THE FAUNA OF INDIA

AND

THE ADJACENT COUNTRIES

PISCES

(TELEOSTOMI)

SUB-FAMILY : *SCHIZOTHORACINAE*

By

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Edited by the Director, Zoological Survey of India,

1987

Published : December, 1987

Price : Inland Rs. 100·00

Foreign : £ 12·00 ; $ 18·00

Published by the Director, Zoological Survey of India, Calcutta and printed at K. P. Basu Printing Works, Calcutta-6

EDITOR'S PREFACE

Publication of Fauna of India is one of the major tasks of Zoological Survey of India. This department is a premier institute on Systematic Zoology in India and has on its staff experts on almost all groups of animals. The extensive systematic works on different groups of animals conducted by these experts are published in a large number of research publications which are scattered and not easily available to general zoologists and research workers in Universities and Colleges. In order to present these important studies in a consolidated form, various experts on different groups of animals are assigned the job of writing up Fauna of India on respective groups of animals. In this line, the Fauna of India on fishes is being written by renowned ichthyologists ; a few volumes are already published while some are in the process of publication. The present volume on Schizothoracinae is one of this series. Schizothoracinae are a group of cyprinid fishes inhabiting fast flowing streams mostly in high altitude areas. Dr. Raj Tilak has undertaken the task of updating the information on this group of high altitude hill-stream fishes, collating available informations together with those of his own. He has been personally visiting the high altitude areas in Himalaya for many years, studied and collected fresh material of all taxa belonging to this group and presented here morphological account of the valid species of Schizothoracinae alongwith figures.

I hope that this comprehensive account on Schizothoracinae will be found very useful by workers particularly in the Himalayan region and I wish to congratulate Dr. Tilak for rendering this stupendous task.

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AUTHOR'S PREFACE

Schizothoracinae are a specialised group of fishes, inhabiting streams and rivers in high altitude in Himalaya and other parts of Palaearctic region, and in India not much attention has been paid to this group of fishes probably because of the obvious difficulties in study and collection in the difficult terrain where they live. After the celebrated works of Heckel (1838) and McClelland (1839) on this group of fishes, Day's Fishes of India, published in 1877, was the first account to consolidate information on this group of fishes. Day (1877) described only 8 taxa of Schizothoracinae belonging to the genera *Oreinus*, *Schizothorax*, *Schizopygopsis*, *Ptychobarbus* and *Diptychus*; the three species described under *Oreinus* are synonyms of *Schizothorax richardsonii*. As foot-note, Day (1877) has briefly mentioned 18 species under the genus *Schizothorax* (=*Schizothoraichthys*) of which 8 are from Kashmir, 8 from Afghanistan and 2 from Afghanistan and Turkestan. Subsequently, Hora and his associates worked on Schizothoracinae of Afghanistan and Ladakh (J. & K.) and published accounts. Inspite of the masterly works published on this group, the informations were not available at one place. The types of the species published by Heckel (1838) are housed in Vienna Museum whereas types of many other taxa are not traceable in any museum. The collections studied by Day and Hora are available in Zoological Survey of India, Calcutta but these specimens are so old that all colouration on body and fins has vanished and fin-rays are partly broken due to repeated handling

In order to describe these taxa, the present author has studied and collected fresh material of most of the species of Schizothoracinae from high altitude areas in Himalaya and elsewhere and studied types of the species of *Schizothorax* and presented descriptions and figures of various aspects of all taxa so that they could be easily understood by students, teachers and research workers on this group of fishes. I hope that this work will be useful to those who cousult it and stimulate them for further investigation and research.

During the collection of specimens of these taxa from high altitude in Himalaya, the staff of Zoological Survey of India, Solan has been quite helpful for which the author is thankful. The author is grateful to Director, Zoological Survey of India, Calcutta for assignment of this project and for providing encouragement at all stages of work connected with this project. The author is highly thankful to Curator, Vienna Museum for sending types of some of the species described by Heckel (1838) for study ; the types have been figured and included in this work.

Dehra Dun
19.10.1987

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ACKNOWLEDGEMENTS

The author feels grateful to Director, Zoological Survey of India, Calcutta for assignment of this project and for providing the necessary facilities to complete it. Thanks are due to his various colleagues : Dr. P. K. Talwar, Deputy Director, Fish Division, Zoological Survey of India, Calcutta and Mr. A. Husain, Zoologist, Zoological Survey of India, Dehra Dun for their help rendered in getting the old collections of Schizothoracinae and junior colleagues : Messers H. S. Mehta, Zoological Assistant and D. P. Juneja, Zoological Assistant, High Altitude Zoology Field Station, Zoological Survey of India, Solan (H. P.) for helping in the collection of these fishes in the field. Special thanks are due to the Director of Fisheries, Govt. of Jammu & Kashmir, Srinagar and Mr. B. N. Koul, Fisheries Development Officer of the same department for extending help and cooperation in the collection of Schizothoracinae from Kashmir valley. The author would be failing in his duty if a special word of appreciation is not mentioned about the various district level authorities of Ladakh and Anantnag districts (Jammu & Kashmir), Lahaul & Spiti, Pangi valley of Chamba district, Kinnour district (Himachal Pradesh), districts of Garhwal and Kumaon hills (Uttar Pradesh) and Wild Life Warden at Periyar, Department of Forests of Kerala for extending cooperation in making the visits of the author to those areas fruitful. Last but not least, the author expresses thanks and deep sense of appreciation to Mr. Tara Singh Farmahan, Artist (I), Northern Regional Station, Zoological Survey of India, Dehra Dun for diligently delineating the figures included in this work and to Miss Usha Varma for carefully typing the manuscript.

AUTHOR

CONTENTS

INTRODUCTION

Schizothoracinae are a specialised group of fishes which inhabit fast flowing snow-fed streams and lakes from Anatolia, through Afghanistan, Pakistan, Kashmir, all along Himalaya in India and Nepal, China and U.S.S.R. They have adapted themselves well to the special type of environment. Because of the difficult terrain in which these fishes are found, they have not been collected and studied so well as other fish groups. In India, even Day (1877, 1889) did not properly describe many species of the genus *Schizothoraichthys* and put them only in a foot-note. The taxonomy of these fishes was subsequently studied by some workers such as Hora (1921, 1934 a, b, 1937, 1953), Misra (1949), Mukerji (1931, 1936) etc. but a clear picture of the status of these fishes has not been available till recently in a consolidated form.

The schizothoracine fishes were first discovered by Heckel (1838) from a collection made by Von Huegel from Kashmir who described 10 different kinds. McClelland (1839) added three more species of similar kind and subsequently, in 1842, he described a few more species of schizothoracine fishes. McClelland (1942) recognised that they are peculiar from other Cyprinidae and proposed a sub-family name, Schizothoracinae for the fishes. The peculiarity of Schizothoracinae is that they possess minute scales over the body and there is a naked membranous space in front of the anal fin, bounded laterally with enlarged scales placed vertically like eave-tiles. They possess a specialised morphology for hill-stream adaptation.

The Schizothoracinae are the dominant fishes of the mountain streams of Himalaya and Central Asia, and many genera of these peculiar fishes have been described. In India, they are distributed along Himalaya ; as an exception, singular schizothoracine genus is distributed in the Periyar river and lake in Kerala. The Indian Schizothoracinae fall under seven genera, majority of which constitute an important part of the fishery in Himalaya. They have a close resemblance with the Salmonidae and are also commonly called the "Indian Trout".

The schizothoracids form an economically important group of fishes which are most important in Kashmir Valley and other regions all along Himalaya. Because of the predominence of these fishes in those areas, there is hardly any fish-market there which does not sell these fishes, particularly in Kashmir Valley, nor is there any fish-eater of those areas who has not tasted the flesh of these fishes. Not only this, majority of the research projects in the Departments of Zoology of the Colleges and Universities in the area are connected with these fishes. Both from the commercial and scientific points of view, therefore, these fishes are worthy of a detailed study.

The purpose of this volume is to describe with figures all the known and valid species of Schizothoracinae occurring in India so that workers on fish and fisheries can be benefitted and detailed accounts of the Schizothoracinae are available for comparison with other species of this group as well as other groups of fishes.

HISTORY OF OUR KNOWLEDGE ON INDIAN SCHIZOTHORACINAE

The earliest known among the Schizothoracinae is *Cyprinus richardsonii* whose illustration alone was given by Gray (1832). Neither any description of this species was given nor any type or locality-data were deposited in any museum of the world. The illustration of this species by Gray (1832) is quite clear and shows the following characteristics.

(a) The mouth is ventral and is followed by a strip of hard papillated structure at the chin.

(b) The length of head is nearly 4.5 times in standard length of body.

(c) The origin of dorsal fin is slightly nearer the tip of snout than the base of the caudal fin.

(d) Dorsal fin has a strong spine which is posteriorly serrated.

(e) The origin of dorsal fin lies slightly in advance of the root of the ventral fin.

Moorcraft (1833) travelled through India to Leh (Ladakh) and further to Manasarovar lake. He observed a large number of fishes in Sutlej river (fed by the manasarovar lake) and they were never fished out or eaten by Indians. There were no fishermen in Tibet and that is why it was difficult to find fishes in that area for food or scientific study. The fishes mentioned by Moorcraft (op. cit.) are surely Schizothoracids, which the present author has fished from the higher reaches of the Sutlej river in Kinnour district of Himachal pradesh near Indo-Tibetan border.

McClelland (1835) described Kumaon trout, *Gonorhynchus petrophilus* (=*S. richardsonii*) from altitudes ranging between 6,000 ft. and above. In this species, the intestine is long (8 times of totat length). The description of the species is extremely poor and McClelland himself felt dissatisfied with it and needed more material to improve upon the description. The available description indicates that it may be same as *S. richardsonii*.

For the first time, a detailed account of Schizothoracid fishes was given by Heckel (1838) who worked out the fishes of Kashmir, collected by Carl freiherrn Huegel during 1831-1837. Heckel (1838) described 10 species of Schizothoracids of his genus, *Schizothorax*, from Kashmir and divided them into three sections on the position and shape of the mouth. All the 10 species were described under a new generic name, *Schizothorax*.

The three divisions of these fishes were tentatively named 'A', 'B' and 'C' although he opined that each of these divisions could subsequently be given a subgeneric rank. In group 'A', he allocated the first two species (*plagiostomus* and *sinuatus*), which are characterised by the presence of a strip of hard papillated structure at the chin, mouth ventral and lower jaw with a fine cartilaginous horny structure. In the next two divisions, the strip of hard papillated structure behind the chin is absent. In group 'B', he placed the next four species (*curvifrons*, *longipinnis*, *niger* and *nasus*), in which the lips are rounded and fleshy and the lower jaw bears a hump at the symphysis. In his group 'C', he put the last four species (*huegelii*, *micropogon*, *planifrons* and *escocinus*), in which the lips are marginally sharply attenuated, soft, bent back edge of the lower lip interrupted in the middle and present only at the corner of the mouth. The groups 'B' and 'C' have now been separated under a separate generic name.

Soon after, McClelland (1839) gave an exhaustive treatment to cyprinid fishes of India and in his *Indian Cyprinidae* described a new subgenus, *Oreinus* (from *Oreinos*, pertaining to mountains) and mentioned four species under it (*O. guttatus* McClelland, *O. richardsonii* (Gray), *O. maculatus* McClelland and *progastus* McClelland) of which three were new species. These were Schizothoracid fishes and apparently, McClelland was not aware of the work of Heckel (1838) at that time. The description of the genus *Oreinus* given by McClelland (1839) is meagre in the sense that it does not make any mention of the presence or absence of a strip of hard papillated structure at the chin. However, the first three species enumerated by McClelland (op. cit.) bear a strip of hard papillated structure at the chin and are closely allied to the fishes of group 'A' of Heckel (1838) while the fourth species of this list (*O. progastus* = having prominent belly) is without this structure and hence related to the fishes of groups 'B' & 'C' of Heckel (1838). The species, *O. guttatus* and *O. maculatus* are now synonymous with *S. richardsonii*. In a foot note at page 256, McClelland (op. cit.) proposed *O. punctatus* as a new name for *Cyprinus richardsonii* but it is subsequently not held valid.

McClelland (op. cit.) tried to classify Cyprinidae based on the examination of the viscera connected with the digestive system. The fishes of the genus *Oreinus*, althouth similar to those of *Gonorhynchus* in having a ventral mouth, differ from them in having

a smaller length of the alimentary canal (4-5 times of total length). They are, therefore, put under subfamily Paeonominae.

