 185 : 33, pl. 2, fig. 2.

Material examined : 3 ex., Sunapur, 14.12.2006, Coll. : SR, Reg. No. CR-5735; 1 ex., Sunapur, 12.12.2006, Coll. : SR, Reg. No. CR-5747; 5 ex., Mouth, 07.01.2005, Coll. : PMS, Reg. No. CR-5736.

Measurements : L-14.0-47.0, W-24.0-86.0.

Distribution : India : West Bengal, Orissa, Andhra Pradesh, Tamil Nadu, Kerala, Karnataka and Nicobars.

Elsewhere : East coast of Africa, Red Sea, Persian Gulf, Pakistan, Sri Lanka, Hongkong, Philippines, Taiwan, Japan, Australia, New Zealand and Hawaii.

Remarks : Population of this crab appears to rather poor in this estuary.

This species has been reported from Hugli, Godavari, Krishna and Vamsadhara estuaries (Dev Roy and Nandi, 2009).

Subfamily THALAMITINAE Paul'son, 1875

Genus *Charybdis* De Haan, 1833

Key to genera of the subfamily Thalamitinae from Bahuda estuary

- Antero-lateral border of carapace cut into 6 teeth *Charybdis*
 - Antero-lateral border of carapace cut into 5 teeth, 4th tooth often small or rudimentary .. *Thalamita*
- Key to species of the subgenus *Charybdis*
- A transverse granular ridge present on the cardiac region, no spine on posterior border of carpus of last pair of legs *C. (C.) affinis*
 - No transverse granular ridge on the cardiac region, posterior border of carpus of last pair of legs with an acute spine *C. (C.) helleri*

18. *Charybdis (Charybdis) helleri* (A. Milne Edwards, 1867)

1867. *Goniosoma helleri* A. Milne Edwards, *Annls. soc. ent. Fr. sér.*, 4, 7 : 282.
1899. *Charybdis (Goniosoma) merguensis* : Alcock, *J. Asiat. Soc. Bengal*, 68 (2) : 55.
1995. *Charybdis merguensis* : Bhadra, *Estuarine Ecosystem Series. Part 2. Hugli Matla Estuary* : 249-262.
2005. *Charybdis (Charybdis) helleri* : Dev Roy and Bhadra, *State Fauna Series, 5 : Fauna of Andhra Pradesh (Part 5)* : 433, pl. 2, fig. 5.

Material examined : 1 ex., Sunapur, 14.12.2006, Coll. : SR, Reg. No. CR-5733; 1 ex., Keutasunapur, 07.01.2005, Coll. : PMS, Reg. No. CR-5757; 1 ex., Sunapur, 12.05.2004, Coll. : AM, Reg. No. CR-5775.

Measurements : L-15.0, W- 24.0.

Distribution : India : West Bengal, Orissa, Andhra Pradesh, Tamil Nadu, Kerala and Andaman Islands. Elsewhere: Red Sea, Persian Gulf, Mediterranean, Sri Lanka, Mergui Archipelago, Malaya Peninsula, Singapore, Thailand, Hong Kong, China, Indonesia, Australia, and Hawaii.

Remarks : This crab has been reported from Hugli and Subarnarekha estuaries (Dev Roy and Nandi, 2009).

19. *Charybdis (Charybdis) affinis* Dana, 1852 (Pl. 3, fig. 2)

1852. *Charybdis affinis* Dana, *Proc. Acad. nat. Sci. Philad.*, 6 : 85 and *U. S. Explor. Exped. Crust.*, 13(1) : 286, pl. 17, figs. 12a-c.
2005. *Charybdis (Charybdis) affinis* : Dev Roy and Bhadra, *State Fauna Series, 5 : Fauna of Andhra Pradesh (Part 5)* : 429, pl. 2, fig. 3.

Material examined : 7 ex., Antareipur, 29.10.2003, Coll. : AM, Reg. No. CR-5709; 8 ex., Keutasunapur, 22.01.2004, Coll. : SR, Reg. No. CR-5711.

Measurements : L-15.0, W-24.0.

Distribution : India : West Bengal, Orissa, Andhra Pradesh, Tamil Nadu, Kerala and Andaman Islands.

Elsewhere : Red Sea, Persian Gulf, Mediterranean, Sri Lanka, Mergui Archipelago, Malaya Peninsula, Singapore, Thailand, Hong Kong, China, Indonesia, Australia and Hawaii.

Remarks : This species is recorded from Hugli and Subarnarekha estuaries (Dev Roy and Nandi, 2009).

Genus *Thalamita* Latreille, 1829

20. *Thalamita crenata* (Latreille, 1829)

1829. *Portunus crenatus* Latreille, *Collection du Museum*, 33.
2005. *Thalamita crenata* : Dev Roy and Bhadra, *State Fauna Series, 5 : Fauna of Andhra Pradesh (Part 5)* : 440, pl. 2, fig. 6.

Material examined : 1 ex., Sorala, 14.12.2006, Coll. : SR, Reg. No. CR-5729; 2 ex., Sunapur, 01.09.2004, Coll. : AM, Reg. No. CR-5777.

Measurements : L-17.0-43.0, W-22.0-62.0.

Distribution : India : West Bengal, Orissa, Andhra Pradesh, Tamil Nadu, Pondicherry, Maharashtra and Andaman and Nicobar islands.

Elsewhere : East Coast of Africa, Red Sea, Pakistan, Sri Lanka, Mergui Archipelago, Singapore, Philippines, Japan, Indonesia, Australia, New Zealand, Samoa, Hawaii and Society Islands.

Remarks : This species has been observed mostly in the confluence area. It is reported from Krishna, Vamsadhara and Nagavali estuaries (Dev Roy and Nandi, 2009).

Family GRAPSIDAE MacLeay, 1838

Genus **Metopograpsus** H. Milne Edwards, 1853

21. **Metopograpsus messor** (Forskål, 1775)

1775. *Cancer messor* Forskål, *Desc. Anim.*, : 88.

1960. *Metopograpsus messor* : Banerjee, *Temminckia*, **10** : 174, figs. 4h, I and 5c.

2005. *Metopograpsus messor* : Dev Roy and Bhadra, *State Fauna Series*, **5** : *Fauna of Andhra Pradesh (Part 5)* : 477, pl. 3, fig. 3.

Material examined : 2 ex., Sunapur, 12.12.2006, Coll. : SR, Reg. No. CR-5744.

Measurements : L-13.0-21.0, W-17.0-27.0.

Distribution : India : Andhra Pradesh, Orissa, Tamil Nadu, West Bengal, Karnataka, Maharashtra, Gujarat and Andaman and Nicobar Islands.

Elsewhere : Suez Canal, Aden, Red Sea, Madagascar, Pakistan, Bangladesh, Sri Lanka, Myanmar, Australia as far as Hawaii.

Remarks : The materials examined and reported herein comprises of juveniles only. It is reported from Hugli, Mahanadi, Subarnarekha and Vamsadhara Estuaries (Dev Roy and Nandi, 2009).

Family SESARMIDAE Dana, 1852

Key to the genera of the family Sesarmidae from Bahuda estuary

1. Carapace broader than long, pterygostomian regions and side walls reticulated, lower border of orbit not abnormally prominent 2
- Carapace much broader than long, pterygostomian regions and side walls not reticulated, lower border of orbit prominent *Metaplex*
2. Antenna in the orbital hiatus 3
- Antenna excluded from the orbital hiatus *Metasesarma*
3. Palm of chelipeds with a longitudinal pectinated crest on its upper part *Episesarma*
- Palm of chelipeds with 2-3 transverse pectinated crest on its upper part 4
4. Lateral border entire *Parasesarma*
- Lateral border with a tooth behind outer orbital angle 5
5. Upper border of movable finger milled with transverse lamellae, small crab *Perisesarma*

— Upper border of movable finger with longitudinal crenulate crest separated from one another, large crab *Muradium*

Genus **Episesarma** De Man, 1895

22. **Episesarma nederi** (H. Milne Edwards, 1853)

1853. *Sesarma nederi* H. Milne Edwards, *Annls. Sci. nat. (Zool.)*, sér. 3, **20** : 185.

1957. *Sesarma (Sesarma) taeniolata* : Chhapgar, *J. Bombay nat. Hist. Soc.*, **54**(3) : 521.

2000. *Neoepisesarma (Neoepisesarma) taeniolata* : Dev Roy and Das, *Rec. zool. Surv. India. Occ. Paper No.*, **185** : 95.

2005. *Episesarma taeniolata* : Dev Roy and Bhadra, *State Fauna Series*, **5** : *Fauna of Andhra Pradesh (Part 5)* : 485.

2008. *Episesarma nederi* : Ng, Guinet & Davie, *Raffles Bull. zool.*, **17** : 220.

Material examined : 1 ex., Sorala, 14.12.2006, Coll. : SR, Reg. No. CR-5730; 1 ex., Sunapur, 12.12.2006, Coll. : SR, Reg. No. CR-5743.

Measurements : L-11.0-26.0, W-15.0-29.0.

Distribution : India : Andhra Pradesh, West Bengal, Maharashtra, Andaman Islands.

Elsewhere : Pakistan, Mergui, Archipelago, Malay, Peninsula, Singapore, Indonesia, China, Japan, Thailand.

Remarks : This is a mangrove dwelling species, generally occurring in the landward fringe. It is reported to occur in Hugli, Matla, Godavari and Krishna estuaries (Dev Roy and Nandi, 2009).

Genus **Parasesarma** De Man, 1895

23. **Parasesarma plicatum** (Latreille, 1803)

1803. *Ocypoda plicata* Latreille, *Hist. Nat. Crust.*, : 47.

1899. *Sesarma quadrata* : Alcock, *J. Asiat. Soc. Bengal*, **69**(2) : 413.

1957. *Sesarma (Sesarma) quadrata* : Chhapgar, *J. Bombay nat. Hist. Soc.*, **54**(3) : 520, pl. 16, fig. a-c.

2000. *Sesarma (Parasesarma) plicatum* : Dev Roy and Das, *Rec. zool. Surv. India. Occ. Paper No.*, **185** : 91.

2005. *Parasesarma plicatum* : Dev Roy and Bhadra, *State Fauna Series 5: Fauna of Andhra Pradesh (Part 5)* : 483.

Material examined : 4 ex., Keutasunapur, 10.08.2005, Coll. : AM, Reg. No. CR-5786; 1 ex., Keutasunapur, 22.07.2003, Coll. : SZS, Reg. No. CR-5791.

Measurements : L-12.0-18.0, W-13.0-18.0.

Distribution : India : Andhra Pradesh, Orissa, Pondicherry, Tamil Nadu, West Bengal, Gujarat,

Maharashtra, Karnataka, Kerala, Maharashtra and Andaman and Nicobar Islands.

Elsewhere : East Coast of Africa, Pakistan, Sri Lanka, Myammar, China, Korea and Japan.

Remarks : This species inhabits both in brackish and fresh water areas of this estuary. It prefers muddy bottom of mangroves. It is reported from Hugli, Matla, Mahanadi, Subarnarekha, Godavari and Krishna estuaries (Dev Roy and Nandi, 2009).

Genus **Perisesarma** De Man, 1895

24. **Perisesarma bidens** (De Haan, 1835)

1835. *Grapsus* (*Pachysoma*) *bidens* De Haan, In : Siebold, *Fauna Japon. (Crust.)* : 60.

1995. *Sesarma bidens* : Ghosh, *Zool. Surv. India, Estuarine Ecosystem Series, Part-1-2, Hugli Matla Estuary* : 243.

2000. *Sesarma* (*Chiromantes*) *bidens* : Dev Roy & Das, *Rec. zool. Surv. India, Occ. Paper No.*, **185** : 90.

2005. *Chiromantes bidens* : Dev Roy and Nandi, *J. Environ. & Sociobiol.*, **2** (1&2) : 123.

2009. *Perisesarma bidens* : Dev Roy, *Rec. Zool. Surv. India. Occ. Paper No.* **289** : 129.

Material examined : 1 ex., Sorala, 22.01.2004, Coll. : SR, Reg. No. CR-5617; 1 ex., Sunapur, 12.12.2006, Coll. : SR, Reg. No. CR-5742.

Measurements : L-13.0-14.5, W-17.0-20.0.

Distribution : India : Andhra Pradesh, Orissa, West Bengal and Andaman and Nicobar Islands.

