Rec. zool. Surv. India, 87(4) : 263-264, 1990

ON THE WESTERN LIMIT OF PIGTAILED MACAQUE DISTRIBUTION IN N.E. INDIA

J. P. SATI
Zoological Survey of India, Eastern Regional Station, Risa Colony, Shillong
AND
J. R. B. ALFRED
Zoological Survey of India, 234/4, A.J.C. Bose Road, Calcutta

INTRODUCTION

The Pigtailed Macaque, *Macaca nemestrina* Linn. is one of the 11 species of non-human primates found in the North-Eastern Regions of India. This species is found in the Asian continent from Assam in the North through South Burma and Western Thailand to Malaya Peninsula, extending to Sumatra, Borneo and Mentawai Islands in the South (Medway 1970 & Caldecott 1986). In North-Eastern India their occurrence from Naga Hills was reported by McCann (1933) and from Hollongapar (Assam) by Tilson (1982). In the detailed work on Pigtailed macaque, Bernstein (1967) reported that these animals were hunted for food throughout most of their distributional range, which is true also for the North-Eastern Region of India (the authors personally have witnessed the hunting of Pigtailed Macaque by the local tribals and relishing its meat in West Garo Hills, Meghalaya). The present report records for the first time their occurrence in Garo & Khasi Hills of Meghalaya State, which has not yet been reported (Tilson, 1982).

While working on the hoolock gibbon project in the State of Meghalaya, North-Eastern India, the complete area was surveyed extensively to locate/sight groups of gibbons for long term investigations on their ecology and behaviour. In October 1984, the project came into operation and till March 1989 almost all the tropical evergreen and mixed deciduous forests of Garo & Khasi Hills were surveyed thoroughly.

During these four and a half years duration the number of occasions these macaques encountered and field notes were made on their group size and composition, home range and food & feeding. Tilson (1982) while censusing the hill forests bordering the Brahmaputra Valley of Assam, hill tracts of the Garo United Khasi-Jaintia. Mikir & North Cachar Hills lying South of Brahmaputra river and Dafla Hills North of the river during his 62 days duration in July-August 1971 & December-February 1972-73, reported that the pigtailed macaques were not found in the Garo and United Khasi-Jaintia Hills. However, Biswas & Diengdoh (1977) had reported their occurrence in Meghalaya from Khasi Hills. In fact they also reported that a pigtailed macaque was captured and put into the State Zoo at Shillong.

From our extensive survey, we observed 4 groups of these macaques in West Garo

Hills near the village sacred forests and 2 groups in West Khasi Hills bordering East & West Garo Hills. No solitary individuals were encountered. However, the groups sighted were small in size (Fooden 1975). The groups size varied from 4-12 individuals with an average group size of 7.2 individuals. All groups encountered were bisexual, and none of them were either all male or all female. Adult females (mothers) were observed carrying new infants in their ventrum during both winter and summer months.

Invariably these macaques were observed occupying the middle canopy of their habitat and frequently they were seen coming down to lower canopy, and even occasionally on the forest floor too. They maintained apparently an extensive home range, and certainly much more than the territory of the hoolock gibbons. The pigtailed macaques were observed feeding on the fruits of wild *Ficus, Grewia, Dalbergia, Prunus, Vanguria, Vitex, Calamus* and sometimes on fruits of *Artocarpus, Mangifera, Tamarindus* and *Citrus* near the villages. Feeding on Leaves and and flowers of *Bauhinia, Mucuna Stereospermum, Parkia* and number of bamboo species, during different season of the year were also observed, and quite a good time of their total feeding time was spent here.

Hence, West Garo Hills, of the State of Meghalaya probably is the Western most limit of the distribution of pigtailed macaque, in North-Eastern India. Extensive and intensive surveys are required in these regions with particular reference to this species to enable to identify the status of these animals.

REFERENCES

Bernstein, I. S. 1967. A field study of the Pigtail monkey. *Primates* **8** : 217-228.

Biswas, S. & Diengdoh, H. 1977. Notes on the Stumptailed Macaque (*Macaca spciosa* F. Cuvier) and Pigtailed Macaque (*Macaca nemestrina* Linn.) from Meghalaya. *J. Bombay nat. Hist. Soc.* **74** (2) : 344-345.

Caldecott, J. O. 1986. An ecological and behavioural study of the Pigtailed macaque in contribution to Primatology Vol 21. ed : F. S. Szalay, p. 1-259. Karger : Basel, Miinchen. Paris, London. New York. New Delhi. Singapore. Tokyo. Sydney.

Fooden, J. 1975. Taxonomy and evolution of liontail and Pigtail Macaques (Primates : Cercopithecidae). *Fieldiana* (Zool) **67** : 1-169.

McCann, C. 1933. Notes on some Indian Macaques. *J. Bombay nat.* Hist. Soc. **36** : 796-810.

Medway, L. 1970. The monkeys of Sundaland : ecology and systematics of the cercopithecids of a humid equatorial environment : in Napier and Napier, Old World Monkeys, p. 513-553. Academic Press, New York.

Tilson, R. L. 1982. The Western limit of Pigtail macaque distribution in Assam. *J. Bombay nat. Hist. Soc.* **79** (2) : 399.

Rec. zool. Surv. India, 87(4) : 265-266, 1990

TEREBELLODIBRANCHIA AGATTIENSIS A NEW GENUS AND SPECIES OF TEREBELLIDAE (POLYCHAETA) FROM LAKSHADWEEP, INDIA

A. MISRA AND R.K. CHAKRABORTY

Zoological Survey of India, Calcutta

In course of the taxonomic studies on the Ploychaetes recently collected from Lakshadweep Archipelago, three examples of interesting Polychaetes belonging to the family Terebellidae were encountered. The specimens differ from all the known genera under the family and hence, they are described here as a new genus *Terebellodibranchia* with *T agattiensis* as the type species. The types are deposited in the National Collection of the Zoological Survey of India, Calcutta.

Family TEREBELLIDAE

Terebellodibranchia n. gen.

Tentacular lobe very short and collar-shaped with numerous long tentacles and few eye-spots. Two paris of branched gills on segments 3 and 7. No lateral lobes on the first few segments. Notosetae start on segment 4 and continue for a variable number of segments. Notosetae have serrated blades. Uncini are avicular start on segment 5 and are set in double rows face to face from segment 10.

Type species : *Terebellodibranchia agattiensis* n. sp.

Material : Holotype - Agatti Island, Lakshadweep; A. Misra; 29.12.1979; Z.S.I. Reg. No. An 1893/I

Paratype - 1 ex.; Kavaratti Island, Lakshadweep; A. Misra; 3.1.1980; Z.S.I. Reg. No. 1894/1 1 ex.; Agatti Island, Lakshadweep; A. Misra; 4.4.1984; Z.S.I. Reg. No. An 1895/1.

Description : The length of the holotype is 66 mm and maximum diameter is 1 mm. The largest of the paratype is 65 mm long and diameter is 1 mm. The tentacular lobe bears numerous tentacles and with few lateral eye-spots. Lateral lobes absent. Two pairs of branched branchiae on segment 3 and 7, anterior pair is smaller than the posterior one (Plate I, Plate II, fig. 1).

Notosetae commence on segment 4 and continue nearly to the posterior ones and all are capillaries with long finely-tipped blades. The distal portion of the blade is smooth, while the proximal part is finely serrated (Plate II, fig. 4 & 5). Uncini start on segment 5 and arranged in single row on the anterior segments, becoming double from segment 10. Uncini avicular and with a series of three denticles above the main fang giving the formula MF : 3 : 6-7. Attachement button not developed. Abdominal uncini are borne on short, square pinnules.

Remarks Initially, when only one specimen was examinned, it was assumed that

the specimen with two pairs of branchiae well separated along the thorax (segment 3 and 7) was a species under *Terebellobranchia* erected by Day (1951), in which the 3rd pair of branchiae had been lost. However, subsequent examination of two other specimens revealed that two pairs of brnchiae is a constant feature of the species. The present genus differs from all the known genera under the family Terebellidae (see Fauchald, 1977) and hence, the species has been described here as a new species under the new genus.

The genus *Terebellodibranchia* comes closer to two other genera, *Terebellodibranchia* Day, 1951 and *Terebella* Linnaeus, 1767. *Terebellodibranchia* agrees with *Terebellobranchia* in that both the genera are with notosetae from segment 4, uncini from segment 5 and the first two pairs of branchiae originate from segments 3 and 7, while, the later differs mainly in having an extra pair of branchiae on segment 13 and thoracic setigers limited to the anterior part of the body. The notosetae of the present species are unique in having smooth distal part and finely serrated proximal part. The genus *Terebella* differs from other two genera in having closely placed branchiae on segments 2 to 4. Three allied genera are compared (Table I).

TABLE I

Comparative accounts of three allied Genera

	Characters	Genera *Terebellodibranchia*	*Terebellobranchia*	*Terebella*
1	Tentacular lobe shaped	Short and collar indistinct	Short and collar-shaped	Short and collar-shaped
2.	Eye spot	Few	Nil	Many
3.	Branchiae	Two pairs on segment 3 & 7	Three pairs on segment 3,7 & 13	Two or three pairs on segment 2-4
4.	Notosetae	Start on segment 4 and total 35 or more	Start on segment 4 and total 19 or more	Start on segment 4 and continue for a variable number of segments.

Habitat : All the specimens were found to be living within coral crevices in the lagoon floor (2-4 meter depth) collected by dredging.

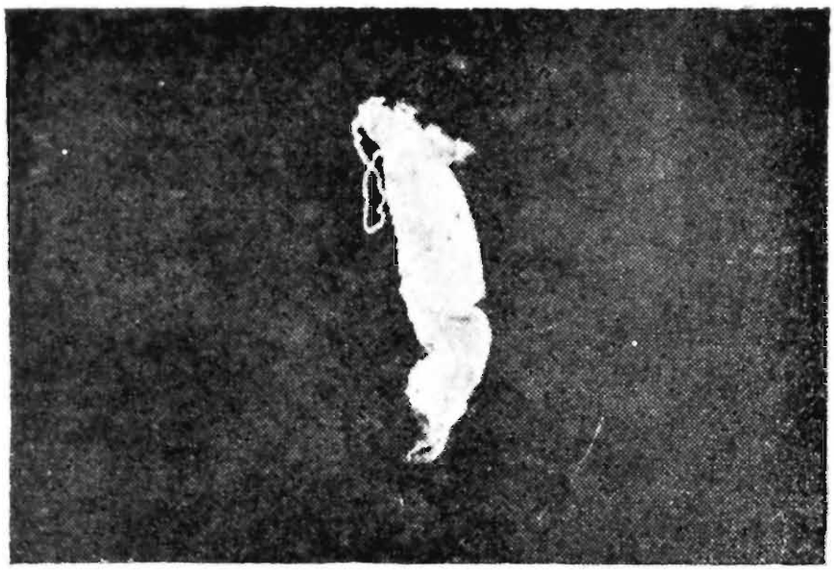
ACKNOWLEDGEMENTS

The authors are indebted to the Director, Zoological Survey of India, Calcutta for providing necessary facilities to carry out this work.

REFERENCES

Day, J. H. 1951. The polychaete fauna of South Africa. The intertidal and estuarine polychaeta of Natal and Mosambique. *Ann. Natal Mus.* **12** : 1-67.

Fauchald, F. 1977. The polychaete worms; difinitions and keys to the orders, families and genera. *Nat. Hist. Mus.* Los Angeles, **28** : 1-188.



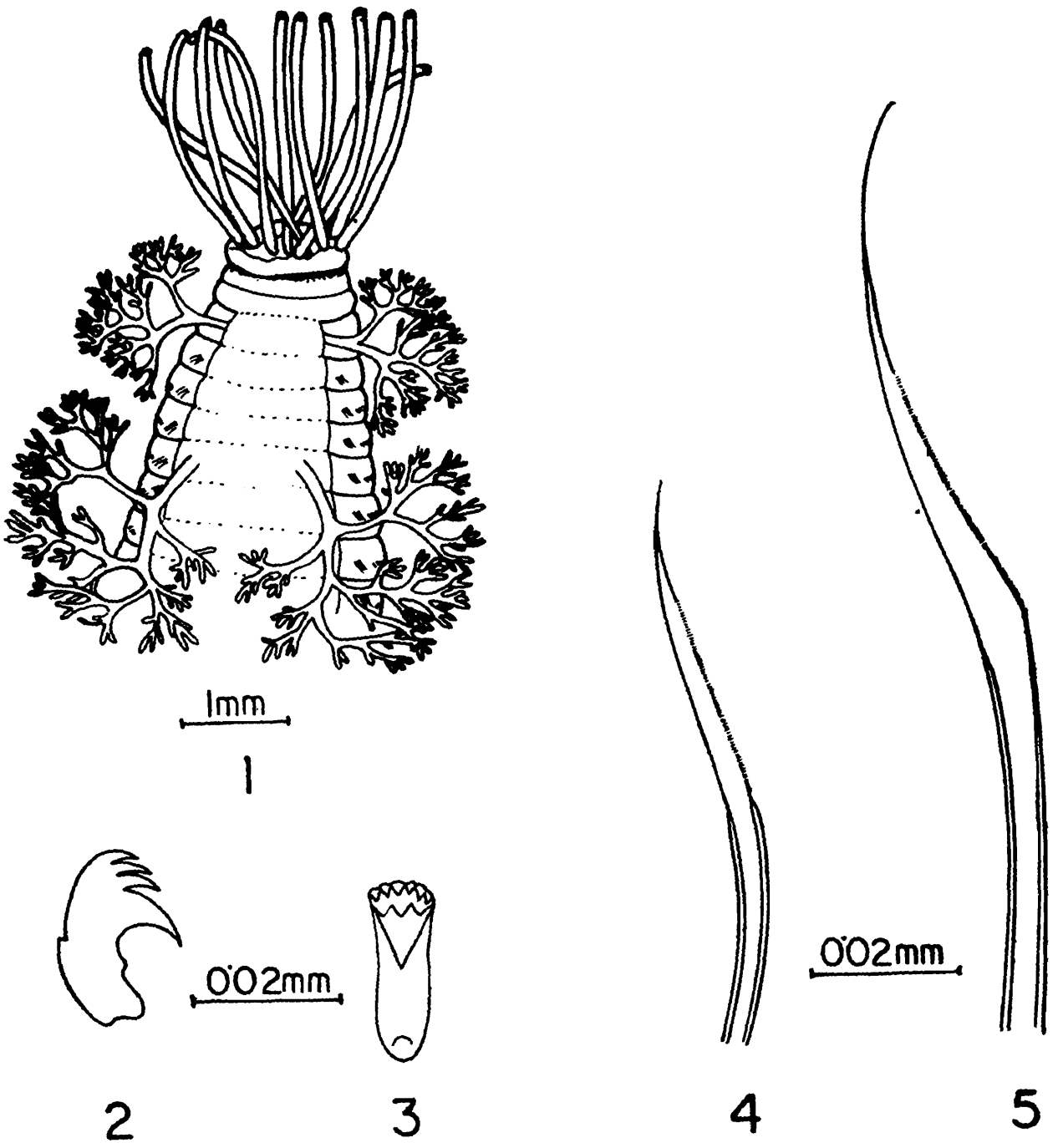
1

2

Fig. 1-2. Photographs of the anterior part of the polychaete *Terebellodibranchia agattiensis* n. g. & n. sp. showing the distance between the anterior and posterior pair of gills.

MISRA & CHAKRABORTY

PLATE II



Terebellodibranchia agattiensis n. g. & n. sp.

Fig. 1. Anterior end ; Fig. 2 & 3. profile and edge-on view of thoracic uncinus ; Fig. 4 & 5. capillary setae.

Rec. zool. Surv. India, 87(4) 267-271, 1990

CERCARIA GURAYAI, A NEW SPECIES (FURCOCERCARIA) FROM THE FRESHWATER SNAIL, *FAUNUS ATER* (LINNAEUS)

S.L. CHOUBISA

Department of Zoology, College of Science,
Sukhadia University, Udaipur - 313 001 (India)

INTRODUCTION

Out of 1,200 specimens of the snail, *F ater* (Linnaeus), collected from Jaisamand and Fateh sagar lakes of Udaipur district, Rajasthan, only one was found liberating a furcocercaria, which is described below as a new species. It has been named in honour of Prof. S.S. Guraya, Department of Zoology, Punjab Agriculture University, Ludhiana.

MATERIAL AND METHODS

The snails, *F. ater* collected from Jaisamand and Fateh Sagar lake, Udaipur, were kept in medium size beakers (500 ml) containig pond water and exposed to light to facilitate cercarial energence (positive phototropic). The cercariae were studied both live and after making stained whole mounts. Intra-vital stains such as Neutral red and Methylene blue were also employed on live cercariae for detailed study of their penetration glands. gut and genital rudiments. For measurements, five living and fixed, cercariae were taken.

Intramoliuscan larval stage, sporocyst was obtained by dissecting the infected snails.

OBSERVATIONS

Sporocyst (Fig. 1) : 25-35 sporocysts were collected from the infected snail. These were elongated, unbranched and whitish in colour, located in the distal part of digestive gland and gonads. The body measures 1.98-3.12 × 0.09-0.13 mm. Sporocysts were observed undergoing contraction and expansion. Each sporocyst become divided into 12-16 pseudocompartments by ingrowths from the body wall, contains few mature and immature cercariae and germ balls.

Emergence and behaviour of cercaria : Cercariae emerge mostly in the morning hours but are continuously shed during day also. They swim in water by lashing of their powerful tail. At the bottom of container, they make caterpillar like movements with the help of their suckers. During rest, it hangs down in water, body downwards with streched furcae. They remain active for a maximum period of about 16 to 18 hours after which they die without encystment.

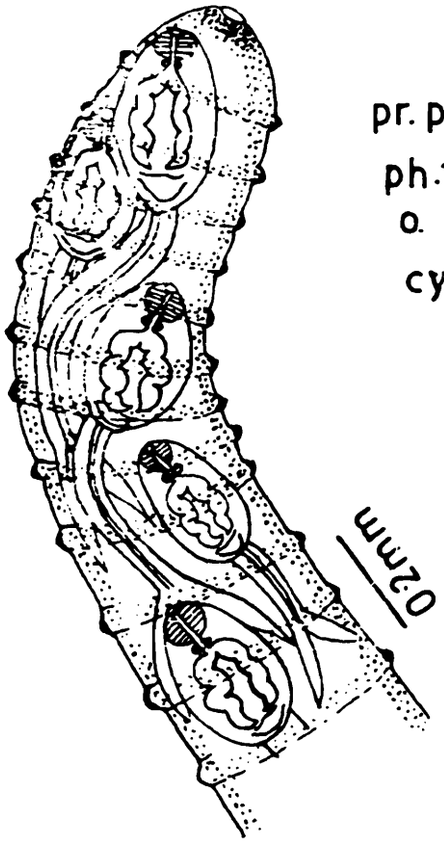


Fig. 1

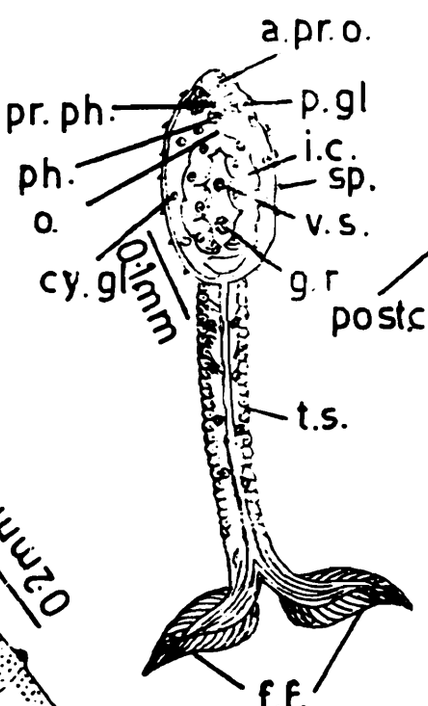


Fig 2

FIG 3

Figs. 1-3. 1. A portion of sporocyst enlarged. 2. *Cercaria gurayai* n. sp. a. pr. o. - anterior protrusible organ; Cy. gl.- Cystogenous gland; f.f. - fin fold; g.r. - rudiments of gonads; i.c. - intestinal caeca; O - Oesophagus; p. gl. - penetration glands; ph - pharynx; Pr. ph. - Prepharynx; Sp. - Spines; t.s. - tail stem; v.s. - ventral sucker. 3. *C. gurayai* n. sp. showing excretory system. Ant. c.c. - anterior collecting canal; C. ex.c. - Caudal excretory canal; ex. bl. - excretory bladder; ex. co. - excretory corpuscles; in. br. inner branch; m.c.c. - main collecting canal; m.l.c. - median longitudinal canal; Out br. - outer branch; Post. c.c. - posterior collecting canal.

Cercaria (Fig. 2) : The body is spinose with narrow anterior and broad rounded posterior ends. The circular and weakly muscular anterio protrusible organ (0.33 × 0.29 mm across) located in the midventral region of the body, is poorly developed and represented by an oval mass of dark staining cells. Mouth leads into a muscular and rounded pharynx which measures 0.01 × 0.01 mm across, prepharynx being present. Oesophagus short, intestinal caeca are sinusus broad and extended posteriorly up to the level of excretory bladder.

Penetration glands (Fig. 2), 18 in number, are located on the either sides of anterior protrusible organ. They are gorged with fine granules, centrally placed nucleus and stain pink with neutral red. Irregular cystogenous glands contain fine granules and are distributed all over the body. The rudiments of the gonads are located a little infront of the excretory bladder and are represented by a small mass of darkly staining cells.

Aspinose tail (Fig. 2), which is longer than the body (0.19-0.26 × 0.01-0.03 mm) is provided with well developed caudal bodies, cercular, longitudinal and oblique muscles. The tail terminates into a furcal rami, each of which measures 0.13-0.22 × 0.01 × 0.02 mm. Each furcae has well developed and prominent fin-fold with fin rays.

V-shaped excretory bladder (Fig. 3) is situated at the hind end of the body. Main collecting canal, one on each side of the body, originates from antero-lateral cornua runs up to the region of intestinal bifurcation, where it divides into an outer and inner branches. Inner branches run transversely for a short distance and unite its fellow form opposite side in the median region of the body to form a transverse canal. Each outer branch turns upwards and then downwards and runs up to middle of the body ad divides into two fine branchees, an anterior and a posterior collecting canals. The former runs up to the region of pharynx and divides into three branches, each with three capillaries capped with flame cells, while the latter runs posteriorly and divides into two fine branches, each with three capillaries capped with flame cells. A median longitudinal canal originates from the transverse canal and runs posteriorly where it divides into two short branches, each opening into cornua of the excretory bladder. Thus the flame cells formula for cercarial body is $2(3 + 3 + 3) + 2(3 + 3) = 30$.

The excretory granules, which are elongated, solid and arranged in a single row are found only in the transverse canal, median longitudinal canal and each out branch up to its turning downwards.

