Vol. 85 (3) Pages 369-485

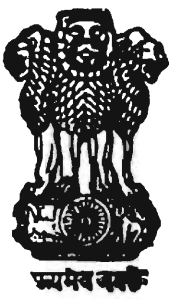
Records of the Zoological Survey of India

A Journal of Indian Zoology

Zoological Survey of India

RECORDS
OF THE
ZOOLOGICAL SURVEY OF INDIA

Vol. 85 No. 3



Edited by the Director, Zoological Survey of India

1988

Published : December, 1988

PRICE : Inland Rs. 75·00
Foreign : £ 7·5 $ 10·00

PRODUCED BY : PUBLICATION DIVISION,
ZOOLOGICAL SURVEY OF INDIA, CALCUTTA.

PRINTED IN INDIA AT SRI AUROBINDO PRESS, 16 HEMENDRA SEN STREET, CALCUTTA-700 006, PUBLISHED BY THE DIRECTOR, ZOOLOGICAL SURVEY OF INDIA, CALCUTTA-700 020.

RECORDS

OF THE

ZOOLOGICAL SURVEY OF INDIA

Vol. 85 (3) 1988 Pages 369—465

CONTENTS

Published : December, 1988

PRICE : Inland Rs. 75·00
Foreign : £ 7·5 $ 10·00

PRODUCED BY : PUBLICATION DIVISION,
ZOOLOGICAL SURVEY OF INDIA, CALCUTTA.

PRINTED IN INDIA AT SRI AUROBINDO PRESS, 16 HEMENDRA SEN STREET, CALCUTTA-700 006, PUBLISHED BY THE DIRECTOR, ZOOLOGICAL SURVEY OF INDIA, CALCUTTA-700 020.

RECORDS

OF THE

ZOOLOGICAL SURVEY OF INDIA

Vol. 85 (3) 1988 Pages 369—465

CONTENTS

Rec. zool. Surv. India, **85**(3) : 369-379, 1988

LABORATORY REARED EGGS AND LARVAE AND SUBSEQUENT STAGES FROM PLANKTON OF VELLAR ESTUARY, PORTO NOVO. I. THE ENGRAULID FISH, *THRYSSA MYSTAX* (SCHNEIDER)

By

M. THANGARAJA*

Centre of Advanced study in Marine Biology, Annamalai University, Parangipettai 608 502, Tamil Nadu.

INTRODUCTION

Literature pertaining to the eggs and larvae of *Thryssa mystax* is very meagre, despite a number of contribution on the early life history of other species of *Thryssa*. Delsman (1929, 1931), Chacko (1950), John (1951), Nair (1952) and Bapat (1955) have described the eggs of *Thryssa* spp. Early larval forms of *Engraulis* sp (= *Thryssa* sp) were first described from the Java sea by Delsman (1929). Panikkar and Aiyar (1937) and Gopinath (1946) recored the postlarvae of the same from Madras and Trivandrum Coasts respectively. Vijayaragavan (1957) dealt with the early life history of *Engraulis gravi* (= *T. grayi*). Basheerudin and Nayar (1962) studied the larval distribution of *T. mystax* in the Mahanadi estuary. Although there are some reports on the distribution of the larvae and juveniles of *T. mytax*, there is no description yet on its egg and larval development. The present work deals with the developing eggs and larvae of *T. mystax* reared in the laboratory upto 112 hours (5.1 mm) and also the postlarvae (7.4 mm) to juvenile (34 mm) stages collected from the plankton.

*Present Address**

MARINE SCIENCE AND FISHERIES CENTRE

MINISTRY OF AGRICULTURE AND FISHERIES

P. O. BOX 467, MUSCAT

SULTANATE OF OMAN

Material and Methods

Eggs and larvae were collected with a plankton net (bolting silk cloth, No. 10, 158 um) from the Vellar estuary (lat. 11° 29′ N ; long. 79° 49′ E), Bay of Bengal by the mechanised boat 'Medusa' Surface water salinity and temperature were also recorded. Eggs were sorted from the plankton samples and kept in culture troughs containing filtered and well aerated estuarine water collected from the collection site. The postlarvae and juveniles from plankton were preserved in 5% neutralised formalin immediately after collection. Stages of development are shown in Fig. 1 : A to O. Eggs and larvae were measured by an ocular micrometer. Drawings were made by using prism type camera lucida. The terminology and other laboratory rearing techniques followed by Thangaraja (1982) were adopted for the present study. The morphometric data of the larvae are presented in table 1.

Laboratory Rearing Techniques

The eggs and larvae of fishes are easily susceptible to infection by ciliates. The ciliates flourish on dead eggs and cast off membranes, and under laboratory conditions, they multiply very rapidly. In order to prevent this, the eggs and larvae were reared in estuarine water filtered several times, and also through frequent changes of water which was kept aerated constantly by means of an aerator. This methods has been found very useful in keeping the larvae moving about and preventing them from resting at the bottom where ciliates and bacteria may be teeming (Cunningham, 1981). Drastic increase in the temperature of the water was controlled by keeping the culture tanks in a water bath filled with circulating water.

The larvae fed with the nauplii of brine shrimp, *Artemia salina*, cultured in the laboratory since they are considered to be the best larval food. They were also fed with such phytoplankton as *Coscinodiscus* sp, *Skeletonema* sp, *Thalassiothrix* sp. etc., and nauplii of copepods and gastropod veligers according to their food preference.

Table 1. Morphometric data for *Thryssa mystax* larvae, Ranging from 3.50 mm to 34.00 mm Total length. (Values are given in mm.)

Morphometric Characters	Total length of the larvae (in mm)											
	3.50	4.20	4.89	5.10	5.00	5,50	5.50	5.10	7.40	16.00	20.20	34.00
Standard length	3.40	4.03	4.74	4.97	4.82	5.32	5.29	4.87	6.94	14.31	18.35	28.09
Yolk sac length	1.97	1.56	1.42	1.31	1.01	Yolk fully absorbed.						
width	0.74	0.42	0.41	0.40	0.40							
Preanal distance	2.64	2.97	3.50	3.51	3.46	3.74	3.65	3.03	4.97	11.74	12.87	15.70
Postanal distance	0.86	1.23	1.39	1.59	1.54	1.76	1.85	2.07	2.43	4.26	7.33	18.05
Eye diameter	0.25	0.27	0.27	0.30	0.30	0.30	0.30	0.30	0.39	0.53	0.92	1.54
Auditory sac diameter	0.09	0.09	0.12	0.20	0.23	0.23	0.28	0.31	(Not visible externally)			
Head length						0.83	0.66	0.71	1.21	1.81	3.69	6.88
Head depth						0.57	0.47	0.57	1.10	1.23	2.54	6.88
Snout length		Not measurable				0.10	0.11	0.11	0.35	0.58	0.92	1.30
Maximum body depth						0.77	0.51	0.62	0.75	1.58	2.14	6.72
Head to dorsal origin		Dorsal not yet formed							4.22	8.41	10.50	12.85
Head to pelvic origin		Pelvic not yet formed									8.02	11.17
Head to anal origin		Anal not yet formed							5.09	11.80	12.99	15.87
Depth at caudal peduncle		Not measurable								0.75	1.15	3.48

Even though intensive care was taken during the laboratory rearing of larvae, most of them were found to persih immediately after the absorption of yolk sac. This phase is considered to be the 'critical period' in the larval growth. The term 'Critical period' was first applied to early development of fish by two early French fish culturists, Fabre-Domergue and Bietrix (1897). They used this term to describe the time of complete yolk absorption when normally high mortality is met with among marine fish larvae in laboratory rearing attempts. Therefore it is no wonder that successful rearing of fish larvae to adult stages has remained an elusive problem to ichthyobiologists and aquaculturists, and still continues to be a major hurdle in fish seed production programme. Until such time when laboratory rearing techniques attain perfection to effectively deal with the critical phase in larval growth and facilitate progressive development from egg to juvenile stages without any break, we will have to continue to depend on both laboratory reared stages and natural collections in order to present the whole range of development sequences.

Results

Developing egg : Egg is pelagic, spherical and colourless with a very narrow perivitelline space. It ranges from 0.921 to 1.012 mm in diameter with an average of 0.966 mm. Yolk is segmented, and there is no oil globule.

Stage I (Fig. 1 A) : The eggs were collected at 3.30-4,00 a.m. and stage I shows the developing eggs as observed at 5 a.m. Cell division is at an advanced stage and the eggs is in morula stage.

Stage II (Fig 1 B) : This stage indicates further development as observed at 11 a.m. Developing embryo has 16 prominent somites, but the head or tail is not yet distinct. The eggs remain floating in the mid column of the water in the trough.

Stage III (Fig 1 C) : This stage reveals the growth at 4.10 p.m., 5 hrs after stage II. The formation of unpigmented eyes, heart and auditory vesicles is seen on the embryo.

Newly hatched prolarva (Fig. 1 D) : The eggs hatched around 8.15 p.m. 4 hrs after stage III described above. Prolarva is 4.52 mm in average length. There are 28 preanal

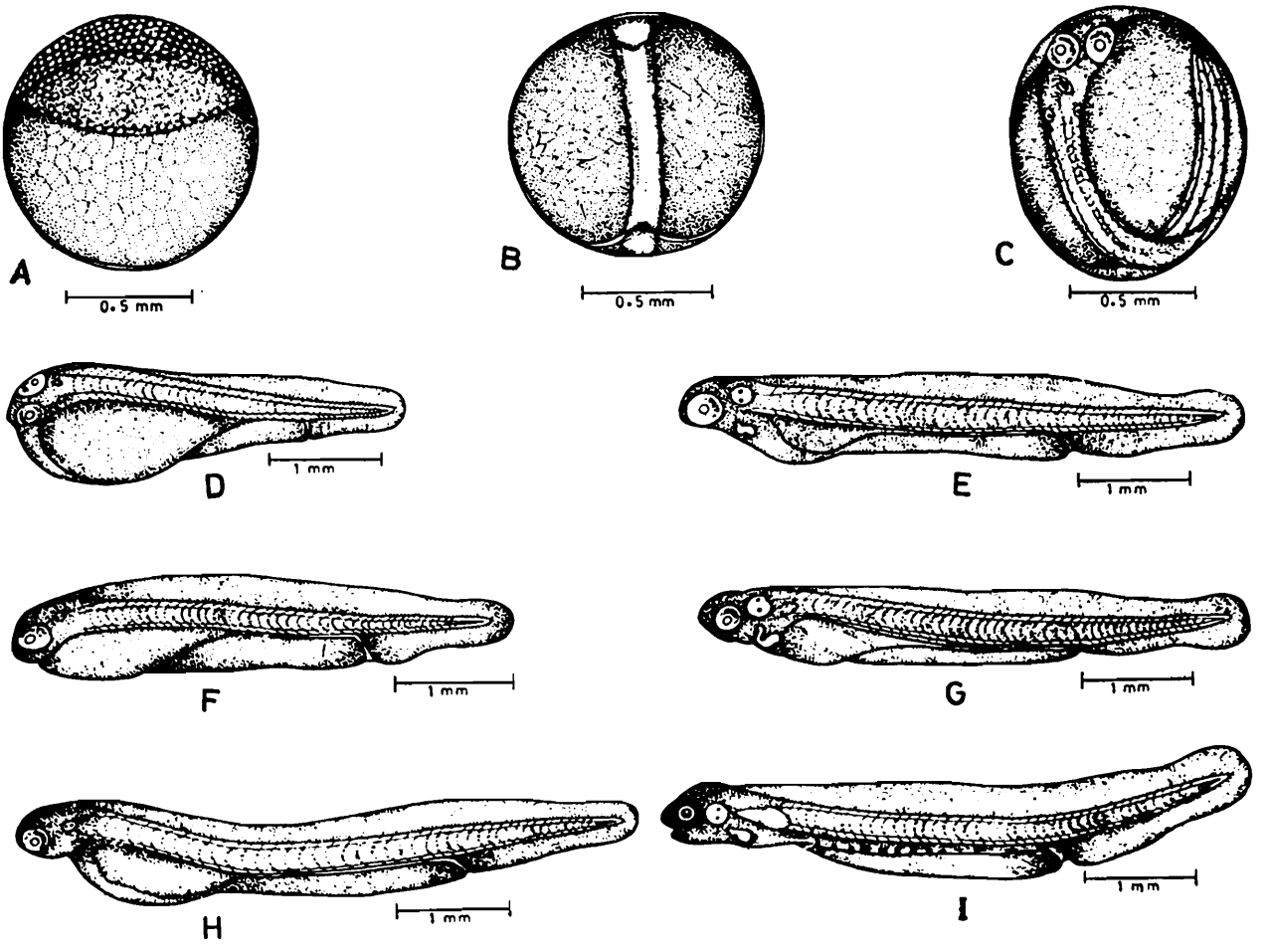


Fig. 1 (A—I). Eggs and larval stages of *Thryssa mystax* : A. Stage I—developing egg ; B. Stage II—developing egg ; C. Stage III—developing egg ; D. Newly hatched prolarva ; E. 16 hr prolarva ; F. 24 hr prolarva ; G. 40 hr prolarva ; H. 46 hr prolarva ; I. 64 hr postlarva

and 16 postanal myotomes. Yolk is heavy, and hence the larva tends to settle on the bottom of the troughs, but frequently moves about using its caudal fold. The caudal has not yet developed any ray. Tubular heart and the eyes are more prominent.

Prolarva—16 hr (Fig. 1 E) : The prolarva has grown to a length of 4.2 mm. Yolk sac is slightly diminished in size. There is no pigmentation on the body or the eye. Myotomes are constant at 28+16. The locomotory behaviour of the larva is the same as in the previous stage.

Prolarva—24 hr (Fig. 1 F) : The larva is 4.89 mm in

length. Yolk sac is further reduced in sizes. Myotomes remain at 28+16. The caudal develops minute rays.

Prolarva—40 hr (Fig. 1 G) : Total length of the larva is 5.1 mm. Eyes are still unpigmented. Yolk is not fully absorbed. Heart is somewhat sac-like. The larva is very active, swimming constantly in a perpendicular manner from the bottom to the surface and *vice versa*, with occasional rest at the bottom. Myotomes are still constant at 28+16.

Prolarva—46 hr (Fig. 1 H) : A slight reduction is noticed in the total length (5.0 mm). Yolk is still present. Myotomes have increased to 27+18.

Postlarva-88 hr (Fig. 1 J) : The larva has not increased in length from that of the previous stage. The eyes are now movable as in the adult. The myotomes are 27+18. Two

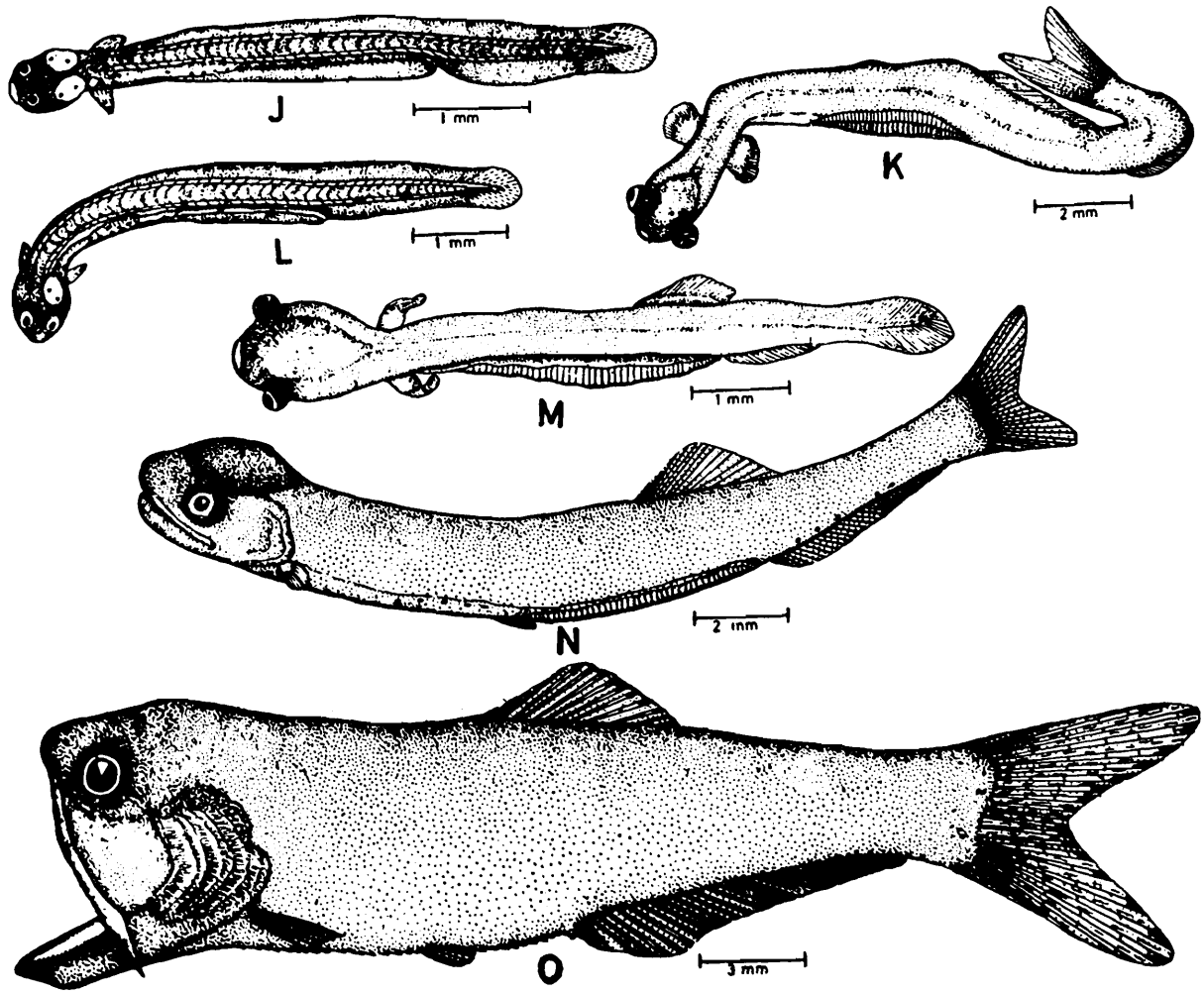


Fig. 1 (J—O). J. 88 hr postlarva ; K. 112 hr postlarva ; L. 7.4 mm postlarva ; M. 16.0 mm postlarva ; N. 20.2 mm postlarva ; O. 34.0 mm juvenile

new pigment spots are present just behind the heart. Caudal rays have increased in number and are very prominent.

Prolarva—64 hr (Fig. 1 I) : Total length has increased to 5.5 mm. with the complete absorption of yolk and the opening of the mouth and anus, the transformation into the postlarval phase has taken place. The eyes and optic vesicles are developed. The heart is sac-like. The pectoral fins develop as mere flaps. The lower jaw is smaller than the upper one. Melanophores are developed for the first time along the abdominal wall : 10 punctate pigments anteriorly and a single row of 10 stellate pigments posteroventrally. Caudal rays have further increased in number. The postlarvae-keep swimming in the subsurface water column.

Postlarva-112 hr (Fig. 1 K) : The larva has reduced to a length of 5.1 mm. Rays have developed in pectoral fins. The caudal rays are very minute, numerous and straight. The chromatophores are not as prominent as in the previous stage, but the pigments near the cardiac region are still present. Two of the 10 pigments spots at the anterior of the abdomen have disappeared. At the posterior of the abdomen there are 2 vertical bands and near the anus there is a stellate pigment. In the postanal region, there are 3 groups of chromarophores arranged in the ventrolateral side. There is no change in the myotomic number.

Postlarva of 7.4 mm length (Fig. 1 L) : The dorsal and anal fins have developed from the larval finfold, but the rays are not yet discernible clearly. All the pigments has disappeared. Anus is located below the level of the last ray of the dorsal, just anterior to the origin of the anal fin. The myotomes are 27+18 as in the previous stage. The notochord is still straight. Alimentary canal appears segmented as in *Stolephorus* spp (Thangaraja, 1982).

Postlarva of 16.0 mm length (Fig. 1 M) : The body is soft and elongate but coiled after preservation. Myotomes are not clear. The tip of the notochord is upturned. There are a few minute punctate pigments at the base of the eyes. The dorsal, anal and caudal rays are clear.

Postlarva of 20.0 mm length (Fig. 1 N) : The pigments have reappeared. There are about 5 punctate pigments along the base of the abdomen, but in front of the pelvic ; 2 punctate pigments on the isthums ; and, 8 punctate pigments between the anus and the caudal peduncle. The pelvic fins has developed. The extension of the maxillary bone is clear. There are 13 dorsal rays, 41 anal rays and 7 pelvic rays. Pectoral rays are minute and difficult to count. Preanal mytomes remain at 27.

Juvenile of 34.0 mm length (Fig. 1 O) : The juvenile is easy to identify. The base of the anal is pigmented. The dorsal side of the head has group of minute punctate pigments. There are minute pigments along the dorsolateral region from the head to the caudal peduncle. Pigments are also seen on the caudal rays. Minute teeth have appeared on the jaws. Gill rays and gill rakers are well developed. There are 15-18 prepelvic and 10-12 postpelvic ventral scutes, which are very prominent. The fin formula is D III, 11-12 ; A III, 32-39 ; P I, 12.

Discussion

Clupeids are generally characterised by the segmentation of the yolk at the fertilised egg stage and the vertical arrangement of the muscles in the myotomes of the larvae. Delsman (1929, 1931) consideres that the elongate eggs found in the Indian waters belong to *Anchoviella* while the irregular spherical eggs are those of *Engraulis*. He described two types of *Engraulis* egg, a larger type where the diameter is 1.0-1.1 mm and a smaller type with a diameter of 0.8-0.9 mm and concluded that the former belonged to *Engraulis gravi* and later to *Engraulis* (=*Thryssa*) *mystax*. The eggs described here resemble *T. mystax* in having an average diameter of about 0.96 mm.

According to Delsman (1929) and Vijayaraghavan (1929) the first day larva of *E. gravi* (=*T. hameltoni*) has 29 and 30 preanal myotomes respectively but in the present case the newly hatched prolarva is found to have only 28 preanal

myotomes. The 46 hr to 112 hr old larva has 27 preanal and 18 postanal myotomes (total 45). The number of larval myotomes (45) corresponds to the vertebral count of the adult (21+24=45). Interestingly enoguh, the preanal myotomes remained at 27 even in the 20.2 mm larva owing to the very slow forward shifting of the anus. However, the anus comes to occupy its adult position (below the 21st myotome), only when the larva grows to 34 mm in total length.

Rao (1964) collected the postlarva (5.5 to 25 mm) of *T. mystax* in all the zones of the Mahanadhi estuary, excluding the freshwater zone, and concluded that *T. mystax* is a purely brackishwater fish. In the present study also, the eggs, postlarvae, juveniles and adult were observed in the strictly estuarine zones of the Vellar estuary with a salinity range of 19.37 to 35.78‰. Both these observations indicate that spawning of *T. mystax* takes place in the estuaries and backwaters.

T. mystax resembles *T. Vitrirostris* in many external characteristics including the meristic counts (Whitehead, 1972). However, *T. mystax* has less number of gill rackers (14-18+9-12) than the latter (21-23+14-17). The serrae on the upper surface of the gill rakers are very few, comparatively short, and rather blunt in *T. mystax* (Thangaraja and Ramaiyan, 1983-1984).

The size of the developing eggs, the number of myotomes in the prolarvae and postlarvae, the number of ventral scutes and finrays in the juvenile and the nature of the gill reker serrae provide sufficient evidence to the identity of the present material as of *T. mystax*. The occurence of mature adults of *T. mystax* in the localities where from the eggs and larvae described here were collected may be taken to be additional evidence to the above inference.

SUMMARY

Eggs and larve of *Thryssa mystax* were collected from Vellar estuary and reared the developing eggs upto 112-hr stage in the laboratory. The postlarvae from 7.4 mm to

34 mm juvenile were studied from the plankton collections. Eggs, postlarvae, juveniles and adult were collected from the Vellar estuary with a salinity range of 19.37 to 35.78%0.