Valenciennes (1842) recorded *Oreinus richardsonii*, *O. maculatus*, *O. progastus*, *Schizothorax plagiostomus* etc. from India without making any comment on their systematic position.

While describing the fishes collected by Mr. William Grifith, a botanist, McClelland (1842) recognised that the fishes with small scales and a peculiar cleft in the lower part of the body in front of the anal fin, bounded laterally with scales of peculiar form, deserve a separate subfamily status and hence, gave a new subfamily name, Schizothoracinae, to accommodate these fishes. He characterised the subfamily schizothoracinae as below :

> "are Barbels with minute scales and a naked membranous space in front of the anal fin, bounded laterally with enlarged scales placed vertically like eave-tiles. Their lips are thick and fleshy and their intestines vary from three and a half to six lengths of the body.
>
> They inhabit the Mountains of India and Central Asia."

He discovered an osteological difference between the fishes of *Oreinus* and *Schizothorax* in their jaw bones. He described many new forms of this group and subdivided the genus *Schizothorax* into three genera ; the characters distinguishing these subgenera and the new species described under them are given below in tabular form.

Schizothorax (McClelland, 1842)

Racoma McClelland	*Schizothorax* Heckel	*Oreinus* McClelland
1. Jaws protractile like those of carps. premaxillaries forming a movable rim around the mouth. premaxillaries are projected forward when mouth is opened.	1. Intermaxillaries fixed. Lower jaw long, narrow and shorter than upper. Lips soft and round.	1. Mouth transverse Premaxillaries suspended horizontally so as to be carried by the muscular structure of the snout upwards and forward in opening the mouth. Lower jaw short and broad.

Species :

R. gobioides McClelland
R. chrysochlora McClelland
R. nobilis McClelland,
R. labiatus McClelland
R. brevis McClelland

Heckel (1843 : 285, 286), while describing the fishes of Lebanon, recognised the difference in the state of the mouth in the fishes of the genus *Schizothorax* and in a bid to improve upon the taxonomic position of these fishes, described earlier by him (Heckel, 1838) from Kashmir, he described another subgenus *Schizopyge* under which he endeavoured to put the fishes with a hard layer of cartilage over the lower jaw, leaving the round lipped species under *Schizothorax.*

The characters of the subgenus *Schizopyge*, given by him are as follows :—

Four barbels, two at the angles of the mouth and two on the super or lateral maxillae. The base of the dorsal fin small, bony spine serrated ; a row of larger scales in a longitudinal line along the anal. Scales small. The species accommodated under *Schizopyge* were the following :—

Schizopyge plagiostomus	Heckel	From Kashmir
Schizopyge sinuatus	Heckel	
Schizopyge curvifrons	Heckel	
Schizopyge longipinnis	Heckel	
Schizopyge niger	Heckel	
Schizopyge nasus	Heckel	

Heckel (1844) published the fishes of Kashmir in Huegel's "*Kaschmir und das Reiche der Siek*" and gave description of all the ten species of the genus *Schizothorax* which he earlier published in 1838.

Of the sixty seven new generic names of fishes proposed by Gistl (1848), *Englottogaster* was suggested as a substitute name for *Oreinus* McClelland which was regarded by him as preoccupied in Coleoptera as *Oreina.* This substitution has been subsequently considered invalid.

Guenther (1861) described *Oreinus hodgsonii* and recorded *O. maculatus* from Nepal. *O. hodgsonii* was later transferred to the genus *Schizothorax* (Günther, 1868). *O. maculatus* was probably not the same as described by McClelland (1839).

Dr. Ferdinand Stoliczka, a Zoologist and Geologist, served for 10 years in Geological Survey of India as Palaeontologist, is probably

the first scientific worker to visit Ladakh and Kashmir (Stoliczka, 1866). He explored Rupshu and joined the second Expedition to Yarkand and collected fishes of hot-springs and gave general details of these fishes. He gave a relationship of the fauna and flora of that region ; the few species of fishes of his collection were from river Sutlej. Dr. Stoliczka died on 18th June, 1876 at the age of 31 years. The fishes collected by Dr. Stoliczka were sent to Vienna Museum where Steindachner (1866) and Day (1878) studied them and described.

Steindachner (1866) described the fish fauna of Kashmir and under *Schizothorax* (*Schizopyge*) referred *richardsonii*, *sinuatus* and *curvifrons*, the former two strangely from Kulu in Himachal Pradesh. He treated *S. plagiostomus* as synonymous with *S. richardsonii*. He described three new geners, viz.

Schizopygopsis	(*S. stoliczkai*)
Diptychus	(*D. maculatus*)
Ptychobarbus	(*P. conirostris*)

Günther (1868) treated *Oreinus* and *Schizothorax* as separate genera. He described a new genus, *Gymnocypris*. He included the following species under different Schizothoracid genera.

Genus :	*Oreinus* :	*O. plagiostomus* Heckel
		O. sinuatus Heckel
		O. richardsonii Gray
Genus :	*Schizothorax*	*S. planifrons* Heckel
		S. micropogon Heckel
		S. huegelii Heckel
		S. curvifrons Heckel
		S. niger Heckel
		S. intermedius McClelland
		S. nasus Heckel
		S. longipinnis Heckel
		S. esocinus Heckel
		S. hodgsonii Günther
		S. ritchianus McClelland
		S. barbatus McClelland
		S. microlepis Keyserling.
Genus :		*Ptychobarbus conirostris* Steindachner
Genus :		*Gymnocypris dobula* Günther
Genus :		*Schizopygopsis stoliczkae* Steindachner
Genus :		*Diptychus maculatus* Steindachner

The famous explorer of Tibet, Brother Schlagintweit, through a life-time work in Kashgar in 1854, collected many species of Schizothoracids (Schlagintweit, 1872). The fishes were mentioned by Günther in his catalogue of the fishes of British Museum. Brother Ermanno, in the biography of Brother Schlagintweit, wrote that a large number of beautiful fishes were seen in lake Tsomognalari (inferior) in Pangkong at an altitude of 15,000 ft.

Day (1876, 1878) gave an account of the fishes collected by Dr. Stoliczka during Sir Douglas Forsyth's Expedition in 1873 to Yarkand. In these works many new species are described such a *Schizothorax punctatus, S. microcephalus, S. irreguleris* (? = *edeniana* McClelland) *Ptychobarbus laticeps* and *P. longicaps.* Apart from these, *Oreinus richardsonii, Schizopygopsis stoliczkae,* and *Diptychus maculatus* have also been described. Of the new species described by him, one species, *S. punctatus,* has been from the Indian region i.e., a Kashmir lake.

Day (1877), in *Fishes of India,* gave on account of *Oreinus sinuatus, O. richardsonii, O. plargiostomus, Schizopygopsis stoliczkae, Schizothorax progastus, S. esocinus, Ptychobarbus conirostris* and *Diptychus maculatus.* He included 18 species of the genus *Schizothorax* as foot-note with brief characteristics of each of them. He remarked that amongst the foregoing 18 species, it is most probable that several will turn out to be synonyms.

Anderson (1878) studied the fishes found in the waters of Yunnan.

The works of Herzenstein (1889, 1891, 1892), although not based on the fishes of the Indian region, yet these works are important because they cover a wide range of the Schizothoracid fishes with well delineated figures. He described many new genera and species from Central Asia.

Alcock (1898), while describing fishes from Yasin river (Pamir mountains, Central Asia), compared *S. nasus* and *S. progastus* from Zoological Survey of India with his material and found them different. He strongly felt that *S. hodgsonii,* which has been synonymised with *S. progastus* by Day (1977), should be a valid species because his material showed characters of this species. He also recorded *P. conirostris* from that area.

Lawrence (1895), in his book *"The Valley of Kashmir"* has described the fauna of Kashmir and in it he mentions the local names of Schizothoracids such a Sattar gaad, Khront gaad, Paikut or Pekri gaad, Chash gaad etc.

Anikin (1906) has studied the systematics, variations in characters and phylogeny of the fishes of the genus *Diptychus.* The original work is in Russian and not available for reference and hence details of his study are unknown (quoted from *Zool. Records,* 1906).

Regan (1907) worked out a collection from Nepal and on the basis of three very young specimens (70 mm. total length) from Pharping described a new species under the genus *Diptychus* (*D. annandalei*). His collection included *S. richardsonii*. The generic status of *D. anandalei* has been clarified later by Mukerji (1831).

Zugmayer (1909 and 1910) described two new species, *schizothorax ladacensis* (from 2 specimens from Indus river at Leh) and *S. montanus* (one example from Indus river at Leh). Subsequent workers on Schizothoracinae of Ladakh appear to have taken no notice of these publications. Dr. E. Zugmayer made a journey through Central Asia during 1906 and his collections were sent to the Museum of Monaco. He crossed Turkestan and entered Tibet, Ladakh etc. and collected nearly 400 examples belonging to 18 species of Schizothoracids and Cobitids.

Chaudhuri (1913) described a new species, *Oreinus molesworthi* from Yambung (1100 ft. alt.) in Abor hills, based on a single example.

Berg (1914) considered *Gymodiptychus* and *Ptychobarbus* as subgenera of the genus *Diptychus*. The species *laticeps* and *longiceps* of Day (1876) were referred by him to the genus *Aspiorhynchus*.

Vinciguerra (1916) studied a collection of fishes from Ladakh and Central Asia, collected during the expedition led by de Filippi. He has shown the distribution of 57 species of *Schizothorax*, many of which are either synonyms or belonging to genera other than this. He described *S. longipinnis*, *S. esocinus*, *Schizopygopsis stoliczkae*, *D. maculatus* etc. He has made several remarks on the relationship of the Schizothoracinae.

Annandale and Hora (1920) have described the species of the genera *Schizothorax*, *Schizocypris* and *Schizopygopsis* of Seistan and made general remarks on the evolution of Schizothoracinae and their apparent resemblance with Salmonidae.

Annandale (1921) remarked that the three Schizothoracinae of Seistan are not related to the representatives of this group which have made their way to southern slope of Himalaya but to the true Central-Asiatic Schizothoracinae and are palaearctic in origin.

Mukerji (1931) restudied the type material of *Diptychus annandalei* Regan to ascertain its generic position.

Hutchinson (1933, 1937) made observations on the limnology of the lakes in Ladakh and compared them with similar lakes in high altitude arid zones of Alps and the lakes of low lands in Europe and North America ; these lakes resemble those of the latter region, being eutrophic. The correlation between the schizothoracid fishes and the ecology of the lakes and streams in Ladakh have

been studied by Hutchinson (1939). *Oreinus sinuatus* was considered as rheobiont (feeding on bottom material), *S. planifrons* and *S. micropogon* as Limnadophil (feeding selectively on water plants and invertebrates) and *S. esocinus* as rheophil (carnivorous). According to her (Hutchinson, 1939), *S. stoliczkae* and *D. maculatus* inhabit large streams. *S. stoliczkae* inhabits least and medium rapid streams and *D. maculatus* inhabits medium to fast streams where *P. conirostris*, *O. sinuatus*, *S. esocinus* and *S. labiatus* are also found. Her rough estimate indicates that *Schizothorax* and *Diptychus* take about 10% of total oxygen through skin. The reduction of scales in *Diptychus* and *Schizopygopsis*, therefore, appears to have no respiratory significance, a conclusion in agreement with Hora and Annandale (1920).

Hora (1934 a) described the fishes of Afghanistan after a lapse of about 90 years ; McClelland's (1842) was the first account of the fishes of this region. Hora (op. cit.) revised the descriptions of the species of *Schizothorax* described by McClelland (op. cit.). He made zoogeographical remarks on the distribution of Schizothoracinae to Afghanistan from the Turkestan Plateau.

Hora (1934 b), in his fishes of Chitral, from river Kunar (or Chitral river) in Afghanistan redescribed *S. labiatus*, *S. esocinus* and *Oreinus sinuatus griffithi* and indicated that there are many intermediate forms between these species. The hybrids identified by him pose taxonomic problems for a worker on fish.

Hora and Mukerji (1935 a) reported *O. molesworthi* from Chindwin drainage system in the Naga hills and extended its range of distribution.