A caudal excretory canal originates posteriorly from the excretory bladder, runs medially along the tail stem and bifurcates to open out side through excretory pore at the tip of furcal rami. Three pairs of flame cells (Fig. 3) originate laterally from the caudal excretory canal are present in the tail stem. Thus, the flame cells formula for tail is $2(1 + 1 + 1) = 6$.

DISCUSSION

Different types of sporocysts such as oval, spherical, elongated and branched and

unbranched have been reported by many parasitologists time to time. In an available literature no such sporocysts having segmeted body by pseudocompartments have yet been reported from India. However, Erasmus (1972) has discussed regarding the presence of pseudocompartments in the body of certain sporocysts of cercarial species, e.g. *Plagiorchis muris*. Although the significant role of segments in the sporocysts is still unknown, but it may be presumed that they may have some role in the locomotion.

The present cercaria belongs to the Cyathocotylidae as it has long furcal tail, slender tail stem, well developed oral sucker, ventral sucker undeveloped, penetration glands near caecal bifurcation, protonephridia mesostomate and develop in elonhgated sporocysts.

The present form shows affinities with folowing species belonging to Cyathocotylid cercariae viz., *C. pendulata* Baugh, 1954; *C. multiplicata* Premvati, 1955; *C kumauensis* Singh and Malaki, 1963; *C. kukrailensis* Thaper, 1969; *C. sewelli* Pandey and Agrawal, 1977; *C. esplanadensis* Mukharjee and Ghosh, 1982 and *C. udaipuriensis* Sharma and Choubisa, 1983; but chiefly differs from all of them except *C udaipuriensis* in the number and arrngements of penetration glands and flame cells. It differs from *C. udaipuriensis* in having (i) prepharynx, (ii) prominent fin fold, (iii) arrangement of flame cells, flame cell formulae and presence of three pairs of flame cells in tail (iv) excretory granules in transverse canal, median longitudinal canal, and one fourth of outer branches of each main collecting canal.

SUMMARY

A new species of cercaria, *Cercaria gurayai*, collected from a freshwater snail, *Faunus ater* (Linnaeus), is reported. It belong to the Cyathocotylidae family and is characterised by spinose body, differential sucker ratio, number and position of penetration gland, extension of cystogenous glands and prominent furcal ramii. The affinities of the new cercaria have been discussed. A peculiar sporocyst of it, characterised by evidence of pseudocompartments which has also been reported first time from India.

ACKNOWLEDGEMENTS

I am grateful to Dr. P.N. Sharma for his constant encouragement, Dr. L.L. Sharma, Assistant Professor, Department of Limnology and Fisheries for the identification of snail host and to Prof. H.B. Tewari, Head of Zoology Department for providing laboratory facilities. Author also thankful to Dr. R.P. Mukherjee, Scientist 'SE' Zoological Survey of India, Calcutta for providing literature.

REFERENCES

Baugh, S.C. 1954. Studies of larval flukes of *Vivipara bengalensis* Part II on a new furcocercous cercaria of the Fivax type. *J. zool. Soc. India*, **6** : 123-128.

Erasmus, D.A. 1972. *The Biology of Trematodes.* Printed in Great Britain at the University Press, Belfast. pp. 69.

Mukherjee, R.P. & Ghosh, R.K. 1982. Studies on the larval trematodes of west Bengal Part I. *Cercaria esplanadensis* Mukherjee and Ghosh, 1975, a furcocercous cercaria. *Rec. zool. Surv. India,* **80** : 111-116.

Pandey, K.C. & Agrawal, N. 1977. Studies on cercarial fauna of Kathauta Tal Lucknow. *Ind. J. Zoot.,* XVIII, **1** : 1-50.

Premvati, G. 1955. *Cercaria multiplicata* n. sp., from the snail, *Melanoides tuberculatus* (Müller). *J. zool. Soc. India,* **7** : 13-24.

Sharma, P.N. & Choubisa, S.L. 1983. *Cercaria udaipuriensis* n. sp., from freshwater snail, *Vivipara bengalensis* from Fateh Sagar lake, Udaipur. *Ind. J. Parasitol.,* **7** (2) : 209-212.

Singh, K.S. and Malaki, A. 1963. Parasitological survey of Kumaon region. Part XVIII. One known and two new cercariae from freshwater snails. *Ind. J. Helminth.* **5** : 54-69.

Thaper, G.S. 1969. Studies on the life history of trematode parasites. II-Some new and little known cercariae from Lucknow and its environments. *Indian J. Helminth.* **21** (2) : 119-146.

Rec. zool. Surv. India, 87(4) : 273-275, 1990

ON NEW RECORD OF DISTRIBUTION AND ASSOCIATION OF A NORTH INDIAN ROOFED TURTLE, *KACHUGA TECTA* (GRAY) (REPTILIA : TESTUDINES : EMYDIDAE) AND FRESHWATER LEECH, *OZOBRANCHUS SHIPLEYI* HARDING (HIRUDINEA : ICHTHYOBDELLIDAE) IN UTTAR PRADESH TERAI.

RAJ TILAK, N. K. SINHA AND P. RAY

Zoological Survey of India, Dehra-Dun.

INTRODUCTION

During a survey and study programme of Uttar Pradesh Terai, the authors came across a specimen of a freshwater turtle, *Kachuga tecta* (Gray) which was heavily parasitised by a freshwater leech, *Ozobranchus shipleyi* Harding at river Rapti, Bandhghat in district Gorakhpur. The individuals of the leech in question adhere strongly on the soft parts of the plastorn of the tortoise. The attachment of the leech appears quite strong because the turtle was brought alive to Dehra Dun and kept for observation for months and the leeches still remain in position on the body of the tortoise. The leeches even laid fresh batches of eggs on the plastron of the turtle. The fertilised ova of the leech were firmly cemented to the skin of the tortoise. The record of the turtle *Kachuga tecta* (Gray), the leech *Ozobranchus shipleyi* Harding and their association with each other is made for the first time here.

Kachuga tecta (Gray)

Smith (1931) has mentioned the distribution range of this species as Northern India, covering the Ganga the Brahmaputra and the Sind river system. The exact limit of its range was not clearly defined. It is also recorded in fossil forms in the Pleistocene deposits of the Shiwalik Hills. Tilak and Sinha (1984) have also dealt with the occurrence of the species in U.P. Terai in general. But the present record of this species has a definite locality data. Recently Hall (1980) has recorded the species from Nepal-Bihar border and extended its range to Nepal. It appears that this species occurs all along the low hills in the Himalayan and the adjoining plains from Brahmaputra upto Pakistan.

Kachuga tecta (Gray) is a herbivore living in freshwater and quite active in its movements. The flesh of this species is liked by some communities settled in U.P. Terai who capture this animal in large number. Such a mass killing of turtles in U.P. Terai, threatening the existence of the creature, has recently been reported by Tilak and Sinha (1984).

The turtle has more or less flattend limbs with webbed digits. The top of the head is

covered withe smooth skin. The hexagonal neural plates are short-sided in front. The plastron is united with carapace by sutures. The axillary and inguinal buttresses are extensively developed, extending nearly to the neural plates, the former connected with the first rib. The fourth vertebral shield is elongated, much longer than broad and much longer than the third one. The fore-limbs bear five claws. The second vertebral shield is usually longer than third. The dorsal side of the head is black. The temporal region is yellow to orange in colour. The neck is black with fine yellow longitudinal lines. The carapace is elongated and bears a elongated vertebral keel which is produced into a strong spinous process at the posterior margin of the third shield.

Ozobranchus shipleyi Harding

Ozobranchus shipleyi Harding is one of the aquatic leeches in India and belongs to the family Ichthyobdellidae. This genus is monotypic. It possesses eleven pairs of lateral branchiae for respiration. According to Harding and Moore (1927), *Ozobranchus shipleyi* is recorded from Orissa, river Ganga, Pakistan and Ceylon. This has been associated with *Nicoria trijuga* Schweigg in Ceylon, with *Kachuga intermedia* Blanford in river Mahanadi (Sambalpur, Orissa), with *Kachuga smithi* (Gray) in river Ravi (Lahore, Pakistan) and *Kachuga dhongoka* (Gray) from river Ganga. The present record of the species extends the range of its distribution to U.P. Terai.

ASSOCIATION OF THE LEECH WITH THE TURTLE

The association for the freshwater leech with freshwater turtles is well known (Harding and Moore 1927). *Ozobranchus shipleyi* has been found parasitically associated with tortoises of the genus *Melanochelys* in Ceylon and different species of *Kachuga* in India and Pakistan as mentioned above but its association with *Kachuga tecta* (Gray) is reported here for the first time.

The freshwater bodies, ponds, lakes and streams form an ideal ecological habitat for the aquatic leeches. They play a significant role in the aquatic ecosystem because they parasitise some of the economically and ecologically important animals and form an item of food for them. The present turtle and the leech were collected from the side pool near river Rapti where the flow of water was extremely slow and the area was infested with aquatic weeds.

It appears that this species of leech does not have a fixed host but takes advantage of coincidence and chance in selecting its host to suitably discharge its life function such as feeding, respiration, reproduction, care and maintenance of its young ones. Since the leech is aquatic and respires by branchiae it can not parasitise a host which is likely to remain out of water for a long period, endangering the existence of the leech and dessicating the fertilised ova and young ones. The association of *Ozobranchus shipleyi* with *Kachuga tecta* appears to be quite harmonious and is related suitably with the life-

style of the aquatic turtle. During the period when the turtle comes out of water for laying its eggs in the sandy bed along the river, the leeches depend largely on the algal encrustations growing on the body of the turtle for moisture to avoid dessication and to certain extent for exchange of gasses through the branchiae.

The leech is hermaphrodite and lays fertilised ova. Hermaphroditism is a perfect adaptation to the way of life of the leech which is more often attached even singly to its hosts and has a rare chance to meet another of its kind for fertilisation of the ova. The ova are arranged in rows adjacent to each other. The young leeches emerge from the eggs and immediately attach themselves on the soft exposed parts of the skin of the host. In an aquarium where the turtles with the leeches were kept for observation, the fish species of the genera *Puntius*, *Rasbora*, *Esomus* etc., fed on young leeches by plucking them from the body of the turtles one by one. The leech, therefore, appears to be linked with the food chain of other vertebrates like fishes in the surrounding body of water.

SUMMARY

The association of *Ozobranchus shipleyi* Harding, a freshwater leech of the family Ichthyobdellidae with the freshwater turtle, *Kachuga tecta* (Gray) is reported for the first time. The range of distribution of this leech and the turtle is extended to U.P. Terai for the first time. The manner of parasitic association of the leech with the turtle and the style of living of these animals have been briefly explained.

ACKNOWLEDGEMENT

The authors are greatly indebted to the Director, Zoological Survey of India, Calcutta, for necessary facilities.

REFERENCES

Hall, Philip M. 1980. A new turtle from Nepal. *J. Bombay nat. Hist. Soc.*, *77*(3): 521-522.

Harding, W.A. & Moore, J.P. 1927. *The Fauna of British India including Ceylon and Burma-Hirudinea.* Taylor and Francis, London: I-xxxviii + 302 pp.

Smith, M.A. 1931. *The Fauna of British India including Ceylon and Burma - Reptilia and Amphibia* Vol.I. *Loricata, Testudines.* Taylor and Francis, London: I-xxviii + 185pp.

Tilak, R & Sinha, N.K. 1984. A note on tortoises and turtles of Uttar Pradesh Terai in relation to Trade. *Cheetal*, **25**(4) : 7-9.

Rec. zool. Surv. India. 87(4) : 277-292, 1990

THE IMPORTANCE OF UROHYAL IN FISH SYSTEMATICS

G. M. YAZDANI AND OM PRAKASH

Zoological Survey of India, Gangetic Plains Regional Station, Patna

INTRODUCTION

Traditionally, the studies on fish systematics have been based on morphology, especially the skeleton which is the only complete organ system available for comparison with fossils. Among the skeletal elements, the urohyal bone which lies in the lower part of the head between the lower jaw bones, has proved to be of exceptional significance in fish systematics. This is because of the fact that the differences found in urohyal shapes between fish groups seem to be correlated with other morphlogical differences between them.

Chabanaud (1933a, 1933b), Kyle (1921), Tyler (1959) and Datta & Rao (1965) referred to the taxonomic importance of urohyal in classifying flatfish (Pleuronectiformes). Kusaka (1974), after studying the urohyal of about 700 spp, belonging to 460 genera, 184 families and 21 orders, came to a definite conclusion that the urohyal shape is so characterstic in different groups of teleostean fishes that it could be safely used for classifying families, genera and species.

This paper presents an attempt to assess the importance of urohyal in fish systematics by observing urohyal shape of different fish groups, representing members of different evolutionary levels.

MATERIAL AND ILLUSTRATION

The urohyal bones of the following species have been studied; those of the species marked with asterisk have been examined and relevant informations on the structure and shape of urohyal of other species have been obtained from the published work of Kusaka (1974) for the sake of comparison. The classification followed here is that of Greenwood, Rosen, Weitzman & Myers (1966).

Clupeiformes

Clupeidae	*Clupea pallasi* (Cuvier & Valenciennes)
	Ilisha elongatea (Bennett)
Engraulidae	*Engraulis japonica* (Houttuyn)

Osteoglossiformes

Notopteridae	*Notopterus* sp

Cypriniformes		
	Characidae	*Serrasalmus natteri* (Kner)
	Cyprinidae	*Cyprinus carpio* Lin.
		Labeo bicolor Smith
	Cobitidae	*Misgurnus* sp.
		Botia macracanthus (Bleeker)
Siluriformes		
	Clariidae	*Clarias lazera* Cav. & Val.
	Chacidae	*Chaca* sp.
Anguilliformes		
	Anguillidae	*Anguilla japonica* Temn & Schlegel
	Ophichthyidae	*Microdonophis erabo* Jerdan & Snyder
Atheriniformes		
	Poeciliidae	*Gambusia affinis* (Baird & Girard)
		Lebistes reticulatus (Peters)
Channiformes		
	Channidae	*Channa maculata* (Lacepede)
Scorpaeniformes		
	Scorpaenidae	*Sebastes joyneri* Gunther
Perciformes		
	Nandidae	*Monocirrhus polyacanthus* Heckel
	Cichlidae	*Tilapia nilotica* (Linn.)
	Mastacembelidae	**Mastacembelus armatus* Lacepedae
		**Macrognathus aculeatus* (Bloch)
		**Pillaia indica* Yazdani
Pleuronectiformes		
	Psettodidae	**Psettodes belcheri* Bennett
	Pleuronectidae	**Pleuronectes platessa* Linn.
	Scophthalmidae	**Scophthalmus maximus* (Linn.)
		Lepidorhombus whiffiagonis (Walbaum)
	Bothidae	*Laeops lanceolata* Frans
	Soleidae	**Solea solea* (Linn.)
	Cynoglossidae	**Cynoglossus* sp.

The main outlines of the figures have been drawn free hand. The evolutionary relationships of major groups of teleostean fishes are illustrated in Fig.1 in accordance with the concepts of Greenwood *et al.* (1966).

Structure and function of Urohyal

The position of urohyal in the head of fish is shown in fig. 2.

The urohyal is a single bone, the anterior tip of which is generally connected to the ventral hypohyal, the anterodorsal part connected to the first basibranchial and the posterior part connected to the pectoral girdle by a large muscle (Fig.3). The point of attachment of urohyal with the hypohyal is invariably thickened, sometimes forked to allow the connections of a paired ligament to the ventral hypohyals. In those fishes wherein the urohyal head is well-developed the anterior part is fixed to the hypohyals and first basibranchial without a ligament. The relative position of urohyal attachment with the hypohyal and basibranchial is an important feature in determining the differnt types of urohyal among fishes.

The urohyal length is defined as the length of the horizontal line joining the anterior and posterior most tips of the bone (Fig.3). The dorsal edge is the part behind the basibranchial attachment extending to the posterodorsal end and ventral edge is the ventral side from the hypohyal attachment to the postero-ventral end; the vertical plate extends vertically and lengthwise, the dorsal spread is a lateral expansion on the dorsal side and the ventral spread is a lateral expansion on the ventral side, the lateral spreads or pleat is a lateral expansion extending on a level about midway of the height. The posterior edge is the side between the posterodorsal and postero ventral ends. The frontal side is the interval between the hypohyal and basibranchial attachments.

The urohyal is the most functional bone in fishes. Its position is related to the functional difference of the mouth-opening mechanism. The urohyal is necessary for movement of the jaws and in those group of fish where the jaw bones are mechanically fused into a single hinge. This bone has degenerated or lost as in members of Tetraodontiformes and Lophiiformes.

The V-shaped urohyal bone in most flatfish (Pleuronectiformes) also performes an important function in breathing (See Yazdani & Alexander, 1967). In most flatfish the branchio-stegal membranes lie within the V-shaped urohyal and form a channel connecting the two opercular cavities. It is believed that water pumped through the gills of the blind side of a resting flatfish passes through this channel to escape through the opercular opening of the ocular side. Normally, resperatory water is not expelled from the opercular opening of the blind side of resting flatfish.

OBSERVATION

The outlines of fish, representing typical body form of each family and the urohyal of species dealt with in this paper are shown in Figs.4-8. The observations on the

urohyal of mastacembeloid and pleuronectid fishes are detailed below.

Mastacembelidae : In *Mastacembelus*, the vertical plate of the urohyal is elongated, roughly triangular, its posterior edge wavy, deeply forked, the basibranchial attachment protrudes dorsally, hypohyal attachment having two lateral lobes, well-developed. The urohyal length is nearly 30 % of head length.

In *Macrognathus*, the urohyal is similar to that of *Mastacembelus*, except that the posterior edge is not deeply forked, and the basibranchial attachment is better developed. The urohyal length is nearly 30 % of head length.

Pillaiidae : In *Pillaia*, the vertical plate of the urohyal is rather narrow, elongated, the posterior edge very wavy; dorsal spread fairly developed anteriorly the basibranchial attachment situated dorsally well behind the hypohyal attachment which is well marked and deeply divided into two lateral lobes. The urohyal length is nearly 30 % of head length.

Psettodidae : In *Psettodes*, the vertical plate of the urohyal is rather elongated, its ventral edge slightly concave, the dorsal edge somewhat convex, the frontal side projected dorsally; the posterior edge tapering.

Pleuronectidae : In *Pleuronectes*, the vertical plate of the urohyal is curved in such a way that it looks hook-shaped or V-shaped; the posterior edge of the vertical plate is bent down and turned forward to give this shape; the actual ventral edge of the urohyal forms the cavity of the 'V' The real dorsal edge of the bone now forms the posterior side of the urohyal.

Scophthalmidae : In *Scophthalmus*, the urohyal is similar to that of the *Pleuronectes*, except that the antero dorsal part of the vertical plate is longer than the postero ventral part and the cavity thus formed is typically 'V' shaped.

In *Lepidorhombus*, the vertical plate is roughly triangular in shape, the antero-dorsal and postero ventral parts forming a shallow cavity.

Bothidae : In *Laeops*, the urohyal is similar to that of *Scophthalmus*.

Soleidae : In *Solea*, the urohyal is a narrow, angular bone, its anterodorsal and postero-ventral parts forming a very broad 'V' or 'U'

Cynoglossidae : In *Cynoglossus*, the urohyal is a small, roughly triangular bone, its ventral edge is straight or slightly curved not forming any 'V' shaped cavity; the dorsal edge much developed and convex; posterior edge is tapering, frontal side narrow and tapering.

DISCUSSION

The fore going observations on the urohyal of different species clearly reveal the fact that each taxonomic group possesses a characterstic type of urohyal shape. The differences between urohyals seem to correspond to the known differences between groups of teleostean fishes.

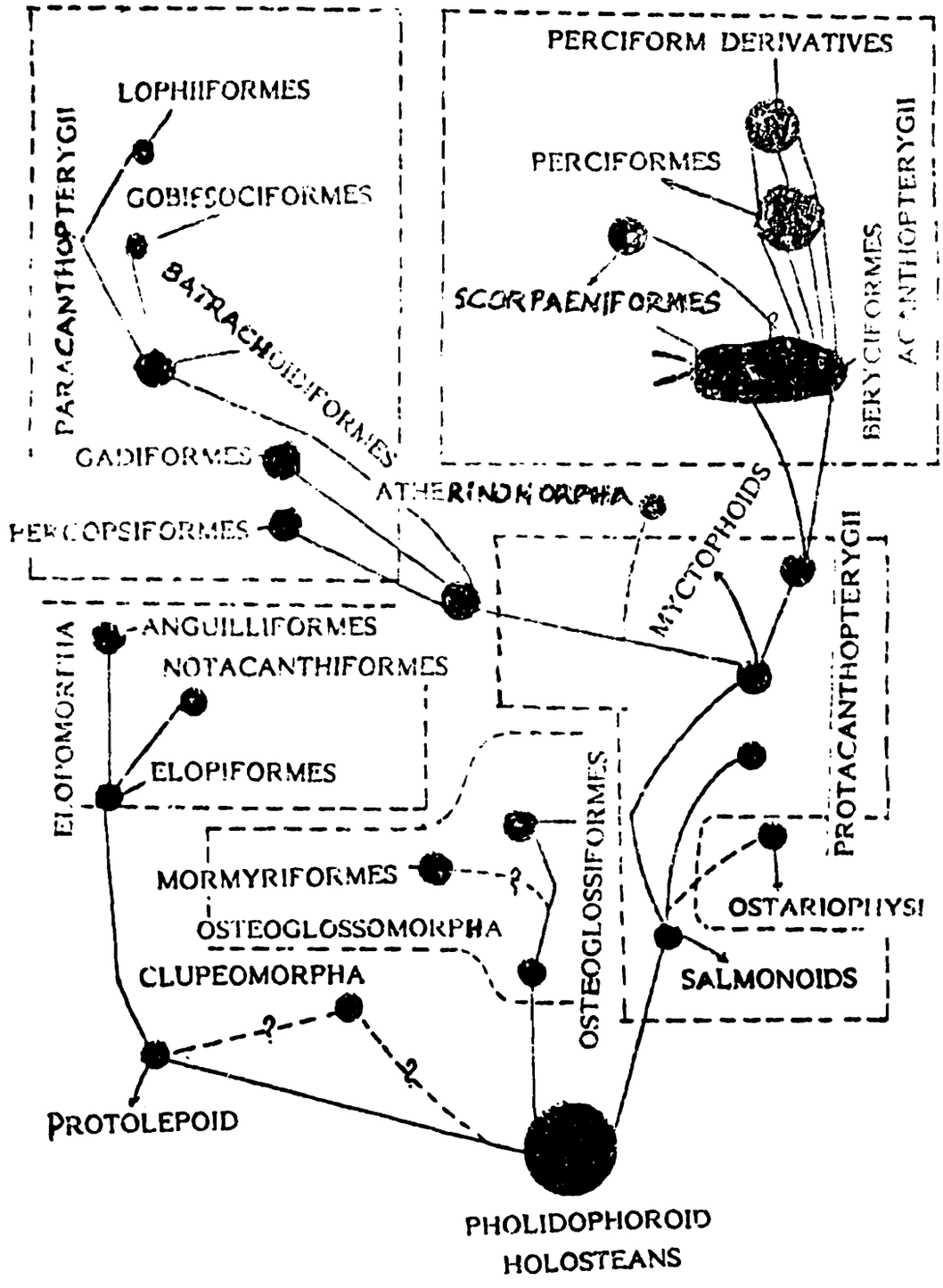


Fig. 1. Diagram showing the evolutionary relationships of major groups of teleostean fishes (based on the conception of Greenwood *et. el.* (1966).