Acknowledgements

The author expresses his sincere thanks to Prof. K. Ramamoorthi and Prof. R. Natarajan, CAS in Marine Biology, Annamalai University, for the guidance and providing facilities. Thanks are due to the UGC for financial support and the authorities of Annamalai University for giving the facilities during the tenure of research.

References

Bapat, S. V., 1955. A preliminary study of pelagic fish eggs and larvae of the Gulf of Mannar and Palk Bay. *Indian J. Fish* **2** : 231-255.

Basheeruddin, S. and K. N. Nayar, 1962. A preliminary study of the juvenile fishes of the coastal waters off Madras city. *Indian J. fish.*, **8** : 169-188.

Chacko, P. I., 1950. Marine plankton from the waters around Krusadi Island. *Proc. Indian Acad. Sci.*, **31B** : 162-174.

Cunningham, J. T., 1891. On some larval stages of fishes. *J. mar. biol. Ass. U. K.*, **2** : 68-74.

Delsman, H. C., 1929. Fish eggs and larvae from the Java sea. 12. The genus *Engraulis*. *Treubia*, **11** : 275-281.

Delsman H. C., 1931. Fish eggs and larvae from the Java sea. 19. The genur *Stolephorous*. *Treubia*, 13 : 217-243.

Fabre-Domergue and E. Bietric, 1897. La periode critique postlarvaire des poissons marins. *Bull. Mus. Nat. Hist. Nat. Paris*, **3** : 57-58.

Gopinath, D., 1946. Notes on the larval and post larval fishes found along the Trivandrum Coast. *Proc. natn. Inst. Sci. India*, **12** (1) : 7-21.

JOHN, M. A., 1951. Pelagic eggs and larvae of the Madras Coast. *J. Zool. Soc. India*, **3** : 38-66.

NAIR, R. V., 1952. Studies on some fish eggs and larvae of Madras plankton. *Proc. Indian Acad Sci.* **35** B : 181-208.

PANIKKAR, N. K. and R. G. AIYAR, 1937. The brackish water fish fauna of Madras. *Proc. Indian Acad. Sci.*, **6** : 284-337.

RAO, N. G. S., 1964. On the distribution of larvae, post-larvae and juveniles of fishes in the Mahanadi estuary. *India J. Fish.*, **11** (1) : 407-422.

THANGARAJA, M,, 1982. Studies on development, distribution and abundance of fish eggs and larvae in the Vellar estuary, Porto Novo (South India). *Ph.D thesis. Annamalai University*, 265 pp.

THANGARAJA, M. and V. RAMAIYAN, 1983-84. Notes on the gill raker serrae and food of *Thryssa* and *Thrissina* of Porto Novo (Bay of Bengal) *Matsya* 9-10 : 73-77.

VIJAYARAGHAVAN P., 1957. Studies on the fish eggs and larvae of Madras coast. *Ph. D thesis, University of Madras* 79 pp.

WHITEHEAD, P. J. P., 1972. A synopsis of the clupeoid fishes of India. *J. mar. biol. Ass. India,* **14** (1) : 160-256.

Rec. zool. Surv. India, 85(3) : 381-389, 1988

POPULATION FLUCTUATIONS OF THREE FAMILIES OF AQUATIC HETEROPTERA IN A PERENNIAL POND.

By

G. THIRUMALAI and M. B. RAGHUNATHAN*

Zoological Survey of India, Madras

INTRODUCTION

Notwithstanding the abundance of aquatic heteropterans in lentic habitats, not much information is available on their seasonal fluctuations. Available information relating to the fluctuation in natural population with particular reference to the aquatic bugs (Tonapi, 1959 ; Rao, 1976 ; Julka, 1977 ; Ahmad & Ahmad, 1983) appear to indicate that when biotic factors are not operating, abiotic factors such as temperature, rainfall or alkalinity could exert an influence over the population of aquatic bugs. On the contrary, biotic factors like migration, vegetation and organic matter in the water have also been observed to play an important role in the bionomics of many species especially among notonectids and corixids (Hutchinson, 1933 ; Maccan, 1976 ; Fernando, 1961). The observations include the population fluctuations of Gerridae, Notonectidae and Corixidae and their seasonal variations particularly among the population of notonectids along with the periodicity and abundance of gerrids and corixids also inhabiting along with the notonectids. This study was undertaken in Kovur Pond.

TOPOGRAPHY OF KOVUR POND

Kovur pond is rectangular, situated about 25 Kms. west of Madras city, with an area of 0.5 hectares and an average depth of 0.6 metres. It has only one inlet on the northern

* Western Ghat Regional Station, Zoological Survey of India, Calicut.

side and no outlet. It mainly depends on rain water besides the inlet from Chambarambakkam tank, which is 30 Kms. west of Madras city. During the period of investigation the following macrophytes namely *Pistia* sp. and *Neptunia* sp. were noted near the margins. No regular fishing is carried out in this pond and the occasional fishing by hook and line reveals the following species namely *Puntius sarana*, *P. dorsalis* and *Channa* sp.

Material and Methods

The aquatic bugs were collected bimonthly for a period of 13 months from May, 1981 to May, 1982 at different stations by filtering a sample of forty litres of water, with the help of a pond net. The stations were established in transects so as to constitute a sample, covering the entire pond. Five replicates of samples were made during each collection and number of insects were calculated per litre. The relative frequency indices of occurrence of all the species were determined basing the formula followed by Julka (1969). To confirm whether the fluctuations are random or not on the population, non-parametric statistical tests namely 'runs' technique and 'The Kruskal Wallis test' were also applied (Schefler, 1980).

Surface water samples collected from different stations were analysed for dissolved oxygen and p^H. Dissolved oxygen was estimated by Winkler's method with azide modification. The p^H was measured in the field by using wide and narrow range 'BDH' p^H papers. The values were again corroborated in the laboratory by using a philips p^H meter. The transparency values were noted by using a Secchi disc. Other parameters like depth, air temperature, and weather conditions were also noted.

For productivity studies initial dissolved oxygen values were noted first. Then light and dark bottles were incubated just below the water level and the quantum of respiration, net production and gross production were estimated.

RESULTS

Temperature : The water surface temperature tends to increase gradually from March, the maximum being reached during May. During the present study, the surface temperature ranged from 23.5°C to 31.5°C, The Figure 1 indicates that the population of aquatic bugs were sufficiently high during the summer months when the maximum temperature is 33.0°C and as well as during the winter months (Temperature 22.5°C), thereby indicating that the temperature range did not appear to determine the population density of aquatic bugs.

p^H : During the present study, p^H of the water varied

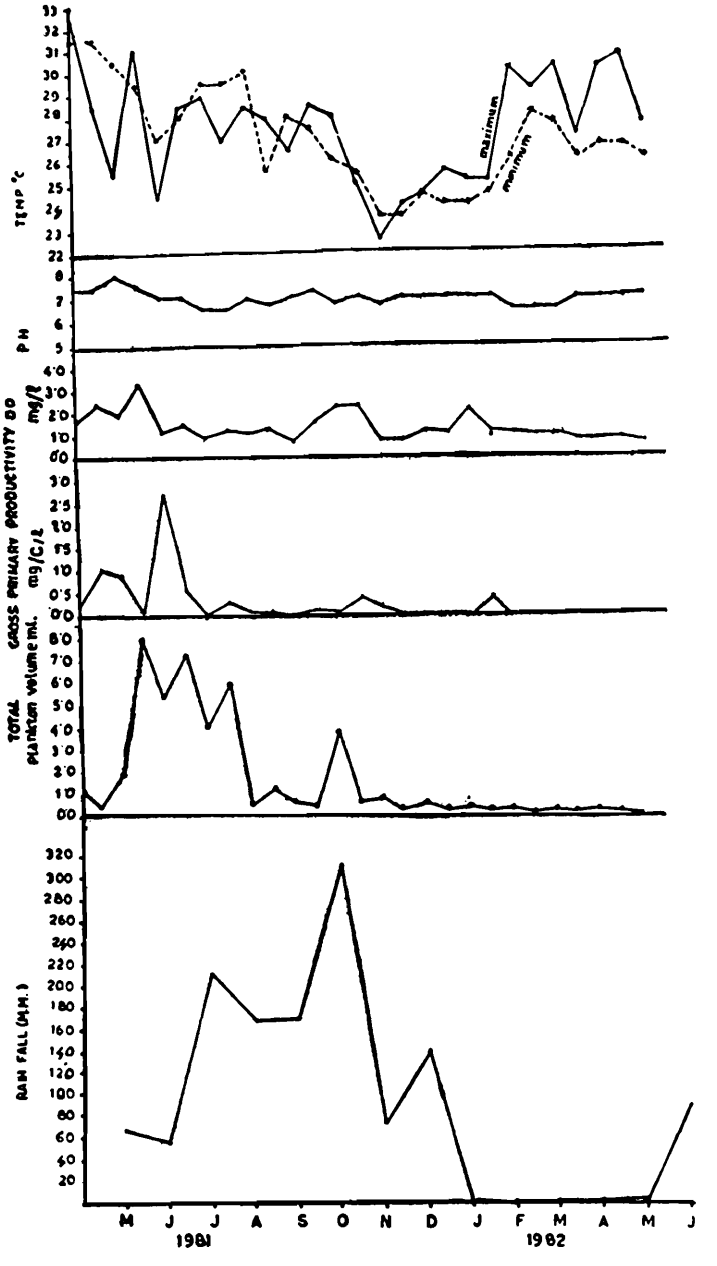


Fig. 1. Graph showing physico chemical parameters along with total planktonic volume and gross primary propuctivity.

from 6.5 to 8.0 and this range did not seem to appear to affect the density of the population.

Dissolvod Oxygen : The D. O. concentration during the study period ranged from 0.76 to 2.4mg/lit. The figures 1 & 3 show that when the D. O. is at its maximum, the population of bugs is high. However, the population is not reduced to lowest levels with minimum D. O., indicating no direct correlation between these two.

Rainfall : The rainfall is observed to be maximum during the month of October (312.0 mm) and the minimum is recorded during June (55.2 mm). There is no rainfall during the months of February and March. The presented graphs 1 & 3 clearly indicate the rainfall has no significane on the fluctuation of aquatic bugs.

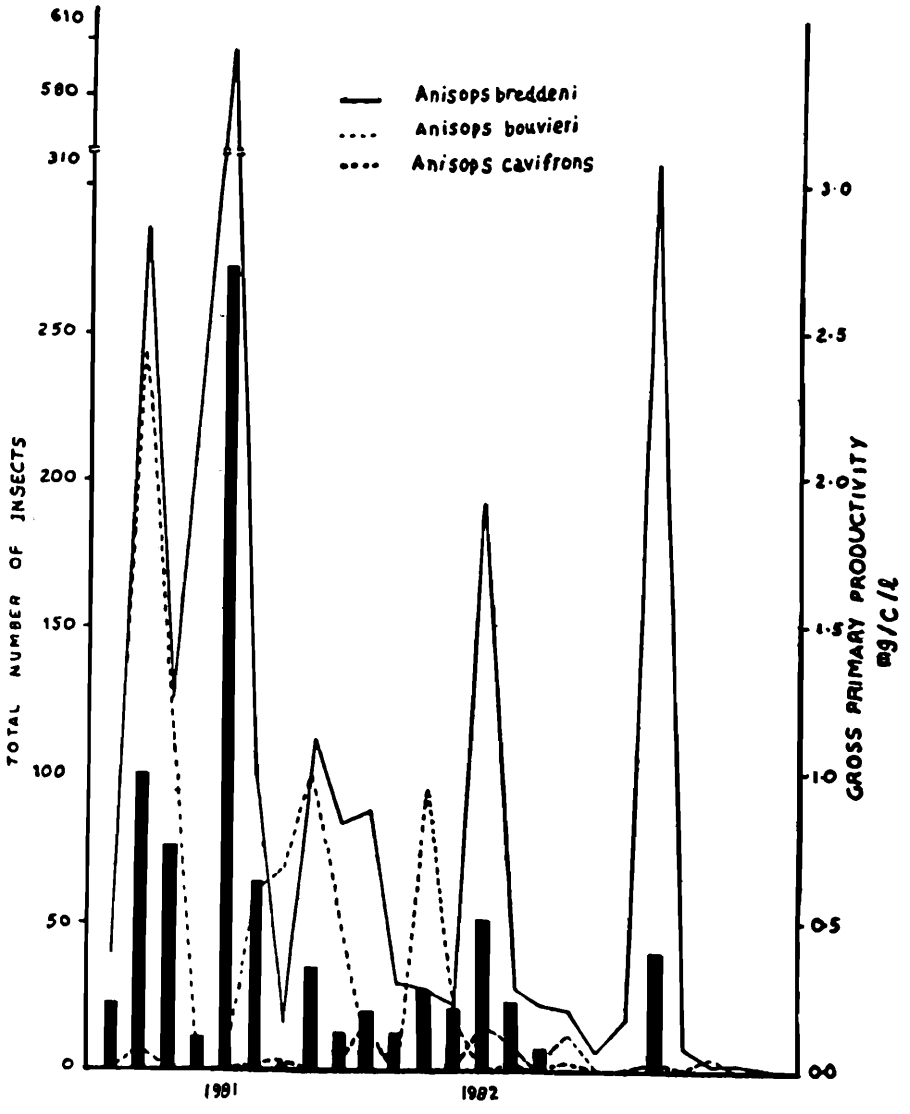


Fig. 2. Graph showing effect of gross primary productivity on the population of *Anisops* spp.

Gross Primary Productivity : The gross primary productivity during the study period ranged from 0.013 to 2.715 mg/c/l. During January, February, April and May the gross production was nil due to a thick carpet of macrophytic vegetation over the water. The insect during these months was also correspondingly very low.

Total Plankton volume : The plankton volume fluctuated between 0.2 ml to 8.0 ml with maximum in July and minimum in April and May. During July and August, the planktonic volume was more due to increase in numbers of

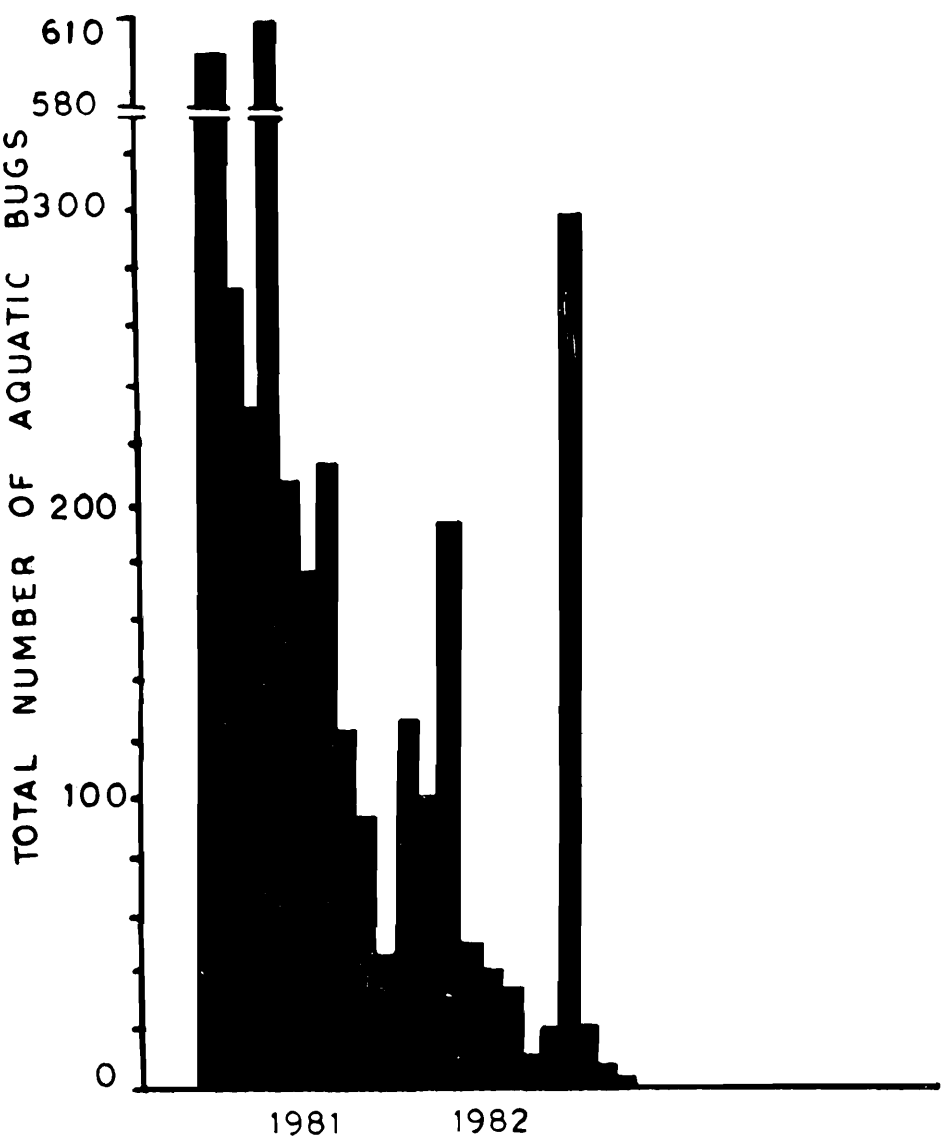


Fig. 3. Bar chart showing the total number of Aquatic bugs during the study period.

two cladocerans namely, *Moina micrura* and *Ceriodaphiania laticaudata*. During November also there was an increase in the volume of plankton due to increase of *C. laticaudata*.

Aquatic Heteropteran Fauna : *Micronecta* (Family : Corixidae), *Gerris*, *Limnogonus* (Family : Gerridae) and *Anisops* (Family : Notonectidae) were the four genera of aquatic bugs found in the samples. The genus *Micronecta* was represented by *M. scutellaris* (Stål) and *M. quadristrigata* Breddin, while three species of *Anisops*, viz., *A. bouvieri* Kirkaldy, *A. breddini* Kirkaldy and *A. cavifrons* Brooks were present. Gerridae was represented by *G. spinolae* Leth. & Serv., and *L. fossarum* (Stål). In view of its occurrence almost throughout the study period, *A. breddini* is the 'Primary Species' among the aquatic bugs collected while *A. bouvieri*, is the 'Secondary Species' and *M. scutellaris*, the 'Tertiary Species' on the basis of their relative abundance. Relative frequency indices show that *A. breddini* (0.958), *A. bouvieri* (0.542) and *M. scutellaris* (0.375) may be considered as fairly well represented forms constituting substantially to the Heteropteran fauna of the of the pond. The rest of the species namely, *A. cavifrons* (0.292), *G. spinolae* (0.25), *L. fossarum* (0.25) and *M. quadristrigata* (0.18) are found to occur less frequently.

The maximum abundance of the primary species was noticed in July and the minimum in April corresponding to the maximum and minimum gross primary productivity of of the tank (2.715 mg/c/l and O restpectively) (Fig. 2). The associated secondary and tertiary species namely *A. bouvieri* and *M. scutellaris* also had their maximum abundance when the gross primary productivity values were at their optimum level. The higher incidence of notonectids during the month of July tends to suggest that their predominent occurrence, was directly related to the gross primary productivity of the tank. The non-parametric statistics tests also confirm that there are no random fluctuations among the notonectids during the study period, the existing fluctuations being related to external factor, the gross primary productivity of the tank in this study. By commutating the values the 'Kruskal-Wallis Test' also proved that significant difference exist among the seasonal population of notonectids, the significance being well beyond 0.005 level.

DISCUSSION

Studies and analysis of the samples establish the existence of seasonal fluctuations and periodicity among *A. breddeni* and *A. bouvieri.* The build up of peak population of *A. breddeni* during July, in particular, appears to be directly related to high gross primary productivity of the pond and the abundant supply of these will explain the build up. The presence of *A. breddeni* through out the study period and their presence even in the situations when the gross primary production of the tank was zero, marks it as the most successful inhabitant compared with other two dominant species. While studying the population of Nepidae, Rao (1976) has pointed out that abiotic factors such as rainfall, temperature together with abundance of food have an augumentative effect on their population.

Tonapi (1959) and Julka (1977) have observed that the governing factors among five families of aquatic bugs including notonectids are temperature and rainfall. During the present study, however, these factors appear to play a less significant role in the annual rhythm of the notonectids population. It may be that rainfall and temperature could together control the population only when density-dependent factors are not operating as has been established in some terrestrial insects (Andrewartha & Birch, 1954 ; Anantha-krishnan & Thirumalai, 1978).

Though Devic (1954) considers p^H as the most important chemical factor affecting the abundance of living organisms in water, the present study does not seem to support it. Alkalinity of the water beyond p^H 8.5 proved to be unsuitable to the corixid, *M. scutellaris* (Ahmad & Ahmad 1983). This is perhape due to the respiratory distress among the population of the aquatic animals caused by higher level in p^H (Thornton and Wilhm, 1974).

Dissolved oxygen apparently has no effect on the population during this study. Popham and Lansbury (1960) have indicated that the deficiency in oxygen is a strong stimulus

for migration of corixids. The capacity of aquatic bugs to migrate appears to be yet another important factor causing fluctuation in their population (Hutchinson, 1933 ; Fernando, 1961 ; Julka, 1977). The sudden decline of *A. breddeni* during August appears to suggest that emigration caused due to over crowding. Such a trend was observed by Julka (1977) while studying the notonectids population in a perennial rainfed tank in Barrackpore. The present study clearly indicates that *A. breddeni* and *A. bouvieri* show a regular annual rhythm while the other species studied including corixids and gerrids exhibit a random fluctuation due to emigration.

Summary

Data collected over a period of thirteen months indicate certain seasonal fluctuations on three families of aquatic bugs viz., Gerridae, Notonectidae and Corixidae from a perennial pond. High incidence of notonectids is correlated with the high gross productivity of the tank. The abiotic factors play a secondary role.

Acknowledgements

We are grateful to Dr. B. K. Tikader, Director, Zoological Survey of India, Calcutta and Dr. R. S. Pillai, Deputy Director, Southern Regional Station, Zoological Survey of India, Madras for the facilities provided. The help of Shri G. Sankaran, photographer, Southern Regional Station, Zoological Survey of India, Madras is also acknowledged.

References

Ahmad, M. & Ahmad, S. 1983. Field observation on the occurrence of *Micronecta scutellaris* Stål (Hemiptera : Corixidae). *J. Bombay nat. Hist. Soc.*, **80** (1) : 236-239.

Ananthakrishnan, T. N. & Thirumalai, G. 1978. Population fluctuations of three species of Anthophilous Thysanoptera with notes on the biology of the seed feeding species *Chirothrips mexicanus* Crawford. *Bull. zool. Surv. India.*, **1** (2) : 197-201.

ANDREWARTHA, G. G. & Birch, L. C. 1954. *The distribution and abundance of animals.* University of Chicago Press, 782 pp.

DEVIC, C. C. 1954. A preliminary study of the plankton of the Cleveland Harbor area, Ohio, II. The distribution and quantity of the phytoplankton. *Ecol. Monogr.*, **24** : 321-347.

FERNANDO, C. H. 1961. Colonization of freshwater habitats with special reference to aquatic insects. *Rec. Cent. Bicent. Congr. Singapore* : 182-186.

HUTCHINSON, G. E. 1933. The Zoo-geography of the African aquatic Hemiptera in relation to past climatic change. *Int. Revue. Ges. Hydrobiol. Hydrogr.* **28** : 436-468.

JULKA, J. M. 1969. Aquatic Bugs of a Fish Pond. *The Entomologist's Record*, **81** : 174-176.

JULKA, J. M. 1977. On possible seasonal fluctuations in the population of aquatic bugs in a fish pond. *Oriental Insects*, **11** (1) : 139-149.

MACCAN, T. T. 1976. A twenty one year study of the water bugs in a moorland fish pond. *J. Anim. Ecol.*, **45** (3) : 913-922.

POPHAM, E. and LANSBURY, I. 1960. The uses and limitation of light traps in the study of the ecology of Corixidae. *Entomologist*, **93** : 162-169.