Elsewhere : Sri Lanka, Japan, Thailand, Hong Kong.

Remarks : This crab was found to occur very rarely in muddy areas of mangroves. It is reported from Hugli, Matla, Mahanadi and Krishna estuaries (Dev Roy and Nandi, 2009).

Genus **Muradium** Serène and Soh, 1970

25. **Muradium tetragonum** (Fabricius, 1798)

1798. *Cancer tetragonum* Fabricius, *Ent. Syst. Suppl.*, : 342.

1900. *Sesarma tetragonum* : Alcock, *J. Asiat. Soc. Bangal*, **69** (2) : 355.

2000. *Neoepisesarma* (*Muradium*) *tetragonum* : Dev Roy and Das, *Rec. Zool. Surv. India. Occ. Paper No.*, **185** : 97.

2005. *Episesarma tetragonum* : Dev Roy & Bhadra, *State Fauna Series, 5 : Fauna of Andhra Pradesh* (Part-5) : 485.

2008. *Muradium tetragonum* : Dev Roy, *Rec. zool. Surv. India, Occ. Paper No.*, **289** : 125.

Material examined : 1 ex., Keutasunapur, 22.07.2003, Coll. : SZS, Reg. No. CR-5792.

Measurements : L-11.0, W-13.0.

Distribution : India : West Bengal, Orissa, Andhra Pradesh, Tamil Nadu and Andaman Islands.

Elsewhere : Sri Lanka.

Remarks : This crab occurs in landward fringe of mangrove forests and has been reported from Hugli, Mahanadi, Godavari and Krishna estuaries (Dev Roy and Nandi, 2009).

Genus **Metasesarma** H. Milne Edwards, 1853

26. **Metasesarma obesum** (Dana, 1851)

(Pl. 3, fig. 3)

1851. *Sesarma obesum* Dana, *Proc. Acad. nat. Sci. Philad.*, **5**(1) : 250.

2005. *Metasesarma rousseauxii* : Dev Roy and Bhadra, *State Fauna Series 5 : Fauna of Andhra Pradesh* (Part 5) : 492.

2008. *Metasesarma obesum* : Dev Roy, *Rec. zool. Surv. India, Occ. Paper*, 289 : 124.

Material examined : 1 ex., Antareipur, 29.10.2003, Coll. : AM, Reg. No. CR-5724.

Measurements : L-14.0, W-17.0.

Distribution : India : West Bengal, Orissa, Andhra Pradesh, Tamil Nadu, Andaman Islands and Lakshwadeep.

Elsewhere : East Africa, Madagascar, Maldives, Sri Lanka, Mergui archipelago, Philipines, Austarlia and Samoa.

Remarks : This species appears to be rare in this estuary.

Family VARUNIDAE H. Milne Edwards, 1853

Genus **Metaplax** H. Milne Edwards, 1852

27. **Metaplax distincta** H. Milne Edwards, 1852

1852. *Metaplax distinctus* H. Milne Edwards, *Annls. Sci. nat. (Zool.)*, sér. 3, **18** : 162. pl. 4, fig. 27.

2005. *Metaplax distincta* : Dev Roy and Bhadra, *State Fauna Series, 5 : Fauna of Andhra Pradesh* (Part 5) : 488.

Material examined : 1 ex., Antareipur, 22.01.2004, Coll. : SR, Reg. No. CR-5718; 1 ex., Keutasunapur, 22.01.2004, Coll. : SR, Reg. No. CR-5721.

Measurements : L-16.0-17.0, W-24.0-25.0.

Distribution : India : West Bengal, Andhra Pradesh, Tamil Nadu, Karnataka, Maharashtra and Andamans.

Elsewhere : Mergui Archipelago, Thailand.

Remarks : This is a mangrove inhabiting species is truly estuarine in nature. It is reported to occur in Hugli, Mahanadi, Subarnarekha and Krishna estuaries (Dev Roy and Nandi, 2009).

Genus **Varuna** H. Milne Edwards, 1830

28. **Varuna litterata** (Fabricius, 1798)
(Pl. 3, fig. 4)

1798. *Cancer litteratus* Fabricius, *Ent. Syst. Suppl.*, : 342.

2005. *Varuna litterata* : Dev Roy and Bhadra, *State Fauna Series, 5 : Fauna of Andhra Pradesh* (Part 5) : 480.

Material examined : 2 ex., Keutasunapur, 22.01.04, SR, CR-5717; 3 ex., Mouth, 01.09.04, AM, CR-5776; 1 ex., Antareipur, 22.01.04, SR, CR-5787.

Measurements : L-17.0-37.0, W-18.0-40.0.

Distribution : India : Andhra Pradesh, Orissa, Tamil Nadu, West Bengal, Kerala, Maharashtra.

Elsewhere : Myanmar, Bangladesh, Philippines, Hongkong, Japan, New Zealand, New Guinea, Singapore, Australia, East Africa.

Remarks : This species is very common occurring both in brackish and fresh parts of this estuary. It is recorded from Hugli, Matla, Mahanadi, Subarnarekha, Godavari, Krishna and Vamsadhara estuaries (Dev Roy and Nandi, 2009).

Family OCYPODIDAE Rafinesque, 1815

Key to the genera of the family Ocypodidae from Bahuda estuary

- Antennular flagella concealed under front, eyes large occupying major part of the eye stalk
..... *Ocypode*
- Antennular flagella small but not concealed, eyes small, eye stalk long and slender *Uca*

Genus **Ocypode** Weber, 1795

Key to species of the genus Ocypode from Bahuda estuary

- Carapace and its appendages whitish or yellowish, fingers of both chela pointed
..... *O. ceratophthalma*
- Carapace and its appendages red, finger of smaller chela expanded *O. macrocera*

29. **Ocypode ceratophthalma** (Pallas, 1772)

1772. *Cancer ceratophthalmus* Pallas, *Specilegia Zool.*, **9** : 83, pl. 5, fig 7.

2005. *Ocypode ceratophthalma* : Dev Roy and Bhadra, *State Fauna Series, 5 : Fauna of Andhra Pradesh* (Part 5) : 500.

Material examined : 1 ex., Antareipur, 29.01.2003, Coll. : AM, Reg. No. CR-5725 ; 2 ex., Sunapur, 13.12.2006, Coll. : SR, Reg. No. CR-5750 ; 1 ex., Mouth, 07.01.2005, Coll. : PMS, Reg. No. CR-5761; 5 ex., Keutasunapur, 18.09.2003, Coll. : SZS, Reg. No. CR-5764.

Measurements : L-11.0-19.0, W-15.0-24.0.

Distribution : India : West Bengal, Orissa, Andhra Pradesh, Tamil Nadu. Elsewhere: Sri Lanka.

Remarks : This is a common species of this estuary. It occurs in Hugli, Subarnarekha and Godavari estuaries (Dev Roy and Nandi, 2009).

30. **Ocypode macrocera** H. Milne Edwards, 1837
(Pl. 4, fig. 1)

1837. *Ocypode macrocera* H. Milne Edwards, *Hist. Nat. Crust.*, **2** : 49.

2005. *Ocypode macrocera* : Dev Roy & Bhadra, *State Fauna Series 5 : Fauna of Andhra Pradesh* (Part 5) : 502.

Material examined : 1 ex., Keutasunapur, 22.01.2004, Coll. : SR, Reg. No. CR-5715; 1 ex., Sunapur, 14.12.2006, Coll. : SR, Reg. No. CR-5736; 2 ex., Sunapur, 12.12.2006, Coll. : SR, Reg. No. CR-5741, 1 ex.; Keutasunapur, 22.07.2003, Coll. : SZS, Reg. No. CR-5765; 6 ex., Keutasunapur, 22.07.2003, Coll. : SZS, Reg. No. CR-5766; 4 ex., Nuagaon, 18.09.2003, Coll. : SZS, Reg. No. CR-5767; 1 ex., Mouth, 12.05.2004, Coll. : AM, Reg. No. CR-5771; 4 ex., Keutasunapur, 10.08.2005, Coll. : SR, Reg. No. CR-5784.

Measurements : L-10.0-26.0, W-13.0-32.0.

Distribution : India : West Bengal, Orissa, Andhra Pradesh, Tamil Nadu. Elsewhere: Myanmar, Gulf of Thailand.

Remarks : This crab is very common in this estuary. This species has earlier been reported from Hugli, Mahanadi, Subarnarekha, Krishna, Vamsadhara and Nagavali estuaries (Dev Roy and Nandi, 2009).

Genus **Uca** Leach, 1814

Key to species of the genus Uca from Bahuda estuary

- Carapace subquadrilateral, major cheliped porcelain white with truncated tip
..... *Uca lactea*

PLATE-1

Prawns of Bahuda Estuary, Orissa



1. *Penaeus (Penaeus) monodon* Fabricius, 1798



2. *Penaeus (Penaeus) semisulcatus* De Haan, 1844



3. *Penaeus (Fenneropenaeus) indicus* (H. Milne Edwards, 1837)



4. *Metapenaeus monoceros* (Fabricius, 1798)

PLATE-2

Prawns of Bahuda Estuary, Orissa



1. *Metapenaeus dobsoni* (Miers, 1878)



2. *Parapenaeopsis acclivirostris* Alcock, 1905



3. *Macrobrachium malcolmsonii* (H. Milne Edwards, 1844)



4. *Macrobrachium equidens* (Dana, 1852)

PLATE-3

Crabs of Bahuda Estuary, Orissa



1. *Matuta planipes* Fabricius, 1798



2. *Charybdis (Charybdis) affinis* Dana, 1852



3. *Metasesarma rousseauxii* H. Milne Edwards, 1853



4. *Varuna litterata* (Fabricius, 1798)

PLATE-4

Crabs of Bahuda Estuary, Orissa



1. *Ocypode macrocera* H. Milne Edwards, 1837



2. *Uca triangularis* A. Milne Edwards



3. *Macrophthalmus (Mareotis) tomentosus* Souleyet, 1841

— Carapace hexagonal, major cheliped yellow, finger tips never truncated *Uca tringularis*

31. *Uca lactea* (De Haan 1835)

1835. *Ocypode (Gelasiums) lacteus* De Haan, In : Siebold, *Faun Japon. (Crust.)* : 54.

1900. *Gelasiums lacteus* : Alcock, *J. Asiat. Soc. Bangal*, **69** (2) : 355.

1975. *Uca (celuca) lactea lactea* : Crane, *Fiddler Crabs of the world* : *Ocypodidae* : Genus *Uca* : 300.

2005. *Uca lactea* : Dev Roy and Bhadra, *State Fauna Series*, **5** : *Fauna of Andhra Pradesh* (Part 5) : 508.

Material examined : 1 ex., Keutasunapur, 22.01.2004, Coll. : SR, Reg. No. CR-5713; 3 ex., Sorala, 22.01.2004, Coll. : SR, Reg. No. CR-5714; 5 ex., Keutasunapur, 10.08.2005, Coll. : SR, Reg. No. CR-5719; 4 ex., Sunapur, 12.12.2006, Coll. : SR, Reg. No. CR-5740; 2 ex., Sunapur, 12.12.2006, Coll. : SR, Reg. No. CR-5745; 1 ex., Sunapur, 13.12.2006, Coll. : SR, Reg. No. CR-5749; 1 ex., Mouth, 07.01.2005, Coll. : AMS, Reg. No. CR-5758; 4 ex., Mouth, 07.01.2005, Coll. : PMS, Reg. No. CR-5762; 18 ex., Keutasunapur, 29.10.2003, Coll. : AM, Reg. No. CR-5768; 3 ex., Keutasunapur, 18.09.2003, Coll. : SZS, Reg. No. CR-5769; 4 ex., Keutasunapur, 22.07.2003, Coll. : SZS, Reg. No. CR-5770; 1 ex., Mouth, 12.05.2004, Coll. : AM, Reg. No. CR-5773; 1 ex., Keutasunapur, 10.08.2005, Coll. : SR, Reg. No. CR-5785.

Measurements : L-6.0-12.0, W-8.0-20.0.

Distribution : India : West Bengal, Orissa, Andhra Pradesh, Tamil Nadu, Kerala, Karnataka, Maharashtra, Andaman & Nicobar Islands.

Elsewhere : Africa, Red Sea, Persian Gulf, Madagascar, Mauritius, Pakistan, Singapore, Malaya Peninsula, Thailand, Philippines, China, Japan, Indonesia, New Guinea and Australia.