Abbrevations used in figures

ba - basibranchial attachment; bb - basibranchial; 1st bb - First basibranchal; 2nd bb - Second basibranchal; 3rd bb - Third basibranchal; bh - basihyal; bm - branchiostegal members; br - branchiostgal ray; ch - ceratohyal; chl - channel; cr - cranium; d - dentary; dhh - dorsal hypohyal; ds - dorsal spread; e - eye; eh - epihyal; ha - hypobranchial attachment; ih - interhyal; kp - keep part; I - ligament; Is - lateral spread; m - muscle; me - migratory eye; mst - mesopterygoid; mx - maxilla; ne - normal eye; pal - palatune; pe - posterior edge; pf - pectoral fin; pmx - premaxilla; ps - parasphenoid; s - section; t - tendon; uh - urohyal; ve - ventral edge; vhh - ventral hypohyal; vs - ventral spread.

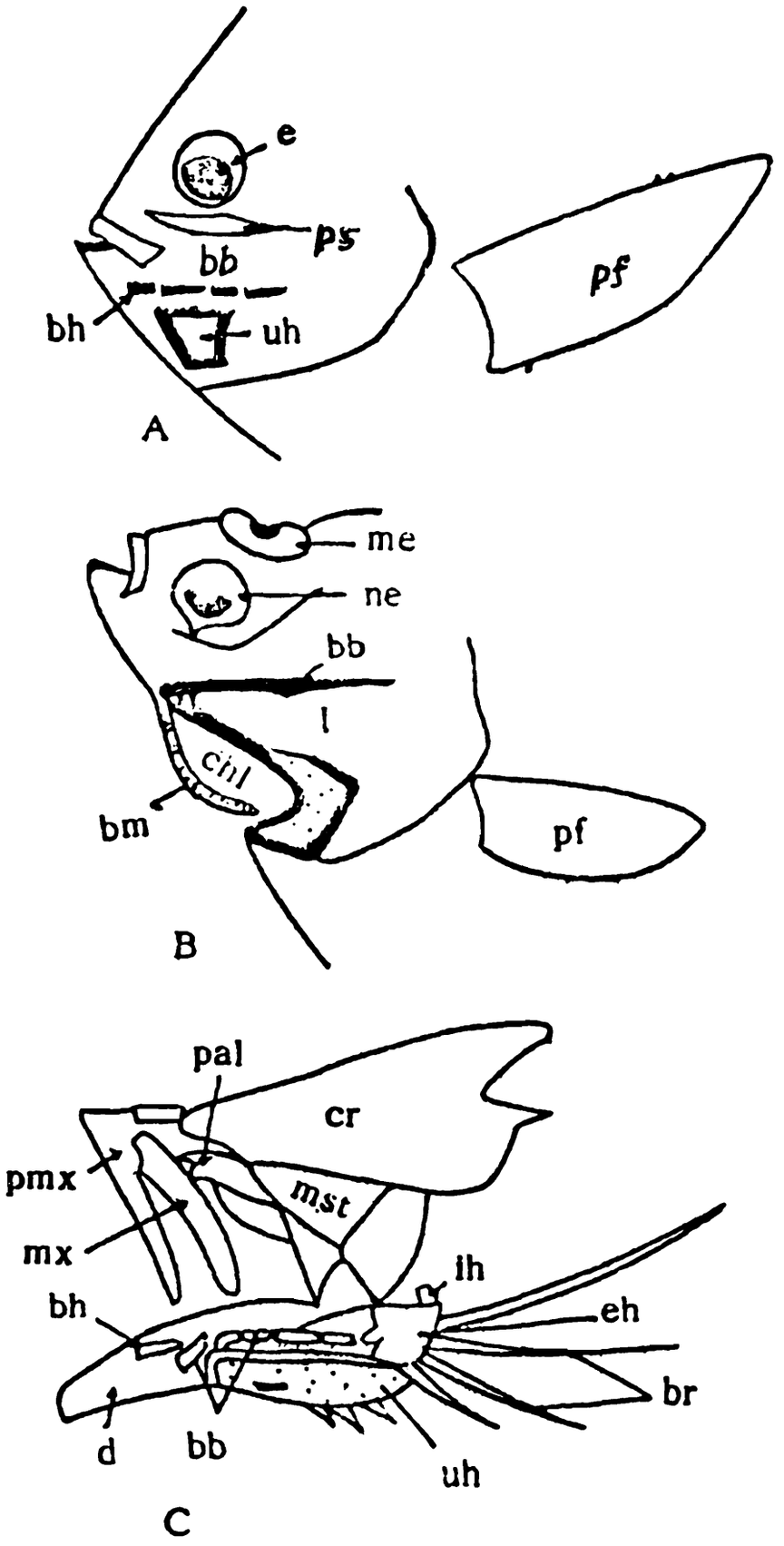


Fig. 2. Position of urohyal in the lower part of the head of (A) a percoid fish (B) a flatfish (Pleuronectiformes) (C) a teleost, when the mouth is opened.

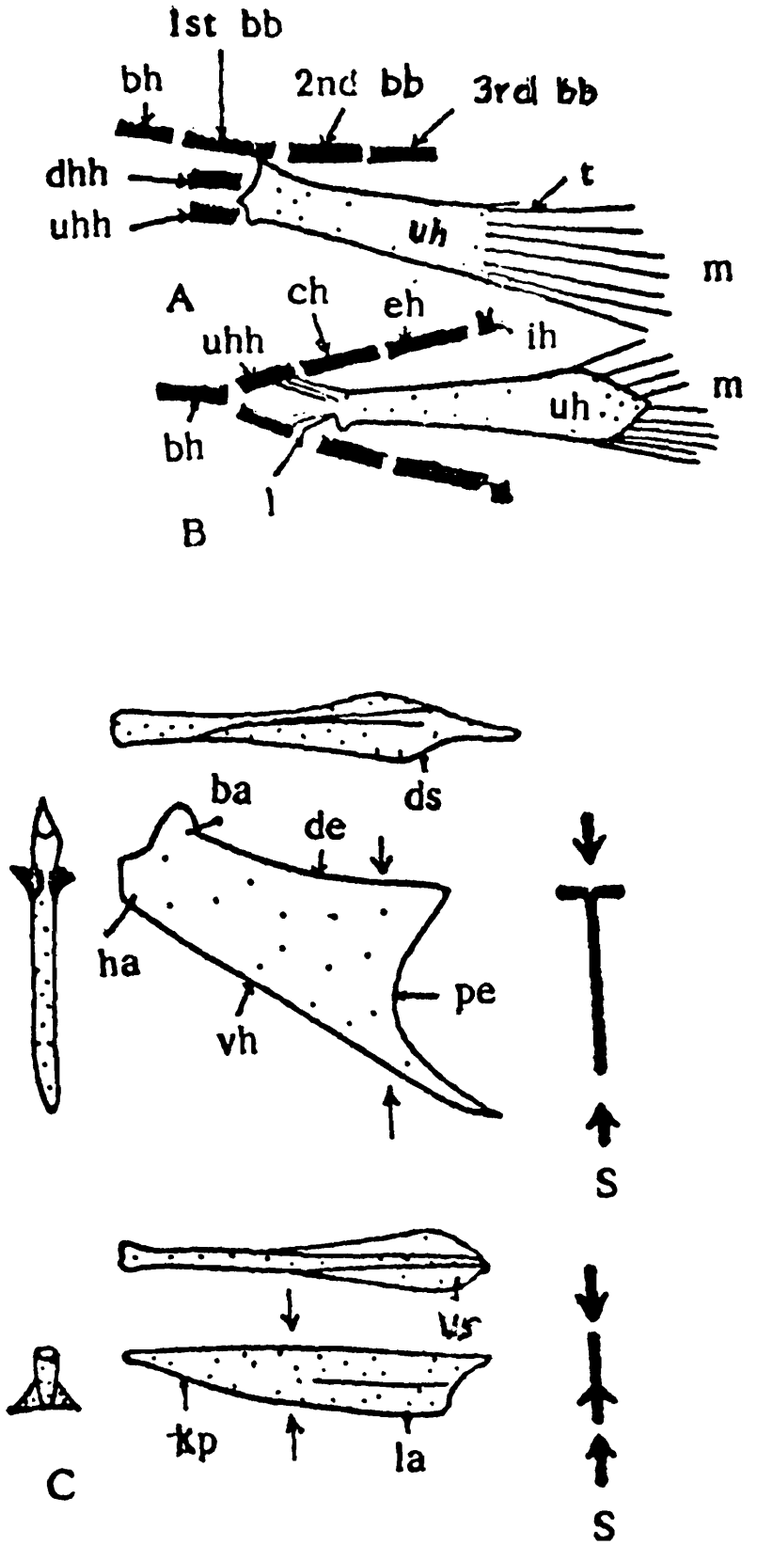


Fig. 3. Relative position of urohyal in (A) Lateral view (B) Ventral view (C) Shape of urohyals in dorsal, lateral, anterior views, showing terminology of parts.

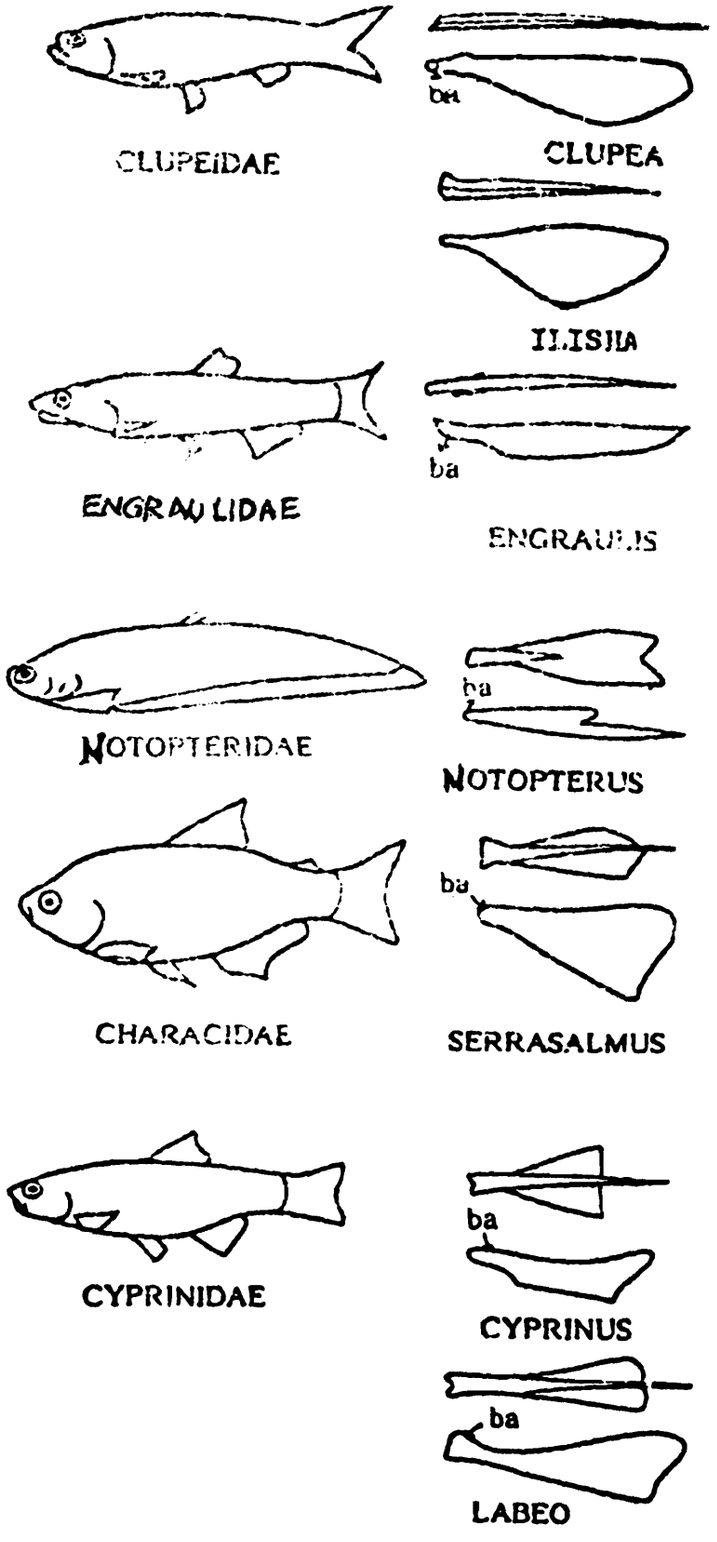


Fig. 4. Dorsal and lateral view of urohyal in some members of Clupeiformes, Osteoglossiformes and Cypriniformes.

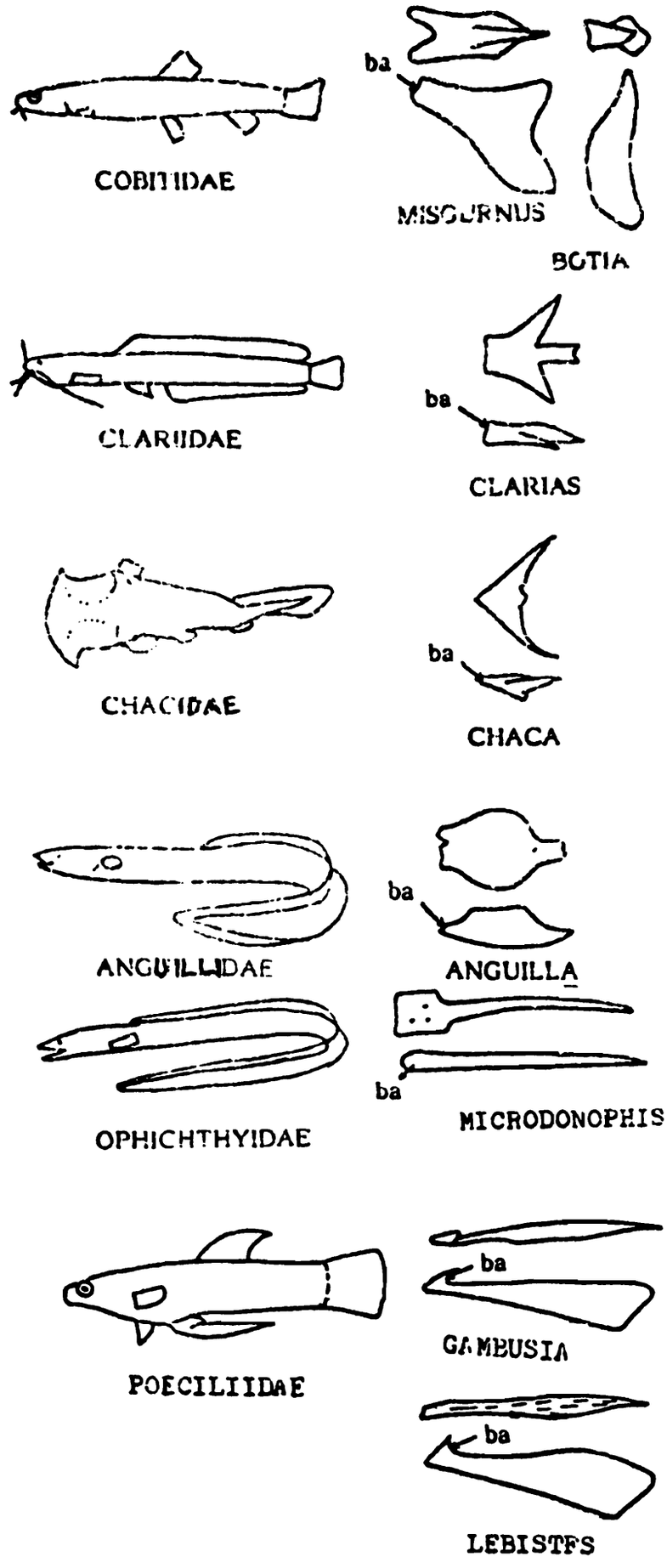


Fig. 5. Dorsal and lateral view of urohyal in some members of Cypriniformes, Siluriformes, Anguilliformes, and Athereniformes.

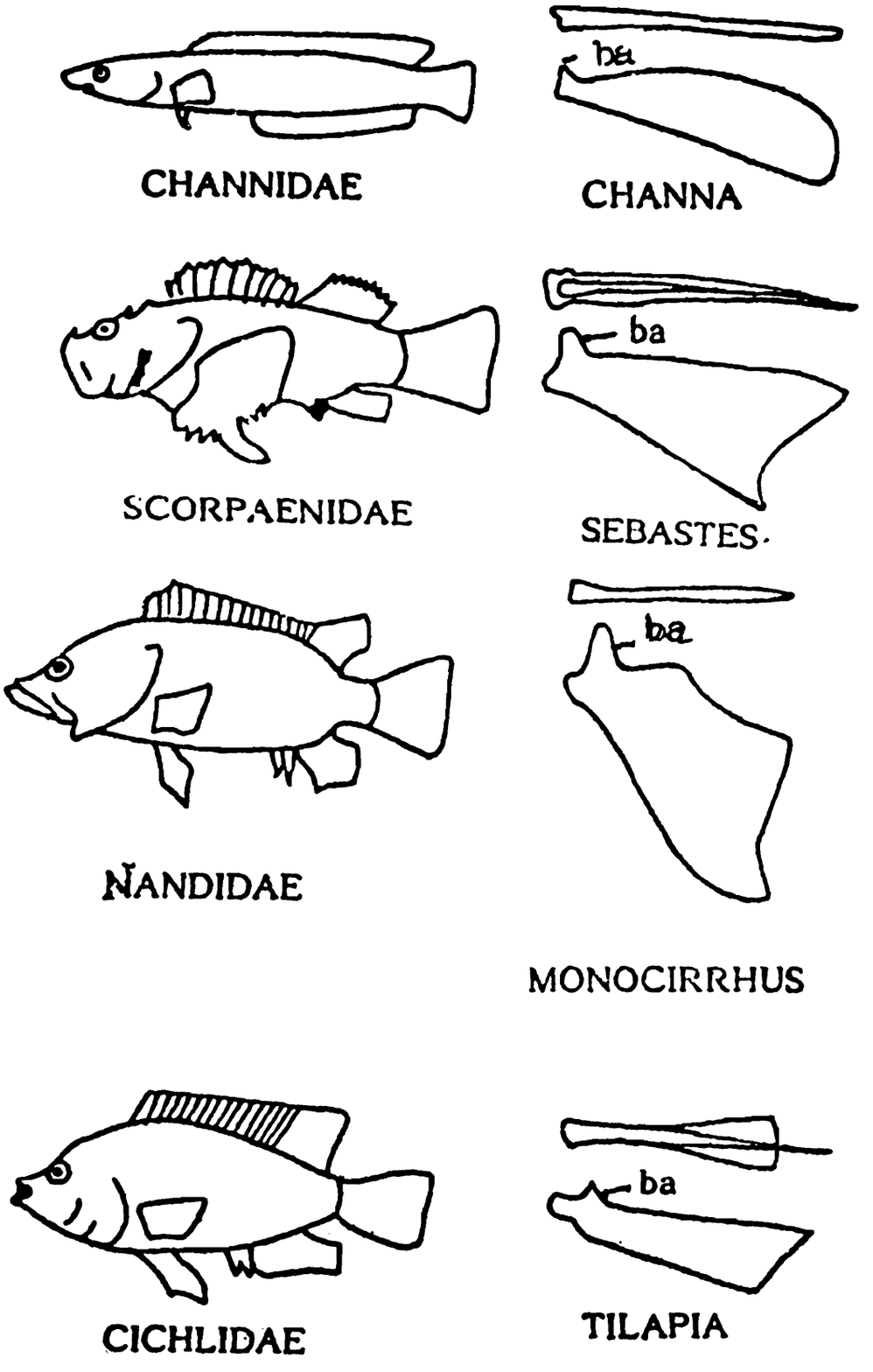


Fig. 6. Dorsal and lateral view of urohyal in some members of Channiformes, Scorpaeniformes, Perciformes.

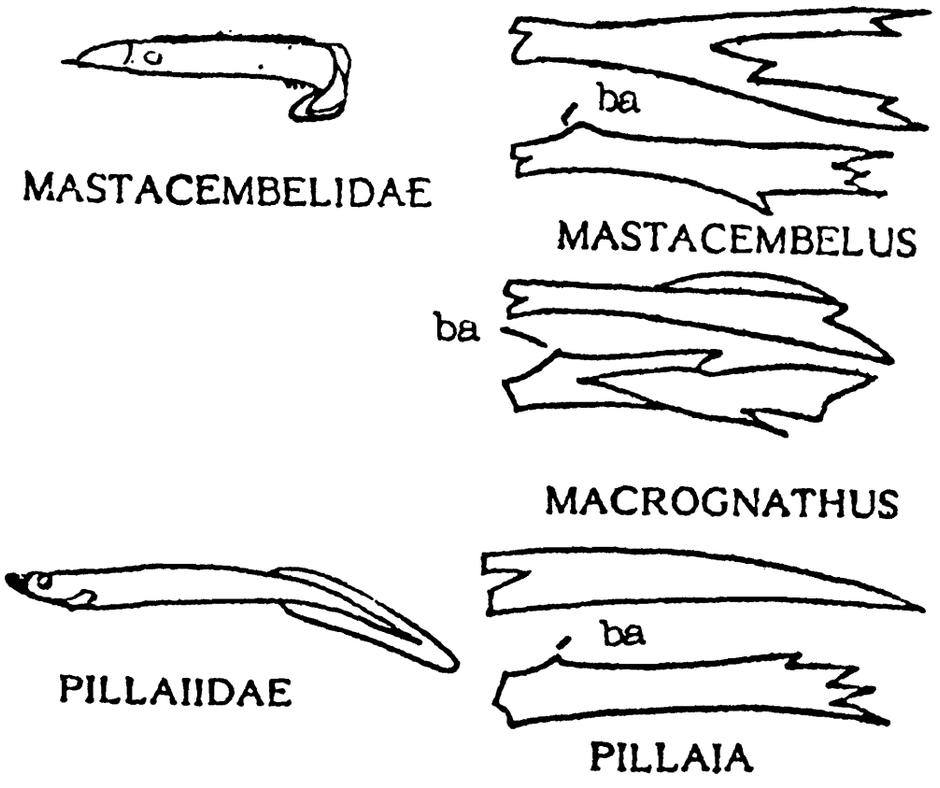


Fig. 7. Dorsal and lateral view of urohyal in some members of suborder Mastacembeloides (Perciformes).