Hora and Mukerji (1935 b) studied fishes collected by Mr. J.A. Sillem during Netherland-Karakorum Expedition (1929-30) from Ladakh and Karakash valleys. They believed that the forms from Pamir (Alcock, 1898), Seistan (Annandale and Hora, 1920) and Tibet (Stewart, 1911) could be subspecies of *Schizopygopsis stoliczkae*. They treated *D. maculatus* and *P. conirostris* under separate genera.

Hora (1935 a) made further reports on the fishes of Afghanistan with a view to standardising the classification of the fishes of this region described by McClelland (1842). Apart from making remarks on *S. intermedius* and *S. chrysochlora*, he reported a single specimen of *O. sinuatus griffithi* and hybrids of *Schizothorax* species.

Hora (1935 b, 1936) extended the range of distribution of *O. molesworthi* to Chindwin drainage and in the streams of the Barail range in Naga hills respectively.

Chu (1935) described the pharyngeal bones and teeth, and scales of a large number of schizothoracid fishes and made remarks on the evolution of this group of fishes. He has pointed out the

taxonomic importance of these structures in the taxonomy of Schizothoracinae but opined that these structures alone are insufficient to distinguish all the genera.

Mukerji (1936) reported on the Schizothoracinae, collected by Yale North India Expedition from Ladakh and Kashmir Valley. Most of the species of Schizothoracid mainly described by Heckel (1838) and Steindachner (1866) are identified. He felt that the hybridisation, which is so common in this group, accentuates the difficulty of separating species and genera from one another. He considered *S. punctatus* as a synonym of *S. esocinus*. He is inclined to synonymise *S. niger* with *S. planifrons*.

Hora (1937 a) identified the fossil remains of scales, pharyngeal teeth and dorsal spines of different species of *Schizothorax* and *Schizothoraichthys* out of the collections made by Yale North India Expedition (1932-35) from Ningal nulla near Gulmarg (9800 ft. alt.), belonging to lower Karewas or Glaciation period.

Hora (1937 b, c) again recorded *O. molesworthi* from upper Chindwin drainge, Manipur and *O. richardsonii* from Nepal respectively.

Malik (1940) made remarks on the food and the length of the alimentary canal in relation to body length in *O. sinuatus* and compared it with observations of McClelland (1842) and Hora (1934) on *O. sinuatus griffithi*.

Ahmad (1943) studied 4 specimens of *S. longipinnis* from Dal lake and observed sexual dimorphism in this species with males having tubercles on the snout in two groups, one on either side of the head. The tubercles are taken as nuptial organs. No difference was observed in the length of fins of the two sexes.

Nichols (1943) in his account of "*The freshwater fishes of china*" divided *Schizothorax* into subgenera and put *molesworthi* under the subgenus *Schizopyge*. The genera *Schizopygopsis*, *Diptychus* and *Gymnodiptychus* were treated independent from one another.

Raina (1945) reported that *Schizothorax progastus* in Kangra Valley acts as a larvicidal fish. The brief description of the species appears to have been copied from Day (1877). The specific identity of the species appears highly doubtful. He mentions that it is a surface feeder and could be carried alive to 800 kms. to Lucknow; both statements about *S. progastus* appear wrong. There is no authentic record of this species from Kangra valley.

Ahmad (1946 : 119) recorded *Schizopygopsis* sp. from Gadar Sar lake in Sogput range at 55°F temperature and gives a brief description of the species.

Misra (1949) discussed the systematic status of two species, *S. plagiostomus* Heckel and *S. sinuatus* Heckel and found that they

were only male and female respectively of *S. plagiostomus*, Therefore, he considered *S. sinuatus* as a synonym of *S. plagiostomus*.

Vijayalakshmanan (1952) reported *Oreinus sinuatus griffithi* from Helmund river, Afghanistan.

Hora (1953), while commenting on the zoogeography of Schizothoracinae, remarked that these fishes did not become widely distributed until the first glacial period of the Pleistocene. These fishes initially lived in low lands but were later lifted by about 500 ft. through the uplift of pir panjal range. These fishes came from Central Asia with which this region was connected through low lands and marshes.

De Witt (1956), in his contribution to the ichthyology of Nepal, recorded a single specimen 87.9 mm. of *Schizothorax* sp. and remarked that it could be same as *D. annandalei* Regan. He also reported *S. richardsonii* and reproduced the original figure of this species from Gray (1832).

Chaudhuri and Khandalwal (1961) mentioned that *O. plagiostomus* was primarily a mud feeder belonging to herbivorous group of fishes. The chitinous sharp blade of lower jaw is used for scrapping the algal material from rocks and for scrapping and scooping the mud. The anatomy and histology of alimentary canal of the species are also described.

Misra (1962) recognised that the fishes having a hard papillated structure at the chin belong to the genus *Schizothorax* Heckel for which Bleeker (1863) had designated *S. plagiostomus* as the type species. The genus *Oreinus* McClelland, with *O. guttatus* McClelland as its type species (designated by Bleeker, 1863) with the similar characters is a synonym of the genus *Schizothorax*. Misra (op. cit.) established the genus *Schizothoraichthys* with *S. esocinus* as its type-species to accommodate Schizothoracid fishes of Heckel (1838) without a hard papillated structure as the chin because they were left without a generic name. Misra (op. cit.) also described *Schizothorax molesworthi* Chaudhuri, *S. plagiostomus* Heckel, *Schizothoraichthys esocinus* Heckel and *S. progastus* (McClelland).

Malhotra (1963) studied the phenomenon of nucleolar extrusions in *Schizothorax niger* Heckel. The extruded nucleoli appear to take part in the process of vitellogenesis of the oocytes.

Tsao (1964) described the schizothoracinae of china. The genera *Oreinus* McClelland, *Racoma* McClelland and *Schizopyge* Heckel have been considered synonymous with *Schizothorax* which is subdivided into subgenera *Schizothorax* and *schizopyge*. The species *plagiostomus* is put under *Schizothorax*. *S.* (*Schizothorax*) *molesworthi meriodionalis* (with naked thorax) has been described as a new subspecies ; *meridionalis* could be a separate species of

Schizothorax. Ptychobarbus longiceps Day has been synonymised under *laticeps* and put under another genus, *Aspiorhynchus* Kessler. A new genus, *Paraschizothorax* has been created for *S. O'Connori* Lloyd ; this new generic name is already preoccupied by a generic name proposed by Bleeker (1863) for *S. hügelii* Heckel. The main characteristic of this genus is the presence of 4 rows of pharyngeal teeth which is not constant in all representatives of the species. *Gymnocypris, Diptychus* and *Schizopygopsis* have been stated to be valid genera. *Ptychobarbus* is treated as a subgenus of *Diptychus.* A new subgenus, *Oxygymnocypris* has been erected to accommodate *Schizopygopsis stewarti* Lloyd from Tibet.

Das and Subla (1964) described the Oral Valves of Kashmir fishes, and mentioned the absence of mandibular valves in *O. plagiostomus* and *S. niger* as in many other cyprinid fishes.

Das and Malhotra (1964) have reported the presence of solid 'Corpus luteum' in an oviparous teleost, *Schizothorax niger.* The luteal cells are derived from the granulosa. The corpus luteum in this fish is reported to help the secretion of a steroid which antagonises the function of ovulation gonadotrophin.

Das et al. (1964) recognised *Schizothorax, Ptychobarbus Diptychus* and *Schizopygopsis* as palaearctic elements in fish fauna of Kashmir.

Das (1965), while revising the list of fishes of Kashmir Province, recognised the presence of 15 species of schizothoracids of the genera, *Oreinus, Ptychobarbus, Diptychus, Schizothorax* and *Schizopygopsis.*

Das and Daftari (1965) described the pituitary gland in the brain of *S. esocinus.*

Das and Koul (1965) described the gonads and the fecundity of *Oreinus sinuatus.* In fish of 32.9 cm. body length and weight of 537.1 gms., there are 11.675 ova.

Das and Nath (1965) have reported the presence of *Schizothorax progastus* in Betar nalla and the fast flowing streams of Poonch valley.

Malhotra (1965) studied the seasonal variation in the ovary of *S. niger.* The ovary is in phase I in May-July, II in August-September, III in October and IV and final stages of maturity in December-March. The weight of the ovary accordingly increases from July-December.

Das (1966) while naming the palaearctic elements in fauna of Kashmir, introduced the idea of distribution of Kashmir fishes from Central Asia through Pamir Knot.

Das and Malhotra (1966) observed that the ovarian activity is arrested at IV stage after the completion of vitallogenesis in

Schizothorax and *Oreinus*. The reason for this diapause in these fishes has been thought to be the low environmental temperature.

Das and Rampal (1966) studied the size, colour and texture of eggs of *Oreinus plagiostomus*, *Schizothorax niger* and *S. esocinus*. The size of eggs of these three species are 2 mm, 5 mm, and 3 mm. in diameter respectively.

Das and Qadri (1966) studied the characteristic features of the brain of *S. esocinus* and observed that the medullar lobes and large optic and olfactory lobes indicate a better taste and sight feeding habit, supplemented by smell feeding. The scales of *O. plagiostomus*, *S. niger*, *S. hügelii* and *S. micropogon* have been studied by Dulari and Das (1966) for age-determination study.

Khanna and Pandey (1966) studied the visceral skeleton of *O. plagiostomus* and observed that it is of cyprinid type and the suspensorium is of methyostylic type.

Malhotra (1966) observed that the ovary of *S. niger* is of cystovarian or hollow type and contains nearly 100,000 ova, of which 33,000 are mature.

Malik (1966) studied the representatives of *Oreinus sinuatus* from different drainage systems of Himalaya such as Indus system, Gangetic system and Brahmputra system. He is in favour of retaining the generic name *Oreinus* for the fishes having a hard papillated structure at the chin and does not consider the treatment of Misra (1962), particularly the erection of another generic name, *Schizothoraichthys*. He recognised four subspecies of *sinuatus* viz. *molesworthi* Chaudhuri, *griffithi* McClelland, *richardsonii* (Gray) and *akhtari* ssp. nov. The subspecies *griffithi* and *akhtari* belong to Afghanistan while the *sinuatus*, *richardsonii* and *molesworthi* belong to Kashmir, Ganges system and eastern Himalaya respectively.

Saxena and Bakshi (1966) studied the anatomy of the heart and its functional adaptations of *Schizothorax curvifrons*. The skull of *Oreinus sinuatus* has been studied by Das and Daftari (1967) for a study of relationship between *Schizothorax* and *Oreinus*.

Das and Nath (1967) studied the food, feeding habits and alimentary canal of *O. plagiostomus* and mentioned that there is an intestinal bulb for storage of food and the length is 4.75 times of body length.

Bhatnagar (1967) observed that *Schizothorax plagiostomus* breeds twice in a year during two different but relatively short spawning seasons i.e. July-August and December-January.

The anatomy and histology of the pituitary gland of *Oreinus plagiostomus*, *Schizothorax esocinus* and *S. niger* have been studied by Das and Daftari (1967).

The structure of the feeding apparatus of *O. plagiostomus* and *S. esocinus* has been studied by Subla (1967).

They have developed a large and efficient mesticatory apparatus and pharyngeal teeth.

Das and Shabir (1968) demonstrated that hormone injections, Duogynon for the female and Testoviron for the male, were most effective in spawning of *S. esocinus* by 2-3 weeks prematurely. The urinogenital organs of *O. plagiostomus* have been studied by Das and Koul (1968) who found that the urinay bladder in this species is of tubular type.

Malhotra (1968) reported the atrophy of the ovary of the right side in *S. niger* as a case of abnormality.

The heart, efferent and afferent arches of *S. esocinus* have been studied by Das and Akhtar (1969).

Das and Peer (1969) studied the Weberian apparatus of *O. plagiostomus* and *S. esocinus*. The mechanism of feeding of *Schizothorax* and *Oreinus* has been described and compared by Das and Subla (1969). These fishes are herbivorous.

Das and Subla (1970) offered explanation on Pamir-Kashmir Theory of origin, evolution and distribution of Kashmir valley and added notes on the ecology of Kashmir fishes. According to these authors 56.4% of the species of this region are palaearctic in origin and they have entered the Kashmir region somewhere in the late Cretaceous (nearly 80 million years ago) through Pamir Knot.

Malhotra (1970) confirmed, through a study of the seasonal changes in ovary, that *S. niger* breeds from mid-April to mid-June and spawns once a year only.