Remarks : This is one of the commonest mangrove species of this estuary. It is reported to occur in Hugli, Matla, Mahanadi, Subarnarekha, Godavari, Krishna and Vamsadhara estuaries (Dev Roy and Nandi, 2009).

32. *Uca triangularis* A. Milne Edwards, 1837

(Pl. 4, fig. 2)

1852. *Gelasimus triangularis* A. Milne Edwards, *Nouv. Arch. Mus. nat. Paris (N.S.)*, **9** : 275.

1995. *Uca (Celuca) triangularis Bengali* : Bairagi, *Estuarine Ecosystem Series, Part 2, Hugli Matla Estuary* : 274.

2005. *Uca triangularis* : Dev Roy and Bhadra, *State Fauna Series*, **5** : *Fauna of Andhra Pradesh* (Part 5) : 508.

Material examined : 1 ex., Keutasunapur, 10.08.2005, Coll. : SR, Reg. No. CR 5720.

Measurements : L-12.0, W-19.0.

Distribution : India : West Bengal, Andhra Pradesh, Tamil Nadu.

Elsewhere : Myanmar, Malaysia and Australia.

Remarks : This is also a very common species of this estuary occurring in mangroves. It is known to occur in Hugli, Matla, Mahanadi, Subarnarekha and Krishna estuaries (Dev Roy and Nandi, 2009).

Family MACROPHTHALMIDAE Dana, 1851

Genus *Macrophthalmus* Latreille, 1829

Subgenus *Mareotis* Barnes, 1967.

33. *Macrophthalmus (Mareotis) tomentosus*

Souleyet, 1841

(Pl. 4, fig. 3)

1841. *Macrophthalmus tomentosus*, Souleyet, *Voy. "Bonite", Zool. (Crust.)*, **1** : 243, pl. 3, fig. 8.

2005. *Macrophthalmus tomentosus* : Dev Roy and Bhadra, *State Fauna Series*, **5** : *Fauna of Andhra Pradesh* (Part 5) : 519.

Material examined : 1 ex., Antareipur, 22.01.2004, Coll. : SR, Reg. No. CR-5788.

Measurements : L-24.0, W- 27.0.

Distribution : India : West Bengal, Orissa, Andhra Pradesh.

Elsewhere : Mergui Archipelago, Aru Islands, Philippines and New Caledonia.

Remarks : This species is very rare being represented by a single specimen.

SUMMARY

11 species of prawns under 4 genera and 2 families and 22 species of brachyuran crabs under 16 genera and 4 families have been recorded from Bahuda estuary which includes few marine elements. Key to genera and species have been given along with distribution of each species.

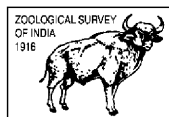
ACKNOWLEDGEMENTS

The authors are grateful to the Director Zoological Survey of India, to Dr. S.Z. Siddiqi the then Officer-in-Charge, Dr. D.V. Rao present Officer-in-Charge of Estuarine Biological Station and Dr. A.K. Singh,

Scientist 'E' and Officer-in-Charge, Fire Proof Spirit Building, Kolkatta for providing literatures, facilities and encouragements. The authors are also grateful to Sri B. Dalai and Sri P. Varma of this station for helping in collection of specimens and for taking digital photograph of specimens respectively.

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Rec. zool. Surv. India : 111(Part-1) : 63-70, 2010

LENGTH-WEIGHT RELATIONSHIP OF *SCHIZOTHORAX RICHARDSONII* (GRAY) FROM INDUS (BEAS RIVER SYSTEM, H.P.) INDIA

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INTRODUCTION

The Drainage System of Himachal-Pradesh feeds by the five major rivers, i.e. Chenab, Ravi, Beas, Satluj and Yamuna. The Beas River is division of Indus River System. It originates from mighty Dhauladhar range of great Himalaya at an altitude of 4062m asl near Rohtang Pass in District Kullu. The Beas River is a snow fed River and with its perennial tributaries forms major water resources of districts Kangra, Mandi and Kullu of Himachal Pradesh.

The Schizothorax fishes are commonly known as Indian trouts. The fishes have commercial as well as the sport value in the region. These fishes generally inhabit in an elevation above 670m asl all along the Himalayan range. The schizothoracids fishes have shown a sharp decline in catches all along the Himalayas due to indiscriminate fishing and the environmental degradation (Sehgal, 1999).

The length-weight relationship in fishes is influenced by the environmental factors. The relationship is useful in differentiating small taxonomic units, for variation may occur with population of different localities (Lecren, 1951, Chonder, 1972). The length-weight relationship has been used for two different reasons. Firstly, the length- weight relationship is commonly used to describe the mathematical model between weight and length so as to derive one from the other. Secondly, length-weight relationship is used to compute the departure from the expected weight for

the length of the individual fish or a group of fishes as indication of well being of the fishes (Wotton, 1990). The length weight relationship has been carried out by several workers for different species in the different localities (Jhingran 1952, Nautiyal 1985, Dhanze *et al.*, 2005 and Madan Mohan, 2006).

During the present studies it has been analyzed that the catch of this fish has declined in the Beas River due to over fishing and anthropogenic stresses. Therefore, an attempt has been made to know the length weight relationship and relative condition factor (Kn) which will show the growth pattern and well being of the of the fish in the existing environmental conditions. Further, previously no studies have been carried out on the length-weight relations of the *Schizithorax richardsonii* (Gray) in the Beas water.

MATERIALS AND METHODS

110 examples of *Schizothorax richardsonii* (Gray) were sampled from tributaries of Beas River during the period from 2000 to 2006. Fishes were collected with the help of cast net and preserved in 10% formalin. The length-weight relationship was calculated by the equation $Y = A + BX$ (LeCren, 1951). Length and weight descriptive and statics viz. length range, weight of fish, average standard length, average total length, calculated weight, value of log a and value of n were calculated (Table-1& 2). The relative condition factor (Kn) was calculated by the formula $Kn = w/w^1$, where w is the calculated weight and w^1 is the observed weight.

RESULT

The following equation is used in computing the statistics :

$$W = aL^n \quad \text{or}$$

$$\text{Log } W = \text{Log } a + b \text{ Log } L$$

Where W= weight of fish, L = Length of fish, a = constant, b or n = An exponential expressing relationship between length-weight. The values are determined empirically from data.

$$\text{Log } W = -4.727 + 2.933 \text{Log SL} \quad (r = 0.9838)$$

$$\text{Log } W = -5.123 + 3.000 \text{Log TL} \quad (r = 0.9870)$$

The entire data were pooled into an equation for standard length and total length in relation to weight separately. The value of exponent 'b' is 2.993 and 3.00, when the standard length and total length respectively was taken as the parameter as such the fish is growing isometrically in relation to length and thus followed a cube law. On plotting the observed weight of the species against the observed standard and total length, a curvilinear graph (Fig. 1 & 2) has been obtained. The accuracy of the equations arrived at was confirmed by back calculation of the weight and comparison with the observed weight. It has been found that the calculated weight is less than that of observed weight after attaining a size of 210 mm SL (Table-1). Similar observation has been noticed while plotting the graph between average observed weight and length (SL and TL) (Fig. 1). This is due to gonad development as this fish get maturity after attaining a size of 175 mm and 250mm in male and female respectively in the present climatic conditions (Personal observation). However, the logarithmic values of observed length and corresponding weight revealed a straight-line relationship (Fig. 2). Thus the present findings implied the applicability of the cube law to this species. The regression coefficient 'r' was found as (r = 0.9838) for standard length while (r = 0.9870) for total length.

The value of relative condition factor 'Kn' was calculated for different size groups of fishes, which ranges from 0.87 to 1.10 (Fig. 3). The graph depicts three highest values (1, 1.2, and 1.1) with little variations. The highest value of 'Kn' was found between the length ranges of 200-210 mm of fishes, which reflect that fish is towards maturity. Further, the high values

are also recorded in the group of lower length range of 50-60 mm and 70-80 mm i.e. 1.10 and 1.02 respectively. The sudden decline of 'Kn' value was noticed at 230-240 mm group which might be due to first maturity of fish.

DISCUSSION

According to Wootton (1990) if the fish retains the same shape and their specific gravity remains unchanged it shows isometric and the value of exponent 'b' will be exactly 3.0. The value less than 3.0 shows that fish becomes lighter and greater than 3.0 indicates heavier for a particular length as it increases in size. Similarly, the analysis of the length-weight data for *Schizothorax richardsonii* reveals that the value of 'b' is close to 3 and fish shows the isometric growth. Further, Madan Mohan (2006) reported the value of 'b' 3.0556954 and 2.9695189 for male and female fishes respectively for the same fish in the Kumaon hills, which is almost similar to that of present observation. Though, many fishes do not follow the cube law and may be due to feeding intensity, spawning stresses and the prevailing water chemistry. According to Hile (1936) and Martin (1949) the value of exponent 'n' i.e. 'b' usually ranges between 2.5 and 4 and remain constant at 3 for an ideal fish and coincide with present findings. Further, Tesch (1968) also opined that the exponent 'n' or 'b' values of 3 which indicates the specific gravity of the tissue remains constant throughout its life for an ideal fish and due to this reason, the 'n' value is found very close to 3 in many cases. It is known as cube law. Though the value of 'b' or 'n' varies as per different species but variation with in the species is under the influence of several factors such as seasonal, physiological condition of the fish at the time of collection, sex, gonadal development and nutritive condition of the environment. However, Baloni and Tilak (1985) recorded first maturity in this fish for the female 175mm and male 140mm in the Garhwal hills though based on present study it is noticed that fish get first maturity after attaining a size of 210mm SL due to which observed weight is more than that of the calculated weight. Further, the correlation coefficient "r" in case of standard length as well as total length was above 0.9 and indicating high correlation coefficient.

Table-1 : Length-weight relationship of *Schizothorax richardsonii* (Gray)

S. N.	Range (mm)	No. of Fish	Av. Observed wt. (g)	Log W	Av. S.L. (mm)	Log SL	(Log SL) ²	Log SLx LogW	Calculated log W	Calculated wt. (g)	Av. T.L. (mm)	(Log TL)	(Log TL) ²	Log TLx Log W	Calculated Log W	Calculated wt. (g)
1.	50-60	3	2.17	0.336	54.67	1.738	3.021	0.584	0.378	2.39	68.0	1.833	3.359	0.616	0.662	4.59
2.	60-70	3	4.67	0.669	68.33	1.835	3.367	1.228	0.668	4.65	85.0	1.929	3.721	1.291	0.935	8.61
3.	70-80	6	6.33	0.801	76.83	1.886	3.557	1.512	0.813	6.50	92.83	1.968	3.873	1.576	1.045	11.09
4.	80-90	7	9.71	0.987	83.86	1.924	3.702	1.899	0.921	8.34	100.14	2.00	4.0	1.974	1.249	17.74
5.	90-100	5	12.4	1.093	96.0	1.982	3.928	2.166	1.086	12.19	121.4	2.084	4.343	2.278	1.375	23.71
6.	100-110	3	19.0	1.278	110.0	2.041	4.166	2.608	1.254	17.95	127.5	2.105	4.431	2.690	1.435	27.23
7.	110-120	10	21.0	1.322	116.0	2.064	4.260	2.729	1.319	20.84	139.93	2.146	4.605	2.837	1.552	35.64
8.	120-130	13	29.95	1.476	127.85	2.107	4.439	3.109	1.441	27.60	155.79	2.193	4.809	3.237	1.685	48.42
9.	130-140	17	32.82	1.516	135.29	2.131	4.541	3.231	1.510	32.36	164.63	2.217	4.915	3.361	1.754	56.75
10.	140-150	8	42.2	1.625	146.67	2.166	4.692	3.519	1.609	40.64	174.0	2.240	5.018	3.64	1.819	65.92
11.	150-160	9	43.8	1.641	156.75	2.195	4.818	3.602	1.692	49.20	188.73	2.276	5.180	3.735	1.921	83.37
12.	160-170	9	57.08	1.756	166.0	2.220	4.928	3.898	1.763	57.94	198.75	2.298	5.281	4.035	1.984	96.38
13.	170-180	4	65.15	1.814	176.17	2.246	5.044	4.074	1.837	68.71	216.65	2.336	5.457	4.238	2.09	123.03
14.	180-190	2	74.0	1.869	183.0	2.262	5.117	4.228	1.882	76.21	223.5	2.349	5.518	4.390	2.129	134.59
15.	190-200	3	92.0	1.964	193.0	2.286	5.226	4.489	1.978	92.6	235.0	2.371	5.622	4.657	1.99	93.2
16.	200-210	2	109	2.037	201.0	2.303	5.303	4.691	2.027	108.46	249.01	2.393	5.726	4.874	2.056	110.02
17.	210-220	2	125	2.097	210.0	2.322	5.392	4.869	2.08	124	258.0	2.412	5.818	5.089	2.113	125.95
18.	220-230	2	152	2.182	221.0	2.344	5.494	5.115	2.147	149.56	267.01	2.427	5.890	5.296	2.158	150.32
19.	230-240	2	178	2.250	229.0	2.359	5.565	5.308	2.192	173.41	275.0	2.439	5.949	5.488	2.194	173.57
		110		Σ Log W = 28.713		Σ Log SL = 40.411	Σ Log (SL) ² = 86.56	Σ Log SL X Log W = 62.859				Σ Log TL = 42.016	Σ Log (TL) ² = 93.515	Σ Log TL X Log W = 65.302		