RAO, T. K. R. 1976. Bioecological studies on some aquatic Hemiptera, Nepidae. *Entomon*, **1** (2) : 123-132.

SCHEFLER, W. C. 1980. *Statistics for the biological Scicnces* Addison Wesley publishing company, Philippines. II edition pp. 211-227.

THORNTON, K. & Wilhm, J. 1974. The effect of p^H, phenol and sodium chloride on survival and caloric, lipid of nitrogen content of a laboratory population of *Chironomus attenuatus* (Walk.). *Hydrobiologia*, **45** (2) : 261-280.

TONAPI, G. T. 1959. Studies on the aquatic insect fauna of Poona (Aquatic Heteroptera). *Proc. natn. Inst. Sci. India*, **25** : 321-332.

Rec. zool. Surv. India, **85**(3) : 391-402, 1988

A NEW SPECIES OF RAT-TAILED BATS (CHIROPTERA : RHINOPOMALIDAE) FROM IRAQ

By

H. KHAJURIA

*Iraq Natural History Museum, Baghdad.**

INTRODUCTION

The monotypic family Rhinopomatidae including the genus *Rhinopoma* contains only three species : *R. hardwickei* Gray, *R. microphyllum* Brünnich and *R. muscatellu*m Thomas. The last species was given full specific status recently (De Blasse et el, 1973). The genus is confined to Africa and south Asia. The species are easily separable. Corbet 1978, p. 39 ; Hill, 1977 and Harrison, 1964, PP. 53 & 58, have discussed their characters in detail. In Iraq, the genus appears to be curiously confined to some caves in small area of Western Iraqi desert particularly around the town of Haditha on the western bank of the Euphrates river. In the end of September, 1980, *R. hardwickei* and *R. microphyllum* were found inhabiting a small artificial cave but in the end of May, 1981 and subsequently the species under report was also detected in the same roost and in another cavern (a sinkhole), which was, however, not inhabited by the other two species of the genus referred to above. The species is named after the town of Haditha around which it is found.

I am much indebted to Dr. Munir K. Bunni, Director, Iraq Natural History Museum, Baghdad for provision of facilities and encouragement during the study and to Dr. H. J. Sakini for help in the collection of specimens. Sincere thanks are also due to the Officer-in-Charge mammal section,

* *Present address* : Zoological Survey of India, (HAZFS) Rajgarh Road, Solan, H. P., India.

Zoological Survey of India, Calcutta for confirmation of the identity of the species,

Description : *Rhinopoma hadithaensis*, new species.

Holotype : Iraq Natural History Museum No. 83-566-Z8 Ad. male, Al-Fassayah cavern (a sink hole) about twenty km. from Haditha town on the left side of Haditha-Romadi Road 24th May to 2nd June, 1981, H. Khajuria Collector, Preserved in formalin and deposited in Iraq Natural History Museum, Baghdad.

Paratypes : ♂, 14 ; ♀ (pregnant/lactating), 12 : Al-Fassayah cavern (sink hole) about 20 km. from Haditha town on the left side of Haditha-Ramadi Road and an artificial cave in a hillock inside Haditha town, May-June, July, September, October, 1980-82, H. Khajuria Collector, collected with the help of INHM party.

Distribution : So far known from some caves around Haditha town, Romadi Governorate, Iraq.

Diagnosis : The new species can easily be distinguished from other three species by the following characters :

(i) Unforked and broader and longer posterior end of the baculum ; (ii) peculiarities of the male external genitalia with the anterior end of the penis converted into a sort of grasping organ ; (iii) distinctly large size of at least the adult males as compared with the subspecies of the most nearly related species, *R. hardwickei* found in the area (iv) generally paler colouration particularly on the ventral side ; and (v) enlarged triangular/quadrangular nasal inflations. From *R. microphyllum* it is further distinguished by its proportionately longer tail. A detailed description of the above characters is given below.

Description and comparison :*

Baculum : The baculum in four adults males examined is very peculiar. The posterior end is not forked as in *R. hardwickei* and *R. microphyllum* (Sinha, 1972, Khajuria, 1979)

* Illustrations of external genitalia are in Baghdad Museum and could not be obtained because of war but may be published later.

but shows a roundish or squarish single plate the dorsal surface of which is smooth but the ventral surface is uneven showing minute depressions. The anterior end of the baculun projects forward as a small process from the dorsal surface of the glans. The baculum and the external male genitalia of *R. murcatellum* do not appear to have been studied ; but the new species can be distinguished from this species by a number of other characters, which are more or less the same which distinguish *R. hardwickei* from *R. muscatcllum.*

External male genitalia : A typical condition is represen ted by a freshly killed adult male collected on 12th July (non-breeding season). The penis in this specimen is clearly distinguishable into three portions. A posterior much thicker, muscular, and paler half is abruptly marked off from the anterior much thinner half which is longitudinally striated, warty and blackish dorsally and is curved upward and then posteriorly. The posterior thicker portion is further longitudinally divided into a dorsal, transeversely ringed, vascular (reddish) and cyclindrical portion ending abruptly anteriorly in a circular, irregularly ridged truncated end and ventral thicker and whitish portion. The anterior ridged disc of dorsal cylindrical portion is in juxtaposition to the posterior curved tip of the penis forming a grasping structure somewhat comparable to the thumb and the index finger concavity of the human hand. It is possihle that this structure helps to grasp the posterior lip of the vulvar opening to facilitate copulation possibly because of the resting position of the female in which this opening is not well exposed. It may be noted that other three species of the genus also show a slight upward curvature of the tips of the penis but without any division of the organ into the parts described above except a few breeding specimens from India belonging to *R. hardwickei* but with very different type of baculum. In other two freshly killed males (which, I suspect to be yearling because of somewhat simpler external male genitalia and tooth wear and their collection with two yearling females considered to be so because they were neither pregnant nor lactating during the parturition season and had unworn

dentition, the penis shows the following characters. In one of the specimens, the dorsal cylinderical portion is indicated by the presence of reddish longitudinal area ending anteriorly in a tuberculated circular area. In the other specimen only the anterior tuberculated area is present. In both the specimens, the characteristic abrupt division of the penis into anterior upturned much thinner and dorsally warty portion and posterior much thicker portion is, however, clear. In still younger freshly killed two males, (fore arm, 59 to 60 mm) collected on 25th and 26th October about 4 months after parturition and may be the young of the year, dorsal cylinder cannot be made out clearly but the anterior portion of the penis show charactristic structure. It may be remarked that the above two specimens were the only ones which could be seen in the end of October. The rest of the colony has disappeared. In twelve males collected in the end of May when the females were in early stages of pregnancy and preserved in formalin for more than a year, the anterior end of the dorsal cylinderical portion either shows the same position as described in a freshly killed male or it is upturned possibly because of distortion of the tissue. Some whitish substance has, in some specimens, been noticed on this portion indicating its possible glandular nature. In the preserved material, it is also difficult to locate clearly the transverse rings on the dorsal cylinder or to detect its reddish tinge. The glans appears to be more or less of the same shape as *R. hardwickei* (Khajuria, 1979) but the penis shaft is bent upward. The blackish area around the preputal opening and between it and the anterior end of the dorsal cylindrical portion are well covered with wart like growth but with very scanty hair.

Nasal inflations: The nasal inflations are enlarged vertically and laterally but not as far forward as in *R. muscatellum* or as far backward as in *R. microphyllum*. It does not appear to be on record that in *R. microphyllum* these inflations extend much more backward than in either species so as to enclose a concavity between them. In *R. hardwickei*, they have been described as 'globular' (Hill,

1977). In the species under report, they appear as triangular, laterally and vertically enlarged areas with generally roundish anterior base but in older specimens (as in the Holotype) the base is angular so that from the dorsal view, they appear quadrangular. However, some overlapping with *R. hardwickei* is expected size. The measurements of the new species are given in table. I. The forearm, at least in adult males, which on the average appear to be larger than the female, is distinctly larger than that of the subspecies of *R. hardwickei, R. h. cystops* Thomas (now considered as *arabicum* by Hill, 1977) found in the area. The detailed measurements of several specimens of *R. h. cystops* found in Arabian peninsula are given by Harrison (1964). The only male definitely referable to *R. hardwickei* in this collection is at least a year old collected in June just before parturition. The forearm in this specimen (collected from area around Haditha town) is 53 mm and the penis is without the characters shown by males, including the yearlings, of the new species. Two freshy killed yearlings of the new species have the forearm 63.0 mm. It may be mentioned that all specimens (all age groups) of the new species so far collected from the type locality where the species occurs alone (not in association with the other two species) have the forearm 60 mm and above, except one young, *c.* 4 months old where it 58 mm. The maximum measurements recorded by Harrison (1964) for *R. h. cystops* are forearm, 59 and 59.3 mm (only two specimens in a sample of 81) and it is also possible that these specimens may not belong to *R. h. cystops.*

It may not be possible to separate all the females of the new species form those of *R. hardwickei* by forearm length and some overlapping may occur as in several other species ; but the specimens with forearm 60 mm and above can safely be referred to the new species. The measurements given by Harrison (1964) and Hill (1977) of *R. hardwickei* from Arabian peninsula and Africa reveal an extraordinary variation in forearm length showing a difference of about 16 mm between minimum and maximum measurements, the maximum measurement approaching 63 mm. It is very

difficult to explain such a variation in the forearm lengths of small insectivorous bats which acquire more or less the adult size soon after they start flying, unless the sucklings, easily distinguishable by their milk dentition, are also included. The present report satisfactorily explains this paradox by showing that larger specimens may belong to the new species if it has a wider distribution outside Iraq. All the age groups, except sucklings, of the new species show normal variation as shown by the measurements given in this report. It is, therefore, suggested that collections showing abnormal variation should thoroughly be examined at least for their external genitalia and bacular characters to ascertain whether they contain more than one species. A more careful examination of the collection made in the end of September, 1980, by me suggests the possibility that it may contain a few individuals of the new species. This collection does not appear to contain any adult male. There is one lactating female with farcarm 60 mm which can be referred to this species. Some specimens are young and some of these may also belong to this species. The fact that *R. h. cystops* does occur in the area is supported by highly experienced mammalogist, like Sanborn, Hatt and Harrison (Vide Hatt, 1959) and by this collection which contain at least one yearling male (referrrd to above) and at least three adult (pregnant) females forearm 54 to 56.7 mm. It appears that because of significant changes made in the roost leading to better exit facilities, the new species and *R. microphyllum* have now become dominant species.

Pelage and colouration : In freshly sacrificed specimens collected on 10th July, the fur is fine, close, and reach 20 mm in length. On the dorsal surface., the general colour in all specimens is whitish and almost white on ventral aspects. There are only two exceptions in a sample of 26 specimens where the ventral aspects are dirty white. Dorsally the tip of the hair is light brown, the base being white. There is a peculiar distribution of yellow colour. It is found on the ears including the tragus, the tip of which is ridged and more yellow, the bases of wing membranes, lower eye lids, corners

of the mouth, the throat, and posterior parts of abdomen, where fat is stored.

Habitat : The bat has so far been found in a sink hole located in the desert about 2 km from the river, and in an artificial cave excavated in a hillock inside Haditha town. The sink hole (Type locality) where the species is not found in association with other two species of the genus, is located about 20 km on the left side of Haditha-Romadi Road. It has somewhat semicircular opening at the level of of the ground aud about 25 m in diameter sinking slantingly about 50 m deep narrowing at places and with boulders strewn all over the floor. There are numerous cavities where bats can hide. Some water is reported to be present at the extreme end in some seasons. The cave gives out a peculiar smell. The species in question has been found suspended from the roof of the cave near the entrance. The second roost, the artificial cave, is being used partly for the storage of house-hold goods and partly as shelter for domesticated animals such as cows. The maximum dimensions are about 100m × 80m with maximum height of about 4m but the new bat has generally been found to occupy a small cavity about 8m in height near the entrance. The narrower entrance is on the main road and is divided into two parts by a thick hollow rocky partition. The wall and ceiling show a number of narrow cavities in which bats can hide. According to a party of Geological Survey of Iraq, the roof and the walls of the cave consist mainly of water bearing stalictate and staligmite. From a portion of ceiling, water drips and salts form small cones measuring upto about 15 cm in length. The bat usually occupies the hollow portion of the rocky partition of the entrance partly hidden from the view. The area to the east and the west of the cave present strikingly contrasting ecological conditions. On the east is the Euphrates with its fertile alluvial banks under perenial irrigation mainly growing date palms, plums, citrus and vegetables. On the west is the desert mainly containing Far series, Euphrates limestone and shelly dolomite with typical desert vegetation.

Breeding habits : Females collected on 30th May and 1st

June carried embryos with the maximum diameter of about 9 mm but very small embryos hardly visible to the naked eye were also found in some specimens indicating that conception period is spread over some weaks, possibly from the end of April to beginning of May. I, (Khajuria, 1972), observed mating in the allied species. *R. hardwickei* in February in central India. On 10th July, out of nine specimens collected, one was adult ♂, 2 yearling ♀, 2 lactating, 2 pregnant (foetus forearm 14.5-15 mm long) and two ♀ (not pregnant). This shows that it probably takes about 2 years to reach maturity. The parturition appears to be spread over a couple of weeks from the end of June to the middle of July.

Miscellaneous habits : The flight is fairly fast and fluttering at the level of, about tree tops. The bats start leaving the roost separately and fly towards the river. The bat has been observed to rest usually with its head and neck raised in line with its slanting back, while in *R. microphyllum* found in the same roost, the back is not usually slanting. Once on 6th July, the bats flew over the intruder and urinated. Sound resembles, *krin krin* but some low sounds were also heard when the bats were approaching mist net. The time of emergence on 10th July was 8.15 p.m. and that of return to the roost in the morning about 5.45 p.m. The bat returns to the roost singly. It could not be seen in the middle of February, air temperature at the roost entrance at 2. p.m. was 20-21.5°C and inside the roost 12°C to 19°C. In the end of October only two young were seen. In the type locality which is in the desert, it is very shy, immediately flying away with its usual sounds on the appearance of the intruder.

Fat deposits are present in the area of external genitalia in autumn and this probably makes the mating in this season, the usual mating season of bats in the area, difficult. Other mammal associates (collected) of this bat are *Hemiechinus auritus calligoni* Satunin, *R. m. microphyllum*, *R. hardwickei cystops*, *Asellia trideda murraiana* J. Anderson, *Myotis capaceini bureschi* Heinrich, *Miniopterus schreibersi pallidus* Thomas, *Pipistrellus kuhli ikhwanius* Cheesman and Hinton and *Eptesicus*

bottae Perers. *Canis aures* Linn. was seen and some domesticated animals also frequent the roost which is inside the town. Domesticated cats have been observed feeding on fallen young of some bats.

DISCUSSION

The monotypic family Rhinopomatidae recently reviewed by Hill (1977) does not show any fossil history at present. Some fossil bats do show long free tail and absence of bony calcar, important characrers of the family. The two species, *R. hardwickei* and *R. microphyllum* are the most widely distributed and have more or less the same distribution- They also occur sometime in the same cavities, but appear to remain somewhat separate as far as observed. The other two species, *R. muscatellum* and the new species appear to be the specialized representatives of *R. hardwickei* group as they show several important characters in common such as proportions of tail and forearm, vertical enlargement of nasal swellings with reduced posterior extensions, size, week cranial ridges, etc. The new species shows specialized male external genitalia and beculum, possibly an adaptation to the resting position of the female during copulation where the vulvar orifice is not well exposed.

It is interesting to note that there is a good possibility that all the four species of the genus *Rhinopoma* may be found in the same roost and that originally they were all considered as only one species, *R. microphyllum*. Later *R. hardwickei* was separated but again synonimized with *R. microphyllum* hy some workers. *R. muscatellum*, usually considered as subspecies of *R. hardwickei*, received full specific rank only recently (De Blasse *et al*, 1973). The new species appears to be also confused with *R. hardwickei* at least in some cases. This emphasizes the necessity of very careful examination of all specimens of bats found in large colonies as closely allied species may occur together because of shortage of specialized roosts as has been found in some other cases also.

TABLE—I

Measurement of R. hadithaensis, sp. nov.

Note : The abbreviations used in measurements are the same as used by Harrison (1964),

BODY

FA	T	HF	E	
		HOLOTYPE		
64.4	71.3	15.1	22.0	

The specimen is larger than others but the only one with good skull

PARATYPES

Males (adults and yearlings).

60.2	79.0	12.0	—	
62.1	71.0	13.0	17.9	
62.6	69.0	11.6	—	
60.4	65	10.7	—	
61.4	71.3	11.5	16.5	
61.2	72.0	13.2	19.3	
61.1	74.0 (+)	12.7	.7	
60.5	71.0	12.2	16.6	
62.5	74.0	12.9	18.2	
60.5	67.0	16.6	17.7	
60.2	68.0	12.0+	16.6	
62.0	71.0	14.0	21	(freshly killed)
63.0	65.0	13 0	20	—do—
60.7	67.0	13.5	21.5	—do—
60.0	65.0	12.1	16.0	
62.0	67.0	12.5	19.0	
60.0	61.0	11.9	18.0	

Note : There are 8 lactating females collected in September, with FA 60.2-62

Skull

GTL	CBL	ZB	BB	IC	CM^3	$C\text{-}M_3$	M
			HOLOTYPE				
19.2	—	12.0	10.2	4.2	8.2	8.5	14.2

PARATYPES

♂

17.7	17.1	10.5	8.6	2.2	6.1	6.7	12.
18.4	17.0		8.1	1.9	6.2	6.2	13.0
17.1	46.5	10.8	7.7	8.4	6.2	6.7	12.
17.8	—	10.2	8.2	2.4	6.0	6,8	11
18.3	17.2	10.9	8.3	2.4	6.1	6.0	12.0
17.9	17.5(—)	11.1	7.7	2.3	6.5	6.8	12.0
17.8	16.6	—	8.2	2.8	6.2	6.5	12.0
17.9	16.4	11.1	8.2	2.7(—)	6.2	6.1	12
17.7	16.7	10.3	7.9	2.1	5.4		
17.5	16.5	10.4	8.0	2.0	6.1	6.4	11.9

♀

17.2	15.8	10.2	7.9	2.4	5.9	6.5	11
17.2	15.8	—	7.7	2.2	5.8	6 1	11
17.1(+)	16.6(—)	10.5	8.0	2.5	5.9	6.6	12
16.5	16.5	9.8	7.6	1.9	6.0	6.6	11
17.2	16.3	10.7	7.8	1.8	6.0	6.4	11.5
17.0	15.7	10.0	7.8	1.8	5.8	6.0	11.5
18.1	16.6	11.3	8.2	2.5	6.2	6.6	12.7

SUMMARY

A new species of rat-tailed bats, *Rhinopoma hadithaensis* is described from the Iraqi western desert. It is, easily distinguished from the other three species of the genus by the characters of the baculum, external male genetalia, size, colouration and to some extent by the form of nasal inflations.

REFERENCES

CORBET, G. B. 1979. The mammals of the Palaeartic region : a taxonomic review. 314 pp. *Brit. Mus. Nat. Hist.* London Ithaca : Cornell University Press.

DE BLASSE, F. SCHLITTER, D. and NEUHAUSER, H. 1973. Taxonomic status of *Rhinopoma muscatellum* from South West Asia. J. Mamm., 54 : 831-841.

HARRISON, D. L. 1964. The mammals of Arabia. Vol. 1, xx+192 pp., 1 map. London : Ernest Benn Limited.

HILL, J. E. 1977. A review of Rhinopomatidae (Mammalia : Chiroptera) *Bull. Brit. Mus. Nat. Hist.* (*Zool.*), 32(2) : 29-43.

KHAJURIA, H. 1972. Courtship and mating in *Rhinopoma hardwickei* Gray (Chiroptera : Rhinopomatidae) Mammalia, 36 : 307-309.

KHAJURIA, H. 1979. Taxonomical and ecological studies on bats of Jabalpur Dist., M. P., India, Part I. Families Pteropidae, Rhinopomatidae and Emballonuridae. *Rec. Zool. Surv. India* : *Occ. Paper* No. 13., 59 pp., 7pls. 74 figs.

SINHA, Y. P. 1976. Bacula of Rajasthan bats. Mammalia : 40 (1) : 97-103.

SINHA, Y. P. 1981. Studies on bats of Gujarat. *Rec. Zool. Surv. India*, 78 : 101-112.

Rec. zool. Surv. India, **85**(3) : 403-404, 1988

FIRST RECORD OF *GOLUNDA ELLIOTI GUJERATI* THOMAS (RODENTIA : MURIDAE : MURINAE) FROM MAHARASHTRA, INDIA

By

M. S. PRADHAN

Zoological Survey of India, WRS, Shivajinagar, Pune—411016, India

While conducting general faunistic survey in Thane Dist. of Maharashtra State, an interesting rodent species was collected and identified as *Golunda ellioti gujerati* Thomas which turned out to be hitherto unreported from the state. Thus, this communication is intended to report the extended distribution of this taxon in this state.

The specimens were collected from the Forest Development Corporation of Maharastra's Nursery at Kasa. Kasa is situated in the northern part of Western Ghat from where the Gujrat border is about fifty kilometers away. The plant Nursery has an area of about thirty five hectures where mostly the teak, subabul and *Acacia* spp. are being raised. It is surrounded by the paddy fields from almost all the sides. The Nursery authorities have informed that this rodent species has almost invaded the region since last so many years as a menancing pest, causing a serious damage to the young sapplings of teak and other plant species. The literature reveals that *Golunda ellioti* is being represented in Maharashtra by the subspecies, *G. e. ellioti* Gray. *G. e. gujerati* Thomas has been reported from Saurashtra and above (*cf.* Lunva, Palanpur, Mt. Abu) (Ellerman, 1961). Agrawal and Chakraborty (1982) recently reported the retention of *G. e. gujerati* Thomas as a separate subspecies on the basis of ventral coloration and longish tail. The details of the specimens are given below. All measurements (in mm.) were taken in the field.

Material : 1 adult ♂, Z.S.I., Regd. No. v/256, in alcohol and 1 adult ♀, Z.S.I., Regd. No. V/457, Rolled specimen.

Locality : F.D.C.M., Nursery Kasa, Dist. Thane, Maharahtra State. Date : 9 March 1984. Collector : Dr. M.S. Pradhan ; collection deposited in the National Zoological Collection of India, Z.S.I., W.R.S., Pune. Measurements : External : ♂ : HB :—135 ; Tl :—Cut ; HF :—29 ; E :—18. ♀ : HB : —122 ; Tl :—105 ; HF :—26 : E :—16. Cranial : ♀ : on : —30.46 ; cb :—28.06 ; n :—9.7 ; pl :—15.32 ; bul : 5.52 : mtr : 6.08 ; apf :—4.86 ; dst :—8.04 ; mdbl :—16.62. ♂ skulll damaged.

Remarks : The dorsal colour of the specimens is blackish brown while the ventral side is much lighter (Yellowish white). The tail is distinctly bicolored. The ventral coloration of the specimens distinctly put them in *G. ellioti gujerati* Thomas. The blood samples of these specimens were collected for haemoglobin studies on PAGE. The studies have revealed that the haemoglobin of *G. ellioti gujerati* Thomas specimens shows similarity in the electrophoretic mobilities with those of *Mus* species. However, confirmation will require collection of more specimens of *G. ellioti gujerati* Thomas. The results are being complied and will be reported separately.

My thanks are due to the Director, Zoological Survey of India, Calcutta,for providing the necessary facilities and also to Dr. V. C. Agrawal, Zoological Survey of India, Calcutta, for going through the article critically.

References

Ellerman, J. R. and Morrison-Scott, T. C. S., 1951. Checklist of Palaearctic and Indian Mammals 1758 to 1946. British Museum (Natural History), London.

Ellermal, J. R. 1961. Fauna of India, Mammalia, Vol. III. Rodentia Part 2. 2nd Ed. Manager of Publ. Delhi.