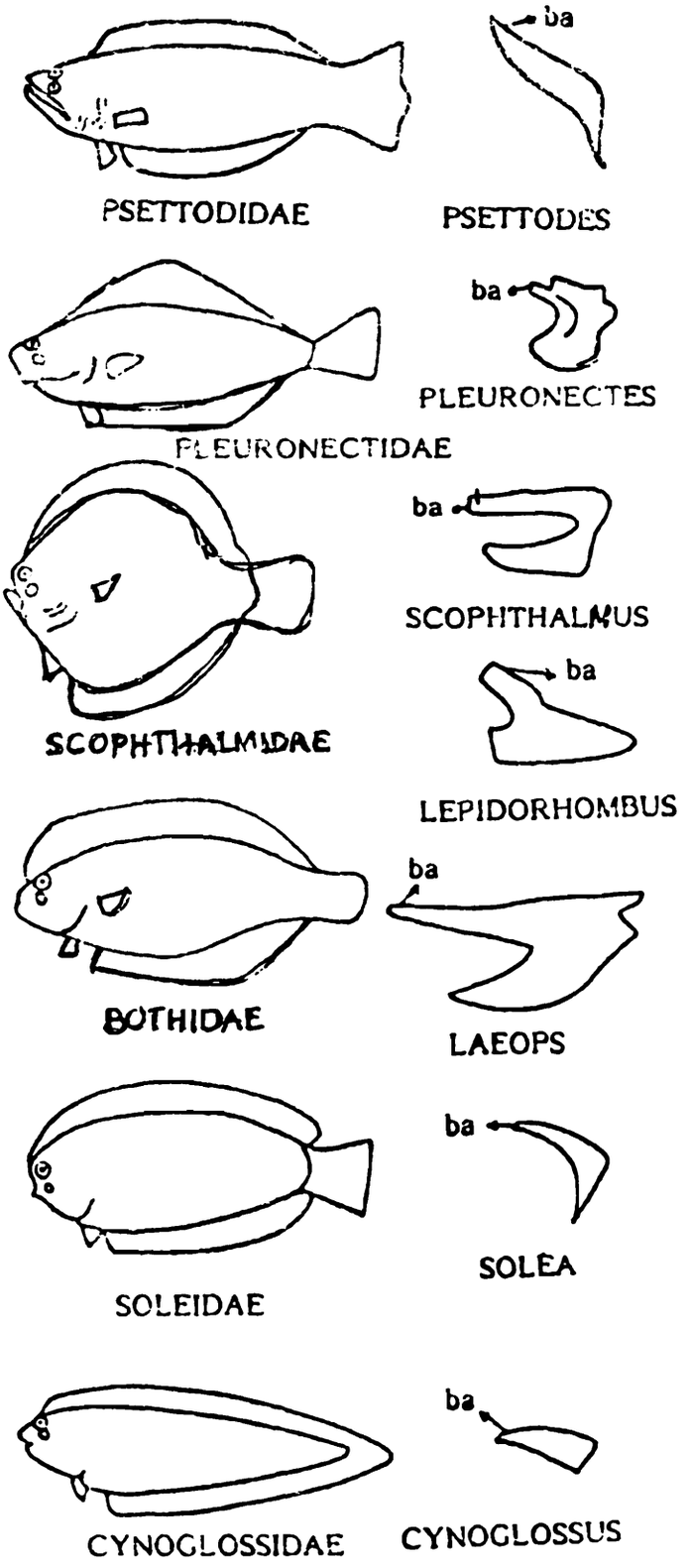


Fig. 8. Dorsal and lateral view of urohyal in some members of Pleuronectiformes.

We shall now discuss in detail the importance of urohyal in fish systematics.

In Clupeiformes which contains primitive teleosts the urohyal is rather large and bears lateral pleats. In *Clupea*, it is spatula shaped, whereas in *Engraulis* it looks like a table-knife. The large urohyal with lateral pleats may be correlated with their active mode of life which would entail active movements of jaws and associated structures.

In Osteoglossiformes, which contain freshwater fishes of ancestry at or near holostean level of organisation, the urohyal is narrow, its vertical plate is less developed than the ventral spread and bears no resemblance with that of Clupeiformes. This may be expected because clupeiform fish are not believed to be involved in the ancestry of Osteoglossiformes. The extraordinary development of ventral spread seems to be related to their specialisation for insectivorous or piscivorous feeding habits.

In Cypriniformes which do not show holostean affinity, the urohyals exhibit diverse forms and shape and in them the ventral spread is always developed. In charcins and cyprinids which are closely related groups there is striking resemblance in their urohyals. As they lead active mode of life, they possess fairly large urohyal. In cobitids which are believed to have evolved from cyprinoid ancestor, the urohyal is small, but the ventral spread is well-developed. This may also be correlated with their mode of life. The remarkable development of ventral spread in the urohyal of all Cypriniformes seems to be related to their feeding habits as Kusaka (1974) pointed out that ventral spread is well developed in omnivorous fish such as cyprinids and this feature perhaps helps in lateral swing of the throat.

Like Cypriniformes, the Siluriformes also contain fishes of extraordinary diverse forms and habits, belonging to teleostean level of ancestry. In them, the urohyal is relatively small, its ventral plate very reduced but the ventral spread fully developed. This may be correlated with the fact that these fishes are mainly carnivorous and their jaws have to move actively for capturing food.

The Anguilliformes (Super order Elopomorpha) contain true eels - a highly specialised group. In most eels, the urohyal is a small narrow, elongated bone possessing a swollen, somewhat flattened anterior end which bears attachments for basibranchial and hypohyals. In *Anguilla*, however, there is a remarkable modification in the urohyal shape. Kusaka (1974) pointded out that the urohyal in young *Anguilla* is shaft-like with anterior tip a little forked. But as soon as the young ones move to freshwater from the sea, the anterodorsal part of the urohoyal develops into a disc on the forked tip dorsally and the posterior part gets reduced. It is rather difficult to explain the reasons for these modifications but it would seem probable that it is related to some kind of specialisation.

In Atheriniformes, which contains small surface feeding fishes of truly teleostean ancestry, the urohyal is fairly large and bears striking resemblance with those of Acanthopterygii (Orders Scorpaeniformes and Perciformes). This is because

Atheriniform fishes are known to be of ancestry more or less at the same organisation levels as the fishes of superorder Paracanthopterygii and Acanthopterygii and their nearest relatives are presumed to be among the ancestors of Acanthopterygii (Fig.1). The difference betwwen urohyal of *Lebistes* and *Gambusia* is well marked to distinguish these genera from each other.

In Channiformes, which contain freshwater fishes belonging to extra perciform group, the urohyal is fairly large, the vertical plate which is not very deep, bears a constriction near the anterior end. Unlike Atheriniformes, the urohyal of Channiformes lacks the dorsal protusion near the anterior end. These difference also support the view that Channiformes is not directly related to either Atheriniformes or Perciformes.

In Scrpaeniformes, which contain truly teleostean fishes of doubtful ancestry among the Acanthopterygii, the urohyal is fairly large and bears close resemblance with those of Atheriniformes and some members of Perciformes, especially in respect of its frontal side where the basibranchial attachments protrudes dorsally and the hypohyal attachment is knob-like anteriorly. This would at least suggest that ancestors of fishes of all the three orders were perhaps related to each other.

In Perciformes, which contains fishes of extremely variable form and habits the urohyal is similar to that of Scorpaeniformes in most of its features. This clearly suggests that both the groups are related and perhaps had common ancestors, although Greenwood *et al.* (1966) believed that Scorpaeniformes are not directly related to Perciformes. The differences in urohyal between genera are also sufficiently marked, to be used in the taxonomy of this order. In Sciaenidae, where the taxonomy has until recently remained in controversial stage, the classification had to be based on the structure of swim bladder, rather than any osteological character. It would be desirable to try to classify sciaenid fishes on the basis of their urohyal shape.

In Mastacembelidae, the spiny eels, which presumably evolved from some perciform stock, the urohyal shape is quite characterstic of the group and offers a osteological basis for classifying these fishes. Like perciform fishes, the basibranchial attachment of urohyal lies on a dorsal protruberance a little posterior to the anterior bilobed head which provides attachment to hypohyals.

In *Pillaia* (Pillaiidae) which is related to Mastacembelidae, the urohyal bears resemblance with those of *Mastacembelus* and *Macrognathus* in respect of basibranchial and hypohyal attachments. However, the difference in urohyal between *Pillaia* and members of Mastacembelidae is also so sharp that it can be used to distinguish these two groups.

In Pleuronectiformes which contains flatfish - a group of asymmetrical fishes related to Perciformes, the urohyal of the most primitive flatfish, *Psettodes* (Psettodidae) is very much similar to that of *Perca* (Percidae) (Yazdani, 1977). In most other flatfishes, such as Pleuronectidae, Scophthalmidae, Bothidae and Soleidae, however, the urohyals

are more or less curved like a 'V', yet differences between them are sufficient to distinguish them at generic or familial level. In *Cynoglossus* (Cynoglossidae), the urohyal is not curved. However, it is much different from that of other groups and may be used for distingushing genera and species.

The functional significance of V-shaped urohyal in most flatfish has already been explained in the earlier section of this paper.

CONCLUSION

The following conclusions may be drawn a result of the present study. The urohyal bone has a definite form and shape in each taxonomic group. It bears closer resemblance in closely related forms. This study further supports the conception of Greenwood *et al.* (1966) about the evolutionary relationship of the principal groups of teleostean fishes.

The study of the urohyal in fishes have also revealed that this bone is large in active fishes, elongated in slender headed fishes and quite deep in deep bodied fishes. The development of ventral spread of the urohyal largely depends on the behaviour of fishes. The spatula-shaped urohyal without development of ventral spread is found in active swimmers such as members of Clupeidae. The well developed ventral spread is found in omnivorous fishes such as members of Cyprinidae.

SUMMARY

The urohyal - a single bone anteriorly connected to the ventral hypohyal and basibranchial and posteriorly to the shoulder girdle by a large muscle, has of late attained special importance in fish systematics. The urohyal of some fish, representing members of different evolutionary levels, have been studied and illustrated to show its modifications in shape and size among different groups of bony fishes. The taxonomic value of such modifications has been assessed and their possible use in fish taxonomy of the group.

It is suggested that an attempt should also be made to classify some fish groups such as cobitids and sciaenids on the basis of urohyal shape and size.

ACKNOWLEDGEMENTS

We are grateful to the Director, Zoological Survey of India, Calcutta for giving us an opportunity to undertake this study and to Dr. R.K. Varshney, Officer-in-Charge, G.P.R.S., Zoological Survey of India, Patna for extending facilities.

REFERENCES

Chabanaud, P. 1933 a. Contribution a '1' Osteologie Comparative des poissons, Principalement des Teleosteans hétèrsomes. *Bull. Sic. Zool. Fr.*, **58** : 140-168.

Chabanaud, P. 1933 b. Poissons hétèrosomes recuillis par M. le Professeur A.Gruvel et par MM.R.Ph. Dollfus et J. Liouville sur la cote atlantique du Maroc. *Mem. Soc. Sc. nat. phys. Maroc.*, **35** : 1-111.

Dutt, S. & H. H. Rao, 1965. A new bothid flatfish, *Cephalopsetta ventrocellatus* Gen. et sp. nov. from Bay of Bengal. *Proc. Indian Acad. Sci.* (B) : **62**(4) : 180-187.

Greenwood, P. H., D. E. Rosen, S. H. Weitzman & G. S. Myers 1966. Phyletic studies of teleostean fishes, with a provisional classification of living forms. *Bull. Am. nat. Hist.* **131** : 339-456.

Kusaka, T. 1974. *The urohyal of fishes* University of Tokyo Press, Japan. i-xiv, 1-319.

Kyle, H. M. 1921. The asymmetry, metamorphosis, and origin of flatfish *Phil. Trans. R. Soc.* London (B), **211** : 75-129.

Tyler, J. C. 1959. Two new flatfish of the genus *Ancyclopsetta* from the Guiana coast. *Copeia*, No.2 : 139-148.

Yazdani, G. M. & Alexander, R.McN. 1967. Respiratory currents of flatfish. *Nature, Lond,* **213** : 96-97.

Yazdani, G. M. 1977. Respiratory adaptation in the flatfish (Pleuronectiformes). *Matsya* Madras, **2** : 23-27.

Rec. zool. Surv. India, 87(4) : 293-298, 1990

ZOOGEOGRAPHICAL REMARKS ON DISTRIBUTION OF FISH IN INDIA BASED ON FISH FAUNA OF UTTAR PRADESH TERAI

RAJ TILAK

Zoological Survey of India, Dehra Dun

INTRODUCTION

In order to explain the presence of Malayan elements in the fauna and flora of peninsular India, Hora (1937) proposed Satpura Hypothesis and mentioned that the hill-stream fish fauna from Malayan, Burmese and Eastern Indian regions travelled to peninsular India along Satpura-Vindhya range of mountains and then to Western Ghats and peninsular India. He also stated that the migration of Malayan fish fauna was checked along the Himalaya because of certain orogenic movements and became deflected along the Satpura range of mountains; the typical Malayan elements in the fish fauna of Himalaya did not extend westwards beyond Tista drainage system on southern face although on the northern face of Himalaya, the fish fauna is uniformly spread from Yunnan (South China) in the east to Seistan in the west. The Malayan elements in the fauna are well represented in all hills of eastern India from where they travelled over the bridged gap between Garo and Rajmahal hills to Satpura-Vinfhys-Western Ghats ranges. It has been now felt that Hora (1937, 1949, 1951) thought on those lines and suggested Satpura Hypothesis because thorough surveys and studies on the fish fauna along Himalaya west of Tista Drainage and plains of Uttar Pradesh were not available at that time. Recently, extensive studies on the fish fauna of the area along the base of Himalaya west of Tista drainage and plains of Uttar pradesh have been conducted and many eastern Indian forms have been discovered from these areas (Tilak & Husain, 1975, 1978, 1980, Tilak, in press a, b, c) which shows that the fish fauna of eastern India travelled along the base of Himalaya towards the west after Pleistocene Glaciation period (Menon, 1954, 1973, 1980). Based on the available information on the fish, notes on the distribution of some of these forms to Uttar Pradesh Terai have been presented in this paper.

COMMENTS ON EASTERN INDIAN FORMS OF FISH RECORDED FROM UTTAR PRADESH.

Order SILURIFORMES

Family SISORIDAE

1. ***Conta conta*** (Hamilton)

Conta conta (Hamilton) is one of the *Erethistes* group of fishes of the family Sisoridae and was known only from eastern India. Tilak (in press, a) has collected a

large number of specimens of this species from Shard river, district Pilibhit, Uttar Pradesh Terai and extended the range of distribution of this species westwards. Tilak (op.cit.) mentioned that the wider distribution of this species as known at present indicates that the species is quite versatile and withstood the changes in the ecological conditions of different geological eras during the period of dispersal and changes in the drainage system.

2. ***Laguvia ribeiroi kapuri*** Tilak & Husain

Laguvia ribeiroi Hora was reported from Bihar, Madhya Pradesh and Mirzapur district of Uttar Pradesh but Tilak and Husain(1975) collected material of an allied form from Seharanpur district of Uttar Pradesh and named it *L. ribeiroi kapuri*. Hora and Nair(1941), while reporting *L. ribeiroi* from Hoshangabad, Madhya Pradesh, stressed its importance in showing a probable continuity of the Satpura renge of mountains with the hills of Assam and Darjiling Himalaya on the one hand and the Western Ghats on the other. The zoogeographic importance of the presence of this species as far west as Saharanpur district has been pointed out by Tilak and Husain (1975).

3. ***Glyptothorax sasii*** (Jenkins)

Glyptothorax sasii (Jenkins) was earlier recorded only from Satpura range of mountains (Bihar) but Tilak and Husain (1978) recorded this species from Malini river, Malan Sanctuary, district Pauri Garhwal and Mohand Rao, Rajaji Nsational Pasrk, district Saharanpur (Uttar Pradesh) and extended the range of distribution of this species to the foot-hills of western Himalaya. These authors explained the importance of discontinuous distribution of this species and opined that Hora's Satpura Hypothesis should be modified to explain the two divergent routes of migration of fish from eastern India, one along the Satpura range of mountains and the other along the base of Himalaya.

Family BAGRIDAE

4. ***Chandramara chandramara*** (Himilton)

Chandramara chandramara (Himilton) is an extremely rare species of fish North Bengal, North Bihar, East Bengal and Assam but Tilak (in press,a) collected two specimens of this species from Sharda river, district Pilibhit, Uttar Pradesh Terai and extended the range of this species to as far west as Pilibhit district of Uttar Pradesh along the base of Himalaya and provided another supporting evidence for the modification of Hora's Satpura Hypothesis suggested earlier.

Order CYPRINIFORMES

Family PSILORHYNCHIDAE

5. ***Psilorhynchus sucatio nudithoracicus*** Tilak & Hussin

P. sucatio (Hamilton) has been recorded from Darjiling district, North Bengal and

Meghalaya and *P. sucatio damodari* David is recorded from the confluence of Barakar and Damodar rivers of Chota Nagpur, Bihar along the Satpura range of mountains. Tilak and Husin (1980) discovered another form, *P sucatio nudithoracicus* from western Uttar Pradesh in district Saharanpur and stressed upon the importance of the distribution of this taxon in various parts of India. The original stock of *P. sucatio* diverged along two routes from eastern India, one along the Satpura range of mountains (*P. sucatio damodarai*) and the other towards the west (*P. sucatio nudithoracicus*) and gave added support to the proposal of modification of Hora's Satpura Hypothesis.

Family HOMALOPTERIDAE

6. ***Balitora brucei*** (Hamilton)

Balitora brucei (Hamilton) is one of rare species of fish which have very well adapted to the torrential stream environment and has so far been recorded from Burma, Assam, Bangladesh and Nepal. Tilak (in press, c) has collected a long series of this species from Gola river, district Nainital, Uttar Pradesh and extended the range of distribution of this species to western part of India. The distribution of different species of *Balitora* in India, as known at present, indicates that the stock of this genus in eastern India travelled along two routes, one along the Satpura range of mountains to travel upto Karnataka (*B. mysorensis*) and the other towards the west along the base of Himalaya (*B. brucei*).

Family COBITIDAE

7. ***Acanthophthalmus pangia*** (Hamilton)

Acanthophthalmus, a cobitid genus, is represented in India by only two species, *A. pangia* (Hamilton) and *A. goaensis* Tilak, the former recorded from North-east Bengal, Assam and Manipur while the latter from Goa. Tilak (in press,b) has recently collected two fine specimens of *A. pangia* from Sharda river, district Pilibhit, Uttar Pradesh Taria and extended the range of distribution of this species to western part of India in Uttar Pradesh. This species is of rare occurrence and shows discontinuous distribution. The distribution of this genus in India exhibits parallel instance to that of *Balitora* because in this genus also the stock of *Acanthophthalmus* in eastern India travelled along two routes, one along the Satpura range of mountains upto Goa *(A. goaensis)* and the second along the base of Himalaya upto district Pilibhit *(A. pangia)*.

8. ***Lepidocephalus (Lepidocephalus) irrorata*** (Hora)

Lepidocephalus (Lepidocephalus) irrorata was described by Hora (1921) from Loktak Lake, Manipur and subsequently, this species was never recorded from any other region of India. Recently, 6 examples of this species (all adults) have been collected from Ranwas Taal, nearly 2.5 kms. north of Belyrain Forest Rest House in Dudhwa National Park, district Lakhimpur Kheri, Uttar Pradesh Terai. The present distribution of this species is discontinuous because the species has not been recorded from the intervening

geographical area between Manipur on the one hand and Lakhimpur in Uttar Pradesh on the other. This record of *Lepidocephalus (L.) irrorata* extends the range of distribution of this species as far west as Uttar Pradesh Terai. The presence of this species in Dudhwa National Park, Uttar Pradesh Terai is zoogeographically important and supports the view that fish fauna from eastern India dispersed to western side of India along the base of Himalaya.

DISCUSSION AND CONCLUSION

The record of *Conta conta* (Hamilton), *Laguvia ribeiroi kapuri* Tilak and Husain, *Glyptothorax saisii* (Jenkins) of the family Sisoridae, *Chandramara chandramara* (Hamilton) of the family Bagridae, *Acanthophthalmus pangia* (Hamilton) and *Lepidocephalus (Lepidocephalus) irrorata* (Hora) of the family Cobitidae, *Balitora brucei* (Gray) of the family Homalopteridae *Psilorhynchus sucatio nudithoracicus* Tilak and Husiain of the family Psilorhynchidae from Uttar Pradesh is zoogeographically important and throws light on the distribution of freshwater fish fauna in India in Time and Space. Hora's Satpura Hypothesis (Hora, 1973,1949,1951) stressed on the distribution of Malayan elements of fish from eastern India to peninsular India through Satpura-Vindhya range of mountains and expressed the opinion that fish fauna did not travel westwards beyond Tista drainage system along Himalaya. Menon (1954,1973,1980) has shown that fish fauna travelled along base of Himalaya towards the west after the Pleictocene Glaciation period. This is amply substantiated by the recent survey and study of fish fauna from base of Himalaya and plains of Uttar Pradesh (Tilak, in press a, b, c; Tilak and Husain, 1975,1978,1980). This also strengthens the belief that the fish fauna from Eastern part of India travelled along two routes, one along the Satpura range of mountains (Hora's Satpura Hypothesis) and the other along the base of Himalaya towards the west. Tilak (in press,d), on the basis of the study of Schizothoracid fishes of India, edduced evidence that palaearctic fish fauna of India entered this region through Ladakh and Kashmir and travelled along the base of Himalaya from its far west end towards the east. The palaearctic elements of fish entered Ladakh through the Pamir mountains. The schizothoracids, while travelling along the base of Himalaya, entered into the new drainage formed due to the uplift of Himalaya during the Pleistocene era. This is amply justified by the fact that the same species of fish, *Schizothorax richardsonii* (Gray), which exists in Indus river at an altitude of more than 4000 mts. has not been able to ascend the drainage system of southern face of Himalaya above an altitude of 1500 mts.

From the foregoing discussion, it is evident that the fish fauna of Himalaya has been received both from the east as well as from the west. They travelled all along Himalaya and then into the plains also but many of these elements could not survive the changes in the ecological set up of the new drainage system where they entered and thus perished at many places along the route of migration, creating discontinuous distribution of some of the faunal elements of fish.