The 'Kn' value is a physiological indicator of general well being of any fish living in a given environment (George *et al.*, 1985 and Raj Kumari *et al.*, 2006). The 'K' value greater than 1 indicates that the general well-being of the fish is good whereas its values less than 1 in some age group indicate that all is not well in their habitat. In present study the 'Kn' values remain almost constant in all size groups (Fig. 3). The three highest values delineated in graph (Fig. 3) reflect well being of the fish and coincide with the findings of Jana and Dasgupta (2008). The sudden decline of 'Kn' value at 230-240 mm group indicated the first maturity of fish and confirmed the view of Raj Kumari *et al.* (2006) in *Catla catla*. The records of highest value in the group of lower length ranges are also reported by Narejo *et al.* (2002) and Jana and Dasgupta (2008) and confirmed

the present findings. Further, when $b = 3$, 'Kn' value would remain constant. If, the weight increases more rapidly than the cube of the length, 'Kn' would increase with increase in length. When the weight increases less than the cube of the length, 'Kn' would tend to decrease with the growth of the fish. Hence, in present study the values of 'Kn' are indicative of the suitability of water body for good fish growth in different length range except few exceptions (Fig. 3) and less value may be due to the competition for food and space within different fish communities in water body. Consequently, the *Schizothorax richardsonii* (Gray) is an ideal fish in the present agro climatic condition because the value of slope 'b' is (3.0) and 'Kn' is almost constant as such confirmed the findings of Hile (*op cit.*) and Martin (*op cit.*).

Table-2 : Regression equation of weight on standard length and Total length of *Schizothorax richardsonii* (Gray) and test of significance

Parameter	Regression Coefficient (n)	Intercept (a)	Correlation (r)
S.L.	2.933	- 4.727	0.9838
T.L	3.00	- 5.123	0.9870

SUMMARY

The specimen of snow trout, *Schizothorax richardsonii* (Gray) of different size were sampled from the various tributaries of Beas River to know the length-weight relationship. The 'b' and 'Kn' values were calculated. The value of 'b' recorded in the present study is 2.993 and 3.00 with standard length and total length respectively. The 'Kn' values are almost constant as narrow range of variation was there. Thus, on the basis of the length-weight relationship and relative

condition factor, it is inferred that the growth pattern follows the cube law and ideal for the fish in the present ecological conditions. The studies are the first reference on length-weight relationship of *Schizothorax richardsonii* (Gray) in this River system.

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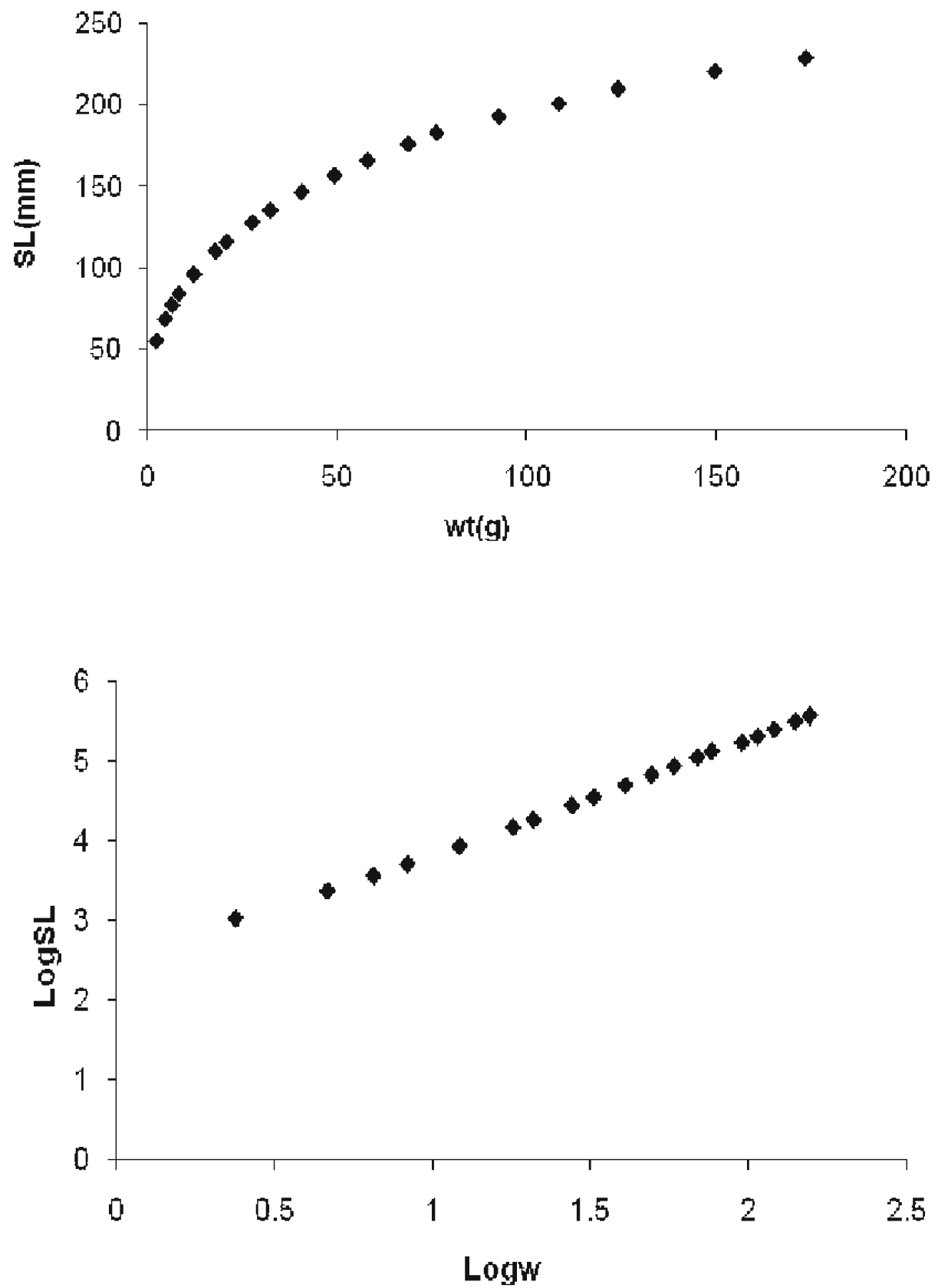


Fig. 1. Length-weight relationship of *Schizothorax richardsonii* (Gray)

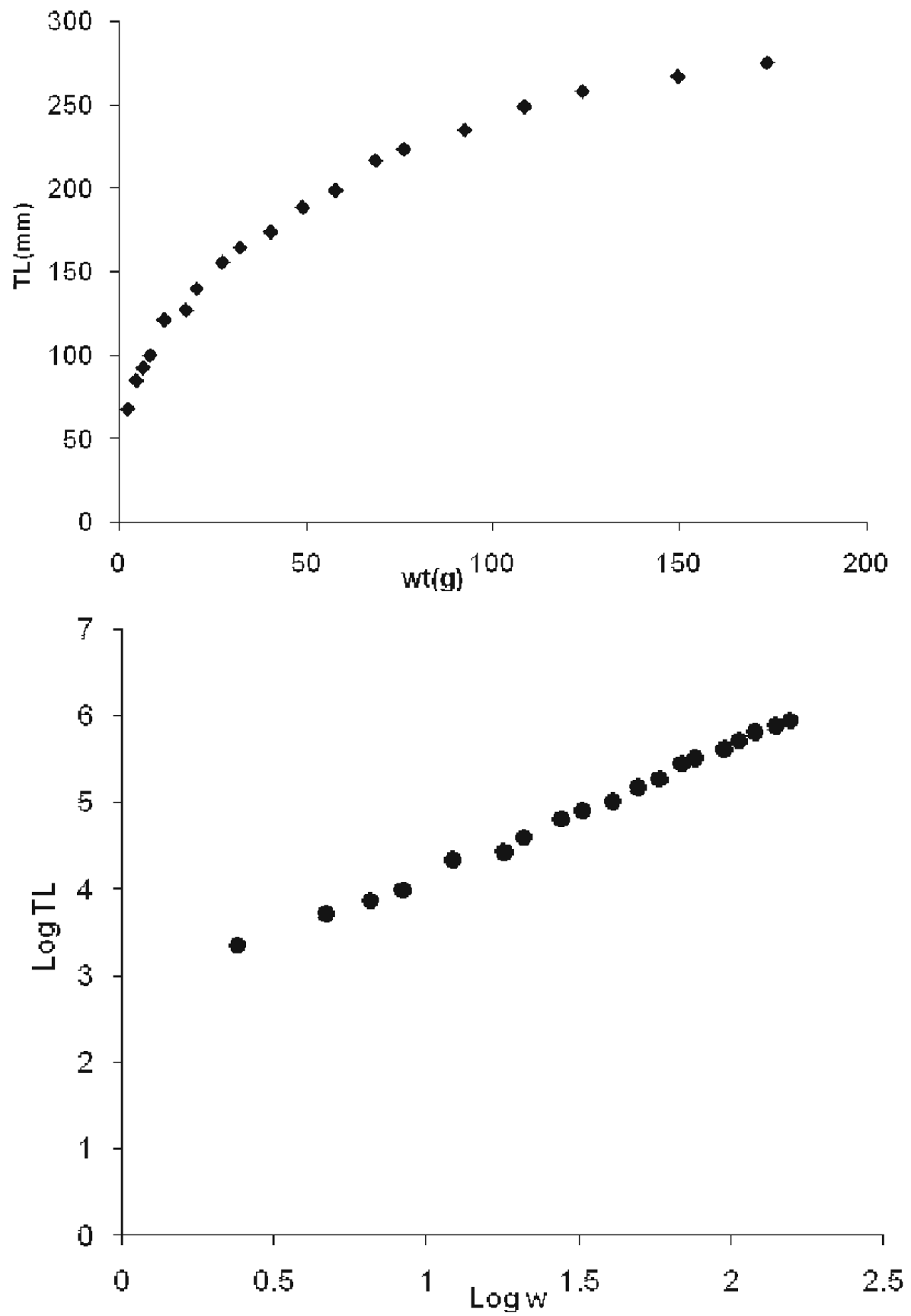


Fig. 2. Length-weight relationship of *Schizothorax richardsonii* (Gray)