Agrawal, V. C. and Chakraborty, S. 1982. Intraspecific geographical variations in the Indian Bush Rat. *Gollunda ellioti* J. E. Gray (Rodentia : Muridae). *Rec. zool. Surv. India*, 79 : 521-533.

Rec. zool. Surv. India, 85(3) : 405-409, 1988

FIRST REPORT ON THE LIZARDS OF DHARMAPURI DISTRICT, TAMIL NADU

By

T. S. N. MURTHY AND S. V. A. CHANDRASEKHAR

Southern Regional Station
Zoological Survey of India, Madras

INTRODUCTION

In order to gain an insight into the faunal composition of Dharmapuri Distrtct, Tamil Nadu, the Southern Regional (S. R. S.) of the Zoological Survey of India has conducted a Mopping Survey of the plains and hills of the district during April, 1985. The present paper constitutes results of the studies so far completed on 34 lizards collected during the survey. Although some six species referable to two families viz., Agamidae and Lacertidae are reported, this paper assumes significance because it is the first authentic document on the herpetofauna of Dharmapuri District which has been imperfectly known zoologically and also because its lizard fauna could not be accorded special attention by Smith (1935). However, a definitive herpetology of the area should await further explorations which are contemplated.

GEOGRAPHY OF DHARMAPURI DISTRICT

The Dharmapuri District lies between 11°54′ and 12°27′N and 77°41′ and 78° 18·E. The Cauvery river bounds it on the west and is joined by the Sanatkumarnadi, which flows through the north-western portion of the district. Near the junction of these rivers are the the falls of Hogenekal or the 'smoking rock'.

Key to the identification of the lizards of Dharmapuri District, Tamil Nadu,

The six species of lizards under report can be identified by the following key—

1. Head covered with small scales ... 2
   Head covered with symmetrical shields ... 5

2.	Four toes only	...	*Sitana ponticeriana*
	Five toes	...	3
3.	Body depressed	...	4
	Body not depressed	...	*Calotes versicolor*
4.	Mid body scale-rows 115-150	...	*Psammophilus dorsalis*
	Mid body scale-rows 80-100	...	*P. blanfordanus*
5.	Lower eyelid distinct from the rudimentary upper eyelid	...	*Cabrita leschenaulti*
	Lower eyelid fused to the rudimentary upper eyelid	...	*Ophiosops jerdoni*

Species Accounts

Family : Agamidae

1. **Sitana ponticeriana** Cuviea
(Fan-threated lizard ; Four toed lizard)

Material : 1 example, Muniyamman bridge, 4.iv. 1985.

Description : Body compressed. No dorsal crest. Hind feet with four toes. No femoral or preanal pores. Males with gular pouch. Tail very long. Snout to vent length 40 mm, tail 90 mm,

Colour : Dark-brown dorsally with a vertical series of black-edged, rhomboidal spots on the back and whitish below.

Distribution : The whole of India and Sri Lanka.

2. **Calotes versicolor** (Daudin)
(Indian Garden Lizard)

Material : 9 examples : 4 exs. Kulumurupallam, 12.iv.85 ; 4 exs. Hogenakal near Cauvery, 16.iv,85 ; 1 ex. Anchetty, R. Todhella, 14.iv.85.

Description : Body compressed, dorsal scales strongly keeled and more or less larger than ventrals. Two spines separated from each other on ear. Dorsi-nuchal crest well developed extending far behind. Tail long and rounded. Snout to vent length and tail lengths of the largest specimen are 150 mm and 275 mm.

Colour : Juveniles with light dorsolateral stripes which

enclose transverse black spots. Adults greyish-brown above with dark transverse bars. Belly whitish, with dark streaks. Tail with dark brown crossbars. This lizard exhibits considerable colour variation.

Distribution : The commonest lizard of India, Pakistan and Sri Lanka. Also recorded from Sumatra, Hainan, Hongkog, Afghanistan, Indo-China, South China, northern Malay Peninsula.

3. **Psammophilus dorsalis** (Gray)
(South Indian Rock-lizard)

Material : 19 examples : 3 exs. Muniyamman bridge, 4.iv.85 ; 5 examples, Hogenakal, 15.iv.85 ; 8 exs. Hogenakal, 16.iv.85.

Description : Body depresed ; 120 scales round the body ; dorsal crest absent ; a deep fold on either side of the neck which unite across the throat. Tail long and slender. No pores. Snout to vent and tail lengths of the largest specimens are 85 mm and 220 mm.

Colour : Olive-brown above with a distinct series of white elongated spots on the back and yellowish below.

Distribution : Hills of South India.

4. **Psammophilus blanfordanus** (Stoliczka)
(Dwarf Rock-Lizard)

Material : 1 example Anchetty, River Todhella, 14.iv.85.

Description : As given for the preceding species but with reduced i.e. 95 scales round the body.

Colour : The only example collected appears to be a juvenile and it is olive brown above with a series of lozenge-shaped dark brown spots on the back.

Distribution : Bihar, Orissa, Madhya Pradesh, Eastern Ghats, and hills south of Madras and Salem District, Tamil Nadu.

Family : LACERTIDAE

5. **Cabrita leschenaulti** (Milne-Edwards)

Material : 2 examples, Hogenakal, 18.iv.85.

Description : Head covered with symmetrical shields ; dorsal scales keeled and imbricate while the ventrals are smooth and imbricate. Lower eyelid large and distinct from the upper eyelid. Tail cylindrical. Femoral pores present. Snout to vent and tail lengths of the largest specimen are 39 mm and 63 mm.

Colour : Dorsally this lacertid is brownish yellow and whitish ventrally. The dorsum is characterised by two white lateral bands, the interval betwwen the two bands being black or green.

Distribution : The Peninsula of India and Sri Lanka.

6. **Ophiosope jerdoni** Blyth

(Snake-eyed Lacerta)

Material : 2 examples, Hogenakal, 17.iv.85.

Description : Lower eyelid fused with the upper. A fold in front of the shoulder. Femoral pores present. Snout to vent and tail lengths of the largest specimen are 55 mm and 105 mm.

Distribution : From N. W. F. P. in Pakistan through most of Northern and Central India to Southern India. Smith (1935) includes "Bellary in Madras Presidency" in the range of this species. Underwood (1948) recorded this lacertid from Pune, Maharashtra and Sharma (1982) recorded it from Gujarat. The present specimen is an additional and interesting record from Dharmapuri District.

SUMMARY

A collection of lizards from the Dharmapuri District, Tamil Nadu is reported. The collections were made during April, 1985 and they include 4 species of agamids and two species of lacertids. In addition to the systematic remarks,

brief notes on the colouration and distribution of each species is given. A key to the identification of the material reported is provided.

ACKNOWLEDGEMENTS

The authors are thankful to Dr. R. S. Pillai, Scientist 'D' & Officer-in-Charge of the Southern Regional Station, Zoological Survey of India, for encouragement and the participant scientists of Southern Regional Station of the Dharmapuri District Mopping Survey for the material discussed.

REFERENCES

SHARMA, R. C. 1982. Taxonomic and ecological studies on the reptiles of Gujarat. *Rec. zool. Surv. India*, **80** : 85-106.

SMITH, M. A. 1935. *The fauna of British India including Ceylon and Burma. Reptilia and Amphibia, Vol. 2 Sauria.* London : Taylor and Francis. i-xiii+1-440 pp., figs. Pl. and a map.

UNDERWOOD, G. 1948. Notes on Poona reptiles. *J. Bombay nat. Hist. Soc.*, **47** (4) : 627-632.

Rec. zool. Surv. India, **85**(3) : 411-418, 1988

OBSERVATIONS ON THE MATING BEHAVIOUR OF *GRYLLODES SIGILLATUS* (WALKER) (INSECTA : ORTHOPTERA : GRYLLIDAE)

By

M. VASANTH

Southern Regional Station, Zoological Survey of India,
100 *Santhome High Road, Madras*-600028.

INTRODUCTION

A review of the literature reveals that description of the mating behaviour of *Gryllodes sigillatus* (Walker) is fragmentary. Alexander and Otte (1967) are of the opinion that mating in this species differs from that of the species of the genera *Gryllus* Linnaeus and *Acheta* Fabricius in only a couple of features. The present study includes descriptions of courtship, copulation and post-copulatory behaviour of *Gryllodes sigillatus* (Walker) based on observations made in the laboratory.

MATERIAL AND METHOD

Two sets of observations were made : the first on 2 females and 3 males collected from the kitchen of a house in Pune, Maharashtra, a male and female collected from under stones on the banks of the reservoir at Mulshi, about 40 Km from Pune, and a male and female collected from a crevice in rocks on the road to Sinhagad, about 26 Km from Pune, and the second on several males and females, some collected from a house in Madras, and others bred in the laboratory at Madras. All observations were made either in 1 litre glass jars, or in a glass cage measuring 60 cm × 30 cm. Pellets of wheat flour were supplied as food. A tube of water was also provided. In all, 31 copulations were observed with different combinations of males and females.

Figs.1—5. Photographs of courtship and copulation in *Gryllodes sigillatus* (Walker)

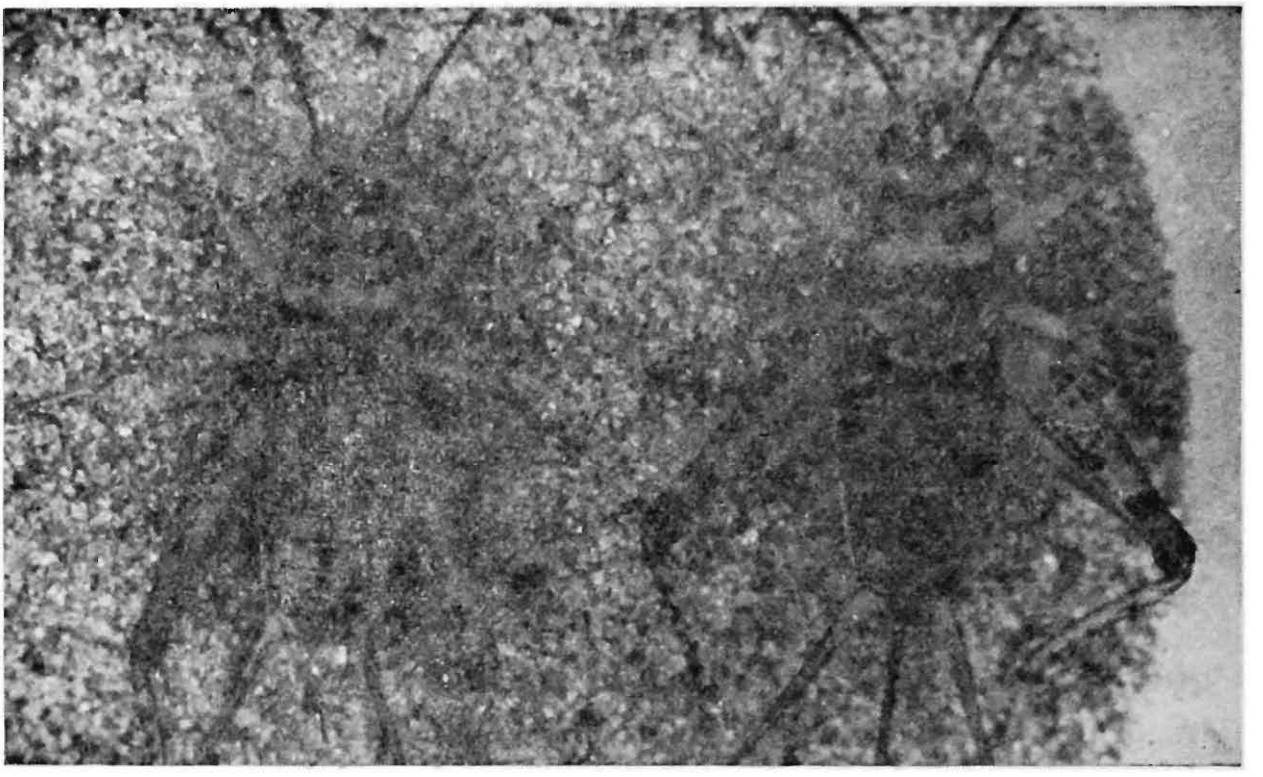


Fig. 1. Courting pair (male on left)

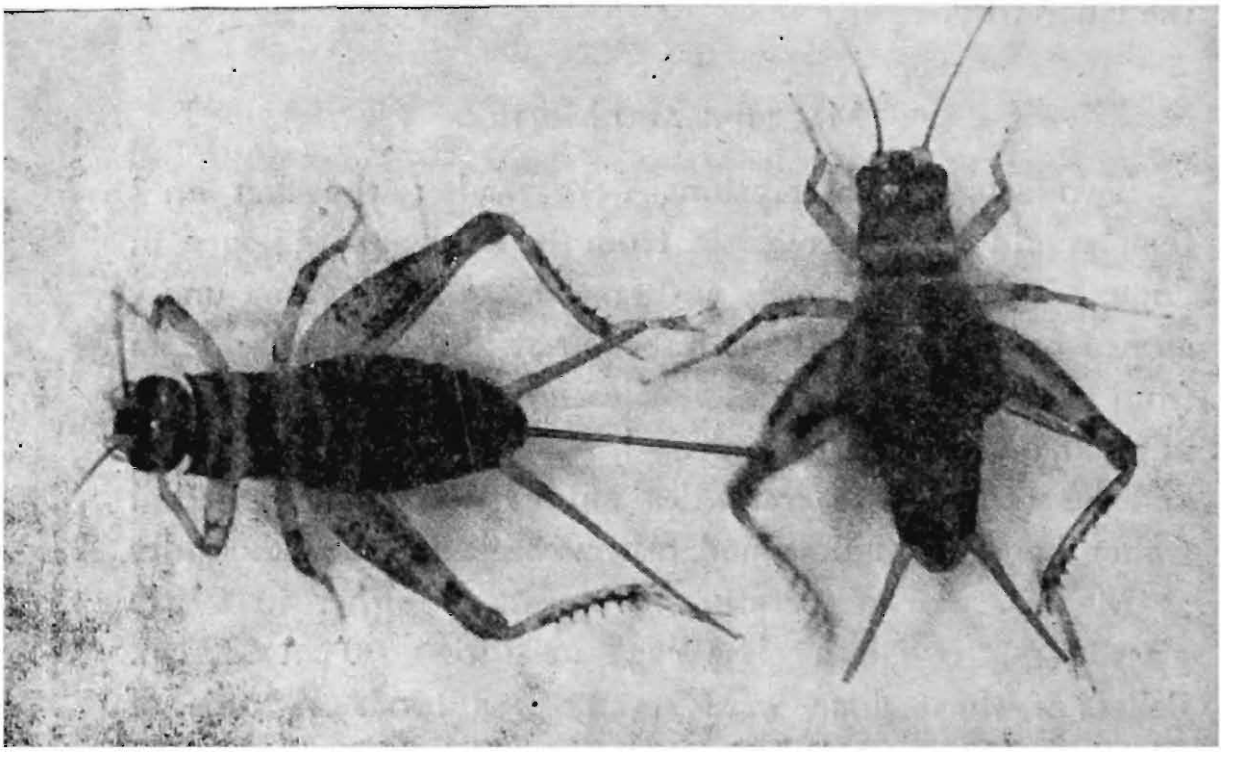


Fig. 2. Courtship, male (right) producing courtship sound

OBSERVATIONS

The basic features of pre-copulatory (courtship), copulatory and post-copulatory behaviour in *G. sigillatus* are as follows : The initial cantact between the two sexes is by the antennae ; in almost every instance observed, the male makes the first contact. He sweeps his antennae over the body of the female, generally from front to back, touching her head and antennae, pronotum, abdomen, posterior legs, cerci and ovipositor. This usually induces the female to turn her

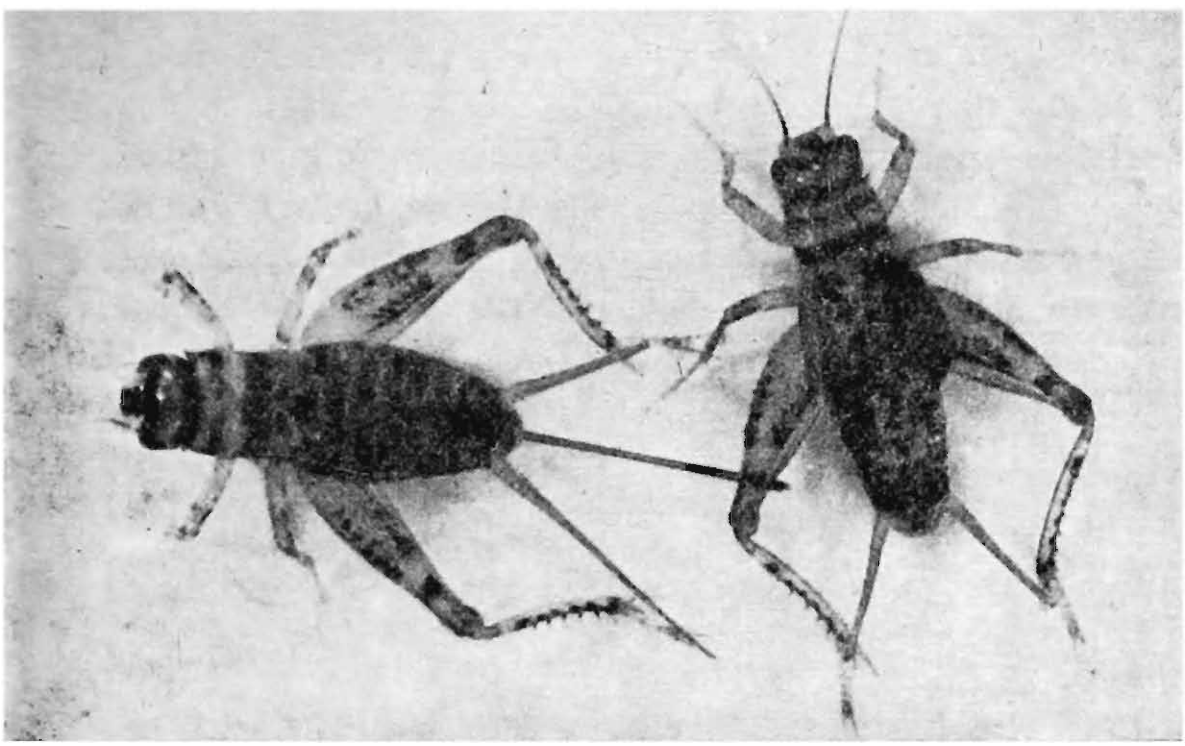


Fig. 3. Courtship, male (right) producing courtship sound

posterior end to the male, raise it and reach out with her posterior leg/legs and place it/them on him. But, sometimes, she moves away evincing no concern, in which case the male pursues her. When he nears her from behind, he antennates her ovipositor, cerci and posterior extremity. Soon, he moves over to her lateral side and starts producing a courtship song, which consists of a series of muffled pulses in very quick succession, interspersed with a frequent, irregular, loud 'tick'. During this song, the tegmina are held tilted roof-like above the abdomen, their bases overlapping

only a little. The song seems to be produced by only the internal portion of the stridulatory file. During the 'tick' the tegmina move a greater distance over each other. The commencement of the song is accompanied by the turning of the male so that his posterior end is usually directed toward the lateral aspect of the female. He begins backing

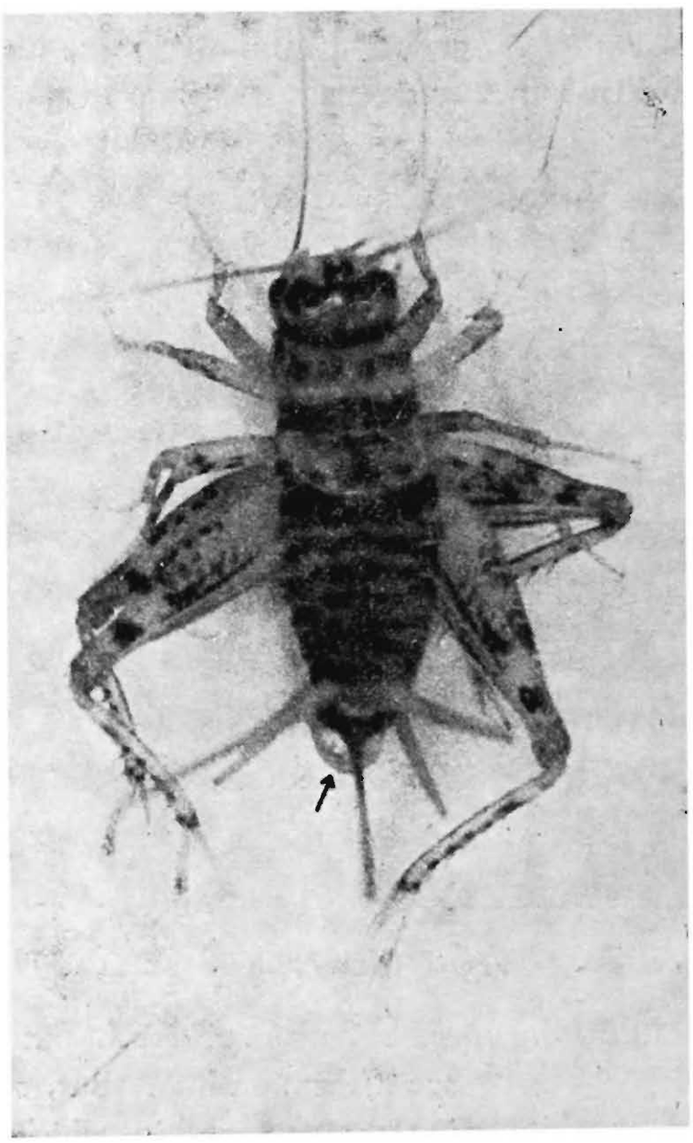


Fig. 4. Copulation (dorsal view)
Arrow indicates spermatophore

toward the female, simultaneously shaking his body up and down and laterally. The male usually backs towards the lateral or antero-lateral aspect of the female, although backing directly from the front of the female has also been noticed in a few cases. By this time, the female, who is usually

aroused, mounts the male. The song ends at once, and a spermatophore appears at the posterior extremity of the male. The spermatophore may be seen slightly protruding from the posterior extremity of the male even during courtship (Fig. 3). The male adjusts himself for a few seconds, probably to bring the posterior end of the female in line with his. The pair, then, becomes motionless. The copulating partners may or may not be parallel to each other. In every case, during copulation, the ovipositor of the female is held just a little over 90° in relation to her body. Once the spermatophore is transferred, the male moves away from beneath the female. The latter immediately bends and plucks off the spermatophylax—"a large fibrous mass attached to the ampulla" (Alexander and Otte, 1967) of the spermatophore-with her mandibles and proceeds to eat it, during which process her maxillary palpi can be seen to be in constant motion. Immediately after removing the spermatophylax, the female rubs the posterior extremity of her abdomen, more or less alternately, with her left and right posterior legs. During this action the legs touch the sperma-

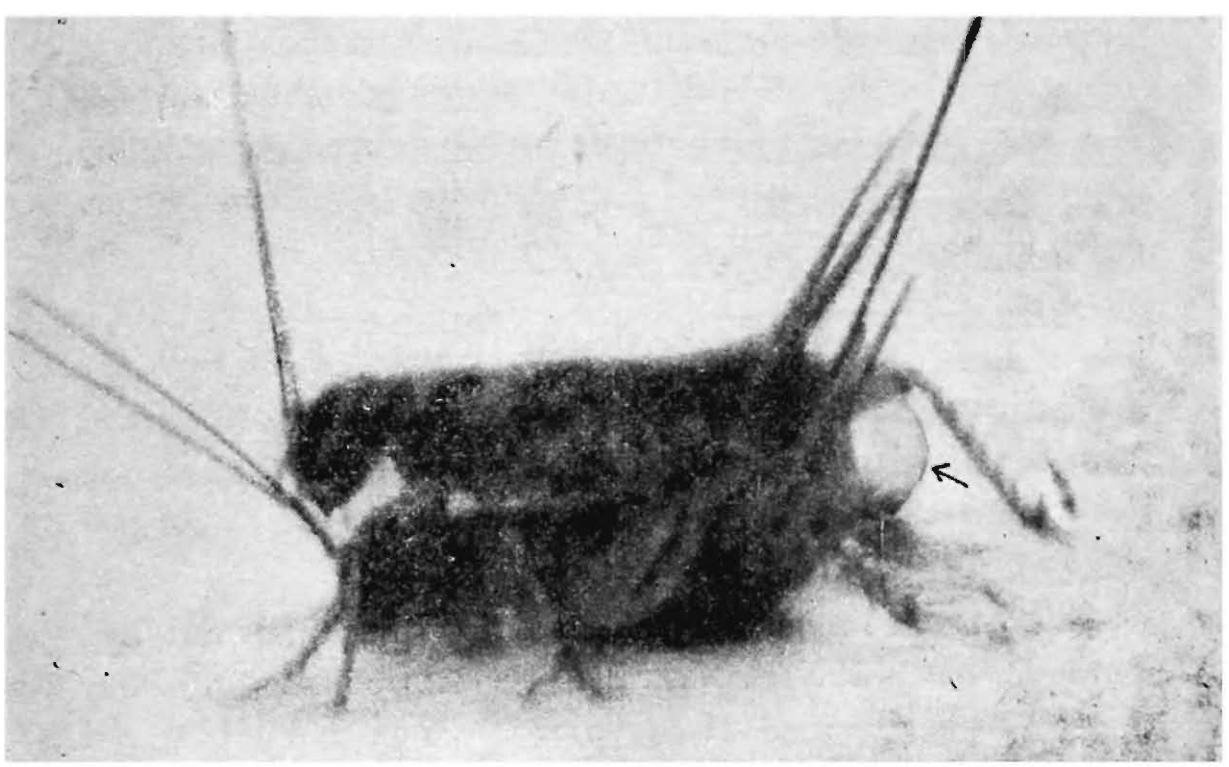


Fig. 5. Copulation (lateral view). Arrow indicates spermatophore.

tophore, which remains attached by its tube to the end of the female abdomen. Upon moving away from beneath the female, the males turns around and antennates the body of the female, and generally reaches out to her with his posterior legs. If the female moves away, he pursues her. If he loses contact with the female, he searches for her frantically.