Subla and Das (1970) studied the food and feeding habits of *O. plagiostomus* and *S. esocinus* and found that they are mainly herbivorous. The former is bottom feeder while the latter is a column feeder.

Jan and Das (1971) studied the seasonal variation in the food of *S. niger* and discovered that the fish is a selective feeder, mainly vegetarian. Since the fish migrates during breeding period, there is a slight change in its diet due to change in place.

Dixit and Bisht (1972) studied the vertebral column and the girdles of *S. richardsonii*.

Jyoti and Malhotra (1972) studied the fecundity of *S. niger* in Dal lake in relation to its size, weight and age. Individual fecundity range from 810 eggs for one year old fish (13.5 cm. long) to 11458 eggs for a year old fish (36.5 cm. long).

Jayaram (1974) discussed the distribution of Schizothoracine genera. He has confused between generic limits of *Schizothorax*,

Oreinus and *Schizothoraichthys*. He considered all the three genera valid. He indicated that *Diptychus* is also distributed in eastern India which is not based on facts. He has shown the distribution of *Lepidopygopsis* in palaearctic region which is incorrect. He treated *Schizopygopsis*, *Schizothorax* and *Ptychobarbus* alone restricted to palaearctic region and excluded *Gymnocypris* and *Diptychus* from this list.

Bisht and Joshi (1975) stated that *S. richardsonii* breeds during late October-December and spawns several times during this period in Nainital lake.

Mirza (1975), while discussing the zoogeography of Schizothoracinae of Pakistan, remarked that the ancestors of these fishes migrated from south-east Asia into Central Asia probably in the Pliocene before the major upheavals of Himalaya, a statement which is contrary of the view held by Das (1966, 1970). He subdivided the genus *Schizothorax* into three subgenera viz. *Schizothorax*, *Racoma* and *Schizopyge*, making it a composite genus. He indicated the distribution of *Schizothorax*, *Diptychus*, *Schizopygopsis*, *Ptychobarbus* and *Schizocypris* in Pakistan.

Tilak and Sinha (1975) clarified the confusion regarding the generic status of *Schizothorax* and *Oreinus*, and observed that *Oreinus* is a synonym of *Schizothorax* which bears a hard strip of papillated structure at the chin. They further opined that the fishes without a hard strip of papillated structure at the chin have been rightly accommodated under a new generic name, *Schizothoraichthys* by Misra (1962).

Seasonal histological changes in the ovary of *S. esocinus* (Heckel) were studied by Raina (1976) who concluded that vitellogenesis in ovary begins from September and continues up to March and ovulation takes place from April onwards up to June ; the ovary enters a regression phase from July to August.

Tilak (1976) reported the occurrence of *D. maculatus* in Chandra and Bhaga rivers in Lahaul and Spiti Valley, Himachal Pradesh.

Talwar (1978) rediscussed the generic status of *Schizothorax* and *Schizothoraichthys* and on the basis of the so-called type designation of *S. plagiostomus* for *Oreinus* McClelland and *S. esocinus* for the genus *Schizothorax* Heckel by McClelland (1842), tried to nullify the type designation of *S. plagiostomus* for the genus *Schizothorax* Heckel by Bleeker (1863). On this ground, he tried to revalidate the genus *Oreinus* and merged *Schizothoraichthys* under the genus *Schizothorax*.

Talwar (1978 b) described the fishes from Ladakh (collected by Ladakh Expedition, 1976) and described a new species, *Gymnocypris*

biswasi Talwar and indicated the distribution of this genus to Ladakh.

Shrestha (1979) tried induced spawning of *S. richardsonii* in Nepal.

Tilak (1980) has given a review of the genera of Schizothoracinae which include *Schizothorax* Heckel, *Schizopygopsis* Steindachner, *Diptychus* Steindachner, *Ptychobarbus* Steindachner, *Gymnocypris* Günther, *Lepidopygopsis* Raj and *Schizothoraichthys* Misra. A further clarification on the generic status of *Schizothorax* Heckel, *Oreinus* McClelland and *Schizothoraichthys* Misra has been provided and shown that contrary to the contention of Talwar (1978 b), McClelland (1842) did not designate a type species for the genera *Oreinus* or *Schizothorax*. He upheld the view earlier expressed by Tilak and Sinha (1975).

CLASSIFICATION

In the Linnaean and prelinnaean eras, the work on the classification of fishes was initiated in Europe. Before Heckel (1838) described fishes of Schizothoracinae from Kashmir, many ichthyologists had, therefore, made important contributions in this direction. Subsequent to Heckel's work, McClelland (1839) gave an exhaustive account of the Indian Cyprinidae in which some Schizothoracinae were also described. McClelland (1839) treated Cyprinidae in a sense higher than a family and included two families, Paeonominae and Sarcoborinae under it. Schizothoracid fishes were adjusted under Paeonominae by him. But subsequently, McClelland (1842) worked out some more Himalayan fishes which included many Schizothoracinae and assigned a new subsfamily name, "Schizothoracinae" to Schizothoracid fishes. Schizothoracinae has been treated as a group of Cyprinid fishes and various taxonomists have classified this group differently.

According to the scheme of classification of Johannes Mueller (1844), Schizothoracinae may be classified as under :

Class : PISCES
Subclass : TELEOSTEI
Order : PHYSOSTOMI (Schizothoracinae)

Agassiz (1857) did not propose taxonomic Categories beyond the class Pisces. Boulenger (1904) divided teleostean fishes into suborders and Schizothoracinae falls under suborder Ostariophysi (Cypriniformes).

Regan (1911) classified this group of fishes as under :

Order : CYPRINIDAE.
Division : 3. Cypriniformes
Family : CYPRINIDAE (Schizothoracid fishes).

Regan (1929) gave a classification based on the study of osteology and Schizothoracinae falls in this classification as under :

Class : PISCES.
Subclass : NEOPTERYGII
Order : OSTARIOPHYSI.

According to Goodrich (1909), the scheme is as follows :

Grade I Class : PISCES.
Sub-grade : Osteichthyes
Group : Teleostomi.
Division 4 : Actinopterygii
Subdivision 2 : Holostei
Order : TELEOSTEI
Suborder : CYPRINIFORMES (Schizothoracid fishes)

The other schemes of classification under which Schizothoracinae can be placed are as follows :

(i) Jordan (1923).

Class : PISCES
Subclass : ACTINOPTERI
Superorder : TELEOSTEI
Order : EVENTOGNATHI (Schizothoracinae)

(ii) Goodrich (1930).

Class : PISCES
Subgrade : OSTEICHTHYES
Subclass : TELEOSTOMI
Division : Actinopterygii
Subdivision : Holostei
Group : b
Order : TELEOSTEI

(iii) Berg (1947).

Class : TELEOSTOMI
Subclass : ACTINOPTERYGII
Order : CYPRINIFORMES
Division : Cyprini
Suborder : CYPRINOIDEI
Family : CYPRINIDAE
Subfamily : CYPRININI (Schizothoracid fishes).

(iv) Greenwood, Rosen, Weitzman and Myers (1966) gave a phyletic classification of teleostean fishes and placed Schizothoracid fishes as under :

Division : III
Superorder : OSTARIOPHYSI
Order : CYPRINIFORMES
Suborder : CYPRINOIDEI
Family : CYPRINIDAE (Schizothoracid fishes)

(v) Nelson (1976) has classified Schizothoracinae as under :

Superclass : GNATHOSTOMATA
Class : OSTEICHTHYES
Subclass : ACTINOPTERYGII
Class : TELEOSTEI
Division : Euteleostei
Superdivision : Ostariophysi
Order : CYPRINIFORMES
Suborder : CYPRINOIDEI
Family : CYPRINIDAE
Subfamily : SCHIZOTHORACINAE.

Recently, Wu et al. (1981) proposed a new systematic system for Cyprinid fishes according to which Schizothoracinae falls under Cyprinidae as under :

Suborder : CYPRINOIDEI
Superfamily : CYPRINOIDEA
Family : CYPRINIDAE (including Psilorhynchidae and Schizothoracinae).

THE TAXONOMIC STATUS OF THE SUBFAMILY SCHIZOTHORACINAE

The Schizothoracinae are a specialised group of fishes inhabiting the torrential streams in the higher altitudes in Himalaya and Central Asia. Due to the presence of a specialised character in the tiled row of enlarged scales along the anal flap, McClelland (1842) proposed a subfamily name 'Schizothoracinae' for them. Karaman (1971) and Banarescu (1972) did not recognise Schizothoracinae and gave these fishes the status of a tribe under the subfamily Barbinae. Although Schizothoracinae have a close relationship with the Barbinae yet they differ from them at a subfamily level. Tchang (1935) described two species of the genus *Barbus* from Yunnan (*Barbus regani* and *Barbus normani*) in which the scales are very small and the shape of the body resembles Schizothoracinae but differs from the latter in the absence of tiled row of enlarged scales along the anal sheath. It is very likely that Schizothoracinae have evolved from such like species of Cyprininae (Hora, 1937). But this provides no ground to merge Schizothoracinae under Barbinae.

The subfamily characters of Schizothoracinae are such that do not exist in any group of Cyprininae and, therefore, the present author does not support the taxonomic treatment given to these fishes by Karaman (1971) and Banarescu (1972) and recognises a subfamily status for them. Schizothoracinae appear a specialised group of fishes particularly in the reduction of scales, barbels and the number of rows of pharyngeal teeth and adaptation to high altitude streams.

According to McClelland (1839 : 261), Schizothoracinae belong to the group Paeonominae (Poionomos = that feeds on herbs) which is characterised by complete herbivorous habits, plain colour and great length of the intestinal canal which varies from 6-12 lengths of body in different groups. *Gonorhynchus* also belongs to Poeonominae and *Oreinus* McClelland is related to it. The mouth of *Oreinus* (= *Schizothorax*) is situated under the head but the alimentary canal is considerably shorter (being 4-5 lengths of body) and the dorsal fin is preceded by a spine.

MORPHOLOGY AND TERMINOLOGY

The Schizothoracine fishes, being found in hilly streams and sometimes in inaccessible stretches of Himalaya, are normally not easily available for study to an ordinary worker. The various morphological features of these fishes are, therefore, not well

described and understood. While putting these fishes under the subfamily Schizothoracinae, McClelland (1842) laid stress on the presence of a row of enlagred and tile-like scales on both anal flaps which distinguished it from all other Cyprinids. He did not describe other morphological features of these fishes in detail. These fishes have acquired a large number of morphological characteristics as a result of adaptation to the special type of hilly environment. Because of these modifications, acquired into the morphology of these fishes, the different genera and species of Schizothoracinae exhibit different characters which entitle them the different taxonomic catagories. The various morphological characteristics of these fishes used for taxonomic purposes are described and discussed here.

THE GENERIC CHARACTERS

Schizothoracinae are notorious for hybridization. Interspecific and intergeneric hybrids occurring in nature are well known in this group. It has been observed that hybridization in Schizothoracinae takes place among closely related species or genera distributed in the same area or inhabiting similar conditions of life. Hora (1934) and Mukerji (1936) have reported forms intermediate between *Schizothorax* and *Schizothoraichthys*. Hybridization, therefore, could pose many taxonomic problems but majority of the genera of this group have very clearly defined generic characters which are described below.

1. THE MOUTH

(i) The orientation of the mouth (Fig. 1) in relation to the longitudinal axis of the body is a factor controlled by the alignment of the jaw bones with the neurocranium and, therefore, it should be a uniform and fixed taxonomic character in fishes. In *Schizothorax*, *Schizopygopsis*, *Diptychus*, and *Lepidopygopsis*, the mouth is inferior while in *Schizothoraichthys*, *Ptychobarbus* and *Gymnocypris*, it is anterior (terminal) or if at all, slightly inferior.