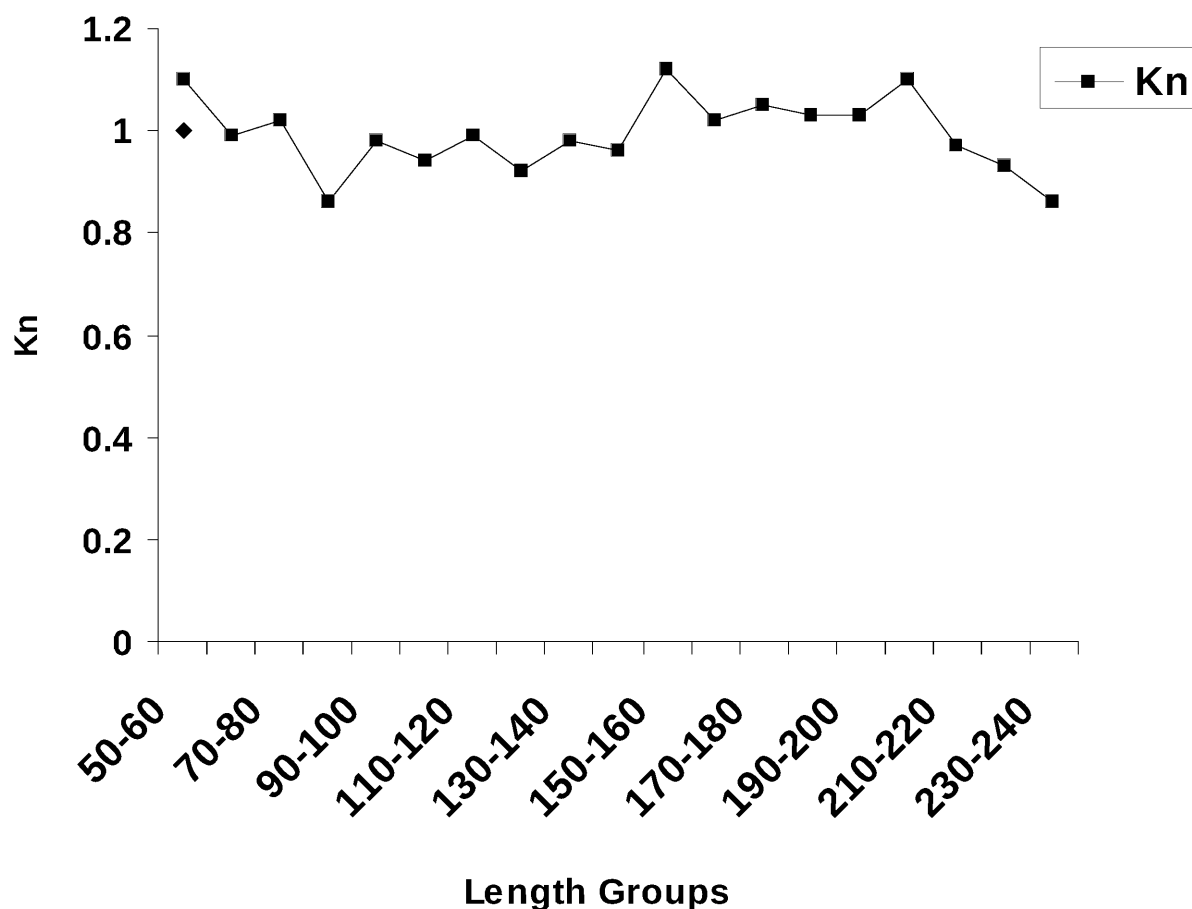
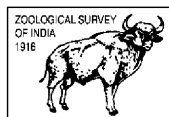


Fig. 3. Relative Condition (Kn) in relation to different length range of *Schizothorax richardsonii* (Gray)

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ORTHOPTERA OF VAN VIHAR NATIONAL PARK, MADHYA PRADESH (INDIA)

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INTRODUCTION

Van Vihar National Park (VVNP) is situated in Bhopal city with an area of 445.21 hectare. The area lies between latitudes 22° 47' to 23° 33' N and longitudes 77° 21' to 78° 49' E. VVNP is developed and managed as a modern Zoological Park as per the guidelines of the Central Zoo Authority.

Vegetation is of southern tropical dry deciduous scrub forests, consisting of major trees like saja, bel, amaltas, babool, doodhi, lendia, amla and tendu etc. Many herbivores and carnivores are housed in the confines of Van Vihar. Carnivores like tiger, leopard, hyena, jungle cat and sloth bear, and herbivores like nilgai, chital, sambar are kept in large enclosures. The area serves as the green lung for Bhopal city.

Little information is available on the Orthopteran fauna of the National parks even though 94 species were reported from the state (Kirby, 1914, Chopard, 1969 and Chandra *et al.*, 2007. The present record of 16 species of Orthoptera accommodated under 16 genus belonging to 5 families from the first report of the group from this national Park.

SYSTEMATIC ACCOUNT

Order	ORTHOPTERA
Suborder	CAELIFERA
Infraorder	ACRIDIDEA
Superfamily	ACRIDOIDEA
Family	ACRIDIDAE
Subfamily	ACRIDINAE

Genus *Acrida* Linnaeus, 1758

1. *Acrida exaltata* (Walker)

1859. *Truxalis exaltata* Walker, *Ann. Mag. nat. Hist.*, 4(3) : 222.

1954. *Acrida exaltata*, Dirsh, *Bull. Soc. Fouad Ent.*, 38 : 149.

Material examined : Bhopal; VVNP, Vihar vithika, 12.x.2003(1♂), 16.x.2003(1♀), 17.x.2003 (2♀); Gate no. 1 & 2, 14.x.2003 (1♀); coll. Dinesh Nema & S. Ahirwar.

Diagnostic characters : Head conically ascending, basal part narrow; fastigium of vertex broad, laminate and truncate at extremity; transverse sulcus of pronotum placed near middle of disc; male sub genital plate elongate; tegmina without pointed apex, a little produced beyond the hind knees; wings slightly shorter than tegmina.

Distribution : India : Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Goa, Gujarat, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Orissa, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh and West Bengal. *Elsewhere*: Afghanistan, Bangladesh, Iran, Pakistan, Saudi Arabia, Sri Lanka, Yemen and West Aden.

Genus *Ceracris* Walker, 1870

2. *Ceracris nigricornis* Walker

1870. *Ceracris nigricornis* Walker, *Cat. Derm. Salt. Brit. Mus.*, 4 : 791.

1914. *Ceracris nigricornis* : Kirby, *Fauna Brit. India, Orth.*, : 110.

Material examined : Bhopal ; VVNP, 15.x.2003 (1♂), coll. Dinesh Nema & S. Ahirwar.

Diagnostic characters : Body colour testaceous-brown; head rugosely punctuate, slightly convex above, with a dusky longitudinal curved depression on each side, but without distinct carina behind the eyes; a black band behind each eye followed by a black line

Key-words : Orthoptera, Van Vihar National Park, Madhya Pradesh, India.

below the lateral carinae; tegmina yellowish along inner margin; wings hyaline; hind femora with a blackish band near extremity, interrupted above and sides and base beneath of the terminal thickening black; hind tibiae black at the base with a yellow spot above.

Distribution : India : Arunachal Pradesh, Assam, Bihar, Himachal Pradesh, Madhya Pradesh, Manipur, Meghalaya, Sikkim, Tamil Nadu, Uttar Pradesh and West Bengal.

Elsewhere : Afghanistan, Myanmar, Taiwan, Thailand, South China and Vietnam.

Subfamily OEDIPODINAE

Genus *Trilophidia* Stål, 1873

3. *Trilophidia annulata* (Thunberg)

1810. *Trilophidia annulata* Kirby, *Syn. Cat. Orth.*, **3** : 244.

1815. *Gryllus annulatus* Thunberg, *Mem. Acad. Sci. St. Petersb.*, **5** : 234.

1965. *Trilophidia annulata*, Hollis, *Trans. R. ent. Soc. Lond.*, **117** (8) : 251-253.

Material examined : Bhopal; VVNP, Vihar vithika, 12.x.2003 (1 ♀), 13.x.2003 (1 ♀), coll. Dinesh Nema & S. Ahirwar.

Diagnostic characters : Vertex behind eyes with a pair of tubercles; fastigium of vertex elongate-trapezoid, antennae filiform, longer than head and pronotum together; pronotum tectiform with well marked crest; prozona shorter than metazona, tooth like projections present on median carina on the dorsum of prozona; metazona with weak median carina; circus narrow and conical; apex of sub-genital plate obtuse-angular.

Distribution : India : Andhra Pradesh, Arunachal Pradesh, Bihar, Chhattisgarh, Delhi, Goa, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Orissa, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh and West Bengal.

Elsewhere : Afghanistan, Bangladesh, Borneo, Myanmar, Hong Kong, Japan, Java, Korea, Malaysia, Mongolia, Nepal, Pakistan, Thailand and Vietnam.

Subfamily GOMPHOCERINAE

Genus *Aulacobothrus* Bolivar, 1902

4. *Aulacobothrus* sp.

1902. *Aulacobothrus* Bolivar, *Ann. Soc. ent. Fr., Paris*, **70** : 597.

Material examined : Bhopal ; VVNP, P. area, 15.x.2003 (1 ♀) coll. Dinesh Nema & S. Ahirwar.

Diagnostic characters : Antennae filiform with segments compressed in basal third or basal half, sub-cylindrical in remaining apical part. Foveolae visible from above, longer than broad. Fastigium with a transverse sulcus between the front margin of the eyes, lateral carinae incurved at and fading behind basal third of compound eyes. Frontal ridge with margins slightly converging above antennae. Disc of pronotum with a prominent median carina cut by the principal sulcus, lateral carinae subparallel or slightly diverging or converging before second or third sulcus.

Distribution : India : Chhattisgarh, Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Meghalaya, Sikkim, Tamil Nadu and Uttar Pradesh. *Elsewhere*: Indonesia, Nepal and Sri Lanka.

Subfamily HEMIACRIDINAE

Genus *Spathosternum* Krauss, 1877

5. *Spathosternum prasiniferum prasiniferum* (Walker)

1871. *Heteracris* (?) *prasinifera* Walker, *Cat. Derm. Salt. Brit. Mus.*, **5** : 65.

1914. *Spathosternum prasiniferum* : Kirby, *Fauna Brit. India, Orth.*, : 208.

1936. *Spathosternum prasiniferum prasiniferum* : Tinkham, *Lingn. Sci. J.*, **15** : 51.

Material examined : Bhopal; VVNP, Vihar vithika, 13.x.2003 (1 ♂), 17.x.2003 (1 ♀); coll. Dinesh Nema & S. Ahirwar.

Diagnostic characters : Body size small, rufo testaceous or green colour; broad blackish or dark-green stripe runs behind the lower part of eyes and below the lateral carina of pronotum; prosternal tubercle spatulate; tegmina and wings well developed; central area of tegmen with a longitudinal black streak well marked in female and almost obsolete in male.

Distribution : India : Andhra Pradesh, Arunachal Pradesh, Bihar, Chhattisgarh, Goa, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Orissa, Rajasthan, Tamil Nadu and West Bengal.

Elsewhere : Bangladesh, China, Hainan, Myanmar, Sri Lanka, Thailand, Vietnam and West Malaysia.

Subfamily CATANTOPINAE

Genus **Diabolocatantops** Jago, 19846. **Diabolocatantops innotabilis** (Walker)

1870. *Acridium innotabile* Walker, *Cat. Derm. Salt. Br. Mus.* **4** : 629.
1943. *Catantops innotabilis* Uvarov, *Ann. Mag. nat. Hist.* **10**(11) : 127.
1953. *Catantops pinguis innotabilis* : Dirsh & Uvarov, *Tijdschr. Ent.*, **96**(3) : 233.
1984. *Diabolocatantops innotabilis* Jago, *Trans. Amer. Entomol. Soc.*, **110**(3) : 371.
1990. *Diabolocatantops innotabilis* Ingrisch, *Spixiana* (Munich), **19** : 174.

Material examined : Bhopal; VVNP, Vihar vithika, 12.x.2003 (4 ♀); Gate no. 1&2 14.x.2003 (1 ♀), coll. Dinesh Nema & S. Ahirwar.

Diagnostic characters : Antennae filiform, shorter than head and pronotum together; basal disc of wing from colourless to weakly greenish; external disc of the hind femur with a small black median spot with varying size.; prosternal tubercle short, sub-cylindrical, rounded at apex; lateral lobe of pronotum without pattern; hind femur broad and thick, external disc without black median spot below upper carinula, internal disc with four small black, irregular spots; hind tibia light red; tegmina and hind wings extend beyond the hind knees; cercus short and conical; valve of ovipositor moderately curved; subgenital plate with truncated apex.

Distribution : India : Assam, Andhra Pradesh, Arunachal Pradesh, Bihar, Chhattisgarh, Delhi, Goa, Himachal Pradesh, Jammu & Kashmir, Kerala, Madhya Pradesh, Meghalaya, Orissa, Sikkim, Tamil Nadu, Uttar Pradesh and West Bengal.

Elsewhere : Afghanistan, Bangladesh, Borneo, Cambodia, China, Hong-Kong, Indo-China, Java, Japan, Kambodia, Korea, Malaysia, Maldives Islands, Myanmar, New Guinea, Pakistan, Philippines, Sri Lanka, Sumatra, Tibet and Thailand.