The duration of mating recorded in the present study, *i.e.* from mounting to the time the male moves away from beneath the female, varies from 21 seconds to 2 minutes, 55 seconds. The female takes from 45 minutes to 1 hour, 20 minutes to consume the entire spermatophylax.

On the whole, courtship was found to be less intense when only a single male and female were kept together. The presence of another male introduced the element of aggression into the picture. When the two males contacted each other, one male usually assumed a proprietary attitude towards the female, chasing away the other male whenever he approached her. Display of aggression was observed to be by three basic means—1. charging headlong at the other male, 2. short bursts of song consisting of only a few quick, loud pulses, sung with the head facing away from the contending male, and 3. 'kicking' by the posterior legs. After a while, the less aggressive (subordinate) male stopped pursuing the female, and the 'victor' began courting her. The female, then, usually copulated.

Discussion

Although the salient features of courtship, copulation and post-copulatory behaviour in *Gryllodes sigillatus* (Walker) are as described above, some other interesting features were also found in the present study :—

1. All mountings of the male by the female did not result in the transfer of the spermatophore. In 10 out of 31 matings (approximately one-third) observed during this study, males were unable to transfer the spermatophore. In one instance, a male was mounted

by a female thrice in succession, each mount lasting shorter than the preceding one (66 seconds and 21 seconds respectively), but ultimately the male was unable to transfer the spermatophore to his partner. Throughout each of these attempted copulations, the male appeared to be continually adjusting his position, movements which were observed in almost all cases of unsuccessful matings. Finally, the spermatophore was transferred when the female mounted the male for the fourth time.

2. Young virgin (unmated) females copulated more readily than older, mated females. Similarly, females confined solitarily or with other females only for several days, mated more readily when presented with a male than females which had been deprived of contacts with males for shorter periods.

3. When a female was presented with more than one male, the choice of the mating partner rested with her; she was even seen to reject the vigorous male.

According to Alexander (1961), in low-density populations of field crickets, the majority of the male-female contacts are brought about by the movement of the sexually responsive female towards the immobile, stridulating male, in response to his calling song, which is different from the courtship song, and is prodnced by the male for extended periods when out of contact with other members of its species. It functions in sexual pair formation. In the present study, most of the contacts between the members of the opposite sexes were initiated by the males, without the production of the calling song. This might have been due to the restricted observation area. Only in one instance was a female observed to be attracted to a male by his calling song.

SUMMARY

A study of the pre-copulatory, copulatory and post-copulatory behaviour of *Gryllodes sigillatus* (Walker) (Orthoptera : Gryllidae) is presented.

ACKNOWLEDGEMENTS

The author wishes to thank Dr T. N. Ananthakrishanan, former Director, Zoological Survey of India and Dr B. K. Tikader, Director, Zoological Survey of India for giving him an opportunity to do this work. He is also grateful to Sri S. B. Mukhopadhyay for his help during the study.

REFERENCES

ALEXANDER, R. D. 1961. Aggressiveness, territoriality and sexual behaviour in field crickets (Orthoptera : Gryllidae). *Behaviour*, **17** : 130-223.

ALEXANDER, R. D. and OTTE, D, 1967. The evolution of genitalia and mating behaviour in crickets (Gryllidae) and other Orthoptera. *Miscl. Publ. Mus. Zool. Univ. Mich.*, **133** :.1-62.

Rec. zool. Surv. India, 85(3) : 419-427, 1988

CANDONOPSIS URMILAE A NEW SPECIES OF SUBTERRANEAN CRUSTACEA (OSTRACODA : CANDONIDAE) FROM INDIA

By

LAKSHMAN PRASAD GUPTA

Zoological Survey of India, G.P.R.S.
Patna-800020

INTRODUCTION

Amongst known Indian freshwater Ostracods, family Candonidae is poorly represented. Only two species of the genus *Candonopsis* Vavra 1891 viz., *C. putealis* (Victor and Fernando, 1979) and *C. kingsleii* (Bhatia and Singh 1970) from India. The present species is an addition to the genus and to the fauna of India. I have followed the terminology of Neale (1977) in this paper.

Candonopsis urmilae sp. nov.

(Figs. 1-5)

Diagnosis : Valves subreniform in lateral view, comparatively higher in relation to length, left with dorsal protuberance overlaping the right dorsally, surface pitted ; mandibular palp much elongated with endopod segment-3 two and half and segment-4 about seven times as long as wide and terminal claw one and half times as long as fourth segment ; furcal claw longer than the ramus.

Description ; *Male carapace* (Fig 4a, b, c) :

Carapace white, finely pitted, with fine hairs, marginal pore canals present, subreniform in lateral view, left valve larger and dorsal protuberance overlap the right, anterior margin broadly rounded, antero-dorsal margin sinuate, dorsal margin somewhat straight, posterior rounded and subacuminate posteroventrally, ventral margin sinuate medially,

greatest height posteromedial and 52 percent of its length; in dorsal view elliptical, more acuminate anteriorly, maximum width medial and one third of the length. Anterior inner lamella broad, mucsle scar typical candonine.

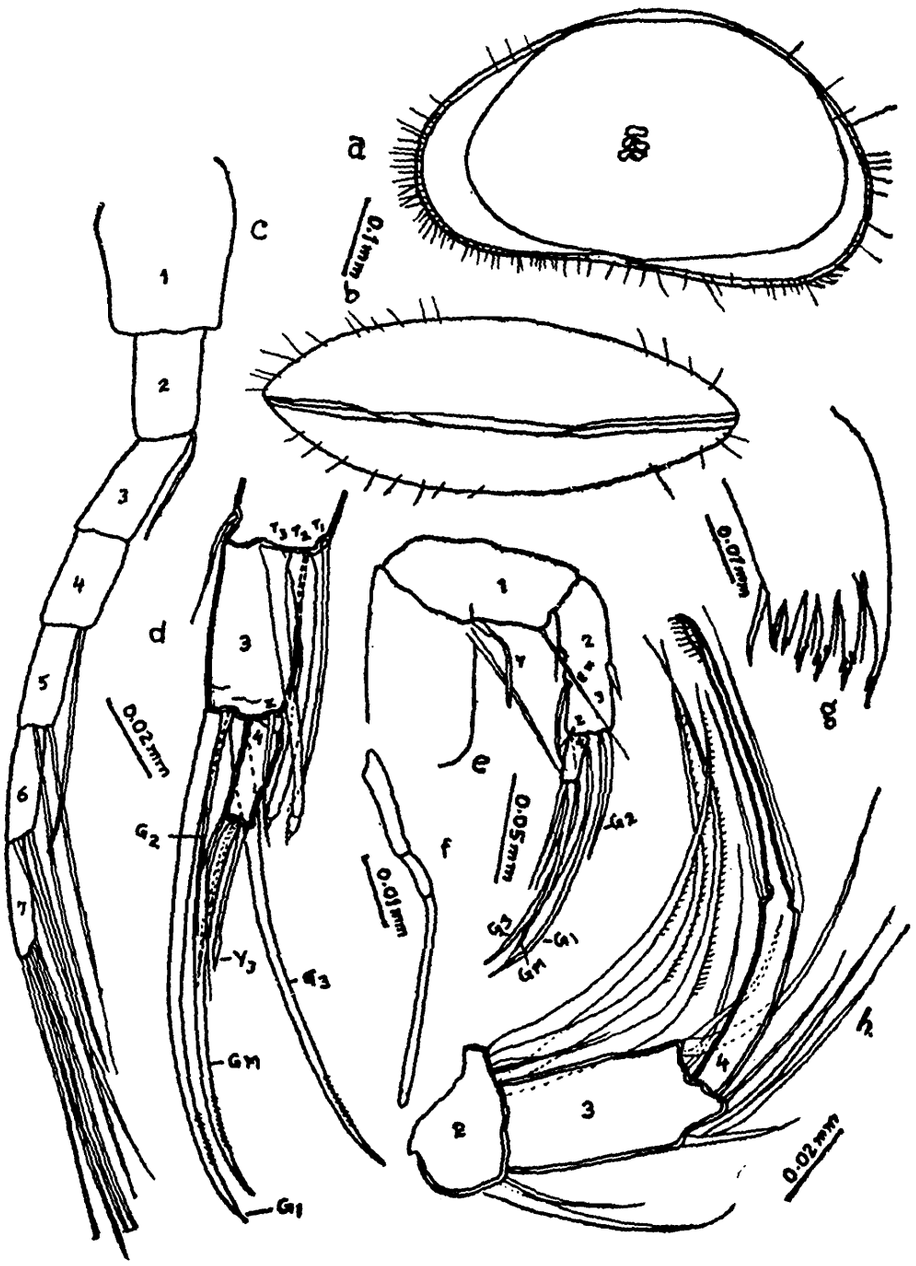


Fig. 1. a. Lateral view of shell ♀ b. Dorsal view of shell ♀ c. Antennule ♂ d. Antenna (distalportion) ♀ e. Antenna ♀ f. Y. Seta g. Mandibular teeth h. Mandibular palp.

Antennule (Fig. 1 C): Seven segmented, relative length 5 : 3 : 3 : 3 : 3 : 3. 5 : 3. 5, natatory setae on distal four segments.

Antenna (Fig. 1d, f, 5a) : Natatory setae absent, endopod 4 segmented length ratio 6 : 3 : 3 : 2, proximal seta simple ; Y seta 57 percent of first segment, distal segment of Y seta 60 percent of its total length ; segment two with one seta, and three inner setae (T_1 T_2 T_3) of which T_2 and T_3 are male bristles ending in conical bulbs ; third segment with two strong long serrated calws (G 1, G 3) and a smooth slender claw (G2) and a 'Z' seta ; fourth segment with one long stout serrated claw (GM), a narrow seta (Gm), an aesthetasc (Y3).

Mandible (Fig. 1g, h.) : Multidentate teeth ; mandibular palp with 4 endopod segments, segment-2 with two simple setae on outer, three long plumose and one slim setae on inner margin ; segment-3 with three long and one small simple setae on outer and one long and two slender setae on inner margins. Segment-4 with two long subequal simple setae and a long terminal claw 1.5 times longer than segment 4 while segment-3 two and half and segment-4 about seven times as long as wide.

Maxillule (Fig 2a) : Third lobe with 2 smooth spines and 2 simple setae.

Maxilla (Fig. 2 b, c, d.) : Prehensile palps asymmetrical, right palp very large with convex dorsal and a toe-like termination, left much smaller with convex ventral margin, exopod with three setae.

Thoracopod-I (Fig. 2 e, e_1 e_2) : Protopodite with a seta in the middle of anterodorsal side ; endopodite 4 segmented ; second and third endopods fused, with distinct suture, length ratio of 4 segments 25 : 11 : 10 : 3 ; each segment with anterodistal seta ; terminal claw smooth about 90 percent of the combined length of 4 endopodial segments excluding claw ; shows similarity with *Candonopsis boui* Dan. In male 4th segment of right leg is nearly half of the left showing asymmetry.

Thoracopod-II (Fig. 2 f) : Four segmented, penultimate segment feebly separated from segment 2 ; segment 4 very

small ; segment 1, 2, 3, with one small seta at their destal ends ; segment 4 with three setae, one anteriorly directed

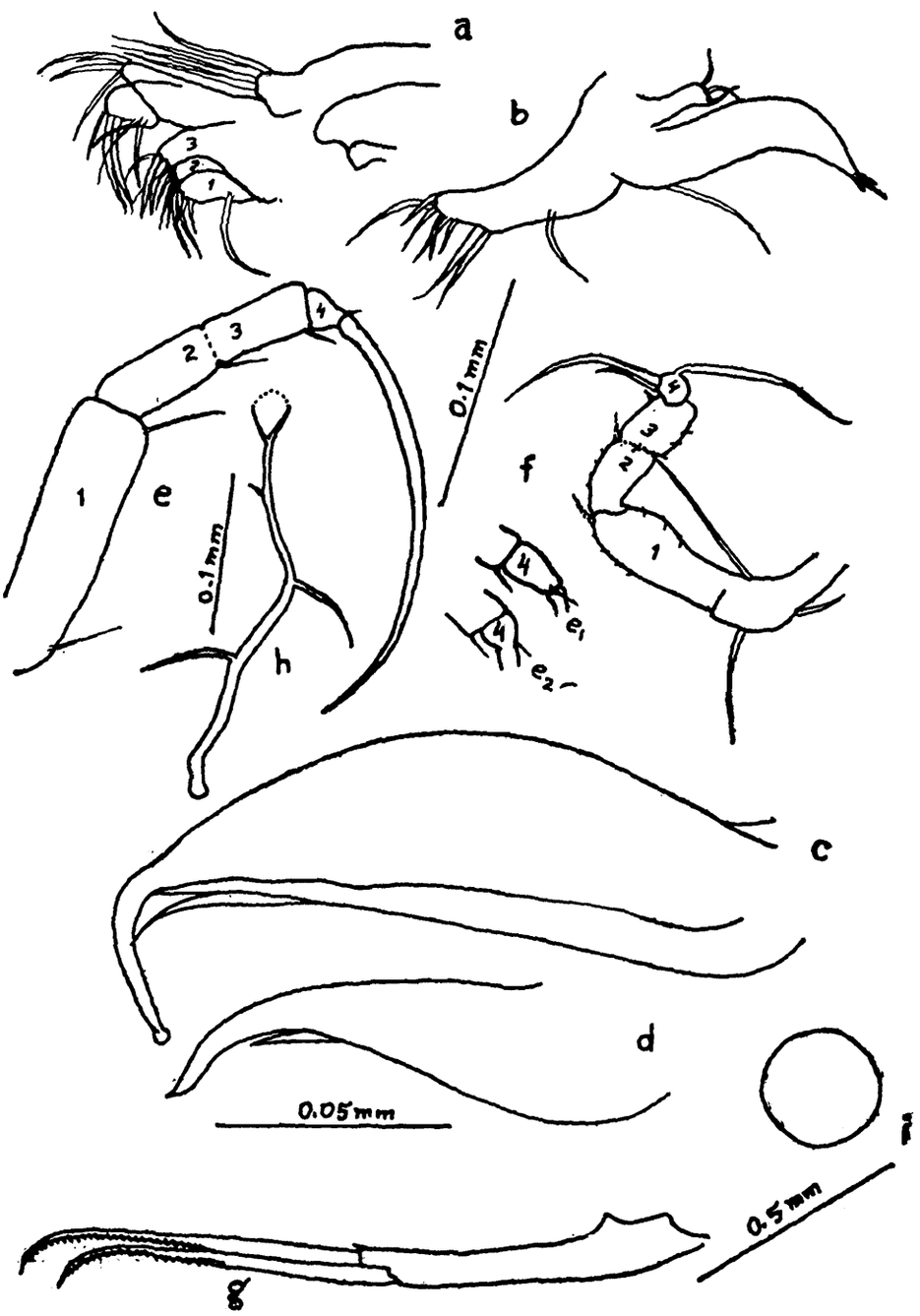


Fig. 2. a. Maxillule ♀ b. Maxilla ♀ c. & d. Right and left palp (Maxilla) ♂ e. Thoracopod I ♀ e_1 distal segment of left thoracopod I ♂ e_2 distal segment of Right thoracopod I. ♂ f. Thoracopod II ♀ g. Furca ♀ h. Chitin suport, Furca ♀ i. egg size.

(reflexed) and long seta reaching the first segment, second and third small setae ; dorsal (anterior) margin of 3rd and 1st and ventral (posterior) margin of 2nd and 1st with 3 to 4 minute spines or denticles each ; all setae in thoracopod II smooth.

Furca (Fig. 3 g, h, 5b) : Symmetrical, ramus short, stout, ventral margin proximally curved gently ; equal terminal and subterminal claws with distal curvature ; dorsal seta absent, terminal seta very minute ; distal half of claws serrate ; claws longer than the length of the ramus ; furcal chitin support similar to *Candonopsis kingsleii* with distinct sexual dimorphism.

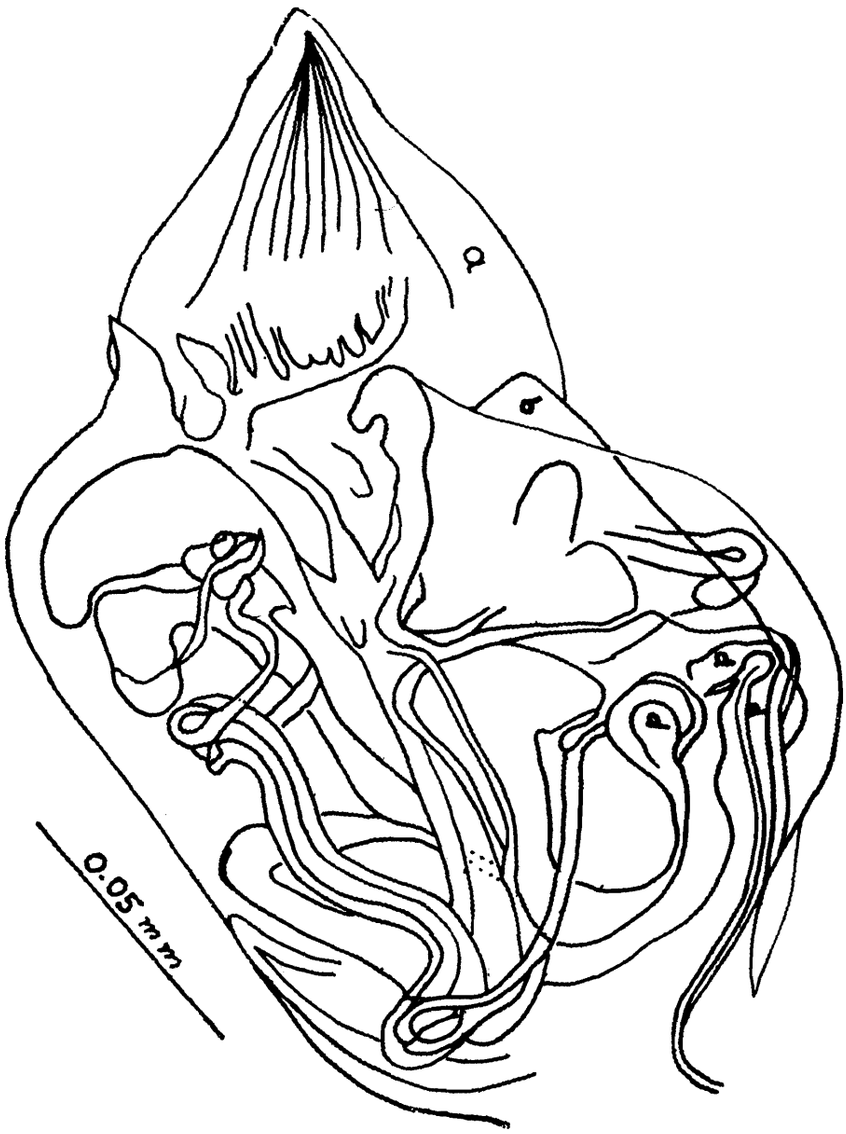


Fig. 3. Magnified view of Hemipenis.

Zenker's organ (Fig. 5 c.) : With 7 whorls of spicules.

Hemipenes (Fig. 3, 5d) : Rectangular in outline ; lateral lobe 'a' triangular with wide base and acute end, dorsal lobe round, median lobe (b) reduced ; labyrinth (d) rectangular ; piece 'M' somewhat like *Candonopsis boui* Dan.

Eyes : Absent.

Female : (Fig. 1a, b, 4d) : Shell length smaller than and height equal to male, dorsal protuberance prominent ; second antenna with only 3 segments, segment 2 and 3 fused, claw

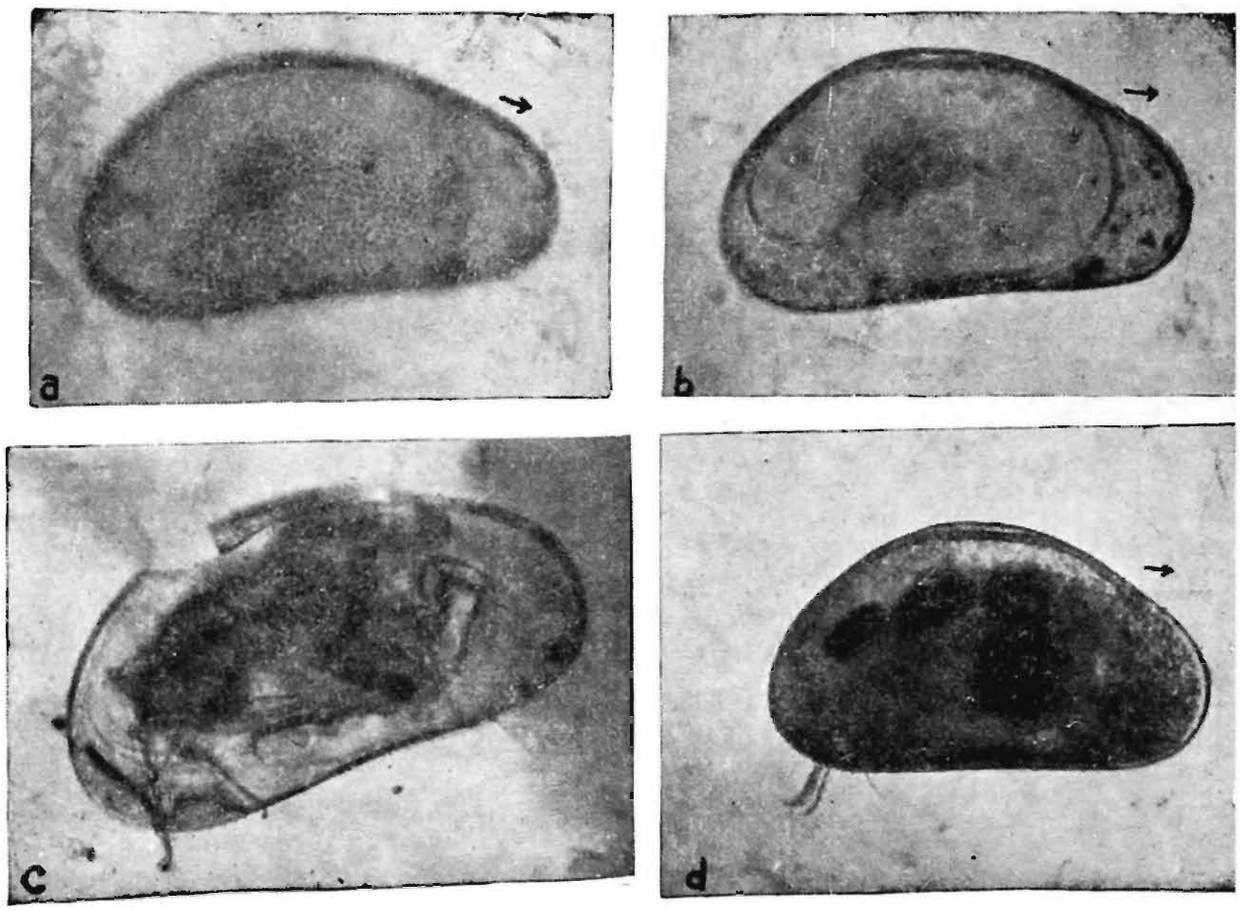


Fig. 4. a. Outer view of shell surface ♂ Photographs b. Inner view of shell ♂ c. Internal Organs after removal of right value ♂ d. Female

G2 small but stout, only one 't' seta present ; chitin support of furca different from male as in *C. kingsleii* Br. & Rob. (Rome 1969). Maxillary palp with 3 small setae.