(ii) Invariably, the lower jaw is covered with a horny layer which may be visible outside as in *Gymnocypris* or it may be clearly seen as a plate, making a sharp anterior edge of the lower jaw as in *Schizothorax*, *Schizopygopsis* and *Diptychus* : this layer may be deciduous as in *Lepidopygopsis*. In *Schizothoraichthys* and *Ptychobarbus*, there is a no sharp horny covering on the lower jaw. The orientation of the mouth and the presence or

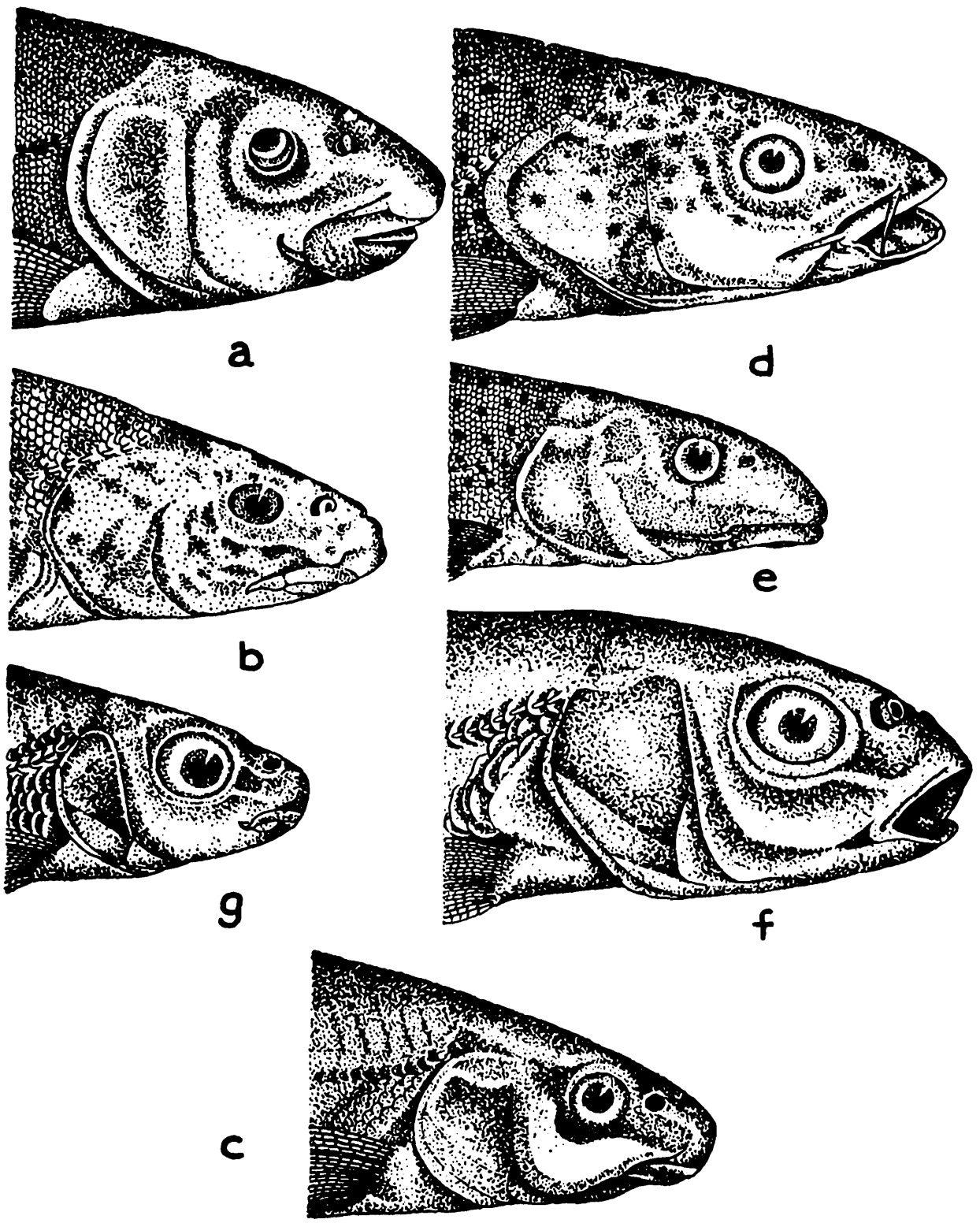


Fig. 1. Lateral view of head of (a) *Schizothorax richardsonii* (Gray) (b) *Diptychus maculatus* Steindachner (c) *Schizopygopsis stolickzae* Steindachner (d) *Schizothoraichthys esocinus* (Heckel) (e) *Ptychobarbus conirostris* Steindachner (f) *Gymnocypris biswas* Talwar (g) *Lepidopygopsis typus* Raj.

absence of a horny edge of the lower jaw are characters associated with the type of feeding habit of the fishes. It will be observed that the presence of sharp horny edge of the lower jaw is invariably associated with the ventral mouth as in *Schizothorax*, *Schizopygopsis*, *Diptychus* and to some extent *Lepidopygopsis* because these fishes feed by scraping algal encrustation from the rocks in the bed of the river. The sharp edge of the lower jaw helps in scrapping off the material from the surface of the rocks while the upper jaw and the lip help in saving the scrapped material from being washed down along with the current of water and thrusting the same into the buccal cavity.

2. THE SUCKER (Fig. 2)

The terms sucker, as used in the fishes of the genus *Schizothorax*, does not appear appropriate for a strip of hard papillated structure at the chin. The term 'sucker' has all along been used for this structure in *Schizothorax* by all workers to date. Although taxonomically this structure is important is differentiating these fishes from other Schizothoracinae yet it is essential to investigate as to how far is it appropriate to use the term 'sucker' for this structure.

In fishes, a sucker is a morphological structure adapted for adhering to some kind of substratum through the process of suction. In the animal kingdom, in general, a sucker is present in many groups of animals right from the Platyhelminthes (Invertebrata) to Amphibia (Chordata) although the shape, structure and function of the sucker of different groups of animals are different.

In fishes, individuals of different groups possess sucker and the structure and function of each kind is obviously different. In marine fishes, the sucking-fish or Ramora (*Echeneis* sp.) has a sucker on the dorsal side of the head and helps in attaching the fish with the substratum which may be the body of a whale, large fish or even a ship. The shape of this sucker is oval and is longitudinally developed over the dorsal side of the head. In freshwater fishes, sucker is reported in the genera *Garra* (Cyprininae), *Schizothorax* (Schizothoracinae), *Glyptothorax* and *Pseudechensis* (Siluriformes). In all the above named genera, the shape and function of the sucker is different.

The so-called sucker in *Schizothorax* is a papillated band at the chin and is a modification of the lower lip. The shape and the size of the papillated area is different in the different species of this genus. The posterior border of the papillated plate may

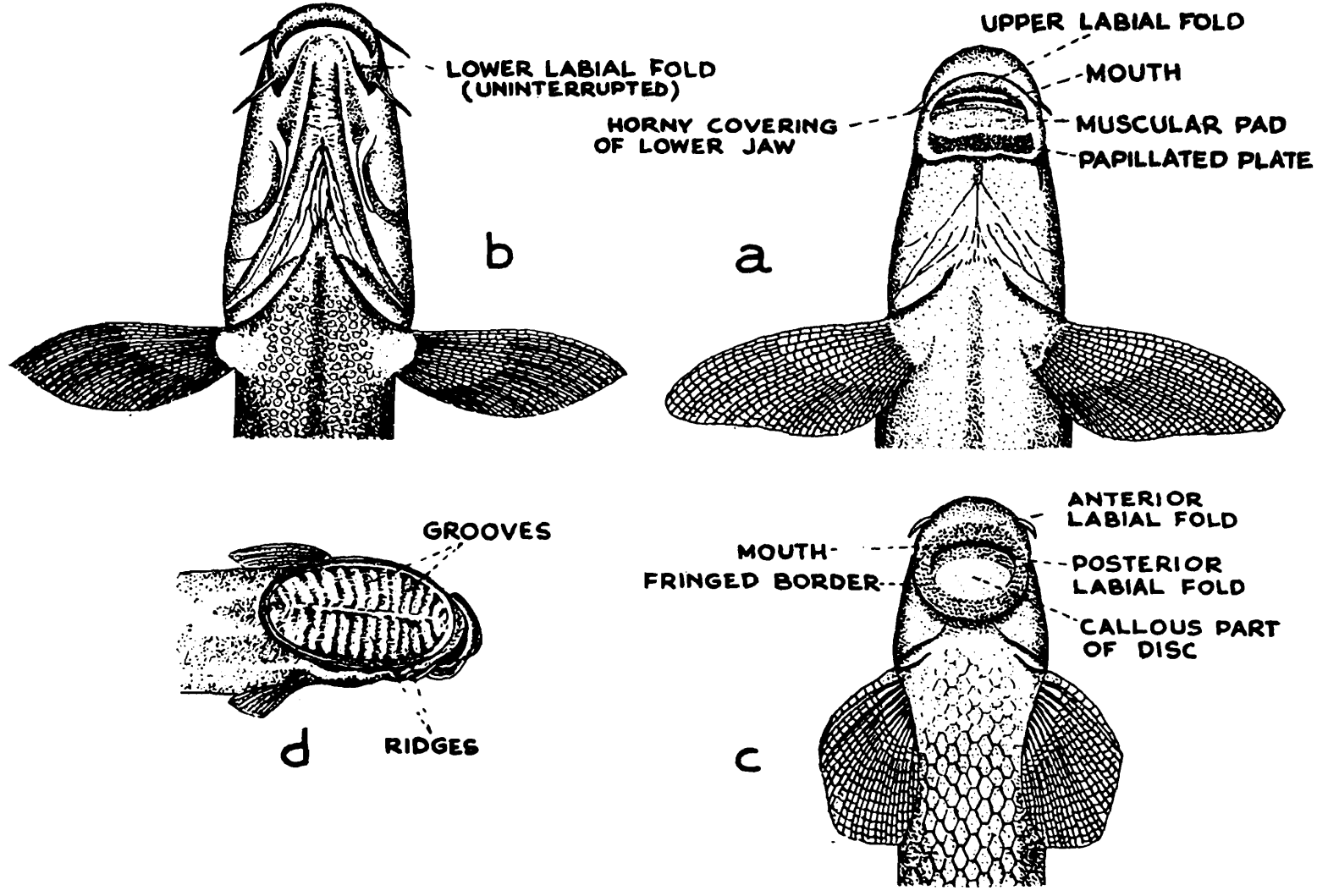


Fig. 2. (a) Ventral view of head and anterior part of body of *Schizothorax richardsonii* (Gray), showing the papillated plate and other structures of mouth and chin. (b) Ventral view of head and anterior part of body of *Schizothoraichthys curvifrons* (Heckel), showing the absence of the plate at the chin. (c) Ventral view of head and anterior part of body of *Garra gotyla gotyla* (Gray), showing a sucker at the chin. (d) Dorsal view of the head of *Echeneis albescens* Temminck and Schlegel, showing sucker.

be convex, concave or straight. It is absent in all other genera of the Schizothoracinae.

It is generally presumed that the sucker in the fishes of the genus *Schizothorax* helps them to attach themselves to the substratum an idea which does not appear appropriate because the size and structure of the so-called sucker in these fishes would hardly create suction to help the fish in attaching itself to the substratum. The present author has observed these fishes in nature and found that while they are feeding, they have to scrape off the algal encrustation from the rocks. The scraping is done with the help of the sharp and horny anterior edge of the lower jaw.

In doing so, the part of lip and the chin behind the horny layer continuously rubs against the rough surface of the rocks. Due to the continuous rubbing of that area, it has developed into a hard papillated strip which is only an adaptation of this fish to the special type of feeding mechanism. The crescentic feeding marks on the rocks made by *Schizothorax richardsonii* have been reported by the present author during a study of the fishes of the river Tawi and its tributaries in Jammu and Kashmir (Tilak, 1971). At no stage it was observed that the fish remains sticking to the rocks, contrary to what is observed in the case of *Glyptothorax*, which only indicates that in these fishes, there is no structure which could create suction for adhering the fish to rocks or any kind of substratum.

Since this structure is uniformly present in the fishes of this genus, it is an important taxonomic character to distinguish them from other Schizothoracinae but at the same time it should not be appropriate to call it a sucker. It is proposed here to name this structure as a hard and papillated labial plate instead of calling it a sucker.

3. BARBELS

It has been seen in many groups of fishes that barbels are not relied upon much as a taxonomic character because they exhibit variation in their number and length in the individuals of the same species or different species of the same genus. But in Schizothoracinae, the number of barbels is very uniform among the genera and can be relied upon as a taxonomic character. There are 4 barbels in *Schizothorax*, *Schizothoraichthys* and *Lepidopygopsis*, two in *Diptychus* and *Ptychobarbus* while none in *Schizopygopsis* and *Gymnocypris*. The length of barbels is, however, a variable character and much reliance cannot be placed on this in differentiating the species of a genus (Fig. 3).