Family PYRGOMORPHIDAE

Genus **Atractomorpha** Saussure, 18617. **Atractomorpha crenulata** (Fabricius)

1793. *Truxalis crenulata* Fabricius, *Ent. Syst.*, **2** : 28.
1969. *Atractomorpha crenulata*, Kevan and Chen, *Zool. J. Lin. Soc.*, **48** : 187.

Material examined : Bhopal; VVNP, Vihar vithika, 12.x.2003 (1 ♂), coll. Dinesh Nema & S. Ahirwar.

Diagnostic characters : Body medium, narrow and slender; antennae sub-filiform; head conical, fastigium of vertex shorter; eyes oval and long; cheeks with a row of granules extending to middle coxae; pronotum submarginate in front, angulated behind and slightly tricarinate; metazona shorter than prozona; tegmina pointed, extending for one-fourth of their length beyond the hind femora; hind wings normally tyrian pink to light mallow purple at base.

Distribution : India : Andaman & Nicobar Islands, Andhra Pradesh, Bihar, Chhattisgarh, Goa, Jammu & Kashmir, Madhya Pradesh, Rajasthan, Tamil Nadu and West Bengal.

Elsewhere : Bangladesh, Lower Myanmar, Malaysia, Sri Lanka, South Vietnam and Thailand.

Genus **Chrotogonus** Serville, 18398. **Chrotogonus (Chrotogonus) trachypterus trachypterus** (Blanchard)

1836. *Ommexycha trachypterus* Blanchard, *Ann. Soc. Ent. France*, **5** : 618.
1959. *Chrotogonus (Chrotogonus) trachypterus trachypterus* : Kevan, *Publ. cult. Diamang*, **43** : 147.

Material examined : Bhopal; VVNP, Gate No. 1 & 2, 14.x.2003 (1 ♀), coll. Dinesh Nema & S. Ahirwar.

Diagnostic characters : Body colour brown, small, rugose and tuberculate; head short, broad and rugose; fastigial furrow present; antennae fulvous; pronotum short, broad with small tubercle, sternum yellowish, with black spot; tegmina shorter than abdomen; hind wings hyaline.

Distribution : India : Andhra Pradesh, Assam, Bihar, Chhattisgarh, Delhi, Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Uttar Pradesh and West Bengal.

Elsewhere : Bangladesh, Iran, Nepal and Pakistan.

Infraorder TETRIGIDEA

Superfamily TETRIGOIDEA

Family TETRIGIDAE

Subfamily TETRIGINAE

Genus **Hedotettix** Bolivar, 18879. **Hedotettix gracilis** (De Haan)

1842. *Acridium (Tetrix) gracile* De Haan, *Temminck. Verhandel., Orth.*, : 167-169.

1914. *Hedotettix gracilis* : Kirby, *Faun. Brit. India, Orth.*, : 72.

Material examined : Bhopal; VVNP, Vihar vithika, 11.x.2003 (1 ♀), 12.x.2003 (2 ♀), 13.x.2003 (1 ♀), 17.x.2003 (1 ♀), coll. Dinesh Nema & S. Ahirwar.

Diagnostic characters : Head not exerted above the pronotum; vertex equal to or narrower than an eye, front margin rounded, frontal costa widely sulcate, rami widened between antennae, antennae inserted below the middle of eyes; pronotum angulated anteriorly, extended behind upto the apex of hind femora or beyond it, dorsum finely granulose, tectiform between shoulders, wings extending upto pronotum or surpass a little.

Distribution : India : Arunachal Pradesh, Assam, Chhattisgarh, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Orissa, Sikkim, Tripura and West Bengal.

Elsewhere : Celebes, Java, Myanmar, Sumatra, Sri Lanka, Taiwan, Thailand and Vietnam.

Genus *Ergatettix* Kirby, 1914

10. *Ergatettix dorsiferus* (Walker)

1871. *Tettix dorsiferus* Walker, *Cat. Derm. Salt. Brit. Mus.*, 5 : 825.

1929. *Ergatettix dorsiferus*: Hebard, *Revue Suisse. Zool.*, 36 : 588.

Material examined : Bhopal : VVNP, Vihar vithika, 11.x.2003 (24 ♂, 22 ♀), 12.x.2003 (1 ♂, 2 ♀), 13.x.2003 (1 ♂), 17.x.2003 (2 ♂, 3 ♀) coll. Dinesh Nema & S. Ahirwar.

Diagnostic characters : Head distinctly exerted above the surface of pronotum, vertex narrower than an eye; antennae situated below inferior margin of eyes; pronotum and wings extend beyond the apex of hind femora, dorsum wide between shoulders, rugulose, median carina depressed in front, undulate behind the shoulders, lateral carinae wavy.

Distribution : India : Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Delhi, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Orissa, Sikkim, Tripura, Uttar Pradesh and West Bengal.

Elsewhere : Bangladesh, Central Asia, Java, Myanmar, Nepal, South China, Sumatra, Greater Sunda Islands, Taiwan and Turkmenistan.

Suborder ENSIFERA

Infraorder GRYLLIDEA

Superfamily GRYLLOIDEA

Family GRYLLIDAE

Subfamily GRYLLINAE

Genus *Phonarellus* Gorochoy, 1983

Subgenus *Phonarellus* Gorochoy, 1983

11. *Phonarellus (Phonarellus) minor* Chopard

1959. *Gymnogryllus minor* Chopard, *Stuttg. Beitr. z. Naturk.*, : 1.

1967. *Gymnogryllus minor* : Chopard, *Orth. Cat.*, pt. 10 : 19.

1983. *Phonarellus (Phonarellus) minor*, Gorochoy, *Entomologicheskoe Obozrenie*, 62(2) : 323.

Material examined : Bhopal; VVNP, Vihar vithika, 13.x. 2003 (1 ♂), 17.x. 2003 (1 ♂); coll. Dinesh Nema & S. Ahirwar.

Diagnostic characters : Head reddish or blackish; middle part of antennae with a long whitish ring; pronotum blackish; anterior and median legs yellowish, posterior femora blackish with yellowish top; posterior tibiae armed with 4 spine on each margin; cerci brown, yellowish at base; male elytra transparent; ovipositor rather short.

Distribution : India : Assam, Bihar, Chhattisgarh, Goa, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Pondicherry and Tamil Nadu. *Elsewhere* : Afghanistan, Iran, Java, Myanmar, Pakistan and South Vietnam.

Genus *Modicogryllus* Chopard, 1961

12. *Modicogryllus confirmatus* (Walker)

1869. *Gryllus confirmatus* Walker, *Cat. Derm. Salt. Brit. Mus.*, 1 : 371.

1964. *Modicogryllus confirmatus*, Randell, *Can. Ent.*, 96(12) : 1584.

Material examined : Bhopal; VVNP, Vihar vithika, 12.x.2003 (1 ♀), coll. Dinesh Nema & S. Ahirwar.

Diagnostic characters : Head brown with narrow yellow band connecting the lateral ocelli; occiput with 6 short yellowish lines, mirror longer than wide, divided by a curved vein; 2 oblique veins, lateral field transparent, two anterior veins strongly curved and separated from other posterior veins.

Distribution : India : Andaman Islands, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Haryana,

Karnataka, Kerala, Maharashtra, Madhya Pradesh, Manipur, Meghalaya, Orissa, Rajasthan, Tamil Nadu, Tripura, Uttar Pradesh and West Bengal.

Elsewhere : Bangladesh, China, Iran, Israel, Malaysia, Myanmar, Nepal, Pakistan, Philippines, Sri Lanka and Thailand.

Genus **Teleogryllus** Chopard, 1961

13. **Teleogryllus** sp.

1961. *Teleogryllus* Chopard, *Eos.*, **37** : 277.

1967. *Teleogryllus*, Chopard, *Orth. Cat.*, pt. **10** : 95.

Material examined : Bhopal; VVNP, Vihar vithika, 16.x.2003 (1 ♀) coll. Dinesh Nema & S. Ahirwar.

Diagnostic characters : Body size large, pubescent body, colour reddish-brown, long legs, well developed tegmina, tegmina and legs often paler. Head with a faint yellowish band long internal margin of eyes.

Distribution : India : Andaman & Nicobar Islands, Assam, Bihar, Chhattisgarh, Karnataka, Kerala, Madhya Pradesh, Meghalaya, Orissa, Tamil Nadu, Uttar Pradesh and West Bengal.

Elsewhere : China, Indochina, Indonesia, Japan, Malaysia, Myanmar, Nepal, Philippines, Singapore, Sri Lanka, Thailand, Tibet and Vietnam.

Subfamily NEMOBIINAE

Genus **Pteronemobius** Jacobson & Bianchi, 1905

14. **Pteronemobius fascipes** (Walker)

1869. *Eneoptera fascipes* Walker, *Cat. Derm. Salt. Brit. Mus.*, **1** : 67.

1931. *Pteronemobius fascipes* : Chopard, *Bull. Raffles Mus.*, **6** : 134.

Material examined : Bhopal; VVNP, Vihar vithika, 17.x.2003 (1 ♀), coll. Dinesh Nema & S. Ahirwar.

Diagnostic characters : Head blackish with four pale lines on the occiput; palpi blackish at base with 4th and 5th joints white; pronotum brownish above, posterior tibiae with 3 external and 4 internal spines in male.

Distribution : India : Assam, Arunachal Pradesh, Bihar, Chhattisgarh, Goa, Himachal Pradesh, Haryana, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Orissa, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh and West Bengal.

Elsewhere : China, Indonesia, Malaysia, Myanmar, Philippines, Singapore, Sri Lanka and Taiwan.

Infraorder ONIIDEA

Superfamily TETTIGONIOIDEA

Family TETTIGONIIDAE

Subfamily COIPHORINAE

Genus **Euconocephalus** Karny, 1907

15. **Euconocephalus incertus** (Walker)

1869. *Conocephalus incertus* Walker, *Cat. Derm. Salt. Brit. Mus.*, **2** : 320.

1912. *Euconocephalus incertus* Karny, *Gen. Insect.*, **2**(139) : 35.

Material examined : Bhopal; VVNP, Vihar vithika, 11.x.2003 (1 ♂), coll. Dinesh Nema & S. Ahirwar.

Diagnostic characters : Fastigium of vertex produced conically in front; radius sector 2 arise much before the middle of wing; male subgenital plate bears two styles at apex, style bifurcated apically; ovipositor subequal to the length of body.

Distribution : India : Andaman & Nicobar Islands, Chhattisgarh, Madhya Pradesh, Meghalaya, Orissa, Rajasthan, Sikkim, Tripura and West Bengal.

Elsewhere : Australia, Borneo, China, Java, Malaysia, Myanmar, Sri Lanka and Sumatra.

Subfamily PHANEROPTERINAE

Genus **Holochlora** Stål, 1873

16. **Holochlora** sp.

1873. *Holochlora* Stål, *Ofv. vet. Akad. Forh.*, **30**(4) : 42.

Material examined : Bhopal; VVNP, Vihar vithika, 12.x. 2003 (1 ♂), 13.x.2003 (1 ♂) coll. Dinesh Nema & S. Ahirwar.

Diagnostic characters : Body colour greenish; antennae long, yellowish; fastigium conically produced with round apex; anterior margin of pronotum concave and posterior margin convex; male subgenital plate at region of bifurcation forms a circle; style foot shaped.

Distribution : India : Andaman & Nicobar Islands, Madhya Pradesh, Meghalaya, Orissa, Rajasthan, Sikkim, Tamil Nadu, Tripura and West Bengal. *Elsewhere* : Bhutan, Java and Sri Lanka.

SUMMARY

The present study reports 16 species of Orthoptera belonging to 16 genera under five families, viz. Acrididae

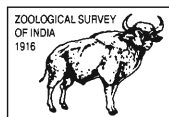
(06), Pyrgomorphidae (02) and Tetrigidae (02), Gryllidae (04) and Tettigoniidae (02), from the Van Vihar National Park, Bhopal, Madhya Pradesh. All the species are recorded for the first time from Van Vihar National Park.

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Rec. zool. Surv. India :111 (Part-1) : 77-78, 2011

OCCURRENCE OF A REEF FISH, *PARAMONACANTHUS JAPONICUS* (TILESIIUS, 1809) IN VELLAR ESTUARY, SOUTHEAST COAST OF INDIA

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INTRODUCTION

Paramonacanthus japonicus is a coral reef fish belonging to the family Monacanthidae of class Actinopterygii and the order Tetraodontiformes. 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 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.