Holotype : 1 ♂ (on slide No. 1) Registration No. A-1032, Zoological Survey of India, Patna, loc. Monghyr, Bihar, India ; from a well (depth 25 ft) in Belan Bazar ; Coll. L. P. Gupta 28-IV-1983.

Paratype : 2 ♂ ♂ in spirit Reg. No. A-1033. 4 ♀ ♀ slides No. 2-5 Reg. No. A-1034 15 ♀ ♀ in spirit Reg. No. A-1035, Zoological Survey of India, Patna ; Details same as for Holotype.

Discussion : Inspite of marked difference *Candonopsis urmilae* Gupta has been placed in *kingsleii* group of the genus. The shape of *C. urmilae* shows similarity in shell outline with *C. boui* Danielopol 1980, *C. trichota* Schafer 1945 and *C. sumatrana* Klie 1933.

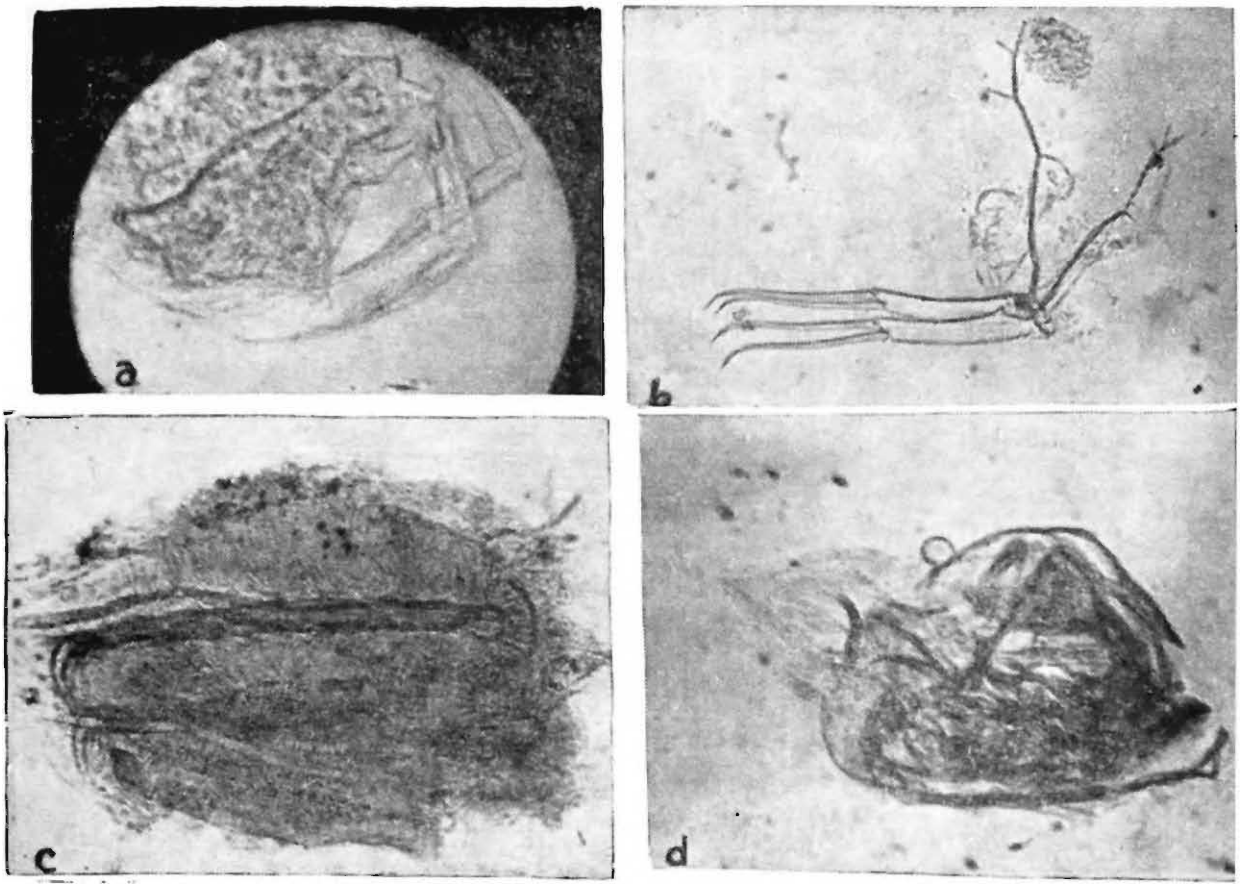


Fig. 5. a. Antenna (dissected) ♂ b. Furca ♂ c. Zenker's Organ ♂ d Hemipenes ♂

Pitted surface and higher unequal valves in *C. urmilae* are features differing from elongated and smooth valves found in *kingsleii* group of species.

The mandibular palp has extremely long segments, like The terminal segment of mandibular palp is one and half times longer than the fourth segment while in *C. kingsleii*, (Sars 1928) and *C. hummelincki* Broodbakker 1983 it is equal.

The most interesting feature and variation from other species of *Candonopsis* is the furcal, claw which is longer than the furcal ramus. Presence of stronger teeth on serrated

claws in *C. urmilae* is very variable and does not seem to indicate any significant specific feature. There is a general reduction in number of the "t" and "z" setae in both male and female. Only one "z" and one "t" setae in female and one "z" and 3"t" in male indicat more effective subterranean adaption in *C. urmilae*. The aesthetasc "Y" is much longer as in other subterranean species. This species was collected from the same locality where from *Indocandona* Gupta (1984) has been described recently.

Summary

A new species of the genus *Candonopsis* Vavra, has been described from subterranean water of Bihar, India. Its relationship with other subterranean species has been discussed.

Acknowledgement

The author is thankful to the Director, Zoological Survey of India, Calcutta and the Officer-in-Charge ZSI, GRPS Patna for providing necessary facilities and to Dr. D. L. Danielpol of Limnological Institute, Austrian Academy of Sciences, Gaisberg 116, A-5310 Mondsee, Austria for providing literature and other help. Thanks are also due to Shri Ram Babu Sharma for help in photography.

References

Bhatia, S. B. and Singh D. 1970. First record of recent Freshwater Ostracods from the Kashmir Valley I. Dal Lake and Nagin Lake. *Indtan Sci. Congr. 57th Proc.* pt. 3. Abstracts : 198.

Danielopol. D.L. 1980. Deus especes hypogees du Genre *Candonopsis* (Ostracoda, Candoninae) du sudde la France et de Cuba. *Vie Milieu*, **30** (3-4) : 315-323.

Gupta, L.P. 1984. *Indocandona krishnakanti*, Gen. et. sp. Nov. (Crustacea : Ostracoda : Candoninae) from subterranean water of Bihar, India. *Rec. zool. Surv. India*, **81** (3-4)-: 291-298.

KLIE, W. 1933. Die Ostracoden der Deutschen Limnologischen Sunda expedition : *Arch. Hydrobiol.*, Suppl. 11 : 447-502.

NEALE, J.W. 1977. Discussion on Ostracode terminology. In. H. Loffler and Danielopol (ed). Aspects of Ecology and Zoogeography of Recent and Fossil Ostracoda, 495-497. Junk B.V. The Hague.

SARS, G.O. 1925. An account of the crustacea of Norway. 9. Ostracoda (3-10) : 33-176.

SCHAFER, H.W. 1945. Grundwasser Ostracoda aus Griechenland. *Arch. Hydrobiol.* **40** (4) : 847-866.

VICTOR, R. and FERNANDO, C.H. 1979. The freshwater Ostracods (Crustecea) of India. *Rec. zool. Surv. India*, **74** (2) : 147-242.

Rec. zool. Surv. Inaia, 85(3) : 429-432, 1988

A NEW GENUS OF AMARYGMINI (COLEOPTERA : TENEBRIONIDAE) FROM INDIA

By

G. N. SAHA

Zoological Survey of India
M-Block, New Alipore
Calcutta-700053

INTRODUCTION

The new genus *Apelina*, under the tribe Amarygmini, described here, is very near to the genus *Platolenes* Gebien (1913) from the Philippines. It can be clearly distinguished from *Platolenes* by having the frons not elevated over the base of the antennae which are more elongate, thin and not clavate apically and for having the elytra distinctly striate and the mesosternum with a pair of elevated sharp spines. The single specimen on which the new genus and species are based and collected from Kavalai (Kerala), is deposited in the National Collections at the Zoological Survey of India, Calcutta.

Apelina gen. nov.

Body oval, curved, shiny and brown in colour. Head deflexed fairly rounded, finely punctate and inserted into prothorax upto behind the eyes ; labrum small, transverse and sparsely hairy ; eyes transverse and emarginate in front ; antennae 11 segmented fairly elongate, thin and not clavate apically ; mandibles moderately broad at base and fairly elongate apically ; apical segment of maxillary palpi fairly flattened and triangular in shape. Pronotum finely punctate, fairly flattened and triangular in shape. Pronotum finely punctate, fairly convex in middle, narrow apically and fairly deflexed laterally in front. Prosternum short, slightly concave ; mesosternum also very short and with a prir of elevated sharp spines ; metasternum moderately large. Procoxae

large, convex ; femora elongate, semi-rounded ; tibiae slender with small spines ; tarsi slender, with setae ; claws simple.

Type of genus : *Apelina keralaensis* sp. nov.

Apelina keralaensis sp. nov.
(Fig. 1)

Male : Body curved, elongate-oblong, shiney, completely brown, length 9mm. *Head* small ; labrum transverse, slightly elevated in front, apically semi rounded ; mandibles small, pointed apically ; clypeus truncate anterioyly ; front margin membranous, remaining part finely and thickly punctate ;

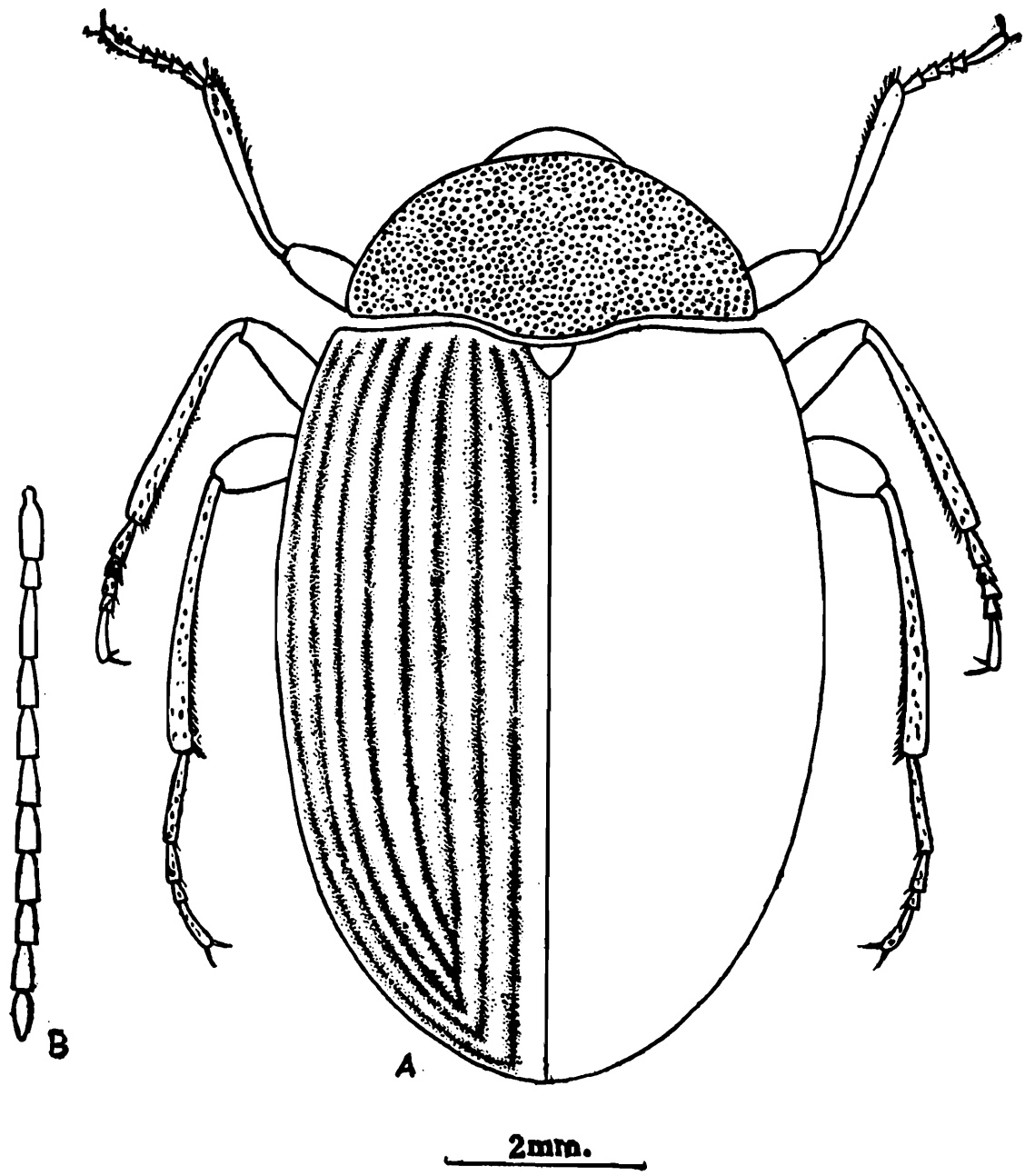


Fig. 1. A. Whole specimen, dorsal view. B. Antenna

fronto-clypeal suture prominent ; frons fairly small, not elevated over base of antennae, finely rugose ; interocular space fairly narrow ; vertex finely punctate ; eyes strongly emarginate and finely granular ; antennae very slender, elongate, apical segment poorly forming a club ; mentum very small ; apical segment of maxillary palpi large and triangular. *Pronotum* : Fairly convex, finely punctate, strongly narrowed apically and explanate laterally. *Scutellum* : Small, flat and triangular in shape. Elytra : Convex, distinctly striate, strongly curved downward apically, fairly narrowed at apex and with distinct epipleura. *Procoxae* : Strongly convex ; prosternal process slightly elevated and pointed at apex ; Mesosternal processes elevated upwards in the form of two sharp spines. Metasternum with a median longitudinal impressed line below. Tibiae and tarsi very slender. *Aedeagus* : Slender, curved at base and finely pointed at apex.

Holotype, Male (Z.S.I. Reg. No. 10767/H_4A), INDIA : Kerala (Cochin State), Kavalai, 396-914m. 24-27.ix.14 (F.H. Gravely Coll.).

SUMMARY

The tribe Amarygmini has larvae inhabiting rotten wood while the audlts are short-lived, active, long-legged beetles which fly readily (Watt 1974). The tribe contains 41 genera, most of which occur in the Old World.

ACKNOWLEDGEMENTS

I am grateful to the Director, Zoological Survey of India for encouragements and facilities and to Late Dr. Z. Kaszab, former Director General, Hungarian Nat. History Museum, Budapest for his kind help and guidance during my study visit at the aforesaid museum.

References

GEBIEN, H. 1913, Die Tenebrioniden der Phillippine. *Phillip. J. Sci.*, **8** (5-6) : 373-433.

WATT, J.C. 1974. A revised subfamily classification of Tenebrionidae (Coleoptera). *New Zealand J. zool.*, **4** (4) : 381-452.

Rec. zool. Surv. India, 85(3) : 433-437, 1988

DISCOVERY OF GENUS *PLATOLENES* (COLEOPTERA : TENEBRIONIDAE) FROM INDIA WITH DESCRIPTION OF TWO NEW SPECIES

By

G. N. SAHA

Zoological Survey of India
M-Block, New Alipore, Calcutta-700053.

INTRODUCTION

The genus *Platolenes* belonging to the subfamily Tenebrioninae was described by Gebien (1913) from the Philippine. Since then fifty species have been described from different parts of the world including thirteen species from the Oriental Region. From the Indian Sub Region Kaszab described one new species from Nepal (1976) and another six new species from Sri Lanka (1980). So far the genus was not known from India, it is reported here for the first time. The genus is redescribed and two new species one each from West Bengal and Sikkim are described.

Genus **Platolenes** Gebien

1913. *Platolenes* Gebien, *Philipp. J. Sci.*, (D) 8 : 420.
1951. *Platolenes* : Kulzer, *Ent. Arb. Mus. Frey*, 2 : 540.

Body hard, usually curved, shiny, winged, head deflexed and inserted into prothorax nearly to middle of eyes ; labrum transverse ; eyes fairly transverse and deeply emarginate in front ; pronotum convex at basal region and explanate laterally ; antenna 11 segmented, slender, clavate, mandibles very broad at base, triangular in shapc and moderately sharp apically ; apical segment of the maxillary palpi strongly flattened and fairly triangular in shape ; prosternum short ; pro and mesoternal processes concave ; procoxae generally rounded ; metasternum long ; femora broad ; tibiae elongate ; tarsi with thick hairs, claws simple.

Platolenes darjilingensis sp. nov.
(Fig. 1)

Female : Body elongate-oval, fairly curved, shiny, metallic black, length 11 mm. *Head :* Small ; labrum transverse, nearly semi-circular apically ; mandibles moderately strong,

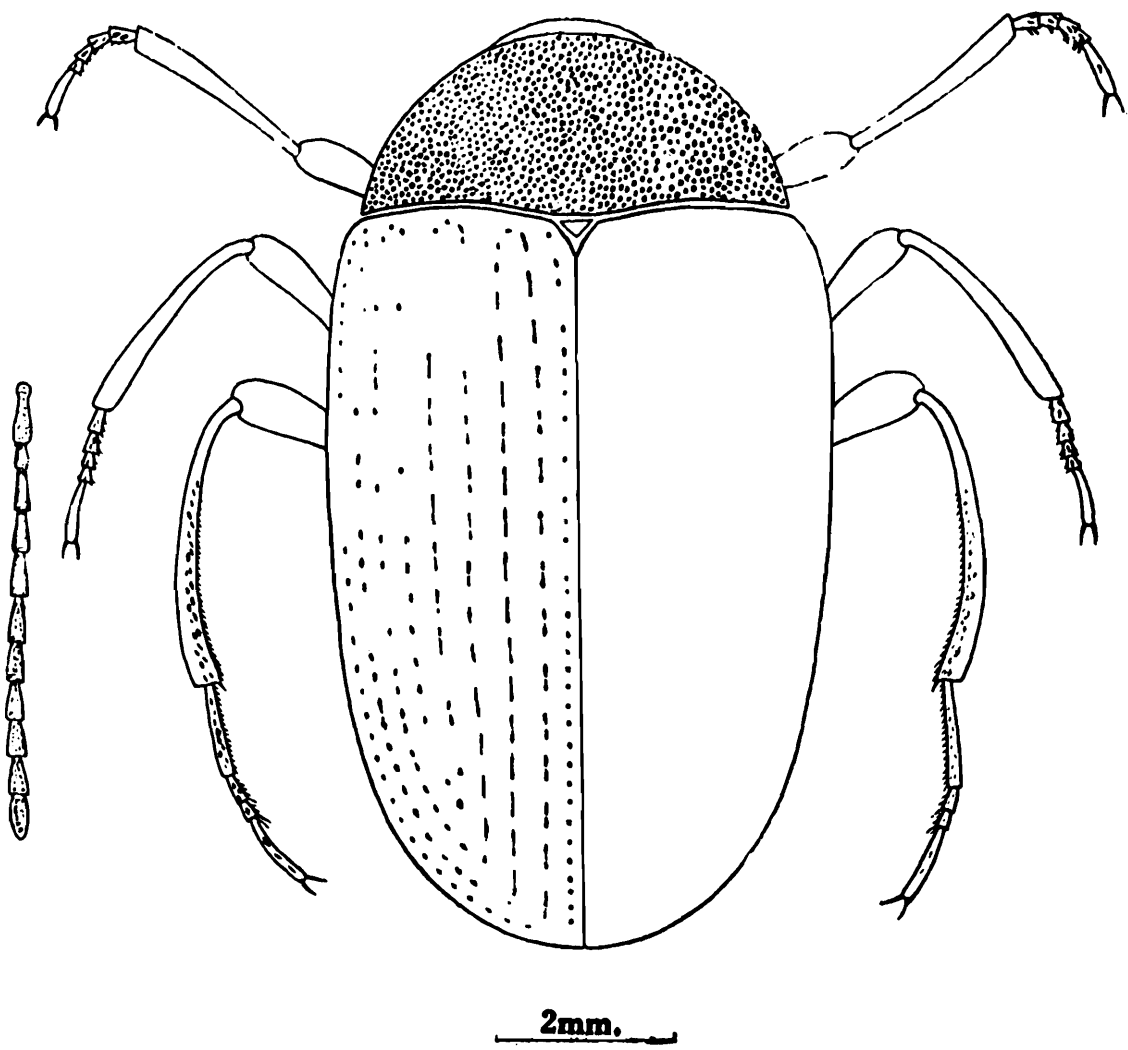


Fig. 1. *Platolenes darjilingensis* **sp. nov. (a) Dorsal view (b) Antenna**

apically blunt ; clypeus finely and thickly punctate, front margin membranous ; fronto-clypeal suture present ; frons finely punctate and with fine distinct impressions ; interocular space narrow ; eyes large, emarginate, transverse and finely granular ; antenna moderately elongate, scape rounded towards apex, pedicel smallest, segments III-IV slender, segments V-XI wider apically and forming a poor club. *Pronotum* : Convex, irregularly and finely punctate, apically narrowed, explanate laterally, lateral and apical margins with fine carina, basal margin moderately lobed at middle.

Scutellum : Moderately large, triangular in shape, with a few punctures and impressions. *Elytra* : Elongate, fairly curved, with elongate bluish punctures in longitudinal rows, narrowed apically and with narrow epipleura.

Ventral side : Mentum moderately large and elevated in middle ; maxillary palpi very large and triangular ; prosternum moderately convex, prosternal process elevated but concave in middle ; metasternum with a medium longitudinal depressed line in middle ; tibiae and tarsi slender and with indistinct tibial spines.

Holotype : female (Z.S.I. Reg. No. 10768/H_4A) INDIA : West Bengal : Darjeeling Dist., E. Himalaya, Pashok, 14.vi. '16, (F. H. Gravely coll.).

This new species can be easily separated from the other species of the genus by its fairly elevated frons, short, antenna, non-striate elytra and depressed mesosternal process.