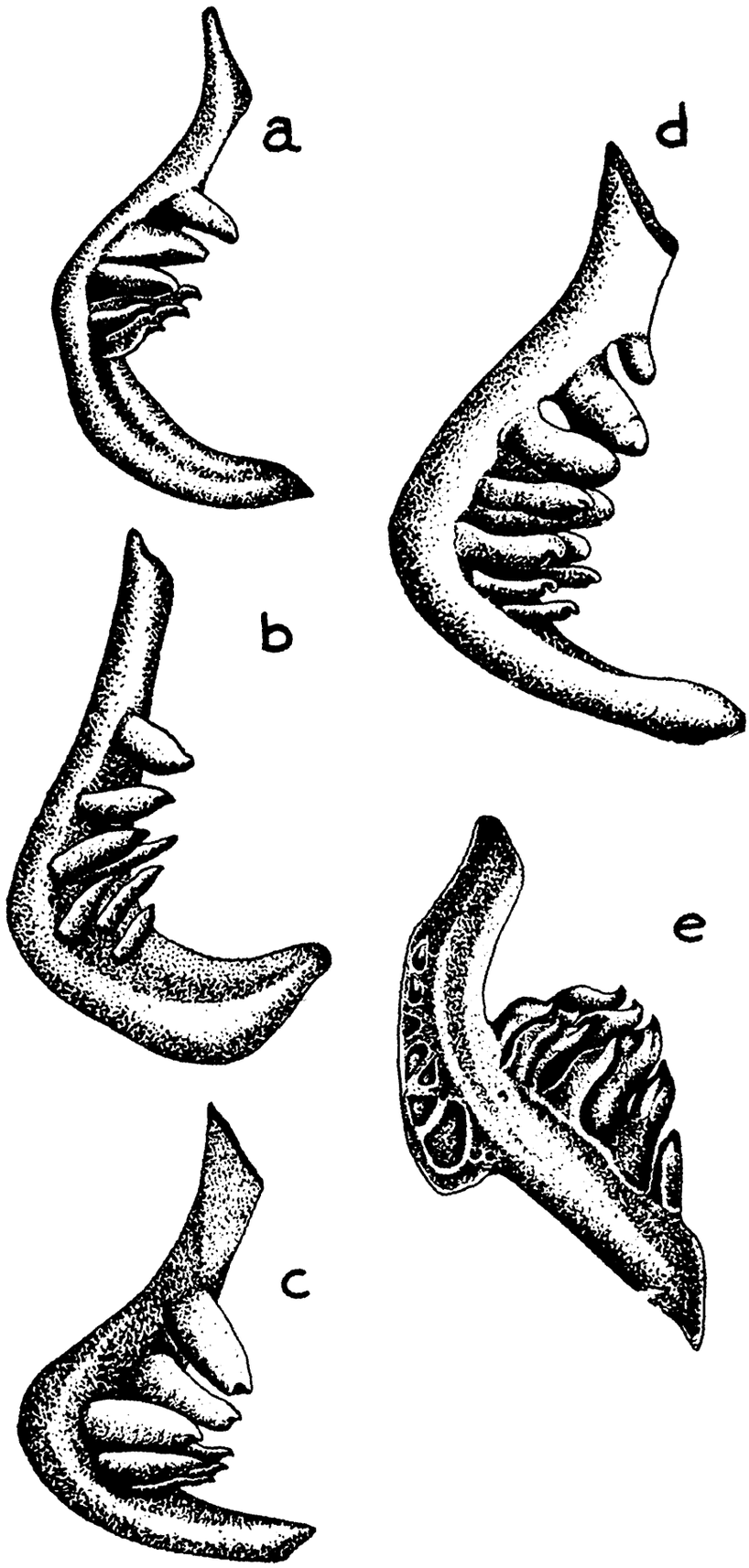


Fig. 3. Pharyngeal bone and teeth of (a) *Ptychobarbus conirostris* Steindachner (b) *Diptychus maculatus* Steindachner (c) *Schizopygopsis stolickzea* Steindachner (d) *Schizothoraichthys labiatus* (McClelland) (e) *Lepidopygopsis typus* Raj

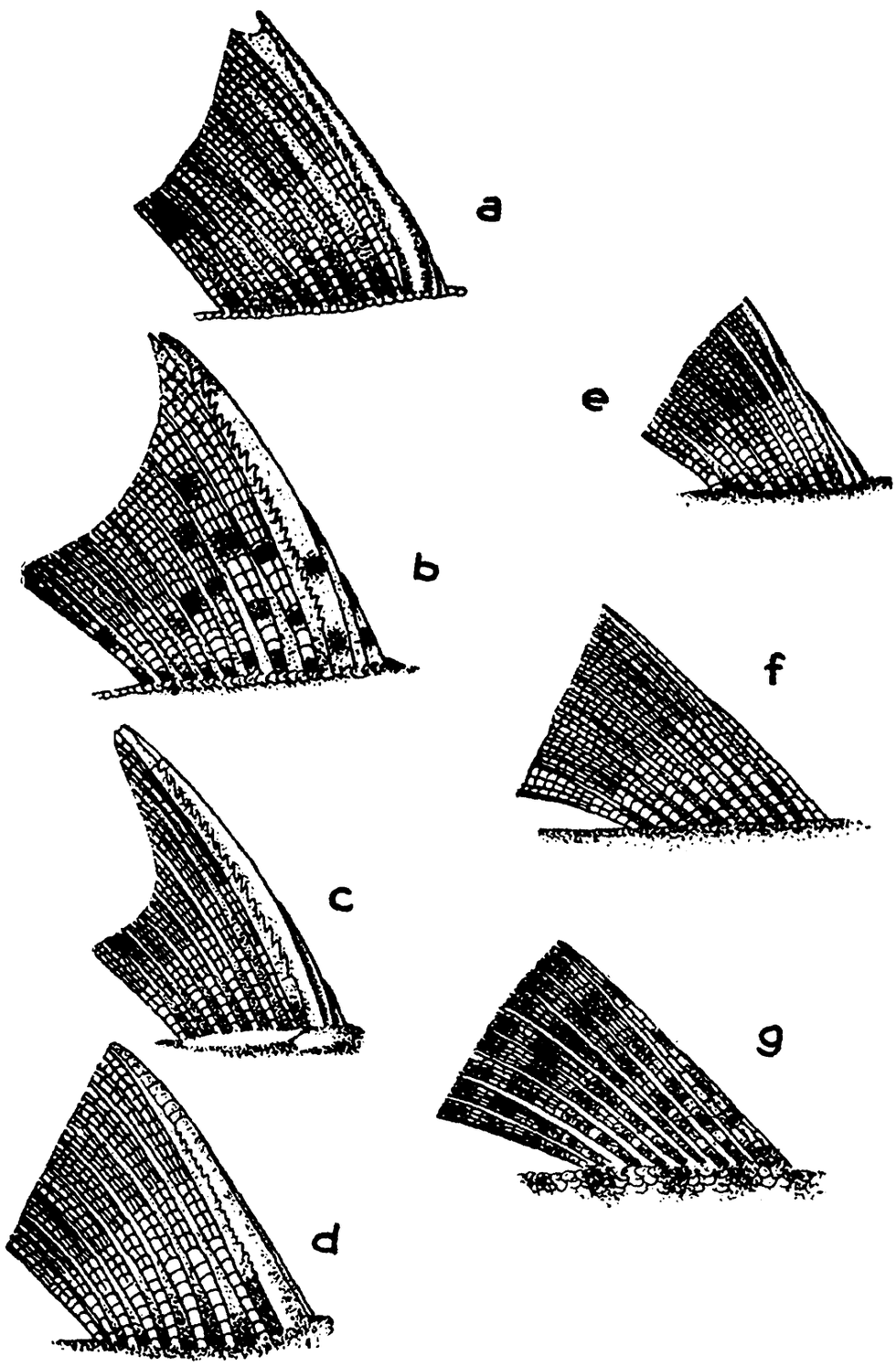


Fig. 4. Dorsal fin of (a) *Schizothorax richardsonii* (b) *Schizothoraichthys micropogon* (Heckel) (c) *Lepidopygopsis typus* (d) *Schizopygopsis stolickzae* (e) *Gymnocypris biswasi* (f) *Ptychobarbus conirostris* (g) *Diptychus maculatus*

4. PHARYNGEAL TEETH

The number of rows of pharyngeal teeth and the number of teeth in each row are taxonomically fixed and important characters in many groups of Cyprinidae and particularly so in Schizothoracinae. The pharyngeal teeth are arranged in three rows in *Schizothorax*, *Schizothoraichthys* and *Lepidopygopsis* while they are in two rows (Fig. 5) in *Schizopygopsis*, *Gymnocypris*, *Diptychus* and *Ptychobarbus*. The taxonomic importance of pharyngeal bones and the number of teeth has been recognised in Cyprinidae by Chu (1935).

The first tooth of the outermost or the main row is much reduced while the second one is large and somewhat swollen at the

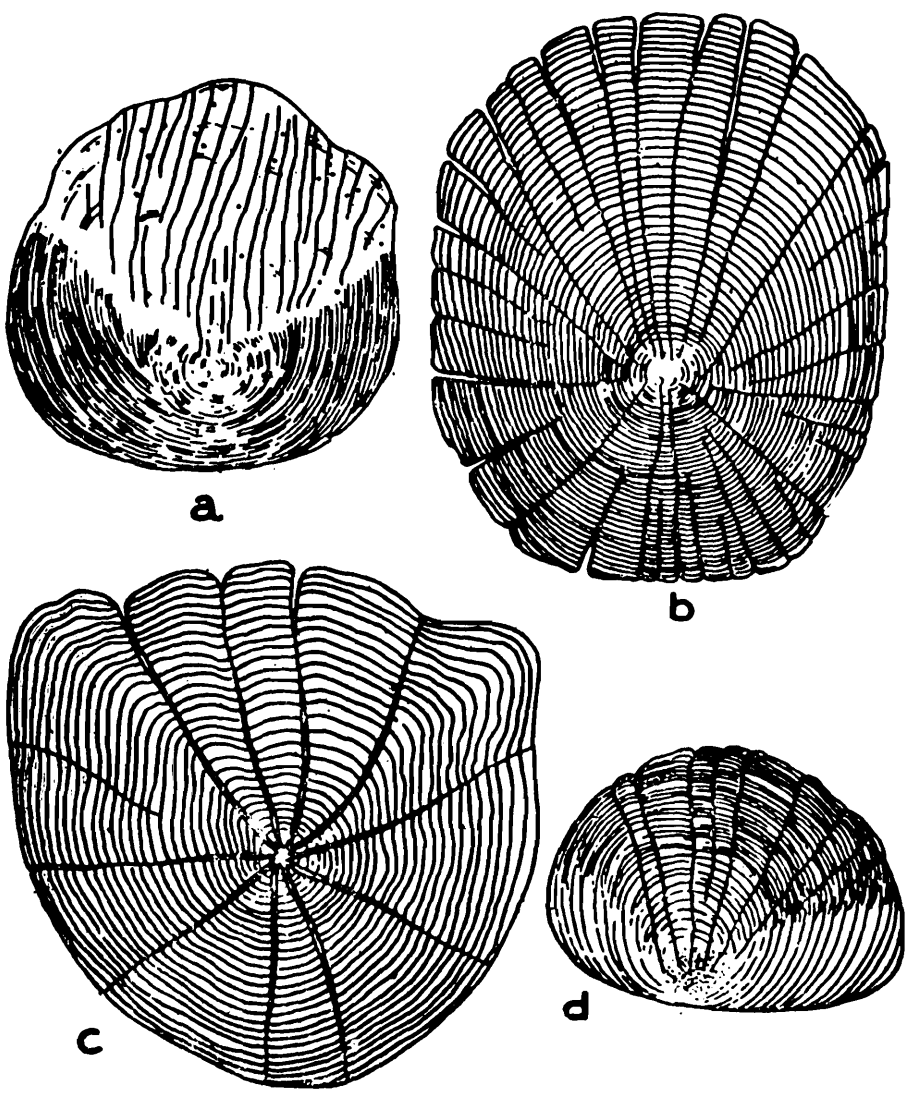


Fig. 5. (a) A scale from the caudal peduncle of *Lepidopygopsis typus* Raj (b) A sub-dorsal scale of *Schizothorax richardsonii* (Gray) (c) A sub-dorsal scale of *Puntius ticto* (Hamilton) (Subfamily : Cyprininae) (d) A sub-dorsal scale of *Brachydanio rerio* (Hamilton) (Subfamily : Abramidinae)

apex. The teeth of other rows are spoon-shaped, resembling those of Cyprinidae. The teeth of the main row are subconical or moderately compressed with oblique grinding surfaces, while those of the other rows are conical or subconical with expanded grinding surfaces. The main characteristic of the dentition of Schizothoracinae that coincides with that of Cyprininae, is that there is a crowding together of the teeth in most of the genera for making a bigger chewing area. This is a specialization for herbivorous feeding habit. The reduction in number as well as in rows of teeth in Schizothoracinae is probably a step towards specialization. The pharyngeal bone is wide in *Schizothorax, Schizothoraichthys, Diptychus* etc. While it is somewhat narrow in *Schizopygopsis, Gymnocypris* etc. The anterior limb of the pharyngeal bone is shorter than the posterior limb although their relative lengths differ in different genera.