MATERIAL AND METHOD

In a routine survey of fishes made from 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 further, no specimen was found in the subsequent days. The fish 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 and artificial aeration was given. 20 nos. of fishes were collected, in which the largest fish measured 60mm in length, 45mm body depth and 6.85 gm in weight. The water sample was also collected from the fishing site and the physicochemical parameters were recorded. The salinity was 25ppt, Dissolved Oxygen 6mg/lit., temperature 28°C and pH 7.8.

SYSTEMATIC ACCOUNT

Order TETRAODONTIFORMES
Family MONACANTHIDAE

Paramonacanthus japonicus (Tilesius 1809)

Description of the Animal

The body is laterally compressed. Head and the body covered with leathery skin and very dark and brown in color and have three dark distinct bands on the body in upward direction. The caudal fin is wedge shaped and anal fin with rudimentary spines with 2-3 dark brown vertical bands. The first dorsal fin has one strong spine with insertion of 8-10 small spines. The second dorsal and anal fins are soft rays which commence from opposite and extending almost to caudal fin base. The snout is piggy shaped and the eyes are distinct which is situated just below the first dorsal spine. Gill slits have very small opening. Upper jaw has distinct three teeth. The color of the fish was observed to change during rearing in captive condition (Fig. 2). Some fishes become fully dark black and faint, if any object come together. This is the peculiar adaptation of these fishes and because of this, the aquarist prefer these fishes.

Fin Formula: D1-I; D2-26; P-12-13; C-12; A-27-29.

Morphometric characters :

Characters	Measurements (in cm)	Characters	Measurements (in cm)
TL	63	SL	49
1 st DFH	21	2 nd DFH	0.7
PcL	0.7	AFL	0.6
T	1.4	PcFB	0.3
2 nd DFB	1.7	AFB	1.6
PDD	1.9	HL	1.9
ED	0.4		

Table : 1. TL : Total length, 1st DFH : 1st Dorsal fin height, P_{CL} : Pectoral fin length, T : Tail length, 2nd DFB : 2nd Dorsal fin base, HD : Pre dorsal distance, ED : Eye diameter, SL : Standard length, 2nd DFH : 2nd Dorsal fin height, AFL : Anal fin length, P_{FB} : Pectoral fin base, AFB : Anal fin base HL : Head length.

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 and 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 environment, hide themselves among

various plants or attached with animals (Mohasin and Ambak 1996). It feeds on wide variety of benthic invertebrates, corals or zooplankton (<http://www.fishbase.com>; Masuda et al., 1984). Machavanpillai (1971) reported in his study, on the occurrence of juvenile *P. choirocephalus* in the Gulf of Mannar area especially in the reef region. In another study conducted by Masuda et al. (1984) reported that the juveniles some times move towards the seaweed and sea grass beds in shallow water region. The moderate salinity of the estuarine water and the abundance of coastal vegetation, particularly mangrove may be the possible regions of this fish into the estuary.

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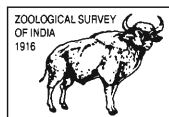
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Fig. 1. *Paramonacanthus japonicus*.



Fig. 2. Color changing behavior of fish *Paramonacanthus japonicus* in the rearing tank.



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NEW SPECIES OF THE GENUS *YPTHIMA* HÜBNER (LEPIDOPTERA : PAPILIONOIDE : SATYRIDAE) FROM NORTH-WEST INDIA

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INTRODUCTION

The genus *Ypthima* Hübner is represented by about 100 species distributed in the Palaetropical and East Palaearctic regions. Identification of certain species and population complexes is, in fact, an intricate problem. Consultation of relevant literature (vide Marshall & de Niveville, 1883; Moore, 1890, 1892; Elwes & Edwards, 1893; Evans, 1932; Talbot, 1947; Shirozu & Shima, 1979) has critically been made. Shirozu & Shima (*loc.cit.*) dealt with seventy three described species from Asia, South Pacific Islands and Australia. They have studied the male genitalia of as many as fifty-three species. In view of the presently collected material represented by fourteen examples are referable to *Hübneri* group of the genus *Ypthima* Hübner. Shirozu & Shima (*loc.cit.*) included three species under *Hübneri* group i.e., *Ypthima hübneri* Kirby, *Y. ceylonica* Hewitson and *Y. kasmira* Moore. Evans (*loc.cit.*) distinguished four groups among the Indian species of this genus. His grouping was mainly based on the wing markings of the hindwing underside. In his book of the Indian butterflies Talbot (*loc.cit.*) followed mainly Evans in the grouping of the Indian *Ypthima* Hübner. This article deals with the description of a new species, viz, *Ypthima rosei* sp. nov. from Terai region of Uttar Pradesh. Type specimens are deposited in the Lepidoptera Section, Zoological Survey of India, Kolkata.

SYSTEMATIC ACCOUNT

Genus *Ypthima* Hübner

Common name : The Rings.

1818. *Ypthima* Hübner, *Zutr.z. samml.exot. Schmett.*, **1** ; 17.

Type-species : *Ypthima hübneri* Kirby.

Ypthima rosei sp. nov.

Adult (Male) : Head with frontoclypeal area clothed with brown and white scales and hair; eyes light brown,

medium-sized and glabrous; labial palpi upwardly directed, three segmented, middle segment long, distal segment acuminate, closely appressed with black and white scales and hair; antenna 7.0 mm, club slender, brown, nudum extends from the base of the club to the base of the flagellum, the latter brown; thorax dressed with fuscous hair and scales dorsally and brown hair and scales ventrally; foreleg strongly reduced, femur longer than tibia, densely fringed with brown scales and hair, meso and meta legs white scaled, femur longer than tibia, tarsus five segmented and clawed; upperside dark brown; forewing upperside with subapical black, bipupilled, ringed with diffuse yellow, rounded or slightly oblique ocellus, discal and marginal fasciae indistinct, brand obscure, underside with grayish-white striations, not very densely covered with short brown striae, subapical ocellus as on upperside but the yellow ring more prominent and broader, a small black, yellow ringed ocellus contiguous with subapical ocellus may present below in Cu1a, marginal and discal fasciae form a loop under the subapical ocellus, another fascia extends between the dorsum and subapical ocellus; upperside hindwing with two black, single pupilled, weakly ring with diffuse yellow, ocelli in M_3 and Cu 1a, yellow ring may absent, sometimes a small additional ocellus may present in Cu1b, fasciae obscure, underside striations as on forewing underside, fasciae indistinct, single pupilled, black, yellow ringed four ocelli in R_s , M_3 , Cu1a, Cu1b, ocellus in R_s may have one black dot above and one black dot below, ocelli in M_3 , Cu1a, Cu1b may be contiguous or spaced.

Androconia broad and notched at base, sharply tapering beyond middle towards apex.

Venation (Figs. 9-10) : Forewing cell less than half the length of the wing, R_1 arising beyond upper angle of cell, M_3 arched, mdc slightly incurved; hindwing cell

more than half the length of the wing, Cu1a before lower angle of the cell, humeral vein (h) (precostal) vein T-shaped.

Abdomen dorsally dark brown and fringed with fuscous scales; ventrally clad with brown scales.

Adult (Female) : Foreleg well developed; forewing upperside with subapical ocellus comparatively larger; otherwise as in male.

Male genitalia (Figs. 1-7) : Uncus shorter than tegumen, nearly straight, distal end pointed and weakly curved ventrally, sparsely setose dorsally; tegumen in dorsal view notched anteriorly, broad basally and narrowed posteriorly; fenestrula oblong; appendices angulares small, blunt distally; vinculum smaller than tegumen, inwardly curved; saccus moderately long, tubular, narrower anteriorly; valva broad basally, strongly narrowed beyond basal half, pilose, costa with flap-like costal process, apex serrate latero-distally, juxta more or less V-shaped; aedeagus long, more or less straight, narrow at both the ends in lateral view; subzone smaller than suprazone; ductus entering dorsad.

Female genitalia (Fig. 8) : Copulatory cavity anteriorly broad and weakly sclerotized; lamella antevaginalis narrow, shorter, weakly bifurcated at apex, lateral lobes of lamella antevaginalis weakly developed, membranous, below on either side of the lamella antevaginalis present more or less oval, moderately sclerotized plates; lamella postvaginalis narrower anteriorly and broader distally, distal end more or less circular; apophysis anterioris wanting, apophysis posterioris reduced and membranous; Papilla analis elongated and pilose; ductus seminalis attaching ductus bursae near ostium bursae; ductus bursae moderately long, transparent; corpus bursae ellipsoidal, weakly sclerotized, signum wanting.

Length of forewing : Male : 15-18 mm. Female : 18.0 mm.

Material Examined : Holotype : ♂, India : Uttar Pradesh, Balrampur, Koyalawas, 8.x.2006 (Registration no. : 22899/H9), Coll. N. Sharma.

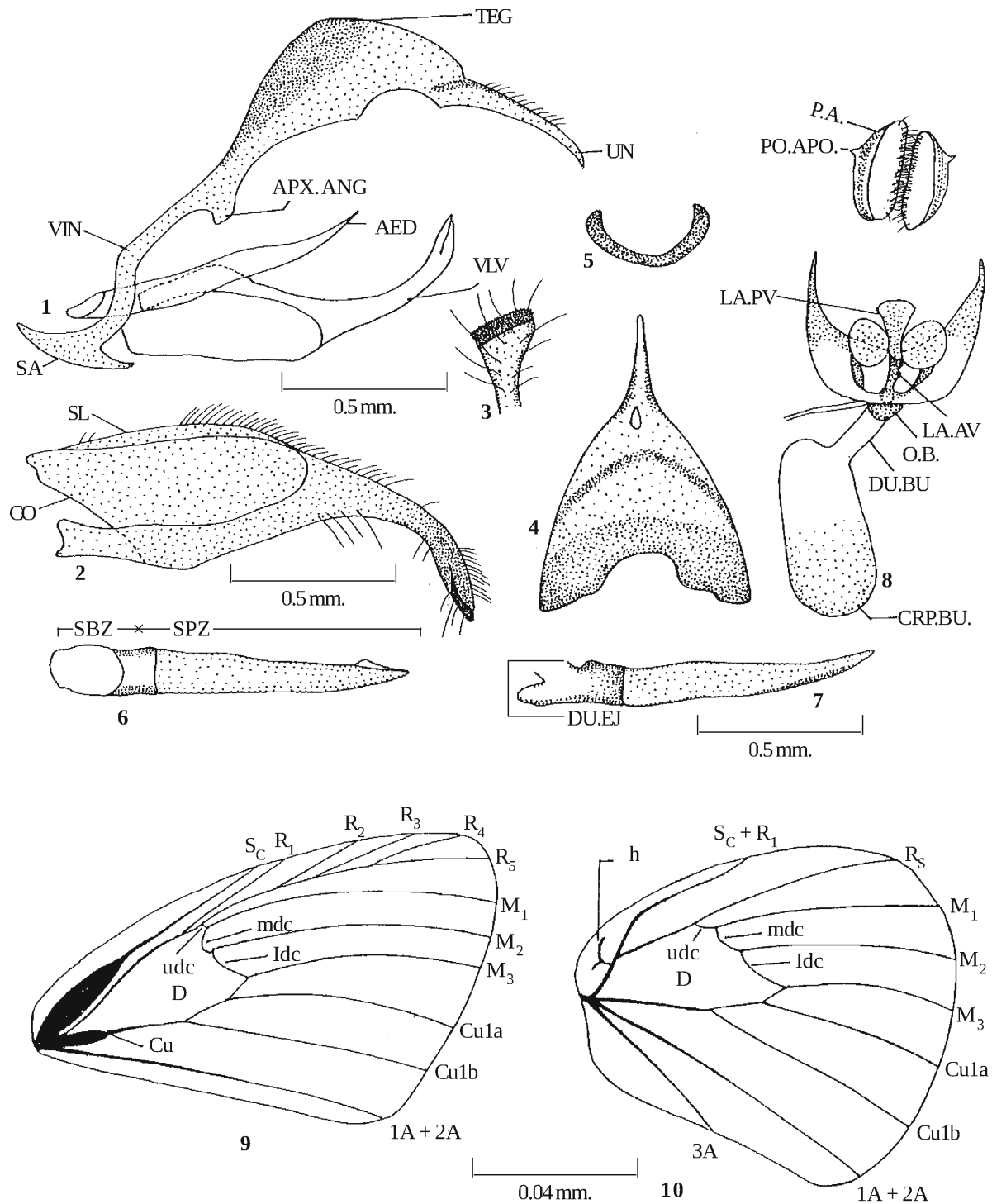
Paratypes : Uttar Pradesh, Balrampur, Koyalawas, 2 ♂, 1 ♀, 8.x.2006 (Registration no. : 22900/H9 to 22902/H9), Coll. N. Sharma; Uttar Pradesh, Balrampur, Jarva, 2 ♂, 7.x.2006 (Registration no. : 22903/H9, 22904/H9), Coll. N. Sharma; Uttar Pradesh, Pilibhit, Mahof Forest, 3 ♂, 26.ix.2006 (Registration no. : 22905/H9 to 22907/H9), Coll. N. Sharma; Uttar Pradesh, Dudhwa, Railway Station Dudhwa National Park, 5 ♂, 2.x.2006 (Registration no. : 22908/H9, 22912/H9), Coll. N. Sharma.