Platolenes sikkimensis sp. nov.
(Fig. 2)

Female : Body moderately curved, oblong, very shiny, body metallic black except metallic brownish elytra, length 10 mm. *Head* : Small ; labrum transverse, with a few hairs ; mandibles triangular in shape, thick, fairly wide at base, narrowed apically ; clypeus truncate apically, front margin membranous, rest part finely and thickly punctate ; frontoclypeal suture distinct ; frons fairly punctate, slightly elevated and covering base of scape and extends into emargination of eyes ; vertex fairly punctate ; interocular space moderately narrow ; eyes large, strongly transverse and finely granular ; antenna slender, short, scape slightly rounded apically, pedicel very small, antennal segments VII-XI gradually becomiug wider and with fine setiferous punctures and forming a somewhat club. *Pronotum :* Fairly convex, finely and irregularly punctate, strongly transverse, narrowed apically, basal margin, broadly lobed at middle, sides with a crrina and moderately explante. *Scutellum* : Moderateiy large, distinctly triangular in shape, flat with a few punctures.

Elytra : Modcrately convex, with elongate punctures in longitudinal rows, rounded fumerus, gradually narrowed apicazry and with narrow epipleura.

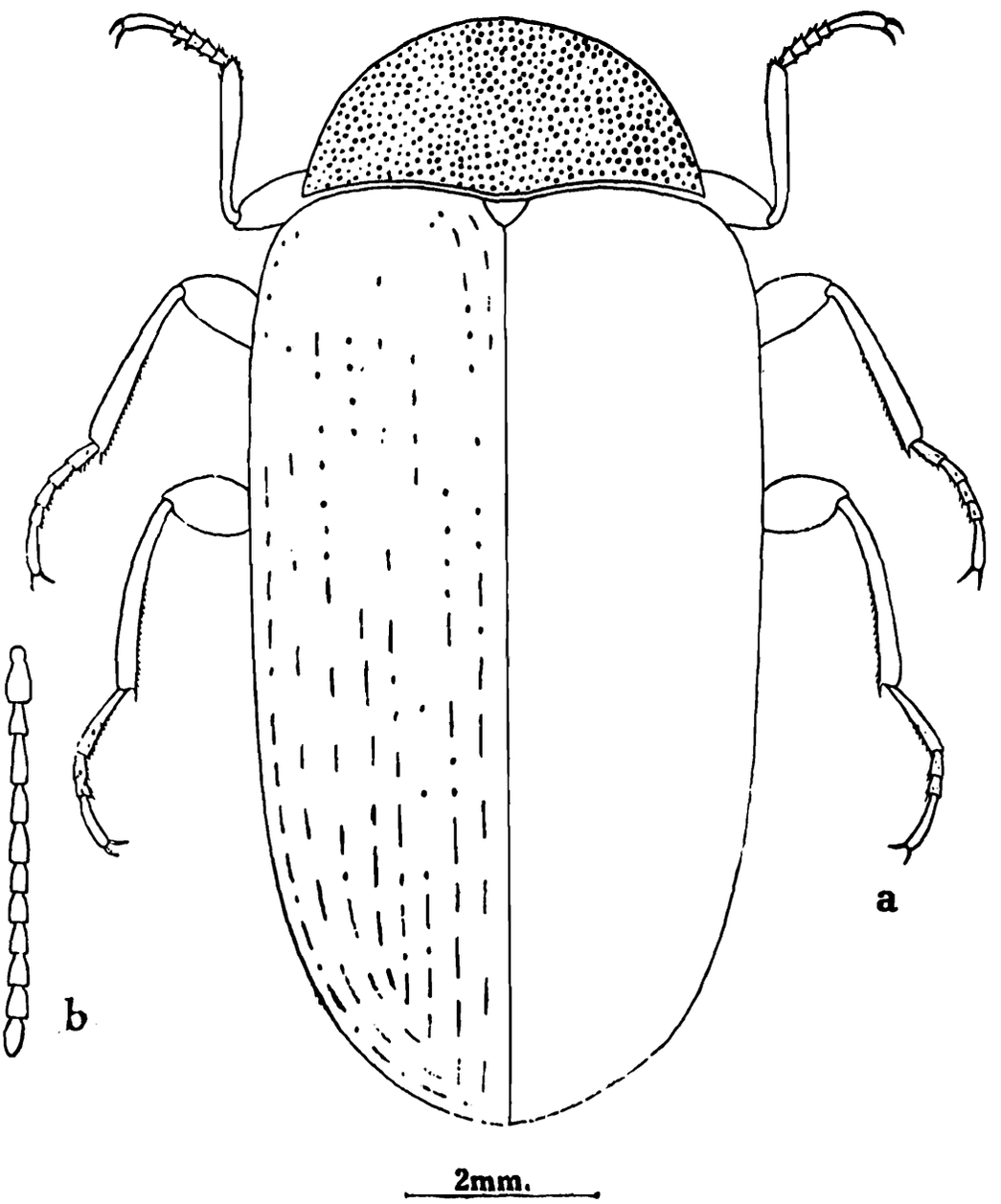


Fig. 2. *Platolenes sikkimensis* **sp. nov. (a) Dorsal view (b) Antenna**

Ventral side : Mentum and labial palpi small, apical segment of the maxillary palpi moderately large, flattened and distinctly taiangular in shape ; pronotum small ; mesosternal process concave ; coxal carities elongate ; tibial spines small and indistinct.

Holotype : Female (Z.S.I. Reg. No. 10767/H_4A) INDIA, SIKKIM (without any other data).

This species is very near to *P. dargilingensis* but differs

for its metallic brownish colour on elytra (blackish in *dargilingensis*), more convex pronotum and foreleg having smaller tarsal segmedts with less setae on the ventral side.

SUMMARY

The genus *Platolenes* Gebien is recorded for the first time from India and redescribed. Two new species, namely, *Platolenes dargilingensis* and *Platolenes sikkimensis* are described here from West Bengal and Sikkim states.

ACKNOWLEDGEMENTS

The author is grateful to Director, Zoological Survey of India for providing the laboratory facilities and to Late Dr. Z. Kaszab, former Director General, Hungarian Nat. Hist. Museum, Budapest, for the confirmation of the new taxa of the present paper.

REFERENCES

GEBIEN, A. 1913. Die Tenebrioniden der Phillippinen. *Philip. J. Sci.*, (D) **8** (5-6) : 373-433.

KASZAB, Z. 1976. Tenebrionidae der Nepal-Expeditionen Von Dr. J. MARTENS (1969-1974). *Biol.* **57** (4/6) : 241-283.

KASZAB, Z. 1980. New Tenebrionidae (Coleoptera) aus Sri Lanka. II. *Acta Zool. Hung.* **24** (4) : 285-375.

Rec. zool. Surv. India, **85**(3) : 439-450, 1988

ON A SMALL COLLECTION OF ODONATA FROM ANDHRA PRADESH, INDIA

By

A. N. T. JOSEPH and I. SATYARANI
Zoological Survey of India, Hyderabad.

INTRODUCTION

Andhra Pradesh is bounded by Madhya Pradesh and Orissa in the north, the Bay of Bengal in the east, Tamil Nadu and Karnataka in the south and Maharashtra in the West. There are three main mountain chains in the state : Eastern Ghats fringing the east coast line, with at some places a very narrow coastal plain ; Deccan plateau with Sahyadri range of Adilabad district the north border of the state ; and Horseley and other hills of the Chittoor and Anantapur districts of the south border.

Andhra Pradesh has hot summer followed by tropical rains and pleasant winter. It is principally fed by south west monsoon and north-east monsoon contributing about one third of the rainfall. The annual rainfall has a wide variation ranging from a minimum of about 500 mm, at some places to a maximum of over 1,400 mm.

Andhra Pradesh has a widely divdrsified farming base, with a rich variety of cash crops. Forest area of the state extends over 644 mha or 23 percent of the land area of the state and has also vast mineral resources. The mineral-based industries in the state are dominated by limestone.

Odonates are true amphibiotic insects, eggs and larvae are aquatic while the adults are aerial in habits. Their aquatic stages are found in almost all types of waters, whether permanent or temporary. They are useful group of insects in biogeographic studies as the larval stages are aquatic and as

many groups show great specificity in larval habitat (Watson, 1962).

No comprehensive work is available so far on the Odonata fauna of Andhra Pradesh. Keeping this in view an attempt is being made here to give an account of systematic collections of this group based on a few collections.

Systematic Account

Suborder : ZYGOPTERA
Family : Coenagriidae
Subfamily : Coenagriinae

1. **Ceriagrion coramandelianum** (Fabricius)

1798. *Agrion coramandelianum* Fabricius, *Ent. Syst. Suppl.* : 287 ; *Ceriagrion coramandelianum* (Fabricius) : Selys, 1876. *Bull. Acad. Belg.* 62(2) : 528.

Material examined : 5♂, 3♀, Hyderabad : Osmania University Gardens, 8.iii.84, Coll : Satyarani ; 4♂, 3♀, Hyderabad : Nehru Zoological Park, 23.ii.85, Coll : Satyarani.

Distribution : Throughout India, Sri Lanka, Burma, Malaysia, Indo China and South China.

Remarks : A large number of males and females are commonly found to occur on shrubs, some distance away from water.

2. **Ischnura elegans** (Vander Lindin)

1823. *Agrion elegans* Vander Lindin, *Opusc. Sci.* 4 : 104 ; *Ischnura elegans* (Vander Lindin) : Selys, 1876. *Bull Acad. Belg.* 61(2) : 277.

Material examined : 1♂, 2♀, Hyderabad : Osmania University Gardens, 8.iii.84, Coll : Satyarani ; 1♂, 1♀, Hyderabad : Himayatsagar, 24.v.84, Coll : Satyarani ; 2♂, 3♀, Kurmalguda : Nadergula, 1.ix.84, Coll : Muley & Satyarani ; 1♂, Saroornagar, 16.ii.85, Coll : Satyarani. 8♂, 4♀, Hyderabad : Saroornagar, 24.iv.85, Coll : Satyarani. 1♂, Hyderabad : Saroornagar, 24.iv.85, Coll : Satyarani.

Distribution : Extending from the British Isles across Europe and mid-Asia, and within Indian region confined to the N.W. Frontier province and Baluchistan.

Remarks : It is a common species occurring in and around Hyderabad.

Suborder : ANISOPTERA

Family : GOMPHIDAE

Subfamily : GOMPHINAE

3. **Ictinus rapax** (Rambur)

1842. *Diastatamma rapax* Rambur, *Ins. Nevrop.* : 169 ; *Ictinus rapax* (Rambur) : Selys, 1854. *Bull Acad. Belg.* 21 : 90.

Material examined : 1 ♂, Hyderabad : Manjeera, 26.ix.84, Coll : Joseph ; 2 ♂, Hyderabad : Bibinagar, 11.iv.85, Coll : Satyarani.

Distribution : Throughout India, Burma, Sri Lanka and Malaysia, except in desert areas.

Remarks : These are extremely fast fliers and it is difficult to catch them. In spite of concentrated attempt of about two hours, only two males were caught at Bibinagar. All the specimens so far collected are males. They generally perch on prominent twigs facing the water. When disturbed, they dive gracefully towards the surface of water and return to their original resting place again and again.

4. **Mesogomphus lineatus** (Selys)

1850. *Gomphus lineatus* Selys, *Rev. Odon.* : 386 ; *Mesogomphus lineatus* (Selys) : Fraser, 1924. *Rec. Ind. Mus.* 26 : 427, 477.

Material examined : 1 ♂, Khammam Dist. : Kothagudem : Wild Life Sanctuary, 6.ii.85 ; 1 ♂ Khammam dist. : Yellandu., 7.ii.85 ; 1 ♂, Karimnagar dist. : Raikal Forest, 14.ii.85 ; all collected by Joseph and Ramakrishna.

Distribution : Found throughout India.

Remarks : So far we have not come across this species in Hyderabad and environs. All the specimens so far collected are males.

Family : LIBELLULIDAE

Subfamily : LIBELLULINAE

5. **Acisoma panorpoides panorpoides** Rambur

1842. *Acisoma panorpoides* Rambur, *Ins. Nevrop.* 28 ; *Acisoma panorpoides panorpoides* Rambur : Fraser, 1936, *Fauna Brit. India* 3 : 330-331.

Material examined : 3♂, 4♀, Hyderabad : Osmania University gardens, 7.i.85, Coll : Satyarani ; 1♀, Nalgonda Dist., 28.vi.85, Coll : Parui.

Distribution : Widely distributed in India, Sri Lanka, Celebes, China, Japan, Java, Moluccan islands, Sumatra and Taiwan.

Remarks : It is commonly found close to the water bodies. The females occur in two colours. Some resemble the males in colouration : azure blue marked with black on abdomen while a few females wholly brown.

6. **Brachythemis contaminata** (Fabricius)

1793. *Libellula cotaminata* Fabricius, *Ent. Syst. Suppl.* 2 : 382 ; *Brochythemis contaminata* (Fabricius) : Brauer, 1868, *Verh. Zool. bot. Ges. Wien.* 18 : 736.

Material examined : 2♂, 1♀, Hyderabad : Osmania University Gardens, 8.iii.84, Coll : Satyarani ; 3♂, 4♀, Hyderabad : NFC Rocky Pond, 19.v.84, Coll : Satyarani ; 3♂, 6♀, Hyderabad : Jeedimetla, 6♀, 6.viii.84, Coll : Satyarani ; 2♂, 5♀, Hyderabad : NFC Rocky Pond, 20.ix.84, Coll : Satyarani ; 4♂, 5♀, Hyderabad : Manjeera, 26.ix.84, Coll : Joseph ; 1♂, Hyderabad : Saroornagar, 24.iv.85, Coll : Satyarani ; 1♂, Hyderabad ; Nehru Zoological Park, 23.ii.85, Coll : Satyarani.

Distribution : Throughout the plains of India, Ceylon and Burma extending east of China, Taiwan and the Philippines and southwards to Java and Sumatra.

Remarks : In this species females differ from males in colour and markings. Usually found them in abundance near the rocky places where there are water bodies.

7. **Bradinopyga geminata** (Rambur)

1842. *Libella geminata* Rambur, *Ins. Nevrop.* : 90 ; *Bradinopyga geminata* (Rambur) : Ris, 1911. *Cat. Cool. Selys. Fasc.* 13 : 545-548.

Material examined : 1♂, 2♀, Hyderabad : Tarnaka, 19.ix.84 ; 1♂, Hyderabad : Tarnaka, 2.vii.85, all collected by Satyarani.

Distribution : Peninsular India, only at altitudes varying from sea level to 450 m.

Remarks : This species breed in wells and small cement tanks. The adults settle on plastered cemented walls. Reported from several places in Northern India.

8. **Brachydiplax sobrina** (Rambur)

1842. *Libellula sobrina* Rambur, *Ins. Nevrop.* : 114 ; *Brachydiplex sobrina* (Rambur) : Kirby, 1893. *J. Linn. Soc. Zool.* 24 : 551.

Material examined : 1♂, 1♀, Hyderabad : Public Gardens, 8. vi. 84, Coll : Satyarani.

Distribution : It is one of the commonest species in India. Also recorded from Burma and Sri Lanka.

Remarks : In spite of its wide occurrence in India, it is rather rare in Hyderabed and environs. These dragoflies fly over the water bodies and generally settle on lotus leaves.

9. **Crocothemis servilia servilia** (Drury)

1770. *Libellula servilia* Drury, *Ill. Ext. Ins.* 1 : 112-113 ; *Crocothemis servilia* (Drury) : Brauer, 1868. *Verh. Zool. bot. Ges. Wien.* 18 : 737 ; *Crocothemis servilia servilia* (Drury) : Fraser, 1936. *Fauna Brit. India*, 3 : 345-347.

Material examined : 2♂, 3♀, Hyderabad : Osmania University Gardens, 8.iii.84, Coll : Satyarani ; 4♂, 3♀, Hyderabad : Jeedimetla, 6.viii.84, Coll : Satyarani ; 1♀, Warangal dist. : Phakal Forest, 10.ii.85, Coll : Joseph & Ramakrishna ; 4♂, 1♀, Hyderabad : Saroornagar, 16·ii.85, Coll : Satyarani ; 1♂, 3♀, Hyderabad : Nehru Zoological Park, 23.ii.85, Coll : Satyarani ; 10, 3♀, Hyderabad : 9.v.85, Coll : Satyarani.

Distribution : Widely occurring in North India· Also recorded from Nepal, Australia, Philipines and Sundaic Archipelago.

Remarks : A very common species of Hyderabad. Teneral males and females give rise to confusion on account of their pale straw yellow colour, quite different from adult males.

10. **Diplacodes lefebvrei** (Rambur)

1842. *Lebellula lefebveri* Rambur, *Ins. Nevrop.* : 112 ; *Diplacodes lefebvrei* (Rambur) : Kirby, 1980. *Cat. Odon.* : 42.

Material examined : 2 ♂, Hyderabad : Saroornagar, 24.iv. 85, Coll : Satyarani.

Distribution : Occurring along the west coast of India, Fraserpet and coorg. Also reported from Africa.

Remarks : It is a rare species. They are swift and hence difficult to catch.

11. **Diplacodes nebulosa** (Fabricius)

1842. *Libellula nebulosa* Fabricius, *Ent. Syst.* **2** : 379 ; *Diplacodes nubolosa* (Fabricius) : Kirby, 1889. *Trans. Zool. Soc. Lond.* **12** : 308.

Material examined : 1 ♂, Warangal dist. : Phakal Forest, 10.ii.85, Coll : Joseph and Ramakrishna.

Distribution : Widely distributed in India. Also occur in Sri Lanka to Australia and southwards to Java.

Remarks : So far we have not come across this species in Hyderabad.

12. **Diplacodes trivialis** (Rambur)

1842. *Libellula trivialis* Rambur, *Ins. Nevrop.* : 115 ; *Diplacodes trivialis* (Rambur) : Karsch, 1891. *Ent. Nachr.* **17** : 246.

Material examined : 3 ♂, 3 ♀, Hyderabad : Tarnaka, 19.ix.84, Coll : Satyarani ; 10 ♂, 3 ♀, Hyderabad : Manjeera, 26.ix.84, Coll : Joseph ; 2 ♂, 1 ♀ Khammam dist. : Nagaram, 5.ii.85, Coll : Joseph & Ramakrishna ; 1 ♀, Kothagudam, 8.ii.85. Coll : Joseph & Ramakrishna ; 10 ♂, Warangal Dist.

Phakal Forest, 10.ii.85, Coll : Joseph & Ramakrishna ; 1 ♀, Warangal Dist. : Kothagudem Village, 11.ii.85, Coll : Joseph & Kamakrishna ; 1 ♀, Karimnagar Dist. : Jagtial Taluk : Raikal Forest, 14.ii.85, Coll : Joseph & Ramakrishna ; 1 ♂, Hyderabad : Himayatsagar, 24.v.85, Coll : Satyarani.

Remarks : The female and teneral male resemble in colouration. The adult male is pruinosed densely.

13. **Hydrobasileus croceus** (Brauer)

1867. *Tramea croceus* Brauer, *Verh. Zool. bot. Ges. Wien.* **17** : 813 ; *Hydrobasileus croceus* (Brauer) : Karsch, 1890. *Berlin Ent. Zeit.* **33** : 351.

Material examincd : 1 ♂, Warangal Dist. : Phakal Forest, 11.ii.85 ; 1 ♂, Adilabad dist. : Jaipur Forest, 19.ii.85 ; all collected by Joseph and Ramakrishna.

Distribution : Its distribution in India is more or less confined to the south. Also occur in Burma, Sri Lanka extending through South Asia to Borneo, Java and Sumatra, and to Formosa and the Philippines.

Remarks : Adults are found in forest areas away from water bodies.

14. **Neurothemis intermedia degener** Selys

1879. *Neurothemis degener* Selys, *Ann. Mus. Civ.* **14** : 290-296 ; *Neurothemis intermedia degener* Selys : Ris, 1911. *Cat. Coll. Selys fasc.* **13** : 552, 564, 565.

Material examined : 3 ♀, Kurnool dist. : Nandayal, 22.vi. 85, Coll : P. Parui.

Distribution : In India it occurs in Bengal, Assam and Sikkim. Also reported from Burma.

Remarks : It is rare in Southern India.

15. **Neurothemis intermedia intermedia** (Rambur)

1842. *Libellula intermedia* Rambur, *Ins. Nevrop.* : 91 ; *Neurothemis intermedia* (Rambur) : Selys, 1889. *Ann. Mus. Civ. Genova.* **27** : 454 ; *Neurothemis intermedia intermedia* (Rambur) : Ris, 1911. *Cat. Coll.* Selys, *fasc.* **13** : 551, 563, 564.

Material examined : 1 ♂, Khammam Dist. : Kothagudem, wild life sanctuary, 5.ii.85, Coll : Joseph & Ramakrishna.

Distribution : In India recorded from Punjab, Uttar Pradesh, Bihar, Madhya Pradesh, and Peninsular India. Also distributed in Burma, Sri Lanka, Indo-China and Malacca.

Remarks ; So far we have not come across this species in and around Hyderabad.

16. **Neurothemis tullia tullia** (Drury)

1773. *Libellula tullia tullia* Drury, *Ill. Exat.* Ins., 2 : 85 ; *Neurothemis tullia* (Drury) : Kirby, 1890. *Cat. Odon.* : 8 ; *Neurothemis tullia tullia* (Drury) : Fraser, 1936. *Fauna Brit. India*, 3 : 360-362.

Material examined : 3 ♀, Hyderabad : Manjeera, 5.v.85, Coll : Joseph ; 2 ♂, 1 ♀, Kurnool Dist. : Nandyal, 23.vi.85, Coll : P. Parui.

Distribution : It is one of the widely distributed species of the genus in India. Also reported from Burma, Sri Lanka, Hong Kong, Malacca.

Remarks : Medium sized beautiful species which are not very common in Hyderabad.

17. **Orthetrum sabina sabina** (Drury)

1770. *Libellula sabina* Drury, *Ill. Exot. Ins.* 1 : 114-115 ; *Orthetrum sabina* (Drury) : Kirby, 1889. *Trans. Zool. Soc. Lond.* 12 : 302 ; *Orthetrum sabina sabina* (Drury) : Mitra et al, 1976. *Third All India Congr. Zool.* : 64.

Material examined : 6 ♂, 4 ♀, Hyderabad : Osmania University Gardens, 8.iii.85, Coll : Satyarani ; 3 ♂, 3 ♀, Hyderabad : NFC gate, 19.v.85, Coll ; Satyarani ; 7 ♂, 1 ♀, Kurmalguda : Nadergul, i.ix.84, Coll : Muley & Satyarani ; 1 ♂, 1 ♀, Hyderabad : Manjeera, 26.ix.84, Coll ; Joseph ; 1 ♂, Khammam Dist, : Yellandu forest, 7.ii.85, Coll : Joseph & Ramakrishna ; 1 ♂, Khammam Dist. : Kothagudem, 8.ii. 85, Coll : Joseph & Ramakrishna ; 3 ♂, Karimnagar Dist. : Raikal Forest, Jagtial, 14.ii.85, Coll : Joseph & Ramakrishna ; 2 ♂, Karimnagar Dist. : Tirumapur Forest, 15.ii.85, Coll : Joseph & Ramakrishna ; 1 ♀, Hyderabad : Bibinagar,

11.iv.85, Coll : Satyarani 1 ♂, Hyderabad : Saroornagar, 24.iv.85, Coll : Satyarani.

Distribution : In India it is reported from Manipur, Assam, Bengal, Bihar, Uttar Pradesh, Punjab, Himachal Pradesh, Karnataka State, Tamil Nadu and Kerala. Also occur in Nepal, Burma, Sri Lanka, North East Africa, eastward across Asia to Australia, Pacific Islands, Siamand Samosa.

Remarks : It is very common in and around Hyderabad. The distinctive shape of the abdomen is characteristic of the genus.

18. **Pantala flavescens** (Fabricius)

1798. *Libellula flavescens* Fabricius, *Ent. Syst. Suppl.* 285 ; *Pantala flavescens* (Fabricius) : Hagen, 1861. *Syn. Neur. N. Amer.* 142.