SUMMARY

The fish fauna of Uttar Pradesh Terai is zoogeographically important and some of the important species of fish recorded recently form this area throw light on the manner of distribution of freshwater fish fauna in India in Time and Space (Tilak, in press a,b,c). Hora (1937) propounded Satpura Hypothesis to explain the dispersal of freshwater fish fauna from Malaya, Burma and eastern India to peninsular India along Satpura-Vindhya range of mountains but this hypothesis lacked the support of geologists. Menon (1954, 1973, 1980) reassessed Hora's Satpura Hypothesis and opined that the Malayan freshwater fish froms entered India during Pliocene Siwalik period and the torrential-water fish fauna developed much later, probably during Pleistocene, and such forms dispersed along Himalaya after Pleistocene glaciation period. The distribution of *Laguvia ribeiroi kapuri* Tilak & Husain, *Glyptothorax saisii* (Jenkins), *Conta conta* (Hamilton), *Chandramara chandramara* (Hamilton), *Acanthophthalmus pangia* (Hamilton), *Lepidocephalus (Lepidocephalus) irrorata* Hora, *Balitora brucei* (Gray), *Psilorhynchus sucatio nudithoracicus* Tilak & Husain to western part of India along the base of Himalaya and the Uttar Pradesh Terai indicates that many of the eastern Indian fish forms dispersed towards the west along Himalaya.

ACKNOWLEDGEMENT

The author feels grateful to the Director, Zoological Survey of India, Calcutta for grant of facilities snd encouragement.

REFERENCES

Hora, S. L. 1921. Fish and fisheries of Manipur with some observations on those of the Naga hills. *Rec. Indian Mus.*, **22**(3) 165-214.

Hora, S. L. 1973. Distribution of Himalayan fishes and its bearing on certain palaeogeographical problems. *Rec. Indian Mus.*, **39** : 251-259.

Hora, S. L. 1949. Symposium on Satpura Hupothesis of the distribution of Malayan fauna and flora to peninsular India. *Proc. natn. Inst. Sci. India*, **15** : 309-422.

Hora, S. L. 1951. Some observations on the palaeogeography of the Garo-Rajmahal gap as evidenced by the distribution of Malayan fauna and flora to peninsular India. *Proc. natn. Inst. Sci. India*, **17** : 437-444.

Hora, S. L. & Nair, K. K. 1941. Fishes of the Satpura range, Hoshangabad district, Central Provinces. *Rec. Indian Mus.*, **43** 361-373.

Jayaram, K. C. 1972. Contributions to the study of bagrid fishes (Siluroidea : Bagridae). 7. First record of *Pimelodus chandramara* Hamilton. *J. Zool. Soc. India*, **23**: 131-133.

Jayaram, K. C. 1973. Contributions to the study of bagrid fishes (Sliuroidea : Bagridae). 10. Systematic position of *Pimelodus chandramara* Hamilton with description of a new genus. *Int. Revue ges. Hydrobiol.*, **57**(5) : 815-820.

Jayaram, K. C. 1981. The Freshwater fishes of India, Pakistan Bangladesh, Burma and Sri Lanka-A Handbook.Z.S.I., Calcutta, i-viii + 1-475, pls.I-XIII.

Menon, A. G. K. 1954. Fish geography of the Himalayas. *Proc. natn. Inst. Sci. Indian*, **22** : 467-493.

Menon, A. G. K. 1973. Origin of freshwater fish fauna of India *Curr. Sci.*, **16**:553-556.

Menon, A. G. K. 1980. The Satpura Hypothesis. *Proc. natn. Acad. Sci. India*, B **46**(1) : 27-32.

Tilak, R. (in press, a). Studies on the fish fauna of Uttar Pradesh Terai. 1. On the extension of range of distribution of *Conta conta* (Hamilton) and *Chandramara chandramara* (Hamilton) (Hamilton) (Sisoridae and bagrida : Siluriformes). *Matsya.*

Tilak, R. 1987. *Fauna of India-Schizothoracinae.* Zool. Surv. India, Calcutta.

Tilak, R. 1990a. Studies on the fish fauna of Uttar Prasesh Terai. 2. On the extension of range of distribution of *Acanthophthalmus pangia* (Hamilton) with zoogeographical remarks. *Rec. zool. Surv. India*, **87**(1) : 51-56.

Tilak, R. 1990b. Studies on the fish fauna of Uttar Pradesh Terai. 3. Notes on the distribution and ecology of Balitora brucei (Hamiilton). *Rec. zool. Surv. India*, **87**(2) : 91-95.

Tilkar, R. & Husain, A. 1975. A new sisorid catfish, *Laguvia ribeiroi kapuri* (Sisoridae Siluriformes) from Uttar Pradesh. *J. Inland Fish. Soc. India*, **6** : 1-5, figs.1-3.

Tilak, R. & Husain, A. 1978. Redescription of *Glyptothorax Saisii* (Jenkins) (Sisoridae : Siluriformes) with notes on zoogeography. *Ann. Zool.*, Agra, **14**(1) : 33-40. figs. 18-22.

Tilak, R. & Husain, A. 1980. Description of a new psilorhynchid, *Psilorhynchus sucatio nudithoracicus* (Psilorhynchidae : Cypriniformes) from Uttar Pradesh with notes on zoogeography. *Mitt. zool. Mus. Berl.*, **56**(2) : 35-40, figs.1-3.

Rec. zool. Surv. India, 87(4) : 299-316, 1990

ABUNDANCE AND DIVERSITY OF BIRD SPECIES IN IDUKKI HYDROELECTRIC PROJECT AREA, KERALA

N.L.N.S. PRASAD*

Zoological Survey of India, 36/802, Karakkamuri Cross Road, Cochin-682 011

INTRODUCTION

Any developmental strategy aimed at economic progress when interferes with a natural ecosystem will necessarily have positive as well as negative effects. While most oif the benefits acruing from such projects as hydroelectric projects reach else where, the ill-effects embrace the locals more than others. The most serious among these would be the problem of rehabilitation of the local people. Others include disturbance to the components of the ecosystem - the flora and fauna - due to activities at various stages of project implementation. Recent awareness of the impact of such projects on a variety of components has led to the present scientific insight into the effects of hydroelectric project on fauna of Idukki. The paper presents the abundance and diversity indices of bird fauna in the study plots and attempts to evalute the possible effects of the project on them.

STUDY AREA AND METHODS

The study was centered around the area of Idukki hydroelectric project and the places of abutting. It is located at a distance of 130 km southeast of Cochin in the Western Ghats (9° 51'N and 76° 59'E) (Fig. 1). The terrain is deeply undulating and lined with gorges through which small streams find their way into the reservoir down below. The height of these hill ranges vary from 560-850 m avove MSL. The Idukki project consists of 3 dams - the Idukki Arch dam and Cheruthoni dam constructed on the rivers Periyar and Cheruthoni, respectively and the third is Kulamavu dam located about 25 km southwest of Cheruthoni dam. These have resulted in the 60 km^2 reservoir submerging vast expanses of rich forest wealth.

Four vegetation types have been described in this area by Mohanan (1982 'unpublished'). These are : (i) West-Coast tropical evergreen forests, (ii) West-Coast semi-evergreen forests, (iii) Southern moist deciduous forests, and (iv) South Indian subtropical hill savanna (grasslands). Some areas have cardamon and arecanut plantations while others have eucalyptus plantations. In the valleys and in the river bed which has become dry due to the constructioon of dams, paddy is cultivated.

---

* Present address : Department of Zoology, Osmania University, Hyderabad 500 007, A.P.

TABLE 1

Vegetation details in the study plots

Plots	Transect length(km)	Place	Characteristics of terrain	Vegetation details
I.	1.00	Painavu	Slightly undulating terrain. Water passage and man-made paths present.	Thick vegetation. Identified trees include *Careya arboria, Dillinea pentagyna, Brinia rhomboides, Terminalia paniculta, Melotus* sp., *Tectona grandis*. Illegal felling of trees still continues.
II.	0.75	Meenmutty	On the hillock, about 70 m from the road.	Open grassland with *Dillinea pentagyna* trees here and there. *Eucalyptus* sp. plantations and activity related to this disturbed the area greatly.
III.	1.00	Kudamurutty	Undulating terrain. Man-made paths and small streams and high-tension pylons.	Thick tree vegetation. Opened up areas with *Lantana camera, Eupatorium odoratum*. Cardamom plantations over 50% of the area.
IV.	0.90	Uppukunnu	Slightly undulating terrain. Streams and man-made paths present.	Approximately 20% of the area constitutes grassland with *Dillinea pentagyna, Sterculia* sp., *Artacarpus* sp., in the forest. Some part of area difficult to penetrate due to *Ochlandra* sp.
V.	0.80	Kulamavu	Gently undulating terrain. Streams, road and man-made paths present. Transect runs towards reservoir.	Tree as well as bushy vegetation present. *Butea monosperma, Melotus sp., Grewia* sp., and creeper -*Micania cordata* dominate the open area. Tree felling activity low.
VI.	0.80	Thanikkandam	Gently undulating terrain. Roads and water passages present.	Maximum area opened up. *Lantana camera, Eupatorium odoratum, Solanum* sp., *Ochlandra* sp., in cleared areas. Trees : *Macaranga indica, Terminalia paniculata, Erythrina indica*. Heavily disturbed.
VII.	0.80	Karimpan	Present on the road side.	Thick vegetation present. Bushes include *Helecterus* sp., *Ochlandra* sp., and *Mussenda* sp., Trees: *Butea monosperma, Macaranga indica, Ficus* sp., *Artacasrpus* sp., *Cuillenia* sp., *Sterculia* sp., *Erythrina indica* and *Actinodaphne* sp.
VIII.	0.75	Naragakkanam	On the hillock about 200 m height from the road.	Vegetation thick. Ground vegetation dominated by *Lantana camera, Ploygynum* sp., *Micania cordata,* etc. Trees include *Erythrina indica, Melia* sp., *Syzygium* sp., *Salmalia* sp., *Terminalia paniculata*. Tree felling for firewood - main disturbance.

TABLE 2

Distribution of bird species, abundace and diversity indices in the study plots

Plots	No. of obser-vations	Total No. of species	Mean and per visit S.E. Species	Individuals	Diversity Simpson's index	Shannon's index
I	7	50	14.86 ± 1.66	47.71 ± 6.08	13.21	1.63
II	3	11	—	—	—	—
III	8	45	15.25 ± 0.97	43.25 ± 2.99	16.25	4.51
IV	7	33	11.14 ± 1.15	35.42 ± 5.23	15.48	4.08
V	9	51	18.11 ± 1.14	54.11 ± 4.16	14.75	3.61
VI	8	43	17.37 ± 0.90	51.00 ± 91	19.38	4.62
VII	6	54	22.17 ± 1.15	75.67 ± 4.89	42.75	6.09
VIII	8	62	20.50 ± 1.79	68.00 ± 6.61	19.30	4.91
All plots :			17.04 ± 1.51	53.33 ± 5.29		

TABLE 3

Analysis of variance of bird species in 7 plots in different months

Source of variation	Degrees of Freedom	Sum of Squares	Mean Square	F value
Between Plots	6	2649.67	441.61	18.72*
Between Months	5	435.75	87.15	3.69#
Residual	30	707.58	23.59	
Total	41	3793.00		

* Significance at $p < 0.05$ # Significance at $p < 0.01$

TABLE 4

Analysis of variance of number of birds in 7 plots indifferent months.

Source of variation	Degrees of Freedom	Sum of Squares	Mean Square	F value
Between plots	6	10814.66	1802.44	4.93*
Between Months	5	5599.42	1119.89	3.06*
Residual	30	10971.92	365.73	
Total	41	27386.00		

* Significance at $p < 0.05$.

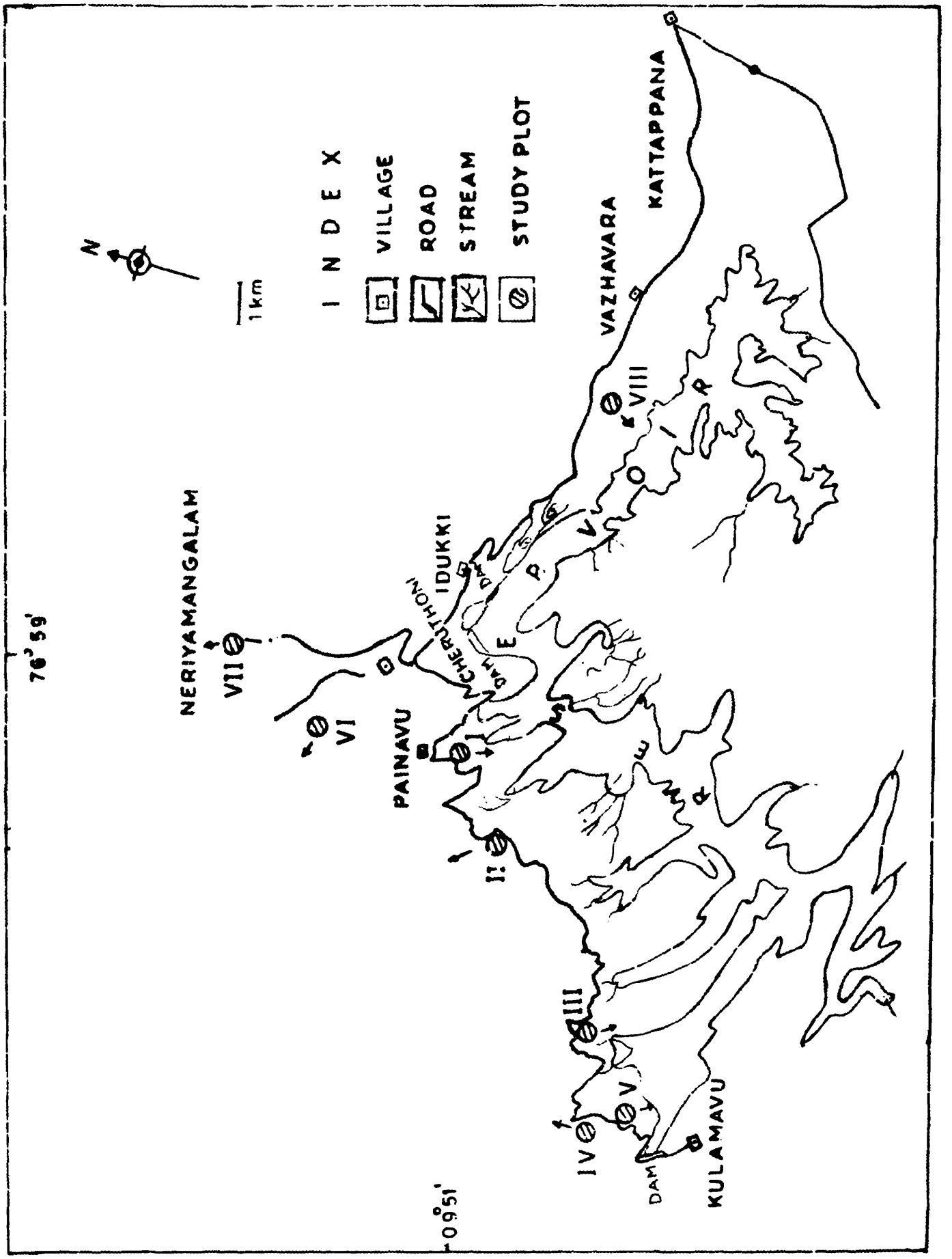


Fig. 1. Distribution of study plots in the study area. Arrow indicates direction of the transect.

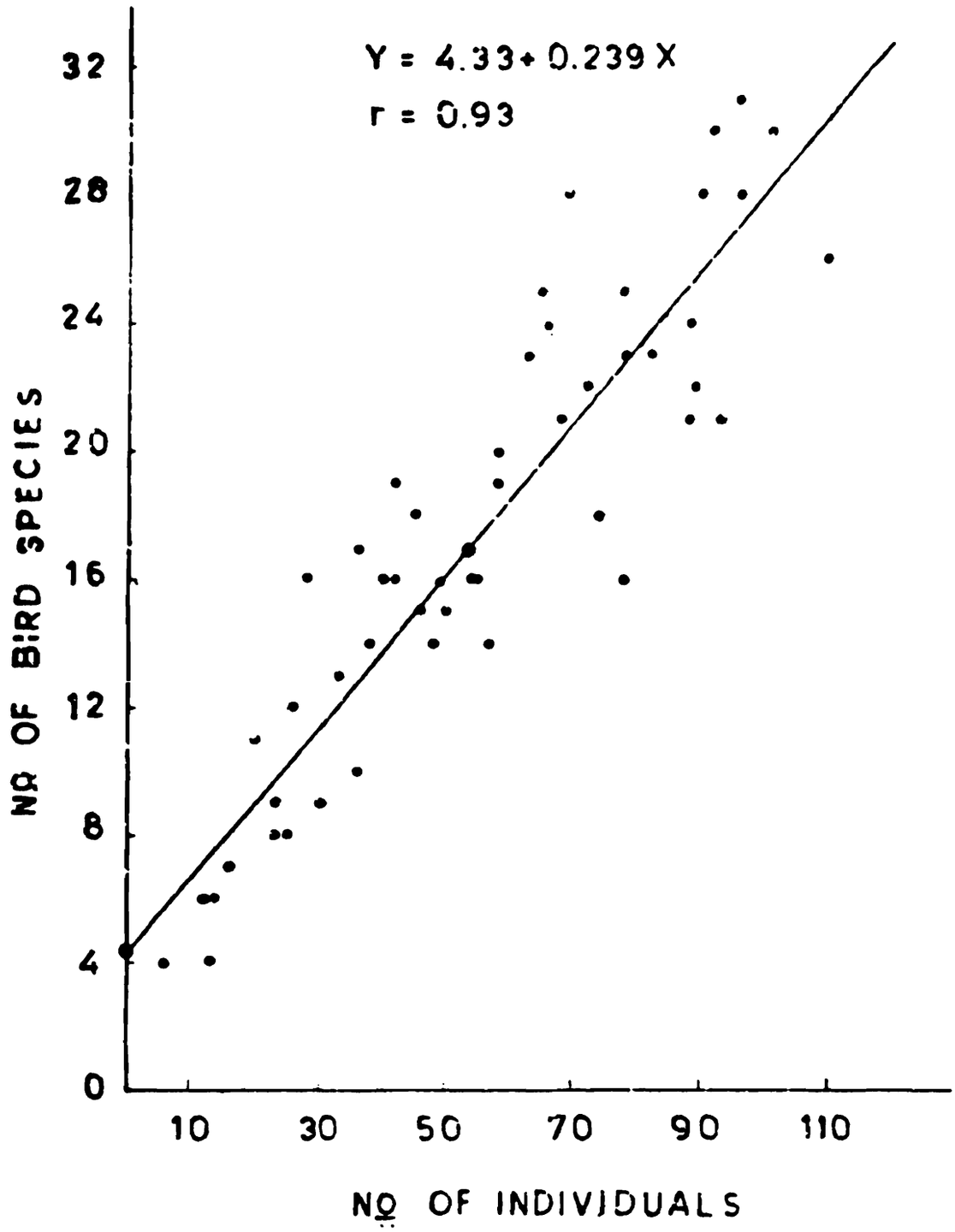


Fig. 2. Regression line showing the relation between the number of individuals against bird species.

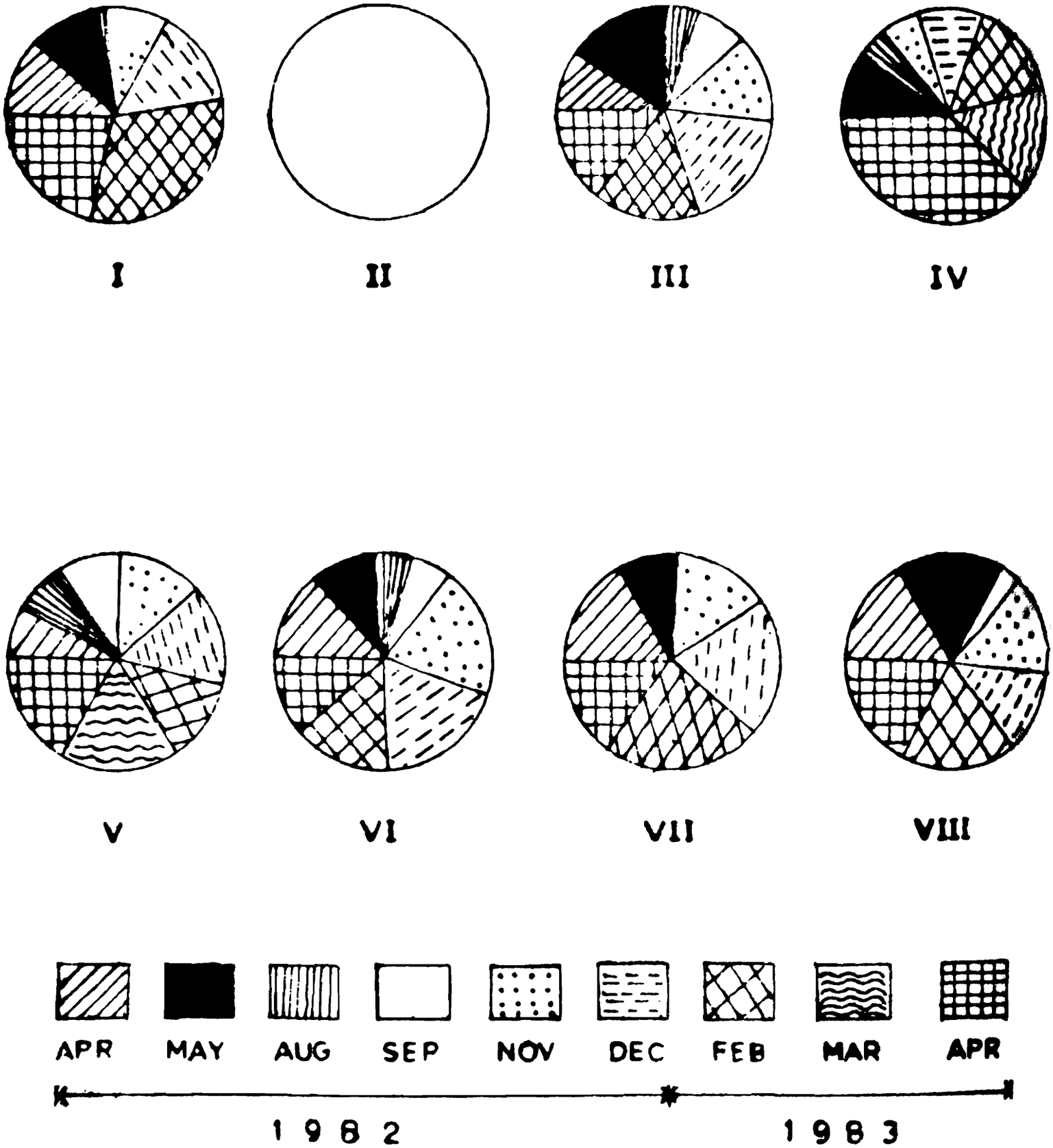


Fig. 3. Monthwise relative abudance of birds. Plot II details are given in the text.