Etymology : The species is named in honour of Dr. H.S. Rose, Ex. Prof & Head, Department of Zoology, Punjabi University, Patiala, Punjab, India, for his contributions in the field of Systematics of Lepidoptera.

Remarks : Elwes & Edwards (1893) pointed out that owing to a lot of variations, different species of the genus *Ypthima* Hübner were difficult to identify/separate and the genus, as such, having been remained for many years a stumbling block to the Lepidopterists. Eliot (1992) has also recommended that the males admit of ready identification from the characteristic forms of their genitalia. During the course of present studies, fourteen examples have been identified to belong to *Hübneri* group (Shirozu & Shima, 1979). In respect of characters such as, the uncus, tegumen, aedeagus and the valva in the male genitalia and the corpus bursae, ductus bursae and genital plate in the female genitalia, the present species differ from the other species of the group (Shirozu & Shima, 1977, 1979).

Two male specimens (one collected from Dudhwa Railway Station, Dudhwa National Park and other from Mahof Forest, Pilibhit) have an additional ocellus on upperside of hindwing in Cu1b. Similarly, a minute, black, yellow ringed ocellus present below and contiguous with subapical ocellus on the underside of the forewing in specimen collected from Koyalawas. One male specimen collected from Dudhwa Railway Station, Dudhwa National Park have on the underside hindwing an additional black dot below ocellus in Rs, while the other male specimen collected from the same locality, on the same date have two additional black dots, one above and one below of the ocellus present in Rs. However, all these individuals found to be conspecific on the basis of genital structures. In fact, these individuals hitherto represent an undescribed species which is accordingly named as *Ypthima rosei* sp. nov. The new species is closely allied to *Ypthima kasmira* Moore from which it differs in respect of following characters :

(i) Fasciae on the underside of the forewing are prominent in *Ypthima rosei*, whereas, in *Y. kasmira* fasciae are indistinct (ii) Uncus in male genitalia weakly curved ventrally in *Ypthima rosei*, while, in *Y. kasmira* uncus is more or less straight (iii) Appendix angularis in male genitalia blunt at distal end in *Ypthima rosei*, whereas, in *Y. kasmira* it is rounded (iv) Apex of valva in male genitalia densely sclerotized in *Ypthima rosei*, while, in *Y. kasmira* it is less sclerotized (v) In male genitalia, aedeagus in lateral view weakly curved dorsally in the posterior half in *Ypthima rosei*, whereas,



Figs. 1-10. *Ypthima rosei* sp.nov. : 1. Male genitalia (lateral view) 2. Valva (Inner view) 3. Apex of valva 4. Dorsum 5. Juxta (Dorsal view) 6. Aedeagus (Lateral view) 7. Aedeagus (dorsal view) 8. Female genitalia (ventral view) 9. Venation of forewing 10. Venation of hindwing.

PLATE 1
Ypthima rosei sp.nov.



1. Holotype ♂ (Dorsal side)



2. Holotype ♂ (Ventral side)



3. Paratype ♂ (Dorsal side)



4. Paratype ♀ (Ventral side)

in *Y. kasmira* it is more or less straight (vi) Lamella antevaginalis of female genitalia short, weakly bifurcated posteriorly in *Ypthima rosei*, while, in *Y. kasmira* it is long, narrow and bifurcated posteriorly.

ABBREVIATIONS USED

1A + 2A : Fused first and second anal veins, 3A : Third anal vein, AED : Aedeagus, APX.ANG. : Appendix angularis, CO : Costa, CRP.BU. : Corpus bursae, Cu1a : Upper branch of first cubital, Cu 1b : Lower branch of first cubital, D : Discal cell, DU.BU. : Ductus bursae, DU.EJ. : Ductus Ejaculatorius, DU.SEM. : Ductus seminalis, h : Humeral vein, LA.AV. : Lamella antevaginalis, LA.PV. : Lamella postvaginalis, ldc : Lower discocellular, M₁ : First medial vein, M₂ : Second medial vein, M₃ : Third medial vein, mdc : Middle discocellular, O.B. : Ostium bursae, P.A. : Papilla analis, PO.APO : Apophysis posterioris, R₁ : First radial vein, R₂ : Second radial vein, R₃ : Third radial vein, R₄ : Fourth radial vein, R₅ : Fifth radial vein, Rs : Radial sector, SA : Saccus,

SBZ : Subzonal portion of aedeagus, Sc : Subcosta, Sc+ R₁ : Stalk of veins Sc and R₁, SL : Sacculus, SPZ : Suprazonal portion of aedeagus, TEG : Tegumen, udc : Upper discocellular, UN : Uncus, VIN : Vinculum, VLV : valva.

SUMMARY

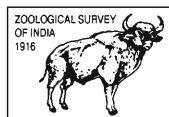
A new species of the genus *Ypthima* Hübner (Lepidoptera : Papilionoidea : Satyridae) from North-West India is described and illustrated in this paper.

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Short Communication

NEW RECORDS OF DERMAPTERA FROM UTTAR PRADESH

INTRODUCTION

Although there is a comprehensive work on the Dermaptera fauna of India (Srivastava, 1988, 2003) the present knowledge on the Dermaptera fauna of Uttar Pradesh is meagre as this state has never been explored extensively earlier by any researchers. The Dermaptera collected during faunistic survey of Uttar Pradesh were studied and four species viz. *Euborellia annulata* (Fabricius, 1793) *Euborellia compressa* (Borelli, 1907) *Forcipula quadrispinosa* (Dohrn, 1863) and *Proreus abdominalis* Ramamurthi, 1965 have been recorded for the first time from Uttar Pradesh state. Out of which first one was collected from the plain land ecosystem of river Ganga and Yamuna, second and third one from Vindhyan ecosystem and last one from Terai ecosystem of the state.

Euborellia annulata (Fabricius, 1793)

1793. *Forficesila annulata* Fabricius, *Ent. syst.*, II : 4.

1981. *Euborellia annulata*; Brindle, *Entomologist's Rec. J. Var.*, **98** : 14 (*Forcinella stali* Dohrn, 1864-treated as a synonym).

Material Examined : India : U.P. Saharanpur district, Shafipur village under bamboo scales, 2♂♂, 3♀♀ and 02 nymphs 17.vii.2008. Alt : 339 m., Coll : V.D. Hegde and Party.

Diagnostic Characters : Wings absent but elytra present in the form of narrow, ovate lateral flaps on mesonotum. Sides of abdominal segments 6-9 acute angled posteriorly. Genitalia with parameres about as long as broad, external apical angles rounded with inner apical concavity, distal lobes with denticulated chitinous pads.

Distribution : India : Kerala, Tamil Nadu, Karnataka, Manipur, Maharashtra, West Bengal, Lakshadweep island and Uttar Pradesh (Saharanpur district).

Euborellia compressa (Borelli, 1907)

1907. *Anisolabis compressa* Borelli, *Boll. Musei Zool. Comp. R. Univ. Torino*, **25**(558) : 3(male, female; Uganda).

1915. *Euborellia compressa*; Burr, *J.R. micr.Soc.*, 1915 : 548, pl. 12, fig. 8(male genitalia).

Material Examined : India, U.P. Allahabad district, Meja forest rest house campus, 3♂♂, 3♀♀ and 9 nymphs 20.viii.2007, Coll : V.D. Hegde and Party.

Diagnostic characters : Head with eyes prominent, distinctly shorter than gena. Legs with femora uniform yellow. Pronotum quadrate, slightly longer than broad, post ocular length gently widened posteriorly, lateral margin straight, gently reflexed, with hind angles rounded. Prozona weakly raised, medium sulcus distinct, meso and metanotum transverse, smooth, hind margin of metanotum emarginate. Abdominal segments 6th to 9th acute angled posteriorly with an oblique carina; penultimate sternite narrowed posteriorly with hind margin in middle subtruncate. Genitalia with parameres about as long as broad with external apical angles acute, tips obtuse, oblique median membrane distinct, distal lobes with denticulated chitinous pads.

Distribution : India : Tamil Nadu, Himachal Pradesh, West Bengal and Uttar Pradesh (Allahabad district).

Forcipula quadrispinosa (Dohrn, 1863)

1863. *Labidura quadrispinosa* Dohrn, *Stettin. ent. Ztg.*, **24** : 311 (male; Tranquabar, India and Ceylon).

1897. *Forcipula quadrispinosa*; Bolivar, *Annals. Soc. ent. Fr.*, **66** : 283.

Material Examined : India : Uttar Pradesh, Jhansi Dist., Barua Sagar jharna, under stones, 3♂♂, 3♀♀ and 2 nymphs. 23.X.2007, Coll : V.D. Hegde and Party.

Diagnostic characters : Colour blackish brown. Pronotum quadrate, a little longer than broad, anterior margin straight, sides gently convex, posterior margin rounded, prozona tumid and metazona flat; elytra well developed, rugose, coastal margin with a linear convexity; wings well developed and rugose. Sides of abdominal segments 3rd to 6th with a sharp gently incurved spines (3rd reduced); penultimate sternite rounded posteriorly; ultimate tergite smooth, transverse

slightly depressed in middle posteriorly with a tumid elevation above the base of forceps. Male forceps with the branches remote at the base, slender and elongate, bowed so as to form an elliptical space up to its two thirds part of their length from where the apical one third is straight downwards with pointed hooks inwards. Genitalia with parameres about five times longer than broad, almost of uniform width and rounded apex with short epimerite.

Distribution : India : Sikkim, Uttarakhand, West Bengal, Tamil Nadu, Kerala and Uttar Pradesh (Jhansi district).

***Proreus abdominalis* Ramamurthi, 1965**

1965. *Proreus abdominalis* Ramamurthi, *Ann. Mag. nat. Hist.*, **8**(13) : 61, figs. 8-10 (♂ ♀ India : Tamil Nadu).

1976. *P. simulans abdominalis*, Srivastava, *Rec. zool. Surv. India Occ. Paper*, **2** : 50.

1987. *P. abdominalis* Steinmann, *Annls. Hist. nat. Mus. natn. Hung.*, **79** : 117.

Material examined : India : Uttar Pradesh: Deoria district, Khukhundu village, 1♂ in crevices of walls, 1♀, attracted at light, 17.VIII.2007, Coll : V.D. Hegde and Party.

Diagnostic characters : Head orange or almond coloured; antennae 22 segmented, 1st club shaped, longer than the combined length of 2nd & 3rd, 2nd small and cuboidal, 3rd, 4th and 5th cylindrical, slightly longer than broad, 6th and onwards gradually elongated and subcylindrical; mesotarsus bearing a spiniform obtuse process visible in a lateral view under 3rd tarsal joint. Eyes small but prominent. Pronotum longer than broad, prozona with almond or light brown colour, metazona fuscus, sides pale yellow. Elytra and wings well developed, yellowish with light blackish brown bands. Abdominal tergites punctuate with scarce pubescence; ultimate tergite quadrate, broader than long with disc



Fig. : Genitalia of *Proreus abdominalis*

terminating posteriorly in a row of 4 tubercles, caudal margin sinuate and raised above base of forceps. Forceps cylindrical, arcuate, so as to form an oval space, armed internally with a sharp tooth, a little behind middle of each arm ending in pointed hooks inwards. Genitalia is as shown in the figure.

Distribution : India : Karnataka, Orissa and Uttar Pradesh (Deoria district).

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