The pharyngeal bone and the teeth, although show taxonomic differences among genera of Schizothoracinae yet they are not so good characters as to distinguish genera based only on them. They may be gainfully employed to distinguish different Schizothoracinae along with other features. For example, *Schizothorax, Schizothoraichthys* and *Lepidopygopsis* have three rows of pharyngeal teeth yet their distinguishing characters are the position of mouth, presence or absence of a papillated strip at the chin, structure of lips, development of scales on the body etc. In the same way, *Schizopygopsis, Gymnocypris, Diptychus* and *Ptychobarbus* have two rows of teeth but they can be mainly distinguished from each other on the bases of scales on the body, number of barbels or their absence, structure of lips and jaws and position of mouth etc.

The point concerning the presence or absence of radii in the scales of Schizothoracinae and their relationship with other subfamilies of Cyprinoids has been discussed under the genus *Lepidopygopsis.*

5. THE DORSAL FIN AND ITS SPINE

The insertion of the dorsal fin in relation to the tip of the snout and the base of the caudal fin is recognised in some groups of fishes as a taxonomic tool but among Schizothoracinae, it is quite variable even among representatives of the same species. Hence not much reliance can be placed on this character. However, the last undivided ray of the dorsal fin, which is sometimes bony and serrated, is of taxonomic importance at the generic level. The last undivided ray of the dorsal fin is bony and posteriorly serrated in *Schizothorax, Schizothoraichthys, Schizopygopsis, Gymnocypris* and *Lepidopygopsis* but it is soft and jointed in *Diptychus* and *Ptychobarbus* (Fig. 6).

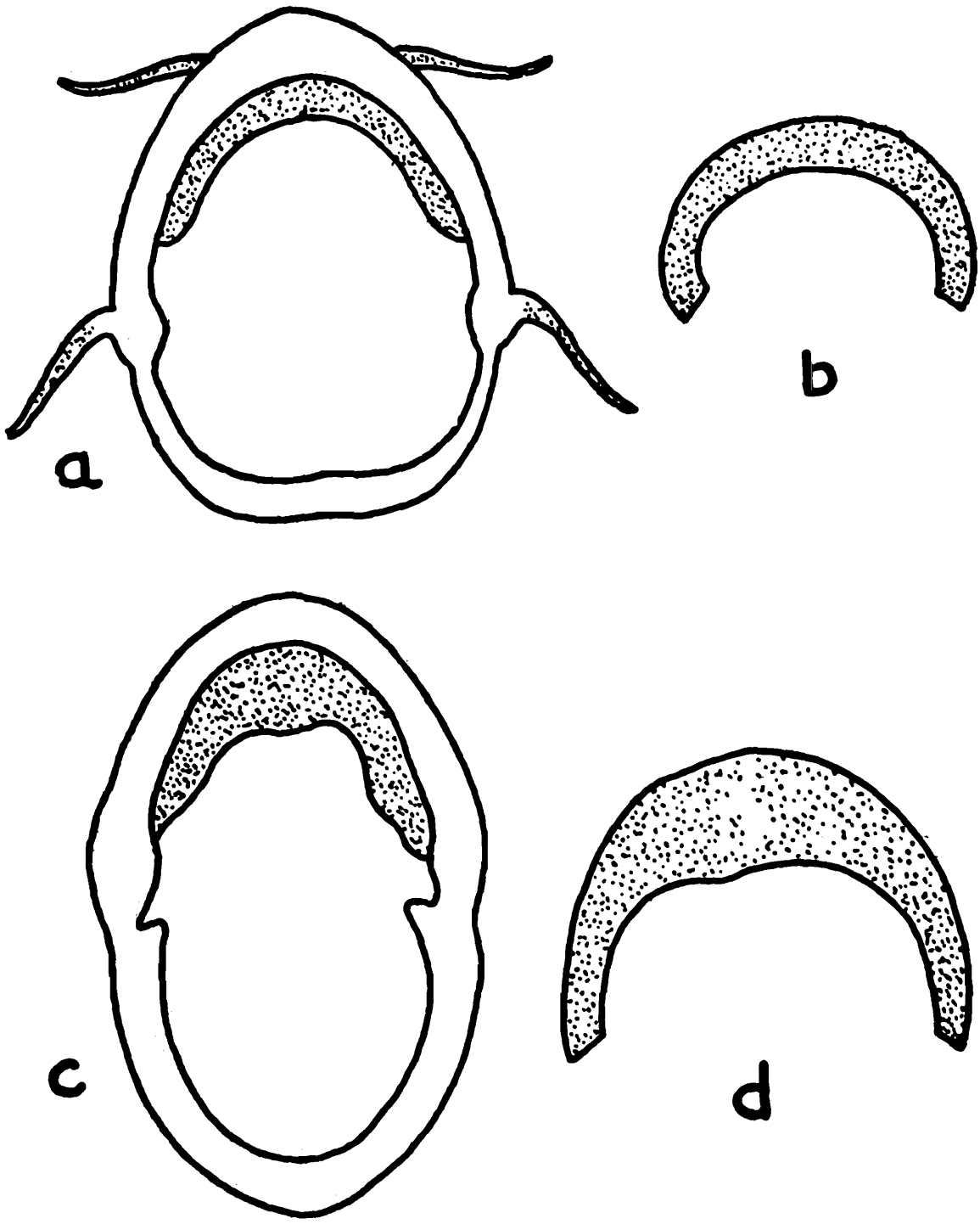


Fig. 6. (a) The opened mouth of *Schizothorax richardsonii*, showing the oral valve (b) The maxillary valve of *Schizothorax richardsonii* (c) The opened mouth of *Schizothoraichthys niger* (d) The maxillary valve of *Schizothoraichthys niger* (redrawn after Das and Subla)

6. SCALES

Chu (1935) has recognised the structure of scales in Cyprinidae as of great taxonomic importance. The number of scales along the longitudinal and transverse series in Cyprinidae has been considered to be a good parameter in differentiating different texa of fishes and even different species of a genus by all ichthyologists to date.

In Schizothoracinae, the scales are very small and reduced in size. The degeneration or reduction in size or absence of scales on the body is a predominant feature of this group of fishes.

The absence or presence of scales and their distribution on the different parts of the body are important at generic level although the number of scales along the lateral line could be taken as a taxonomic character at specific level alone.. The body is completely covered with scales in *Schizothorax*, *Schizthoraichthys* and *Ptychobarbus* while in *Diptychus* only 2/3rd of the upper part of the body above the lateral line is only covered with scales. The scales have vanished from the body except a few along the lateral line, a patch on the shoulder and on the base of the caudal fin in *Schizopygopsis*, *Gymnocypris* and *Lepidopygopsis*. In *Lepidopygopsis*, the scales are larger than those of other Schizothoracinae and also fewer in number, a character approaching other Cyprinidae.

The degeneration of scales in Schizothoracinae is a character shared by these fishes with cobitids of higher altitude streams. It appears, Schizothoracinae have evolved from ancestors possessing well developed scales. All groups of fishes, inhabiting fast currents at high altitude such as Schizothoracinae, Cobitidae and Salmonidae etc. share this character probably because the smooth and soft skin is a requirement of such habitat and heavy armour of scales is a hinderance in performance of their life functions. The naked skin should be more suitable for cutaneous respiration and the fishes at higher altitudes need high rate of respiration for higher intake of Oxygen although this cannot be a rule. Reduction or absence of scales, as long as they are considered reduced or degenerated, should be taken as characters of specialisation.

The enlarged scales along the anal sheath are broad and vertically subelliptical. The form and asymmetrical shape of these scales is due to their lower ends beings produced ventrally and loose. The enlarged scales in the humeral region of *Schizopygopsis* and *Gymnocypris* are usually rhombic in form. They are embedded in the skin and have partially or completely lost the characteristic markings of scales on other parts of the body.

In other genera, the scales have a normal configuration. The size and number of enlarged scales of the anal sheath are different in the different genera and species but the differences are not uniform so as to entitle this feature the rank of a good taxonomic character.

The small scales of Schizothoracinae, when present, have well developed circuli and the radii are complete in all fields.

7. ORAL VALVE (fig. 6)

The oral valves are situated just behind the jaws, They are formed of the mucosa of the buccal cavity. Since they are backwardly directed, they allow free movement of water from out side to the branchial cavity but do not allow the backward flow of water by blocking the way. In Cyprinids, two valves, one maxillary and the other mandibular are present but in *Schizothorax* and *Schizothoraichthys*, the mandibular valve is absent. The maxillary valve is a wide 'U' which does not extend to the angles of the lips. This valve remains pressed against the lower lip in closed-mouth condition.

The absence of mandibular valve is probably connected with the ventral mouth as well as the well developed buccopharyngeal pump system.

8. ALIMENTARY CANAL (fig. 7)

Schizothoracine fishes, on the whole, are Vegetable feeders and accordingly there is no well formed stomach. The anterior wide part of the intestines, the intestinal bulb, performs the function of the stomach. The cystic duct from the gall bladder opens into the anterior part of the intestinal bulb (fig. 7). The intestine is long and coiled. The relative length of the gut is 4.75 in *S. richardsonii*. There are no intestinal appendages.

9. THE BRAIN (fig. 8)

Like other cyprinoids, the brain in Schizothoracids is mainly divisible into three regions viz. fore-brain, mid-brain and hind-brain. In *S. esocinus*, the fore-brain consists of olfactory bulbs, cerebral hemispheres and diencephalon. The large olfactory bulbs indicate sharp sense of smell. The olfactory bulbs are connected with the cerebral hemispheres by long and drawn out olfactory tracts. The cerebral hemispheres are differentiated into frontal, parietal, median and occipital lobes on dorsal side and the frontal, ventro-lateral and axial lobes ventrally.

The diencephalon is small forming a pineal stalk with pineal body dorsally and infundibulum ventrally, posterior to which is a small and thin-walled saccus vasculosus. The lobi inferiores are well developed and the optic chiasma forms a crossing over of two optic nerves.