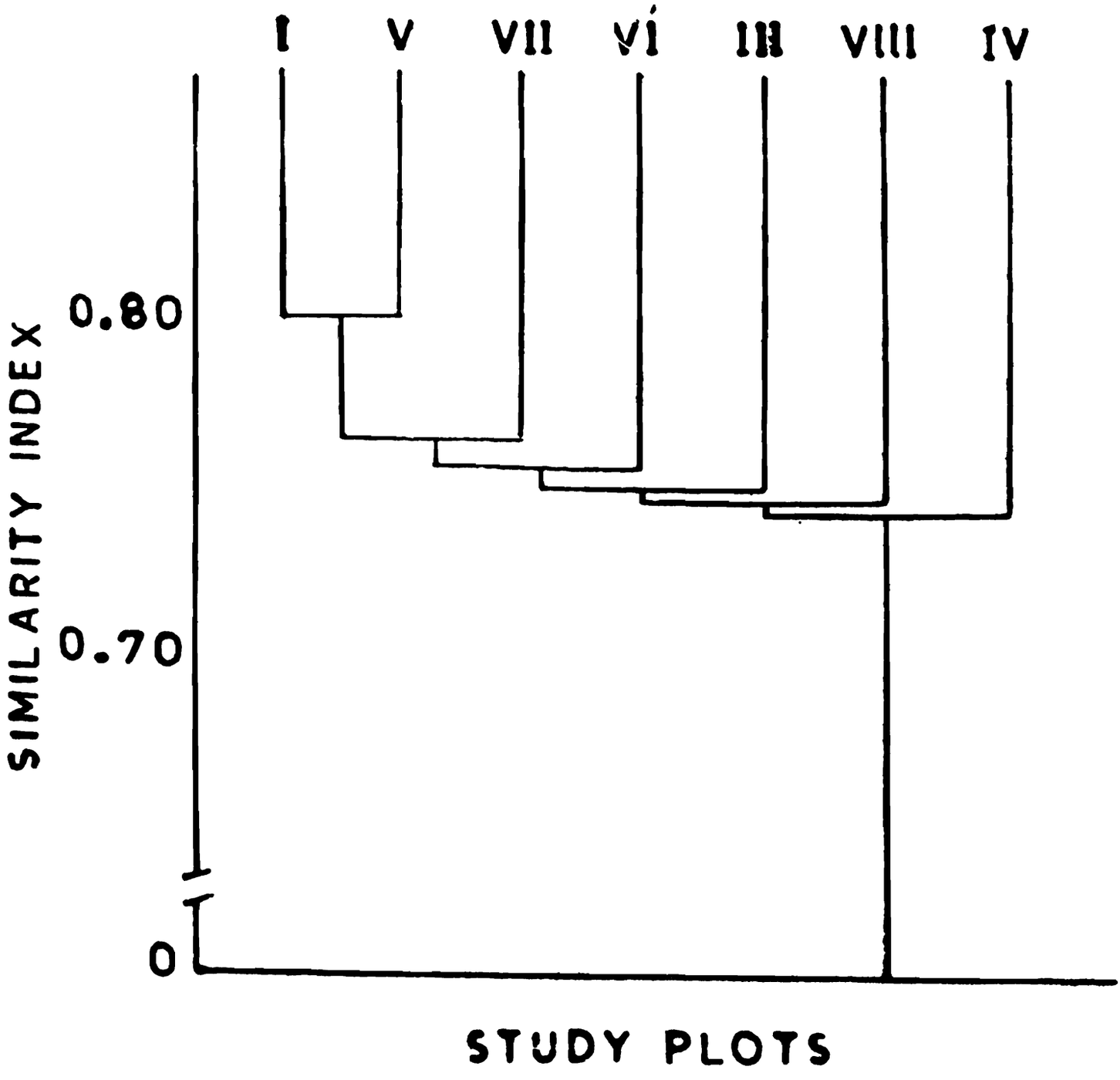


Fig. 4. Dendrogram similarity between plots due to bird species common in between them.

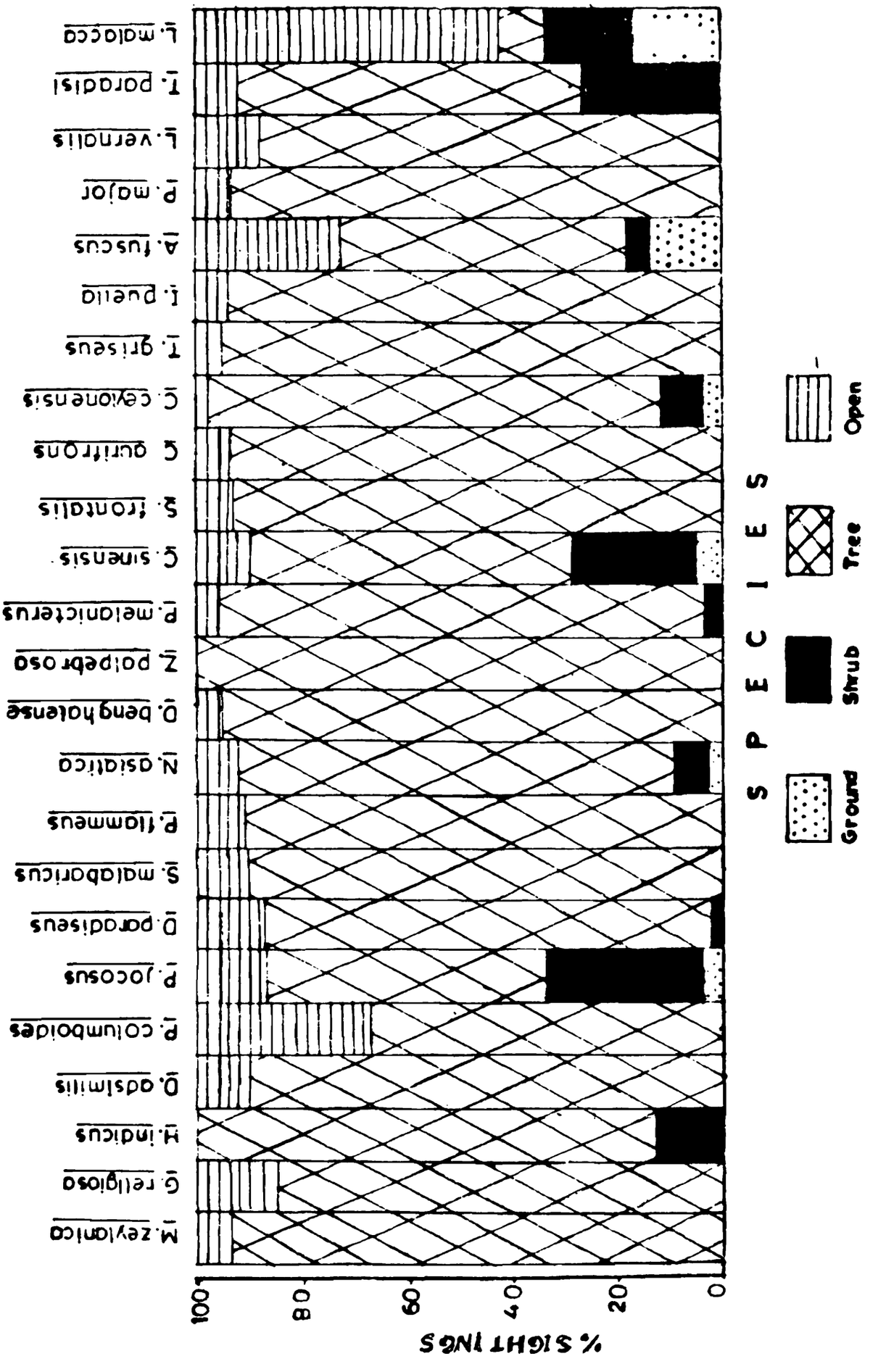


Fig. 5. Occurrence of bird species in different habitats.

Selection of study plots : On the basis of a reconnaisance, a total of 8 study polts were fixed as points of observation in the study area (Fig. 1). The selection of plots was based on the differences in the vegetation structure (Table 1). Each of these plots was a belt transect of approximately 30 m width and with a length varying from 0.75-1.0 km passing through a forest tract. Some transects ran towards the reservoir while the others were away from it. Plot II was abandoned after January, 1983 as the whole area was donned with eucalyptus plantations resulting in total absence of birds due to loss of cover and food in the area. The data analysis hence was confined to only 7 plots.

All observations were made on foot during day time between 0700-1200 h and were aided by a 7 × 50 binoculars. During each observation the name of the bird species and the number of birds sighted were recorded. Ali's (1949, 1969 and 1977) books helped easy identification of birds in the field. Scientific names of birds follow Ali and Reply (1970, 1978 and 1981). Other details such as location of bird - whether on the ground or on shrub or tree and the name of the tree species when known were also noted. Besides, the aquatic birds in the reservoir were as also recorded by survey in a mechanised boat. These, however, were not included in the calculations. A total of over 320 h was spent in data collection from February, 1982 through April, 1983.

The following diversity indices were calculated in each plot and comparisons made.

i) Simpson' index :

$$D = \frac{N\,(N-1)}{\Sigma n\,(n-1)}$$

where, D = the diversity index

N = total no. of individuals of all species

n = number of individuals of a species

ii) Shannon-Weaver index :

$$H' = p_i \log p_i\, H$$

where, $$p_i = \left(\frac{n_i}{N}\right)$$

Where, p_i =

n_i = the number of individuals of a species

N = total number of individuals of all species (Smith, 1980).

RESULTS

Species composition and abudance : A total of 108 bird species were observed in the study area including the birds present in the reservoir (Appendix 1). The total number of species recorded in different plots during the study period varied from11 (plot

II) to 62 (plot VIII). The regression for the number of species versus total number of individuals showed a high positive correlation (r=0.93, fig. 2). 53 observations in all plots showed a mean of 17.04 ± 1.51 species and a mean of 53.33 ± 5.29 individuals. The number of species averaged between 14.86 ± 1.66 (plot I) and 22.17 ± 1.15 (plot VII) while the individuals' average varied from 35.42 ± 5.23 (plot IV) to 75.67 ± 4.89 (plot VII) (Table 2). The variation in the species and number of individuals was significant for different plots and also in different months (Tables 3 & 4). The maximum number of species recorded during a visit was 55 in December,1982 while the minimum was 20 in August, 1982 in all plots. The relative abundance of birds is shown in fig. 3. The maximum number of birds observed during the period of a single visit was 110 (plot VII) in February, 1983 while the minimum was 6 (plot VIII) in August, 1982.

Diversity indices : The values of Simpson' index of diversity varied from 13.21 (plot I) to 42.75 (plot VII), while Shannon' index (H') ranged between 1.63 (plot I) and 6.09 (plot VII) (Table 2). Both indices, however, showed similar tendency in different plots. Plot IV which had only 33 species occupied fourth rank while those having more species occupied subsequent ranks. The diversity indices constitute both the number of species and the total number of individuals and depends upon a variety of combinations of species richness evenness. This makes it difficult to offer a proper explanationas to why it has a higher value of diversity than the plots having greater number of species.

Species composition - similarity between plots : Similarity matrices were obtained by considering the number of species common in between two plots (Odum, 1971; Smith, 1980). These matrices were used to draw dendrogram (Cody, 1974) for comparison. Plots I and V showed the maximum similarity with a value of 0.8 (Fig. 4). These were followed by plots VII, VI, III, VIII, and IV in that order.

Species distribution in the habitat : 92% of the sightings were on the vegetation while 4% were in open areas and 2% on the ground (n=1163). On vegetation, 85% of the sightings were on trees while only 7% were on shrubs. The distribution of sightings of some of the common bird species is shown in fig. 5. Except for the Blackheaded Munia, majority of the sightings of the rest of the birds were on tree vegetation. A few birds such as Redwhiskered Bulbul *(Pycnonotus jocosus)*, Crowpheasant *(Centropus sinensis)*, Paradise Flycatcher *(Terpsiphone paradisi)* were equally sighted on shrub vegetation. Species which dwell on the ground were very few.

DISCUSSION

Each species is adapted to a habitat niche through which the biological needs such as food, cover and water are derived (Thomus, 1979). Any modification, however small in dimension, in a habitat may lead conditions that discourage or encourage a species' existence. Järvinen and Väisänen (1979) have stated that birds constitute a good monitoring tool on account of their ecological diversity despite their limited energetical

role in most habitats. They also vary in their tolerance towards human disturbance, some are jarmed by the impact of man while others respond favourably even to extreme environmental changes. Basically birds of forest and grassland choose their havitats on the basis of density of leaves at different elevations above the ground (Smith, 1980). In the present study, birds such as Hill Myna, Malabar Grey Hornbill, Malabar Trogon, many species of flycatchers, cuckoos, thrushes and pigeons were only a few to mention that were seen only in thick and tall tree vegetation. These presumbaly are more easily effected by changes brought by man. Birds such as Redwhiskered Bulbul, Black Drongo seem to tolerate greater change in the vegetation as shown by their presence in all habitats.

The distribution of bird species depends upon the vegetation characteristics. This is clear by the fact that the study plots which consisted more or less similar vegetation structure showed more bird species in common. Plot II which had the least number of species contained more grassland area with few trees distributed here and there. In plot IV despite thick band of trees there were not as many species as in other plots which may be due to impenetrable shrub and poor light conditions. Although plot VIII recorded the maximum number of species (62), the overall diversity in plot VII was greater. Plot VII, situated by the road side had a thick stand of trees as well as shrubs along the road side thus creating more edge and also had better light penetration. Human disturbance here was comparatively less. Probably due to these factors there was abundant bird fauna resulting in greater values of diversity.

Ferguson and Bourdillon (1903, 1904) reported 332 bird species in different hill ranges of Western Ghats of Kerala. Comparison of this report with the list of birds of Idukki hydroelectric project area could not made, for the present study represents only a small area. An appendix, however, with bird species of the study area is provided showing the common or scientific names of birds that were given by Ferguson and Bourdillon (1903, 1904).

As no scientific data are available on the status of birds of Idukki during the pre-dam period, it became rather difficult to pinpoint the impacts on birds. Since the commencement of our work a number of changes, however, had been witnessed. For example, in plot VI the changes in the bird population were relatively small till January,1983. In this area, which was apparently chosen for rehabilitation of people from other areas of Idukki hydel project, tree felling was started on a large scale resulting in the total loss of cover. Thus due to more openness perching place as well as food for birds was totally lost. With the felling operations still on, one could easily guess what would remain in this area after some time.

Besides this, certain observatrions made outside the study plots in the study area are given below.

1. The birds Darter *(Anhinga rufa)*, Little Cormorant *(Phalacrocorax niger)*, Cattle Egret *(Bubulcus ibis)*, Little Egret *(Egretta garzetta)*, Common Sandpiper *(Tringa*

hypoleucos, and Night Heron *(Nycticorax nycticorax)* were observed in the reservoir. This is considered a favourable impact based on our enquiries with the local people who, apparently, did not see these brids before the reservoir came into being.

2. Large scale deforestation for construction of quarters for the staff of the project and later for the house construction by the immigrants in the area led to the total elimination of birds that preferred tree vegetation. This, however, had favoured birds such as House Crow *(Corvus splendens)* and House Sparrow *(Passer domesticus)* to dominate.

3. Creation of openings in a forest stand, as for example for laying transmission lines through a forest, led to the succession of bushy vegetation mostly dominated by exotic weeds such as *Lantana camera, Eupatorium ordoratum* etc. The dominance of Redwhiskered Bulbul *(Pycnonotus jocosus)*, Tailor Bird *Orthotomus sutorius)* and other warblers, Chestnutheaded Bee-eater *(Merops leschenaulti)* and House Swift *(Apus affinis)* in this vegetation type denote their preference to such a habitat.

4. The obstruction of river waters due to dam construction facilitated cultivation of paddy crop in the river bed of Periyar and Cheruthoni. This attracted birds such as Pond Heron *(Ardeola grayii)* and Whitebreaseted Kingfisher *(Halcyon smyrnensis)*.

SUMMARY

Studies on bird populations of Idukki hydel project area showed a great variation in different plots in different months. The total number of species recorded in 8 study plots varied between 11 and 62. The maximum number of birds observed during a visit was 110 in February, 1983, while the minimum was 6 in August, 1982. The differences in species composition and abundance were mainly due to the differnces in the vegetation structure and the amount of human disturbance in different plots. 85% of the sightings were recorded on the tree vegetation. The diversity indices and similarity with respect to species composition in between various plots were given. The presence of 6 bird species in the reservoir, apparently not noticed during the pre-dam period, was accounted for a positive impact of the reservoir. Based on the present data the other impacts were assessed.

ACKNOWLEDGEMENTS

It gives me great pleasure to acknowledge the facilities extended by Dr. P.T. Cherian, Officer-in-Charge, Idukki Project, ZSI, Cochin. All my colleagues in the project, particularly, Dr. Anil Wason, Dr. P. Gopinath and Dr. T.C. Khatri have been a source of encouragement in the present work. I have greatly benefitted from Sri K. Krishna Rao, Scientist'C', CIFT, Cochin in the statistical calculations and Dr. Vatsavaya S. Raju, BSI, Coimbatore, in the identification of plant species. Tahnks are also due to the Department of Environment, New Delhi, for the financial assistance for the research work.

REFERENCES

Ali, S. 1949. *Indian Hill Birds.* Oxford Univ. press, Delhi. 188 p.

Ali, S. 1969. Birds of Kerala. 2nd Ed. Oxford Univ. Press, London. 444 p.

Ali, S. 1977. *The Book of Indian Birds.* 9th Ed. Bombay nat. Hist. Soc., Bombay. 175 p.

Ali, S. & Ripley, S.D. 1970. *Handbook of the Birds oif India and Pakistan.* Oxford Univ. Press, Delhi. Vol. 4, 265 p.

Ali, S. & S.D. Ripley, 1978. *Handbook of the Birds of India and* Pakistan. Oxford Univ. Press, Delhi. Vol. 1, 384 p.

Ali, S. & Ripley, S.D. 1981. *Handbook of the Birds of india and Pakistan.* Oxford Univ. Press, Delhi. Vol. 3, 327 p.

Cody, M.L. 1974. *Competition and Structure of Bird Communities.* Princeton Univ. Press, Princeton. 218 p.

Ferguson, H.S. & T.F. Bourdillon, 1903. The birds of Travancore with notes on nidification. *J. Bombay nat. Hist. Soc.* **15** (2) : 249-264.

Ferguson, H.S. & T.F. Bourdillon, 1904. The birds of Travancore with notes on nidification. *J. Bombay nat. Hist. Soc.* **15** (3) : 455-474; **15** (4) 654-673; **16** (1) : 1-18.

Järvinen, O. & R.A. Väisänen, 1979. Changes in the bird populations as criteria of environmental changes. *Holarct. Ecol.* **2** : 75-80.

Odum, E.P. 1971. *Fundamentals of Ecology.* 3rd Ed. W.B. Saunders Company, Philadelphia. 574 p.

Smith, R.L. 1980. Ecology and Field Biology. 3rd Ed. Harper and Row Publishers, New York. 835 p.

Thomus, J.W. 1979. *The Blue Mountains of Oregon and Washington.* p.10-22. *In* J.W. (ed.) *Wildlife Habitats in Managed Forests.* Agriculture Hand Book No. 553. U.S. Govt. Printing Office, Washington.

APPENDIX 1

Bird Species of Idukki Hydroelectric Project Area

S.No.	Order	Family	Species	English Name
1.	Podicipitiformes	Podicipedidae	*Podiceps ruficollis* (Pallas)	+ Dabchick[o]
2.	Pelecaniformes	Phalacrocoracidae	*Phalacrocorax niger* (Vieillot)	+ Little Cormorant[o]
			Anhinga rufa (Daudin)	+ Darter[o]
3.	Ciconiiformes	Ardeidae	*Nycticorax nycticorax* (Linn.)	+ Night Heron[o]
			+ *Ardeola grayii* (Sykes)	Pond Heron[o]
			Bulbulcus ibis (Linn.)	+ Cattle Egret[o]
			Egretta garzetta (Linn.)	+ Little Egret[o]
4.	Falconiformes	Accipetridae	+ *Spizaetus girrhatus* (Gmelin)	Crested Hawk-Eagle[b]
			+ *Hieraaetus pennatus* (Gmelin)	Booted Hawk-Eagle[o]
			+ *Haliastur indus* (Boddaert)	Brahminy Kite[o]
			Accipiter badius (Gmelin)	+ Shikra[e]
			+ *Elanus caeruleus* (Desfontaines)	Blackwinged Kite[f]
			+ *Ictinaetus malayensis* (Hodgson)	Black Eagle[f]
5.	Galliformes	Phesianidae	+ *Gallus sonneratii* Temminck	Grey Junglefowl[f]
6.	Charadriformes	Charadridae	*Tringa hypoleucos* Linn.	+ Common Sandpiper[o]
7.	Columbiformes	Columbidae	*Treron pompadora* (Jerdon)	+ Greyfronted Green Pigeon[g]
			Ducula badia (Raffles)	+ Maroonbacked Imperial Pigeon[g]
			+ *Chalcophaps indica* (Linn.)	Emerald Dove[g]
			Streptorpelia chinensis (Scopoli)	+ Spotted Dove[e]

S.No.	Order	Family	Species	English Name
8.	Psittaciformes	Psittacidae	*Psittacula karmeri* (Scopoli)	+ Roseringed Parakeet[g]
			P. columboides (Vigors)	+ Bluewinged Parakeet[a]
			P. cyanocephala (Linn.)	+ Blossomheaded Parakeet[g]
			+ *Loriculus vernalis* (Linn.)	Lorikeet[d]
9.	Cuculiformes	Cuculidae	*Cacomantis merulinus* (Scopoli)	+ Plaintive Cuckoo[f]
			C. Sonneratii (Latham)	+ Baybanded Cuckoo[f]
			+ *Centropus Sinensis* (Stephens)	Crowpheasant[c]
10.	Strigiformes	Strigidae	+ *Glaucidium radiatum* (Tickell)	Barred Jungle Owlet[o]
11.	Apodiformes	Apodidae	*Apus affinis* (J.E. Grey)	+ House Swift[g]
12.	Trogoniformes	Trogonidae	+ *Harpectes fasciatus* (Gould)	Malabar Trogon[f]
13.	Coraciformes	Alcedinidae	+ *Halcyon smyrnensis* (Linn.)	Whitebrasted Kingfisher[o]
			Alcedo atthis (Linn.)	+ Small Blue Kingfisher[f]
			Ceryle rudis (Linn.)	Pied Kingfisher[o]
		Meropidae	*Merops orientalis* Latham	+ Small Green Bee-eater[f]
			M. leschenaulti Vieillot	+ Chestnutheaded Bee-eater[e]
		Coracidae	*Coracias benghalensis* (Linn.)	+ Roller[e]
		Upupidae	*Upua epops* (Linn.)	+ Hoopoe[e]
		Bucerotidae	*Tockus griseus* (Latham)	+ Malabar Grey Hornbill[b]
14.	Piciformes	Capitonidae	*Megalaima viridis* (Boddaert)	+ Small Green Barbet[a]
			M. haemacephala (Muller)	+ Crimsonbreasted Barbet[b]
			M. rubricapilla (Gmelin)	+ Crimsonthroated Barbet[b]