Material examined : 3 ♂, 4 ♀, Hyderabad : Osmania University Gardens, 8.iii.84, Coll : Satyarani ; 4 ♂, 2 ♀, Kurmalguda : Nadergul, i.ix.84, Coll : Muley & Satyarani ; 2 ♂, 4 ♀ Hyderabad : Nacharam, 6.xi.84, Coll : Joseph.

Distribution : Circumtropical and subtropical, in distribution. Widely distributed throughout the whole of India Sri Lanka and Burma to as far north as Tibet.

Remarks : This is a very common species of Hyderabad, seen all round the year.

19. **Rhodothemis rufa** (Rambur)

1842. *Libellula rufa* Rambur, *Ins. Nevrop.* 71 ; *Rhodothemis rufa* (Rambur) : Ris. 1911. *Cat. Coll. Selys, Fasc.* 13 : 592-593.

Material examined : 1 ♂, Hyderabad : Nehru Zoological Park, 23.ii.85, Coll : Satyarani.

Distribution : Extends throughout India, Sri Lanka, Burma and Malaysia to New Guinea, Celebes, Borneo, Java and Australia.

Remarks : It is a very rare species. It differs from Fraser's description of male in that the prothorax and thorax

reddish-brown with markings : prothorax dark-brown with middorsal citron-yellow stripe, thorax golden brown with a bright citron-yellow stripe extending from front of dorsum backwards towards the abdomen up to the fourth segment.

20. **Ryothemis variegata variegata** (Linnaeus)

1763. *Libellula variegata* Linnaeus, *Amoenitates Acad.* **6** : 412 ; *Ryothemis variegata* (Linnaeus) : Hagen, 1867. *Stett. Ent. Zeit.* **28** : 232 ; *Ryothemis variegata variegata* (Linnaeus) : Ris, 1913. *Cat. Coll. Selys, Fasc.* **15** : 931, 935, 936.

Material examined : 1 ♀ , Hyderabad : Manjeera, 5.v.85, Coll : Joseph ; 1 ♀ , Adilabad Dist. : Khanapur Forest, 23.ii. 85, Coll : Joseph and Ramakrishna ; 1 ♀ , Hyderabad : Saroornagar, 9.v.85, Coll : Satyarani.

Distribution : In India it is distributed in Assam, Bihar, West Bengal, Himachal Pradesh and Karnataka State. Also reported from Burma, Sri Lanka, Malaysia and Philippines.

Remarks : While flying this dragonfly moves their wings up and down like a butterfly unlike that of other odonates.

21. **Trithemis pallidinervis** (Kirby)

1889. *Sympetrum pallidinervis* : Kirby, *Trans. Zool. Soc. Lond.* **12** : 327 ; *Trithemis pallidinervis* (Kirby) : Morton, 1907. *Trans. Ent. Soc. Lond.* : 304.

Material examined : 12 ♂ , 10 ♀ , Hyderabad : Jeedimetla, 22.v-84, Coll : Satyarani ; 3 ♂ , 3 ♀ , Hyderabad : Himayatsagar 24.v.84, Coll : Satyarani ; 1 ♂, 3 ♀ , Hyderabad : Public Gardens, 5.vi.84, Coll : Satyarani ; 5 ♂ , ♀ Hyderabad : Jeedimetla, 6.viii.84, Coll : Satyarani ; 5 ♂ , ♀ Hyderabad : Jeedimetla, 6.viii.84, Coll : Satyarani ; 3 ♂ , 4 ♀ , Hyderabad : Manjeera, 8.iv.85, Coll : Joseph ; 1 ♀ , Hyderabad ; Saroornagar, 10.iv.85, Coll. Satyarani ; 2 ♀ Hyderabad : Saroornagar, 24.iv.85, Coll : Satyarani ; 5 ♂ , 3 ♀ , Khandi village, 5.v.85, Coll : Joseph ; 6 ♂ , 2 ♀ Hyderabad : Saroornagar 9.v.85, Coll : Satyarani.

Distribution : It is known to occur throughout India, Burma, Sri Lanka, Taiwan and Philippines.

Remarks : It breeds only in stagnant waters and usually in marshy areas.

SUMMARY

Twenty-one species of odonates from Hyderabad, Warangal, Khammam, Karimnagar, Nalgonda, Adilabad and Kurnool districts of Andhra Pradesh collected during 1984-85 are reported in this paper. Of these sixteen species are recorded for the first-time from Andhra Pradesh, the already recorded species are, *Ceriagrion coromandelianum* (Fabricius), *Crocothemis servilia servilia* (Drury), *Orthetrum sabina* (Drury), *Pantala flavescens* (Fabricius) and *Rhyothemis variegata* (Linnaeus), reported in the unpublished work of Krishnamoorthy *et al.* (1961). The specimens are deposited in the Fresh water Biological Station, Zoological Survey of India, Hyderabad.

ACKNOWLEDGEMENTS

We are grateful to Dr. B.K. Tikader, Director, Zoological Survey of India, Calcutta, for providing opportunity to do this work. Thanks are also due to Dr. Arun Kumar and the Officer-in-charge, Odonata Section, Zoological Survey of India, for confirming indentification of some of the species dealt with in this paper. We are indebted to Shri D. N. Mahato. Field Collector, Fresh Water Biological Station, Zoological Survey of India, Hyderabad, for the help he has rendered in collecting the dragonflies in our trips.

REFERENCES

FRASER, F.C., 1933. *The Fauna of British India*, Odonata, (London) **1** : 1-423.

FRASER, F.C., 1934. *The Fauna of British India*, Odonata, (London) **2** : 1-398.

FRASER, F.C. 1936. The Fauna of British India, Odonata, (London) **3** : 1-461.

KRISHNA MOORTHY, C., DHARMARAJU EDWIN, LAKSHMINARAYANA, K.V., 1961. A systematic catalogue of the main identified Entomological Collection in the scheme building up named reference collection of insects at the Agricultural College, Bapatla, Andhra Pradesh. Department of Agriculture, Hyderabad ; 26-28 and 93.

MITRA, T. R., LAHRI, A.R. and RAYCHAUDHURY, D. N., 1976. Remarks on dragonflies (Odonata : Anisoptera) of Calcutta. *Third All India Congr. Zool.* : 64.

WATSON, J. A. L., 1962. "The Dragonflies (Odonata) of South Western Australia", (*Western Australian Naturalists Club Handbook* No. 7) (W.A.Nat. Club : Perth).

Rec. zool. Surv. India, 85(3) : 451-452, 1988

SHORT COMMUNICATION

ON SOME FRESH WATER LEECHES (ANNELIDA : HIRUDINEA) FROM KARNATAKA-INDIA

The present communication deals with a small collection of leech collected by the author during January, 1981 from the fresh water bodies of Karnataka. Not much work has been done in the present Karantaka state on leeches, ectoparasites, occurring in the fresh water. So an attempt was made to collect and record the little known leech fauna of the state. The collection contains five species belonging to five different genera of which four species hetheretofore un-recorded from this state. The only species *Glossiphonia weberi weberi* Blanchard is recorded previously from Bangalore. So it was considered worthwhile to publish the new records here under.

Class : **Hirudinea**
Order : RHYNCHOBDELLAE
Family : GLOSSIPHONIDAE

1. *Glossiphonia weberi weberi* Blanchard Loc. 20 km. On Kudugeve Sagar Road, Sagar, Shimoga, Karnataka, Material : 1 ex, Reg. No. An 382. Date : 7th Jan, 1981.
2. *Hemiclepsis marginata marginata* Morre Loc. 2 km E. of Sagar, Shimoga, Karnataka. Material : 1 ex, Reg. No. An 384. Date : 5th Jan., 1981.
3. *Paraclepsis praedatrix* Harding Loc. 20 km on Kudugeve Sagar Road, Sagar, Shimoga, Karnataka. Material : 1 ex, Reg. No. An 381. Date : 7th Jan, 1981.

Order : ARHYNCHOBDELLAE

Family : ERPOBDELLIDAE

4. *Barbronia weberi* (Blanchard) Loc : 2 km E. of Sagar, Shimoga, Karnataka. Material : 1 ex. Reg. No. An 383. Date ; 5th Jan., 1981.

5. *Herpobdelloidea lateroculata* Kaburaki Loc : 20 km on Kudugeve Sagar Road, Sagar, Shimoga, Karnataka. Material : 1 ex. Reg. No. An 380. Date : 7th Jan, 1981.

The author is highly indebted to Dr. T. N. Anantakrishnan, Ex-Director, Zoological Survey of India and Dr. Asket Singh Deputy Director, Zoological Survey of India, Solan for providing the facilities for this project.

High Altitude Zoology Fd. Stn.,
Zoological Survey of India,
Solan (H. P.)

RATHIN MUKHERJEE
AND
MAHESH CHANDRA

Rec. zool. Surv. India, **85**(3) : 453-454, 1988

SHORT COMMUNICATION

NEW RECORD OF PSAMMODYNASTES PULVERULENTUS (BOIE) (1827) (REPTILIA : SERPENTIS : COLUBRIDAE) FROM ORISSA

The species, *Psammadynastes pulverulentus* (Boie), popularly known as "Mock Viper", was described from specimens collected from Jeva. It is now known from throughout the Indo-Chinese subregion extending from the Eastern Himalayas, as far west as Nepal, to Southern China, and, South to Malay archipelago. In India, its distribution remained confined to Assam-hills. In any case, it was never before recorded from the southern side of the alluvial gangetic plains etc. Its availability in the dense forest of Simlipal Forest in Orissa is thus not only very interesting from the point of its zoogeographical distribution but also constitutes a new record and an extension of its range of distribution to the southern India.

The specimen which is a younger one, measures 275mm (standard length) and 60mm (tail length) (vs. 510mm and 90mm respectively), was caught from a jungle road, bordering a densely woody hillock, in front of and leading to Jenabil, Simlipal Forest Rest House on 9.10.85 at about 12.30 pm. Apparently the animal was basking in the sun and was very sluggish.

The specimen before us agrees well with the known account of the species as presented by Smith (1943 : 386-370, figs. 116 & 117) ; according to the same author (op. cit.) the number of temporal shield is 2+3 or rarely 2+2 ; our specimen belongs to rare group. The colour is dark-brown above with small black streaks on the dorsal side of back and with pink shade all over the body.

We are grateful to Dr. B. K. Tikadar, Director, and,

Officer-in-Charge, Reptilia section, Zoological Survey of India, for facilities provided.

Reference

Smith M. A., 1943. *Faun. Hrit. India,* Reptilia and Amphibia. vol. 3. Serpentis, 368-370 pp.

Zoological Survey of India,
27, Chowringhee Road,
Calcutta-16.

H. K. Bhowmik
and
S. Sur

Rec. zool. Surv. India, 85(3) : 455-457, 1988

SHORT COMMUNICATION

BHAROANA, A RELIGIOUS SANCTUARY OF WATER BIRDS IN PANJAB

A judicious conservation of environment is highly essential for maintaining the balance of nature. Invariably, this balance is disturbed causing serious environmental problems. In the vast arena of the Indian environment, one important unit comprises the migratory birds visiting this subcontinent from as far off a place as Siberia in U. S. S. R. These birds are winter visitors and settle down in and around large water bodies and very congenially reside here during the winter in close association with many other resident water birds of India. These winter visiting migratory water birds act very precisely as an index of environmental pollution and disturbance ; they settle down in flocks only at such places where environmental pollution or disturbance is negligible or absent. In India, many such wetlands have been recognised where winter migratory birds annually visit and because of this reason, they are being looked after and protected under the laws specially enacted for this purpose. Apart from these officially declared bird sanctuaries, there are at many places animal sanctuaries created out of religious fervour, prominent among them being the Blackbucks conserved around Bishnoi villages in Rajasthan, Panjab and Haryana, Mahseer and other fishes protected at Harki Pauri at Hardwar and near many other temples etc. Similarly a bird sanctuary around Rababsir gurdwara in the village Bharoana, Kapurthala district, Panjab, has been recently spotted and the authors consider it important to mention here the observations made at that spot.

During a recent visit to Harike bird sanctuary, the autors visited Bharoana, a small village situated neatly 30 kms south-east of Harike in Kapurthala district, Panjab. In this village, there is a historic gurdwara, Rababsir, which is encircled on

three sides by a big pond. In this pond, huge flocks of ducks were observed on 4.12.1985 in the afternoon. Most of the ducks were basking in the sun on the sides of the pond, some of them even ventured into the nearby wheat fields. At this spot, the ducks enjoy complete protection because shooting and even fishing in the pond is completely prohibited, the rule being strictly enforced by the sewadars (attendants) of the gurdwara. As a result the ducks of Bharoana pond are not as shy as those the nearby Harike lake. The local people easily approach and walk around the area even at the distance of 10-12 metric from the sitting birds, though this concession was not given to the authors who could watch them from a distance of not less than 30 metric. Ten species of ducks, eight of them migratory, were observed in the pond. The Pintail (*Anas acuta* Linnaeus) was the dominant species followed by the Eastern Greylag Goose (*Anser anser rubrirostris* Swinhoe).

The following species of ducks were observed in the pond :

1. Eastern Greylag Goose, *Anser anser rubrirostris* Swinhoe
2. Barheaded Goose, *Anser indicus* (Latham)
3. Rudy Shelduck, *Tadorna ferruginea* (Pallas)
4. Pintail, *Anas acuta* Linnaeus
5. Common Teal, *Anas crecca crecca* Linnaeus
6. Spotbill Duck, *Anas poecilorhyncha poecilorhyncha* J. R. Forster
7. Mallard, *Anas platyrhynchos* Linnaeus
8. Wigeon, *Anas penelope* Linnaeus
9. Shoveller, *Anas clypeata* Linnaeus
10. Cotton Teal, *Nettapus coromandelianus coromandelianus* (Gmelin)

Three species of rails were also recorded in the pond though in very small numbers. These were :

1. Indian Moorhen, *Gallinula chloropus* Blyth
2. Indian Purple Moorhen, *Porphyrio porphyrio poliocephalus* (Latham)
3. Coot, *Fulica atra atra* Linnaeus

Another striking feature recorded was the complete absence of diving ducks in the pond, although three species of diving ducks viz. Redcrested Pochard, *Netta rufina* (Pallas) ; Common Pochard, *Aythya ferina* (Linnaeus) and Tufted Duck, *Aythya fuliqula* (Linnaeus) were seen in large numbers in the nearby Harike lake.

The protection accorded to these water birds by the attendants of the gurdwara is a commendable job and should be supported by the Government in the interests of the environmental protection. The religious bodies discharging such noble duties at other places in India should also be enlisted and recognised so that religious sanctuaries of animals and birds are placed on official record.

Zoological Survey of India
Northern Regional Station,
Dehra Dun

M. L. NARANG
AND
RAJ TILAK

Rec. zool. Surv. India, 85(3) : 459-461, 1988

SHORT COMMUNICATION

TYMPANAL ORGANS OF PENTATOMIDAE (HEMIPTERA)

Tympanal organs occur in Orthoptera, (Acridoidea, Tettigonioidea and Grylloidea), Cicadidae, some Lepidoptera, (Geometridae, Cymatophoridae, Pyralidae, Uranidae) and some Neuroptera.

Detailed morphological account of tympanal organs in Orthoptera is given by Siebold (1844) Muller (1826) Herbig (1902), and Schwabe (1906) ; in Heteroptera and Homoptera by Vogel (1912, 1921, 1923) ; in Lepidoptera by Jordan (1905) Deegener (1909), Eggers (1916, 1919, 1925) and Kennel (1912) ; in Neuroptera by Miller (1970). Detailed account of histology may be seen in the papers of Schwabe (1906), Eggers (1911, 1919, 1925, 1928), Vogel (1923) Hers (1938) and Friedman (1972).

In Acriididae tympanum is on each side of the first abdominal tergum and is visible externally. In Tettigonioidea and Grylloidea there is one or a pair of tympanum near the proximal end of each anterior tibia. Tympanum is conspicuous in many genera but in others each organ is concealed by a cuticular fold and comes to be in a cavity which communicates with the exterior by a short slit-like opening. In many families of Lepidoptera tympanal organs occur at each side of the metathorax or at the base of abdomen. In Cicadidae tympanal organs occur in both sexes at the base of abdomen.

Tympanal organs are so far unnoticed in Pentatomidae (Hemiptera). Recently the author noticed tympanal organs in five species of *Coridius* Illiger 1807 (Subfamily : Coridiinae). *C. janus Fabr.*, *C. brunneus Thunb.*, *C. nepalensis* Westw., *C. singhalanus* Dist. and *C. chinnensis* Dall. In all these

species the tympanal organs are conspicuous and occur only in female on the hind tibiae.

The tibia is approximately 5-5.5 mm long and the tympanum which is oval in shape is approximately 2 mm long and is located anteriomedially on the inner side of posterior tibia. The tibia is setate except for the region of tympanum.

Acknowledgements

I am deeply grateful to the Director, Zoological Survey of India, Calcutta and the Deputy Director, Southern Regional Station, Madras for facilities.

References

Deegener, P. 1909. Uber ein neus Sinnesorgan am Abdomen der Noctuiden. *Zool. Jahrb. Anat.*, **27** : 631-650.

Eggers, F. 1911. Uber des thoracale tympanal organ der Noctuiden Sitzber *Naturf. Ges. Univ. Jurjew* (Dorpat) **20** : 138-145.

Eggers, F. 1919. Das thoracale bitympanaleorgan einer der Lepidoptera, Heterocera. *Zool. Jahrb. Anat.*, **41** : 273-376.

Eggers, F. 1928. Die stiftfuhrenden Sinnesorgane. Morphologie und Physiologie der chordotonalen und der tympanalen Sinnesapparate der Insekten. *Zool. Baust.*, **2** (1), 354 pp.

Friedman, M. H. 1972. A light and electron microscopic study of sensory organs and associated structures in the foreleg tibia of the cricket, *Gryllus assimilis*,—*J. Morph.* **138** : 263-327 ; 329-348.

Hers, J. 1938. Organe tympanal du *Schistocerca gregaria* Forsk.—*Proc. 5th Inter Locust Conf. Brussels*, P. 434.

Herbig, C. 1902. Anatomie und Histologie destibialen Gehorapparates von *Gryllus domesticus*.—*Arch. Mikroskop* Anat., **61** : 697-729.

JORDAN, K. 1905. Note on a peculiar Sexual character found among Geometridae at the sensory organ situated at the base of the abdomen.—*Nov. Zool.* **12** : 506-508.

KENNEL, J. V. 1912. Uber Tympanalorgane im Abdomen der Spanner and Zunsler.—*Zool. Anz.*, **39** : 163-170.

MILLER, L. A. 1970. Structure of the green lacewing tympanal organ *Chrysopa carnea*, (Neuroptera). *J. Morph.* **131** : 359-382.

MULLER, 1826. Zur vergleichenden Physiologie des Gesichtsinnes des Menscher und Tiere. Lepizig, 1826.

SCHWABE, J. 1906. Beitrage Zur Morphologie und Histologie der tympanalen sinnesapparate der Orthopteren *Zoologica Stuttg.* **20**(50) : 1-154.

SIEBOLD, V. 1844. Uber das Stimm und Gehororgan der Orthopteren. *Weigmann's Archiv. f. Naturgeschichte*, **10** Jahrg.

VOGEL, R. 1912. Ueber die chordotonalorgane in der wurzel der Schmetterling-sflugel. *Z. Wiss. Zool.* **100** : 210-244.

VOGEL, R. 1921. Bericht ueber ein Gehororgan bei Singzikaden. *Naturwissenschaften*, **9** : 427-431.

VOGEL, R. 1923. Ueber ein tympanles Sinnesorgan, das mutmassliche Hororgan der Singzikaden. *Z. ges. Ant.*, **67** : 190-231.

Zoological Survey of India KOSHY MATHEW
Southern Regional Station
Madras-600 028. (India)

Rec. zool. Surv. India, 85(3) : 463-464, 1988

SHORT COMMUNICATION

NEW RECORD OF ZALISSA ALBIFASCIA (WALKER) (LEPIDOPTERA : AGARISTIDAE) FROM ASSAM AND WEST BENGAL

While studying the material received for identification from North Bengal University, Darjeeling and also a named specimen lying in the old collections of Zoological Survey of India the authors encountered the species, *viz.*, *Zalissa albifascia* (Walker) which is reported here for the zoo-geographical interest.

Since the discovery of the species by Walker (1865) the occurrence of the species has been reported by several authors including Cotes & Swinhoe (1888), Hampson (1894) and Jordan (1914) from different countries, namely, North China, Burma (Rangoon & Moulmein) and India.

The perusal of literature reveals the existence of the species in Karnataka (Canara), Sikkim and Andamans in India. So, presently, the species constitutes new locality records both from Assam and West Bengal and has extended the range of distribution. It is therefore, likely that with intensive explorations the species may be available from other states of India.

The material examined from Assam and West Bengal conform with the description given by Hampson in all details. However, the wing expanse in female is 52mm and in the male specimen it varies from 52 to 54 mm. instead of 60 mm. as recorded by Hampson (*loc. cit*).

Material examined : 1 ♂ : India : Assam, 19.iii.1957 (Reg. no. 898/H_{10}), coll. B. K. Tikader ; 1 ♂, 1 ♀ : West Bengal, North Bengal University campus and Sukna forest, coll. D. B. Khawas (collected as larvae ; moths emerged after rearing on 8.6.85).

ACKNOWLEDGEMENT

The authors are grateful to Dr. B. K. Tikader, Director, Zoological Survey of India, Calcutta for rendering laboratory facilities for the work and also for the precious collection and to Dr. D. B. Khawas, J. R. F., North Bengal University, Darjeeling for sending two interesting specimens for identification.

REFERENCES

COTES, E.C. & SWINHOE, C. 1888. Catalogue of the moths of India, pt. 3 : 348 (no. 2275).

HAMPSON, J.F. 1894. The Fauna of British India including Ceylon and Burma, Moths, **2** : 157.

JORDAN, K. 1914. Family Agaristidae, In Seitz, A. The Macrolepidoptera of the World, **3** : 5-8.

WALKER, F. 1865. Catalogue of the Lepidoptera Heterocera in the British Museum, **33** : 933.

Zoological Survey of India,
Calcutta

S. K. GHOSH
AND
M. CHAUDHURY

Rec. zool. Surv. India, **85**(3) : 465, 1988

SHORT COMMUNICATION

ADDITIONAL TYPE MATERIAL OF *CAPULICA ALATA* UVAROV, 1929 (ORTHOPTERA : ACRIDIDAE)

Uvarov (1929) described a new species of grasshopper collected from the plateau of Mysore [now Karnataka], and named it as *Capulica alata*. He stated the type locality as Masinigudi, plateau of Mysore and date of collection as 29.1.1927, based on 2 male and 3 female specimens.

On a study of the type collections in the Zoological Survey of India, Calcutta, the auther has come across three more specimens, the paratypes of above species, which were registered on 4.IX.1929 and bear the folloing labels :

1. Nerbudda survey, Amarkantak, Rewa state, C. P., Stn. 5, 30.I.27, H. S. Pruthi.
   Capulica alata sp. n., Paratype, Det. B. Uvarov, 1929. 301/H5-Female.
2. Nerbudda survey, Amarkantak, Rewa state, C.P., Stn. 5, 29.I.27, H. S. Pruthi.
   Capulica alata sp. n., Paratype, Det. B. Uvarov, 1929, 302/H5-male.
3. Nerbudda survey, Pharissmer Hills, Rewa state, C. P. Stn. 20, 9.II.27, H. S. Pruthi.
   303/H5-female.
   Capulica alata sp. n., Paratype, Det. B. Uvarov, 1929.

This information on the existence of additional type material is unpublished so far. It also extends the known range of distribution of species from Karnataka to Madhya Pradesh as well.

REFERENCE

UVAROV, B. P. 1929. Acrididen (Orthoptera) aus Sud-Indien. *Revue suisse Zool.* Geneve, **36** : 533-563.

Zoological Survey of India,
Calcutta

M. S. SHISHODIA