S.No.	Order	Family	Species	English Name
		Picidae	*Dinopium benghalense* (Jerdon)	+ Goldenbacked Woodpecker[a]
			Dryocopus javenensis (Jerdon)	+ The Malabar Great Black Wood-pecker[e]
			Picoides mahrattensis (Latham)	+ Yellowfronted Pied OR Mahratta Woodpecker[g]
			+ *Picumnus innominatus* Hartert	Southern Speckled Piculet[g]
			+ *Hemicircus canente* (Lesson)	Heartspotted Woodpecker[g]
15.	Passeriformes	Pittidae	+ *Pitta brachyura* (Linn.)	Inidan Pitta[f]
		Hirundinidae	*Hirundo concolor* Sykes	Dusky Crag Martin[o]
		Laniidae	*Lanius schach* Linn.	Southern Greybacked Shrike[g]
		Oriolidae	*Oriolus oriolus* (Linn.)	Golden Oriole[c]
		Dicruridae	+ *Dicrurus adsimilis* (Bechstein)	Black Drongo[a]
			+ *D. paradiseus* (Linn.)	Racket-tailed Drongo[a]
		Sturnidae	+ *Acridotheres tristis* (Linn.)	Indian Myna[g]
			+ *A. fuscus* (Wagler)	Jungle Myna[c]
			Gracula religiosa Linn.	Hill Myna[d]
			+ *Sturnus malabaricus* (Gmelin)	Greyheaded Myna[d]
		Corvidae	+ *Corvus splendens* Vieillot	House Crow[o]
			+ *C. macrorhynchos* Wagler	Jungle Crow[f]
			+ *Cendrocitta leucogastra* Gould	Whitebellied Tree Pie[d]
		Campephagidae	*Coracina melanoptera* (Ruppell)	Blackheaded Cuckoo-Shrike[e]
			+ *Hemipus picatus* (Sykes)	Blackbacked Pied Flycatcher Shrike[e]
			+ *Tephrodornis* sp.	Wood Shrike[c]
			+ *Pericrocotus flammeus* (Forster)	Scarlet Minivet[a]
			+ *P. cinnamomeus* (Linn.)	Small Minivet[g]
		Irenidae	*Chloropsis aurifrons* (Temminck)	+ Goldfronted Chloropsis[b]
			+ *Aegithina tiphia* (Linn.)	Iora[f]
			+ *Irena puella* (Latham)	Fairy Bluebird[b]

S.No.	Order	Family	Species	English Name
		Pycnonotidae	*Pycnonotus jocosus*(Linn.)	+ Redwhiskered Bulbul[b]
			P. cafer (Linn.)	+ Redvented Bulbul[f]
			+ *P. melanicterus* (Gould)	Rubythroated Bulbul[b]
			Hypsipetes indicus (Jerdon)	Yellowbrowed Bulbul[a]
			H. medagascariensis (Muller)	+ Black Bulbul[f]
		Musciapidae	*Turdoides striatus* (Dumont)	+ Jungle Babbler [f]
			T. subrufus (Jerdon)	+ Rufous Babbler[f]
			Dumetia hyperythra (Franklin)	Rufousbellied Babbler[g]
			Alcippe poioicephala (Jerdon)	Quaker Babbler[g]
			Pomatorhinus schisticeps Hodgson	+ Slatyheaded Scimitar Babbler[a]
			Terpsiphone paradisi (Linn.)	+ Paradise Flycatcher[d]
			Monarcha azurea (Boddaert)	+ Blacknaped Blue Flycatcher[g]
			Muscicapa thalassina Swainson	+ Verditer Flycatcher[d]
			M. tickelliae (Blyth)	Tickell's Blue Flycatcher[g]
			M. albicaudata Jerdon	Nilgiri Verditer Flycathcher[f]
			+ *Culcicapa ceylonensis* (Swainson)	+ Greyheaded Flycatcher[b]
			+ *Orthotomus sutorius* (Pennant)	Tailor Bird[d]
			+ *Prinia socialis* Sykes	Ashy Wren-Warbler[g]
			Prinia sp.	Wren-Warbler[o]
			Sylvia hortensis (Gmelin)	Orphean Warbler[g]
			Turdus merula Linn.	+ Blackbird[e]
			Saxicola caprata (Linn.)	+ Pied Bushchat[g]
			+ *Myiophoneus horsefieldii* (Vigors)	Malabar Whistling Thrush[f]
			Zoothera citrina (Latham)	+ White-throated Ground Thrush[e]
			Monticola solitarius (Linn.)	+ Blue Rock Thrush[g]
			+ *Copsychus saularis* (Linn.)	Magpie Robin[o]

S.No.	Order	Family	Species	English Name
		Paridae	*Parus major* Linn.	+ Grey Tit[e]
			P. xanthogenys Vigors	+ Yellowcheeked Tit[f]
			Parus sp.	Whitewinged Black Tit ?[g]
		Sittidae	+ *Sitta frontalis* Swainson	Velvetfronted Nuthatch[b]
			S. castanea Lesson	Chestnutbellied Nuthatch[g]
		Matacillidae	*Anthus novaeseelandiae* Gmelin	+ Paddy field Pipit
			+ *Motacilla alba* Linn.	Hodgson's Pied Wagtail[g]
			M. indica Gmelin	+ Forest Wagtail[g]
			+ *M. maderaspatensis* Gmelin	Large Pied Wagtail[g]
			M. capsica (Gmelin)	+ Grey Wagtail[e]
			M. flava Billberg	Greyheaded Wagtail[g]
		Dicaedae	*Dicaeum Agile* (Tickell)	Thickbilled Flowerpecker[g]
			+ *D. erythrorhynchos* (Latham)	+ Tickell's Flowerpecker[f]
		Nectarinidae	*Nectarinia asiatica* (Latham)	+ Purple Sunbird[a]
			N. zeylonica (Linn.)	+ Purplerumped Sunbird[a]
		Zosteropidae	+ *Zosterops palpebrosa* (Temminck)	White-eye[b]
			+ *Passer domesticus* (Linn.)	+ House Sparrow[o]
			Lonchura malacca (Linn)	+ Blackheaded Munia[e]

* Occurrence in Plots : a = all plots; b = 7 plots; c = 6 plots; d = 5 plots; e = 4 plots; f = 3 plots; g = 2 plots and less; o = outside the plots.

+ Reference to the bird listed by Ferguson and Bourdillon (1903 and 1904)

Rec. zool. Surv. India, 87(4) : 317-320, 1990

AVIAN CESTODES IN THE HIMALAYAN ECO-SYSTEM. I. A NEW SPECIES OF CESTODE *COTUGNIA CHAUHANI* N. SP. (CESTODA : DAVAINEIDEA) FROM *COLUMBA LIVIA DOMESTICA* AND *COLUMBA LIVIA INTERMEDIA**

SANDEEP K. MALHOTRA AND V. N. CAPOOR

Parasitology Laboratory, Department of Zoology, University of Allahabad, Allahabad 211 002, U.P., India

INTRODUCTION

The morphological studies of the tapeworms under study revealed these to belong to the genus *Cotugnia* Diamare of the family Davaineidae Fuhrmann, 1907, order Cyclophyllidea Ben. in Braun, 1900 of the subclass Eucestoda Southwell, 1930.

MATERIALS AND METHODS

Nine out of 123 pigeons *Columba livia domestica* and one *C.l. intermedia* examined for cestode infection yielded 42 and 4 interesting tapeworms. The hosts were collected form Buwakhal (1600-1800 mASL) and Kotdwara (300-325 mASL) in Disurict Pauri-Garhwal, U.P. Whole mounts of the worms were prepared by the method of Malhotra (1983) and measurements recorded in millimeters unless otherwise stated and mentioned as ranges followed by mean in parentheses. Camera lucida drawings were prepared.

RESULTS

Cotugnia chauhani n. sp.
(Figs. 1-4)

Cestodes medium sized, 28-36 (33) × 2.505. Proglottides craspoedote, all broader than long. Scolex (Fig. 1), 0.36-0.495 (0.428) × 0.424-0.57 (0.57). Suckers unarmed, spherical, 0.105-0.135 (0.109) × 0.06-0.135 (0.1). Rostellum, 0.055-0.125 (0.098) × 0.234-0.359 (0.30). Rostellar hooks (Figs. 2a, b) 258-280 (269), arranged in 2 alternate rows. Hooks of the outer row 0..015-0.2 (0.018) long and of the inner row 0.012-0.014 (0.013) long. Neck indistinct. Immature, mature and gravid (Figs. 3, 4) proglottides measure, 0.03-0.195 (0.138) × 0.17-0.81 (0.698); 0.099-0.225 (0.16) × 0.978-2.505 (1.785) and 0.6-0.705 (0.653) × 1.635-1.98 (1.808), respectively. Genitalia double in each proglottid. Testes spherical to oblong, 46-77 (67) in number, located only lateral to the ovary forming 2 groups. Testes never cross lateral excretory vessels.

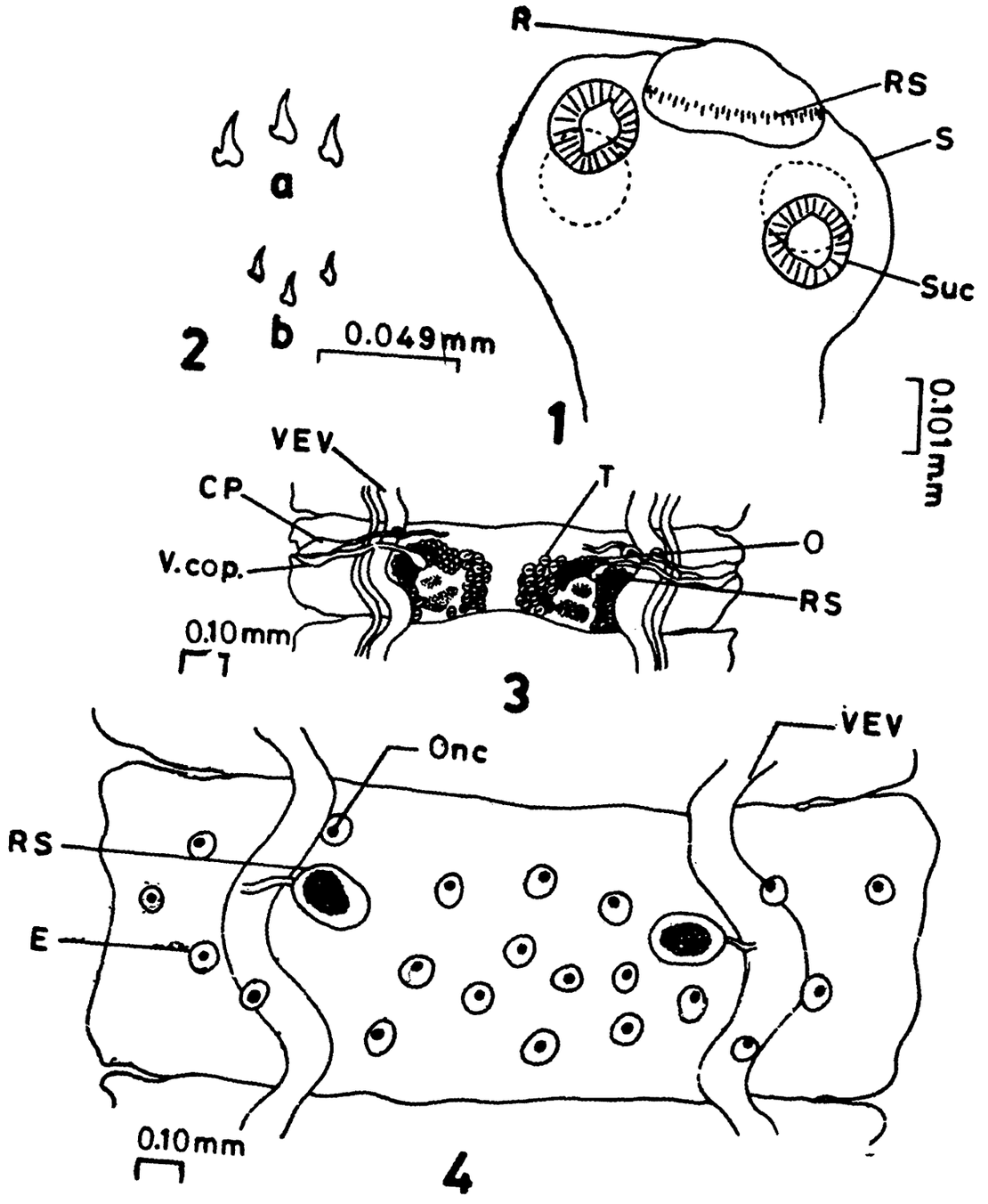
---

* Part of D. Phil. thesis of the senior author.

Poral group of testes, 25-35 (30) and aporal group of testes 21-42 (32). Testes, 0.01-0.056 (0.03) × 0.015-0.061 (0.049). Cirrus pouch elongated, 0.09-0.285 (0.201) × 0.15-0.045 (0.033), not reaching lateral excretory vessels. Cirrus unarmed, 0.015-0.023 (0.019) in diamerter. Vas deferens, 0.007-0.015 (0.011) may form few coils fan-shaped, located close to lateral excreatory vessel on lateral proglottid margin, before entering into cirrus pouch. Ovary follicular, 0.03-0.15 (0.078) × 0.12-0.36 (0.248). Vagina, 0.007-0.023 (0.016) in diameter; copulatory part of vagina, 0.07-0.117 (0.094) × 0.008-0.02 (0.014). Vagina opens posterior to cirrus pouch into the genital atrium. Receptaculum seminis large, 0.03-0.195 (0.132) × 0.022-0.15 (0.089). Vitelline gland, 0.007-0.092 (0.06) × 0.045-0.165 (0.109), postovarian, near posterior border of proglottis. Ootype between ovary and vitelline gland measure, 0.03-0.045 (0.038) × 0.015-0.045 (0.03). Genital atrium, 0.015-0.045 (0.029) deep and 0.022-0.06 (0.038) wide. Genital porcs in anterior third lateral margin of each proglottid. Egg capsules, 0.015-0.075 (0.045) × 0.068-0.12 (0.094), each with a single egg. Eggs, 0.015-0.075 (0.044) × 0.015-0.075 (0.069). Onchosphere, 0.007-0.03 (0.017) × 0.015-0.03 (0.024).

DISCUSSION

C. chauhani n. sp. shows didfference from *C. collini* Fuhrmann (1909) in possessing smaller strobila (28-36 × 2.505 vs 50-70 × 4.5), scolex (0.57 vs 1.34), suckers (0.135 vs 0.38), rostellum (0.359 vs 0.85) and cirrus pouch (0.285 vs 0.42); and larger number of rostellar hooks (280 vs 200). It differs from *C. fleari* Meggitt (1927) in having larger number of testes (77 vs 44) and wider cirrus pouch (0.045 vs 0.03) which does not reach longitudinal excretrory vessels. The worms can be differentiated from *C. govinda* Johri (1934) in possessing shorter (33mm vs 53.5mm) strobila, scolex (0.428 vs 0.565), cirrus pouch not reaching lateral excretory vessels, lesser number of testes (77 vs 54). Two proglottides of *C. govinda* were reported to have single set of female reproductive organs by Johri (1934) but in the present species all the proglottides essentially had 2 sets of reproductive organs. The new species also differs from *C. intermedia* Johri (1934) in possessing shorter (33 vs 48) and narrower strobila (2.505 vs 3.2), cirrus pouch not reaching lateral excretory vessels, and lesser number of testes (77 vs 90) invariably in 2 groups, and not forming a continuous band. It can also be differentiated from *C. noctua* Johri (1934) in consisting of shorter (33 vs 51) strobila, wider rostellum (0.359 vs 0.225), cirrus pouch not reaching lateral excretory vessels, and lesser number of testes (77 vs 182) not extending beyond lateral excretory vessels. It can be distinguished from *C. polycantha* Fuhrmann (1909) in having longer cirrus pouch (0.285 vs 0.2) which is only 0.465 to ventral excretory vessels as against 0.168 found in *C. polycantha* and lesser number of testes (77 vs 88) and from *C. taiwanensei* Yamaguti (1935) in cirrus pouch not reaching longitudinal excretory vessel and lesser number of testes (77 vs 100).



Figs. 1-4. *Cotugnia chauhani* n. sp. (1) scolex × 100 (2a). Rostellar hooks of outer row × 240 (2b) Rostellar hooks of inner row × 240 (3) mature proglottid × 10 (4) gravid proglottid × 10

CP, cirrus pouch; E, egg; O, ovary; ONC, onchosphere; R, rostellum; RH, rostellar hooks; RS, receptaculum seminis; S, scolex; SUC, sucker; T, testis; V Cop., copulatory part of vagina; VEV, ventral excretory vessel.

Hosts	*Columba livia domestica* and *C. L intermedia*
Habitat	Duodenum
Locality	Buwakhal (1600-1800 mASL) and Kotdwara (300–325 mASL), Dist. Pauri-Garhwal, U.P., India.
Holotype	Holotype slide No. PCLS 02/79 deposited with the Parasitological Collections, Department of Zoology, University of Allahabad, Allahabad, U.P.

SUMMARY

The parasitological survey of high altitude pigeons yielded tapeworms of a new species *Cotugnia chauhani* n. sp. These worms exhibit comparable characters from other close species in size of strobila, scolex suckers, rostellum, eggs; size and extension of cirrus pouch; and number of rostellar hooks.

REFERENCES

Braun, M. 1900. In H. G. Bronn, *Klassen and Ordnungen des Thierreichs, Band IV. Vermes; Abtheilung I. b., Cestodes.* 927-1731. Leik pzig.

Fuhrmann, O. 1907. Die Systematik der Ordnung der Cyclophyllidea. *Zool. Anz.*, **32** : 289-297.

Fuhrmann, O. 1909. La distribution faunistique et geographique des cestodes d'oiseaux. *Bull. soc. sci. nat. Neuchatgel*, **36** : 90-101.

Johri, L. N. 1934. Report on a collection of cestodes from Lucknow (U. P., India). *Rec. Indian Mus.*, **36**: 153-177.

Meggitt, F. J. 1927. Report on a collection of cestodes mainly from Egypt. I. Families Anoplocephalidae, Davaineidae. *Parasitology*, **19** : 314-327.

Malhotra, Sandeep K. 1983. Cestode fauna of hill-stream fishes in Garhwal Himalayas, India. VI. *Ptychobothrium nayarensis* n. sp. from *Barilius bola* (Ham.) and *Schizothorax richardsonii* (Gray). *Korean J. Parasit.*, **21** (2) : 205-208.

Southwell, T. 1930. *Cestoda. Vol. 1. In the Fauna of British India*, including Ceylon and Burma, xxxxi + 391p., Vol. **2**, ix + 262p.

Yamaguti, S. 1935. Studies on the helminth fauna of Japan. Part 6. Cestodes of birds, I. *Jap. J. Zool.*, **6** : 183-232.

Rec. zool. Surv. India, **87**(4) : 321, 1990

SHORT COMMUNICATIONS

EXTENSION OF THE RANGE OF *PELLORNEUM RUFICEPS OLIVACEUM* JERDON TO EASTERN TAMIL NADU

There is some controversy regarding the occurrence of *Pellorneum ruficeps olivaceum* Jerdon in Tamil Nadu. Stuart Baker (1922 : 240) said that the "birds of southwestern India from Coorg, Wynaad, southwestern Mysore and Travancore belong to the race called *granti*" (= *olivaceum* Jerdon). Ali & Ripley (1971 : 119) mentioned that it is distributed in Kerala and presumably also of adjoining western Tamil Nadu (Palnis etc.), north to the Palghat Gap, from near sea level to 1800 m. Again Ripley (1982 : 320) restricted its distributional range to Kerala only.

However, while working out a recent collection of birds from Madurai district, eastern Tamil Nadu made on 18, 21 and 28 February 1986 by our colleague, Shri S. S. Saha, we came across four examples of the Spotted Babbler which are proved to be *Pellorneum ruficeps olivaceum* Jerdon.

All the specimens had breeding gonads. Of these four, a female bearing Z.S.I. Regd. No. 36941 taken on February 18, had an oviducal egg.

The present record extends the range of the bird to further east.

ACKNOWLEDGEMENT

We are grateful to the Director, Zoological Survey of India, for giving opportunity to study the material. We express our deep gratitude to Dr. B. Biswas, Joint Director (Retired), for critically going through the manuscript and suggesting improvements.

REFERENCES

Ali, S. & Ripley, S. D. (1971) : *Handbook of the birds of India and Pakistan, together with those of Nepal, Sikkim, Bhutan and Ceylon*, **6** : 119. Oxford University Press, Bombay.

Baker, E.C.S. (1922) : *Fauna of British India, Birds*, **1** : 240. Taylor and Francis, London.

Ripley, S. D. (1982) : *A synopsis of the birds of India and Pakistan*. Bombay Natural History Society, Bombay.

Zoological Survey of India,
535, New Alipur Road, 'M' Block,
Calcutta 700 053.

J. M. DASGUPTA
AND
SIPRA BASUROY

Rec. zool. Surv. India, 87(4) : 323, 1990

SHORT COMMUNICATIONS

NEW RECORDS OF TWO FRESH WATER CILIATES (PROTOZOA) FROM INDIA.

Study of the Protozoa collection made during 1972 by the author from Solan and its environs, Himachal Pradesh, reveals the existence of two species of ciliates hitherto unrecorded from North Western India. So it is considered worthwhile to publish the new records here under from this sub-continent i.e., India.

The material was fixed in Schaudinn's fluid as well as in Carnoy's solution and stained in Heidenhainiron-haematoxylin and counter stained with eosin and mounted in D.P.X. medium.

SYSTEMATIC ACCOUNT

Phylum PROTOZOA

Class CILIATA

Order PLEUROSTOMATIDA

Family AMPHILEPTIDAE

1. ***Amphileptus claparedei*** Stein

Material : 3 exs. 3 slides, Reg. No. Pt. 11-13

Locality : Sunnyside, Solan, H.P. Date. 17 June, 1972.

Remarks : Body flat, flask shsped, posterior end bluntly pointed, anterior end neck like, cytostome almost half of the body length from ventral margin, trichocyst not clear.

Contractile vacuoles situated irregularly. Body-135/145/um long, 36-40/um width.

Order HYPOTRICHIDA

Family UROSTYLIDAE

2. ***Paraholosticha herbicola*** Kahl.

Material : 3 exs., 3 slides. Reg. No. Pt. 70-72.

Locality : Patta, Solan H.P. date. 17 July, 1972.

Remarks : Body elongated oval, flexible, ventral cirri in two parallel oblique rows, with a row of stiff cirri along the frontal margin, posterior to it two short rows of cirri. The peristome is very large with a well developed adoral zone. Body 170-180/µm long, 60-63/µm width.

Zoological Survey of India,
Solan (H.P.) 173212.

RATHIN MUKHERJEE

Rec. zool. Surv. India, 87(4) : 325-326, 1990

SHORT COMMUNICATIONS

REDISCOVERY OF THE SMALL TRAVANCORE FLYING SQUIRREL, *PETINOMYS FUSCOCAPILLUS FUSCOCAPILLUS* (JERDON) FROM KERALA, INDIA.

Close on the heels of the rediscovery of the Malabar Civet *Viverra megaspila civettina* Blyth (Kurup, 1986), I have great pleasure in reporting yet another rediscovery also from Kerala state, India. This time the species is the extremely rare small Travancore Flying Squirrel, *Petinomys fuscocapillus fuscocapillus* (Jerdon), one of several species of small flying squirrels in India, but the only one in southern India. Described in the year 1847 by Jerdon, the species was collected only twice again till now (Jerdon, 1874; Wronghton 1915), both presumably around the same time in last century, once by Rev. M. Baker and the second time by the better known forester cum botanist Mr. Bourdillon both of whom were Englishme ı living in Travancore at the time. The type specimen was lost soon after the species was first described (Wroughton 1915), and the only specimen ever recorded so far to be existing is a mutilated skin in bad condition in the collections of the British Museum of Natural History, London, presumably the one collected by Bourdillon.

The specimen, a female, now obtained almost a century afterwards, was collected from within the crown of a coconut palm at a place called Vennikkulam in Pathanamthitta district of Central Travancore in Kerala, in connection with the programme of district faunistic surveys.

Vennikkulam is a river side village in the countryside on the banks of Manimala river with a small trading center. Nearest forested area is about 24 km. away to the east in the Ranni Forest division. The area is cultivated with coconut, arecanut, sugar cane, paddy, and of late, cocoa also. It has also some riverine vegetation thick at places along the banks of the river. The plot of land from which the squirrel was collected had all these vegetation types, particularly an isolated cultivation of cocoa plants. Though the area was further explored, especially the crown of all the coconut palms in the area, no other individual was seen. However, the area remains to be explored further with some intensive surveys in the nearby Ranni division of forests.

REFERENCES

Jerdon, T. C. 1874. A Hand book of the Mammals of India (Reprint, 1984 by Mittal Publications, Delhi).

Kurup, G. U. 1986. The Rediscovery of Malabar Civet, *Viverra megaspila civettina*. Blyth in India. *Cheetal*, **28** (2) 1-4.

Wroughton, R. C. 1915. Bombay Natural History Society's Mammal Survey of India, Burma and Ceylon. Report Nos. 18 & 19. *J. Bombay nat. Hist. Soc.* **24** : 79-110.

Zoological Survey of India,
Western Ghat Regional Station,
Calicut - 67300 (Kerala, India).

G.U. KURUP

Rec. zool. Surv. India, 87(4) : 327, 1990

SHORT COMMUNICATIONS

ON A NEW RECORD OF *PSEUDOCHLAMYS PATELLA* CLAPAREDE AND LACHMANN (PROTOZOA : RHIZOPODA) FROM INDIA

While examining some ground moss and its inhabiting soil collected from Nohradhar, Dist. Sirmour, Himachal Pradesh, India few specimens of a testacean rhizopod belonging to the species, *Pseudochlamya patella* Claparede & Lachmann were encountered. The present observations on this species were based partly on the study of the living forms and partly on the specimens fixed in Schaudinn's fluid and stained either in Borax carmine or in Heidenhain's ironhaematoxylin. The empty tests were air dried after three to four washing in absolute alcohol and mounted in D.P.X, To avoid crushing of the delicate testss, tiny pieces of coverslip were placed in the mounting medium to support the coverslip. For studying the specimens in the living condition some portion of the ground moss along with the inhabiting soil were brought to the laboratory and kept in few days in party dishes by sprinkling just enough water daily on them. Then aquous drops from the bottom of the above said petry dishes were pipetted by capillary tubes, kept on the cavity micro slides and examined under light microscope.

Pseudochlamys patella Claparede & Lachmann

Test discoid, rigid and brown; with a central nucleus and many contractile vacuoles; a short finger like pseudopodium between fold; 40-42 µm in diameter.

A perusal of available literature reveals that there is no published account of this species from India. Hence *P. patella* is the first record from this country. It belongs to Family Arcellidae, Order Arcellinida, Class Lobosea.

The author is deeply indebted to Shri K.N. Nair, Western Ghats Field Research Station, Z.S.I., for guidance. Thanks are also due to the Scientist 'SE', High Altitude Zoology Field Station, ZSI and Dr. J. M. Julka of the same station for the facilities provided for this work.

High Altitude Zoology Field Station,
Zoological Survey of India,
Solan, Himachal Pradesh.

R. N. MUKHERJEE

Rec. zool. Surv. India, 87(4) : 329, 1990

SHORT COMMUNICATIONS

DETERIORATION OF THE HABITAT OF THE MOUPIN PIKA, *OCHOTONA THIBETANA SIKIMARIA* THOMAS, IN SIKKIM, INDIA

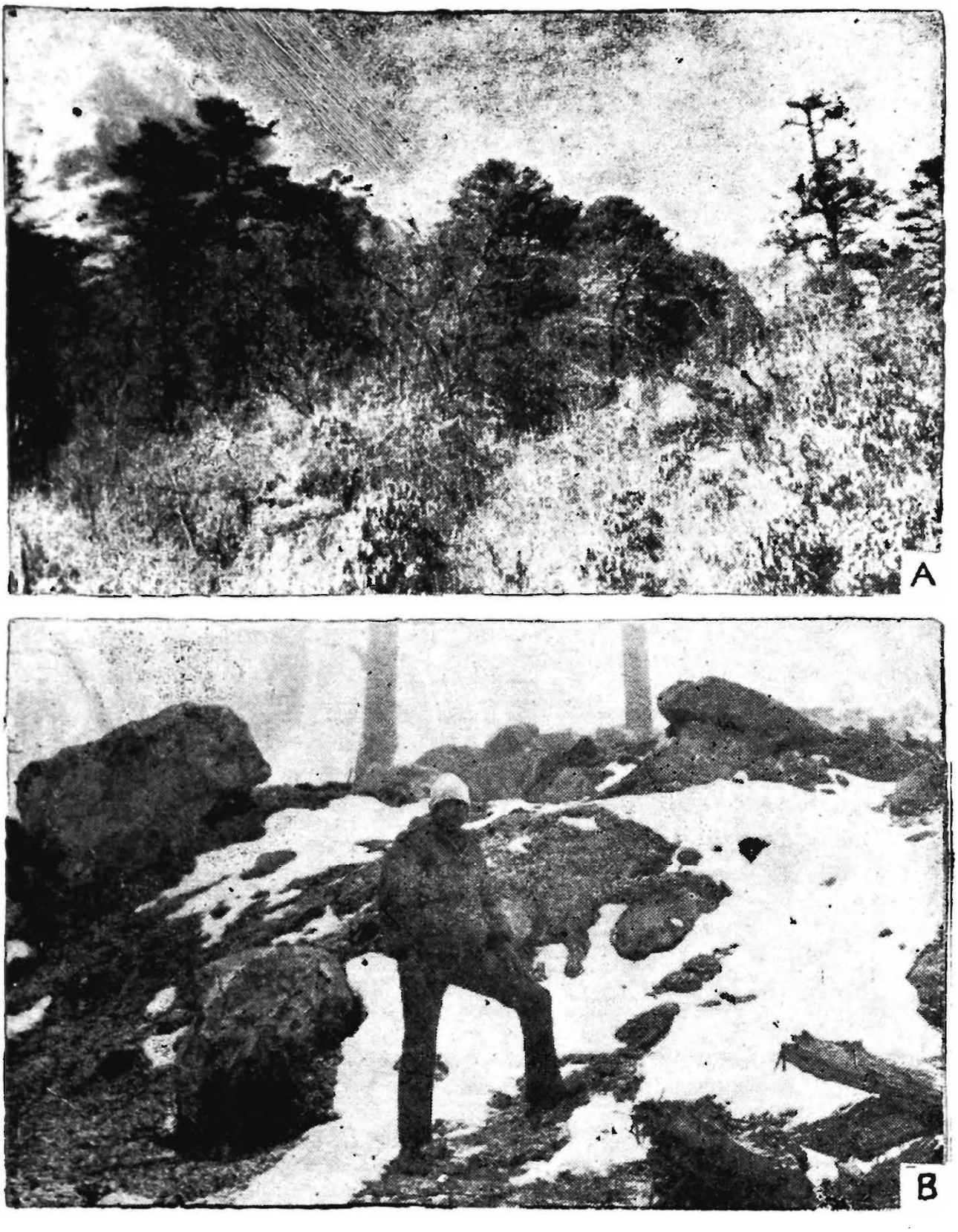
Ochotona thibetana sikimaria Thomas is known in India from a few localities like Lachung (alt. *c* 2622 m) and Lachne (alt. *c* 2865 m) only in North Sikkim. We visited Lachung and Lachen in 1979, 1981 and 1982, in connexion with the topotype collection of the Moupin Pika and study of its ecology. In course of the field work in North Sikkim in 1983, we had occasion to revisit Lachung and returned with gloomy hearts. During our short stay there, we noticed a great change in the ecological condition of the area from what we had seen earlier. The forest zone was completely denuded of vegetation and replaced by human habitation all over. The forest areas on the western slope of Lachung Chu (between 2.5 and 5 km of the forest Rest House) was also destroyed by a massive landslide in September, 1982. On the whole, we had shocking experience. The beautiful area consisting of glades of social grasses, thickets of rhododendron, the preferred habitat of the Moupin Pika (*O. t. sikimaria*), and larger trees (mainly first) with thick growth of mosses and ferns, which used to give cover to the Himalayan Langur (*Presbytes entellus schistaceus*) and the Red Panda (*Ailurus fulgens*) of that area had vanished for ever (Pl. 1).

It may be mentioned that a large area of the forest zone on the eastern bank of Lachung Chu (= river) and some 2 sq.km. area on the western bank of the river up to the Forest Rest House were deforested long back for human settlement, terraced cultivation, firewood collection, road construction, etc. The habitat of the Moupin Pika in the other area, i.e., Lachen, is also highly disturbed for a long time for varius reasons.

The status of the Moupin Pika appears to be some concern to us, due to deterioration of its habitat.

Zoological Survey of India,
'M' Block, New Alipur,
Calcutta 700 053.

R. K. GHOSE



Habitat of Moupin Pika at Lachung.
A. Photograph of habitat, 1979.
B. View in 1983.

Rec. zool. Surv. India, 87(4) : 331-332, 1990

SHORT COMMUNICATIONS

OCCURRENCE OF THE RUFOUSTAILED HARE AT MAHENJODARO

The Archaeological Survey of India excavated a large number of animal remains from Mahenjodaro in Khairpur Division of Sind, now in Pakistan, during 1922-1927. Bulk of these animal remains have been worked out by Sewell and Guha (1931). However, while working out the remaining portion of the animal remains, we have found a skull and some skeletal material of hares which are of considerable interest. Although Nath (1963) referred this material from Mahenjodaro under *Lepus nigricollis dayanus* Blanford, probably following Ellerman and Morrison-Scott (1951), this has been identified by us as that of the Rufoustailed Hare, *Lepus ruficaudatus* Geoffroy* (Mammalia : Lagomorpha). In this connection it may be mentioned that Mackay (1931*a*, *b*) has reported the occurrence of some 'clay models' and 'copper tablets' depicting the pictures of hares, obtained during excavation at Mahenjodaro.

Material : 1 skull and other skeletal material (scapula 1, sternum 1, vertebrae 14, rib bones 19, pelvic girdile 2, sacrum 1, humerii 2, radius 2, ulna 2, femur 2, tibia-fibula 2, calcaneum 1, matatarsus 2, phalanges 2); obtained from 'SD' and 'DK' areas at Mahenjodaro (*vide* Sewell and Guha *op. cit.*). Khairpur Division, Sind, Pakistan.

According to Blanford (1891) *L. ruficaudatus* occurs in the west up to southern Punjab and Sind in Pakistan. Finn (1929) states that *ruficaudatus* does not occur in the southwest Punjab, Sind and western Rajasthan. Ellerman and Morrison-Scott (1951) and Roberts (1977) mention that at present, *Lepus n. dayanus* Blanford which extends its western limit as far as Rajasthan in India, occurs in Pakistan. Within historic times, the physical and climatic condition of Pakistan and Rajasthan have changed considerably. Previously the country was well watered and full of cultivated fields as is now in the other parts of India (Wadia, 1960). From the distribution of *L. ruficaudatus* given by Blanford (*op. cit.*) and the material under report, it is assumed that with the onset of arid conditions species like the Rufoustailed Hare which is an animal of waste ground, grasslands, bushes or dry cultivations, has contacted its distribution from the western limit of its occurrence, and the area thus vacated was taken over by *L. n. dayanus*.

REFERENCES

Blanford, W.T. 1891. *Fauna of British Inia including Ceylon and Burma.* Part 2. Taylor and Francis, London.

---

* Ellerman and Morrison-Scott (1951) treated *ruficaudatus* as subspecies of *Lepus nigricollis* Cuvier. However, the study of the crown pattern of molar teeth of the species shows greatly dissimilarity with *nigricollis*, hence it is retained as a full species here, following Blanford (1891).

Ellerman, J.R. and Morrison-Scott, T. C. S. 1951. *Checklist of Palaearctic and Indian Mammals*. Brit. Mus. (Nat. Hist.), London.

Finn, F. 1929. *Sternadale's Mammalia of India*. Thacker, Spink & Co., Calcutta.

Mackay, E. 1931*a*. Figures and model animals : Terra-cotta and faience animals. *In* J. Marshall ed. : *Mahenjodaro and the Indus civilisation*. A. Probsthain, London.

Mackay, E. 1931*b*. Seals, seal impressions and copper tablets with tabulasion. *In* J. Marshall ed. : *Mahenjodaro and the Indus civilisation*. A. Probsthain, London.

Nath, B. 1963. Advances in the prehistoric and ancient animal remains in India : A review. *Rec. zool. Surv. India*, **61**(1-2) : 1-290.

Roberts, T. J. 1947. *The mammals of Pakistan*. Ernest Benn Limited, London.

Sewell, R. B. S. and Guha, B. S. 1931. Zoological remains. *In* J. Marshall ed. : *Mahenjodaro and the Indus civilisation*. A Probsthain, London.

Wadia, D. N. 1960. The post-glacial dessication of Central Asia. *Monogr. Nat. Hist. Soc. India*, pp. 1-25.

Zoological Survey of India,
535, New Alipur Road, 'M' Block,
Calcutta 700 053

R. K. GHOSE
AND
U. SAHA

Rec. zool. Surv. India, 87(4) : 333-334, 1990

SHORT COMMUNICATIONS

LANGURIID BEETLE (COLEOPTERA) OF SILENT VALLEY, KERALA, INDIA

During 1979-80 Zoological Survey of India surveyed Silent Vally and made interesting collections of various groups of animals. In these collections the family Languriidae (Coleoptera : Clavicornia) is represented by a single, species of *Labidolanguria mucronata* Crotch. The genus *Pentelanguria* Crotch is known from India by two species, namely. *P. elateroides* Crotch and *P. notopedalis* Crotch. Both the species were recorded from Northern India. The species *P. elateroides* was recorded earlier from Kurseong, in Darjeeling district of West Bengal and Sikkim. Whereas *P notopedalis* Crotch has been recorded from Himalaya.

In the present study the specimens collected from Silent Valley agrees with the description of *P. elateroides* except the apices of elytra produced behind and not rounded as mentioned by Arrow (1925). The record of this interesting specimens of *P elateroides* Crotch from Siment Valley is worth mentioning.

A short description of this species is provided.

Genus *Pentelanguria* Crotch

1876. *Pentelanguria* Crotch *Cist. Ent.* 1 : 380.

1925. *Pentelanguria* Crotch : Arrow, *Fauna British India including Ceylon and Burma*, Coleoptera, Clavicornia : Erotylidae, Languriidae & Endomychidae : 179.

This genus of the subfamily Languriinae can easily be recognised after Sengupta and Crowson (1971) by its elytra being produced behind. Eyes lateral, large, prominent and coarsely facetted. Antennae short and stout. The third joint slightly elongate. The last four segments forming a compact club. Pronotum transverse, strongly margined at the sides but not at the base, the front angles blunt and hind angles acutely produced and close to the shoulders of the elytra. Scutellum triangular and acute behind. Elytra without humeral carina and the apices produced but bluntly rounded. Legs short and trasi usual.

Pentelanguria elateroides Crotch

1876. *Pentelanguria elatariodes* Crotch *Cist Ent.* 1 : 380.

1925. *Pentelanguria elateroides* Crotch : Arrow, *Fauna British India including Ceylon & Burma* Coleoptera, Clavicornia : Erotylidae, Languriidae & Endomychidae : 180.

Material examined : 2 exs., Silent Valley, Kerala, 1980, R. S. Pillai.

Length : 11 mm to 13 mm.

Species elongate, slender, coppery and very briliant in colour, head and pronotum rather strongly and closely punctured, the front angles little produced and thickened but blunt, the posterior angles very acute. Elytra closely punctured with larger and smaller punctures. The sides are straight and convergent and the apices well produced behind and not bluntly rounded, like other specimens represented in the Z.S.I. Collection. The lower surface smooth and shining.

ACKNOWLEDGMENT

I am grateful to the Director, Zoological Survey of India, Calcutta for the laboratory facilities in the Coleoptera Section and to Dr. T. Sengupta for his constant guidance.

REFERENCES

Arrow, G.J. 1925. The fauna of British India including Ceylon and Burma, Coleoptera : Clavicornia : Erothlidae, Languriidae & Endomychidae. pp. i – xv + 1 – 416.

Sengupta, T. & Crowson, R.A. 1971. A review of classification of the family Languriidae (Coleoptera : Clavicornia) and the place of Languriidae in the natural system of clavicornia. *Mem. zool. Surv. India*, Calcutta, 15(2) : 1-42.

Zoological Survey of India,
Calcutta 700 053.

A. K. MUKHERJEE

Rec. zool. Surv. India, 87(4) : 335-336, 1990

SHORT COMMUNICATIONS

RECORD OF TICKS (ACARINA : METASTIGMATA) ASSOCIATED WITH REPTILES IN ZOOLOGICAL GARDEN, CALCUTTA

The hard bodied ticks (Ixodidae) are of much economic importance as most of these are considered as potential carrier of variety of diseases in man and his domesticated stock. Considering the fact several attempts to study the tick species associated with animals present in captivity in Zoo-garden were made in different countries. But unfortunately in India they have not received much attention by the acarologists except Robinson (1926) and Sanyal *et al.* 1987.

The available records indicate that the first report on the study of ixodid ticks associated with animals in Zoological Garden, Calcutta was made by Robinson (1926). He recorded only one genus *Amblyomma* Containing two species *viz., helvolum* Koch, 1844 and *Javanensa* Supino, 1897 from *Geomyda grandis* and *Manis pentadactyla* rspectively. The present note is so far the second report of tick species from animals present in the Zoological Garden, Calcutta.

The ticks were collected by the second author at random from two reptiles, *Varanus* sp. and *Naja naja*. All the specimens collected belong to a single species *Amblyomma helvolum* Koch. Further it was noticed that the shoulder region of the host animal was greatly preferred by the ticks. Altogether 40 m.m., 32 m.m. and 4 NN were recovered from *Varanus* sp. and 1 m., 8 m.m. and 3 NN were collected from *Naja naja*.

The present specimens of *A. helvolum* Koch are small sized heavily punctated ticks. There are six symmetrical pale spots on the scutum. The coxa I with two short and II-IV with single elongated spur.

The species is a common pest of large snakes and lizards. It is not serious from economic point of view but it causes discomfort to the animals.

REFERENCES

Koch, C.L. 1844. Systematische Uebersicht Uber die Ordnung der Zecken. *Arch. f. Naturg.* Berlin, 10 (1) : 217-239.

Robinson, L.E. 1926. The genus *Amblyomma* : in Nuttall, Warburton and Robinson : Ticks. A monograph of Ixodoidea II (Part 4), 1-302.

Sanyal, A. K., Rao, A. T., De, S. K. and Acharjyo, L. N. 1987. Ticks (Acarina : Metastigmata) State Fauna Series 1 : Fauna of Orissa, Part 1 : 273-287. (Pub. : Zool. Surv. India).

Sharif, M. 1928. A revision of the Indian Ixodidae with special reference to the collection in the Indian Museum. *Rec. Indian Mus.*, 30 (3) : 217-344.

A. K. SANYAL
S. K. DE
AND
SOMNATH BANERJEE

Zoological Survey of India,
Calcutta, Suri Vidyasagar College,
Suri, Birbhum.

Rec. zool. Surv. India, 87(4) : 337, 1990

SHORT COMMUNICATIONS

PARTIAL ALBINISM IN A SPECIMEN OF THE CROW-PHEASANT, *CENTROPUS SINENSIS SINENSIS* (STEPHENS)

In the course of a faunistic survey in the Tarai region of Uttar Pradesh, three female examples of the Crow-Pheasant, *Centropus sinensis sinensis* (Stephens), were procured by one of the authors (R.K.G.) at Gola and Bhira in January 1985 and January 1986. While studying the material an interesting abnormality was noticed in one of the specimens collected at Gola and is recorded here.

There is a prominent white patch of *c* 55 mm in length in the distal part of the tibial region of both the legs of this specimen (Pl. 1). Other taxonomical characters such as clumsy, glossy black colour with conspicuous chestnut wing and long, broad, black, graduated tail, etc. are present as in the normal specimens.

Measurement :	Head & body	Wing	Tail	Bill	Tarsus
Albinistic female (Gola : 24 Jan, 1985)	482	234	278	46	61
Normal female (Bhira : 2 Jan, 1986)	472	242	284	44	60
Normal female (Gola : 7 Jan, 1986)	462	227	266	43	61

In total three species of Crow-Pheasants, namely, *sinensis*, *toulou* and *chlororhynchus* occur in the Indian subcontinent. Occurrence of similar white patches in distal part of the tibial region in any of these three species is yet unrecorded in literature so far available. It is presumed that such bilaterally symmetrical albinism in the specimen mentioned above might have developed due to genetic mutation.

Zoological Survey of India,
535, New Alipur Road, 'M' Block,
Calcutta 700 053.

D. K. GHOSAL
AND
R. K. GHOSE

GHOSAL & GHOSE PLATE I

Centropus sinensis sinensis specimens collected at Gola.
A. Albinistic female, showing the white distal part of the tarsus ;
B. The normal female.