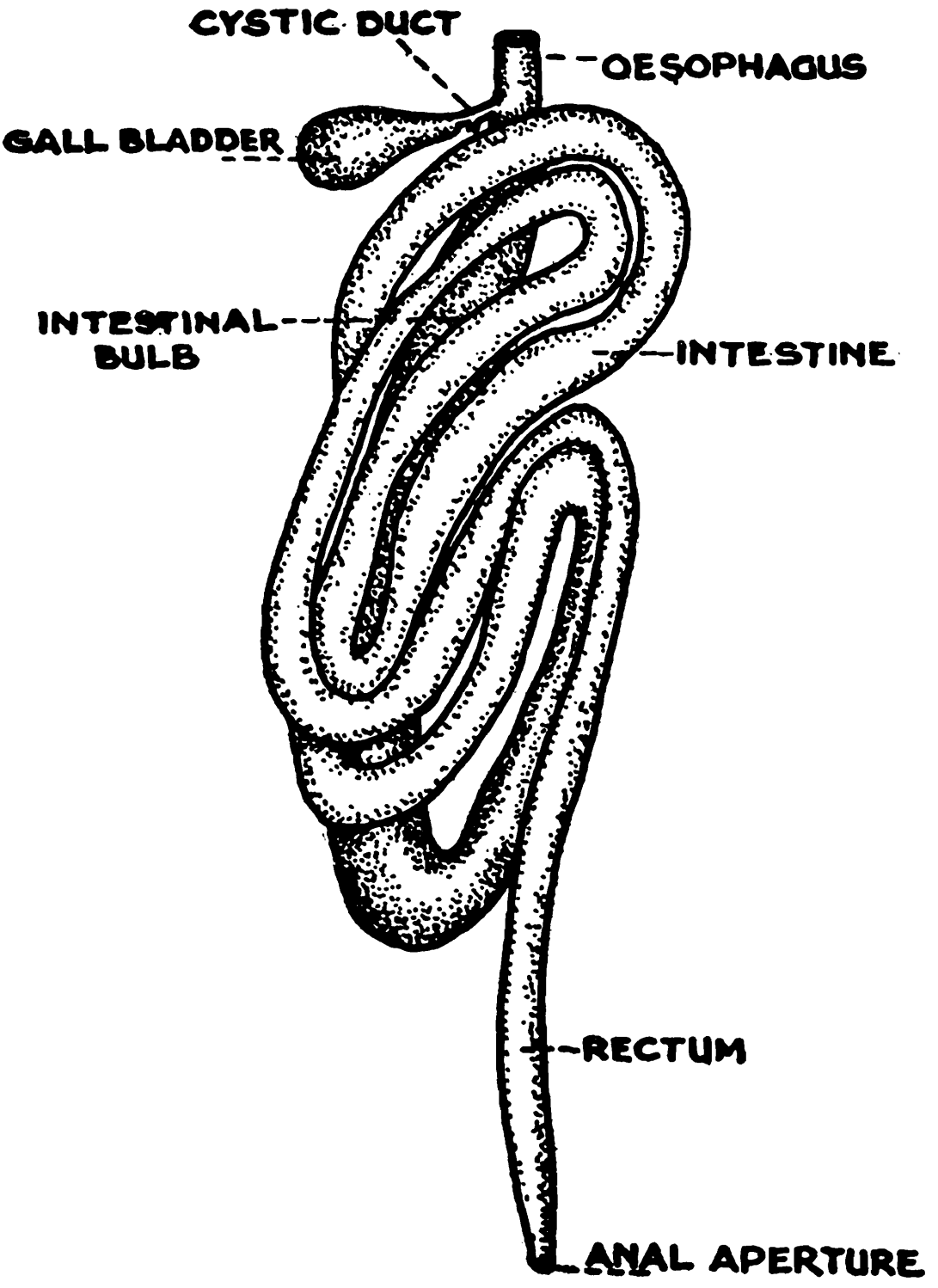


Fig. 7. Alimentary Canal of *Schizothorax richardsonii*

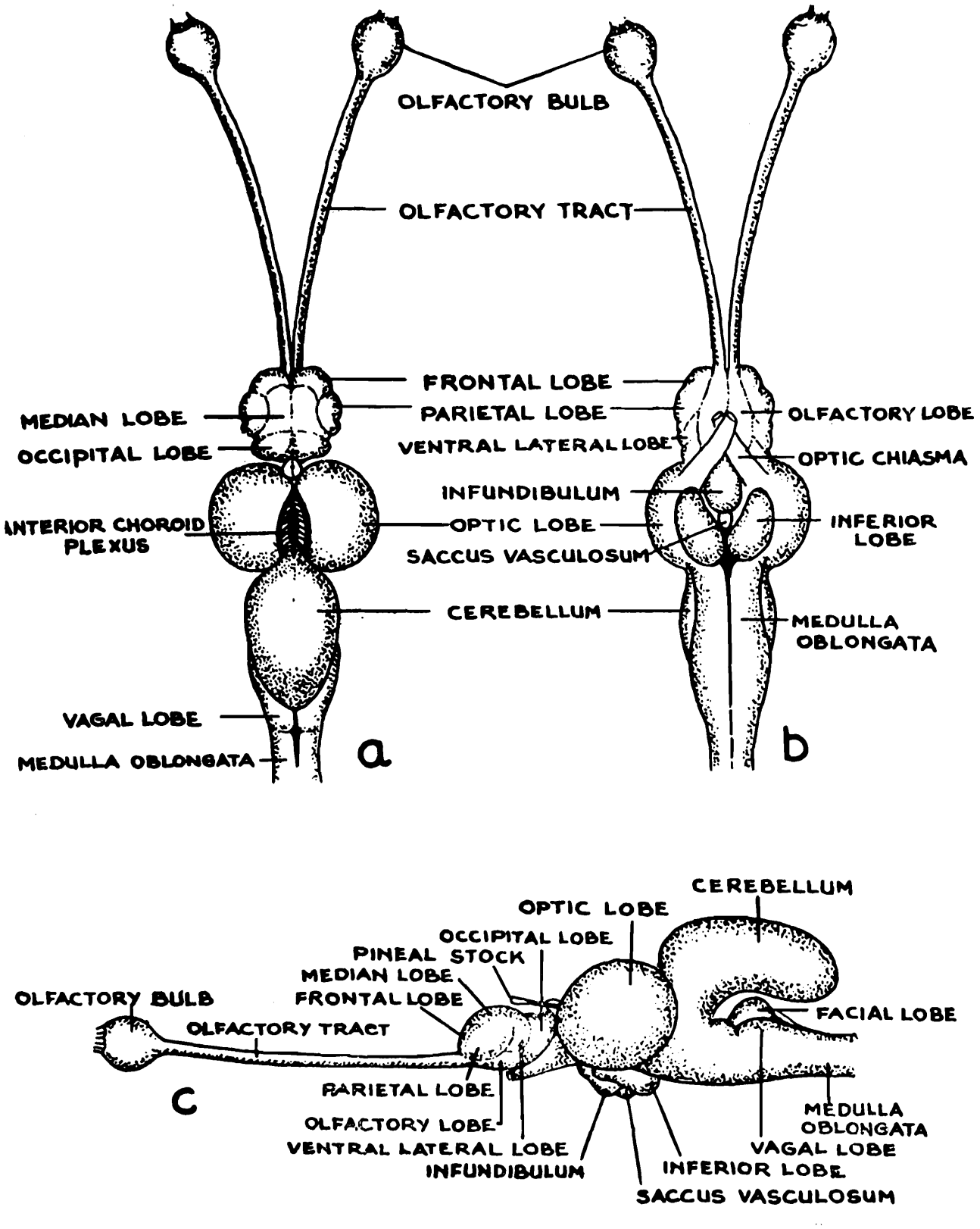


Fig. 8. The brain of *Sceizothoraichthys esocinus* (a) dorsal view (b) ventral view (c) lateral view (redrawn after Das and Qadri)

The mid-brain has two small optic lobes. The hind-brain consists of cerebellum and medulla oblongata. The cerebellum is differentiated into anterior valvula cerebelli and the posterior corpus cerebellum. The anterior lateral walls of medulla oblongata are thickened to form a pair of vagal lobes and median facial lobe between them.

The well developed medullary lobes and the large optic and olfactory lobes indicate that this species has its senses of smell, taste and sight well developed and it discharges its life functions based on all these senses.

10. HEART AND BLOOD VASCULAR SYSTEM

Heart :

The heart lies above the pectoral girdle which gives support and protection to this delicate organ. The heart is enclosed in a membranous pericardium. The main parts of the heart are the conical ventricle, bulbous arteriosus, auricle and a sinus venosus. It is a venous heart. The sinus venosus recieves the venous blood from various parts of the body and pumps into the auricle by a median orifice guarded by sinuatrial valves. The auricle opens into the ventricle by atrio-ventricular aperture guarded by atrio-ventricular valves. The blood is finally pumped into the bulbous arteriosus which leads into the ventral aorta. The ventral aorta breaks into afferent branchial arteries. The afferent branchial arteries take blood to gills and the oxygenated blood is collected by afferent branchial vessels and passed on to dorsal aorta. From the afferent arteries form the lateral aorta, internal carotid arteries etc.

11. URINOGENITAL ORGANS

Male Urinogenital Organs :

In *S. richardsonii*, the male organs are a pair of testes which are lobulated. The right side testis is thicker and longer than the left and has a number of lobes of which the posteriormost lobe is the largest. The testes lie ventral and lateral to the swim-bladder and when fully grown, they cover the swim-bladder completely. The testis remains suspended from the wall of the body cavity by mesenteries called mesorchia. The vas deferens runs along the dorsal side of each testis. The vas deferens of the two sides meet to form a common vas deferens at the posterior end of the urinary bladder and opens at the urinogenital sinus. The urinogenital sinus opens just behind the anal opening.

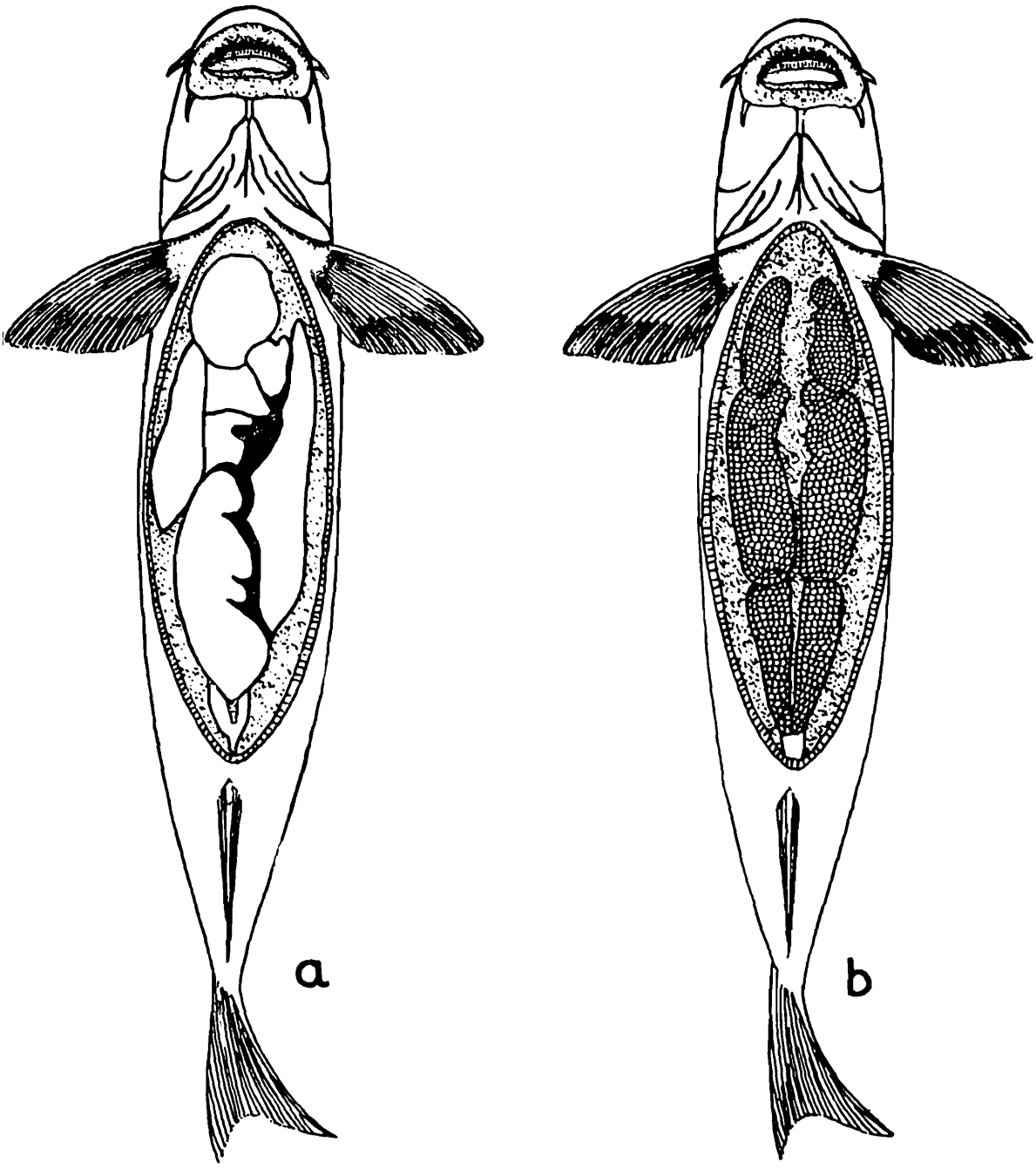


Fig. 9. The gonads of *Schizothorax richardsonii* (in situ)
(a) male (b) female (modified after Das and Koul)

The Female Genital Organs :

There are a pair of ovaries which are elongated, flacid and delicate structures of dirty brown colour.

Each ovary has an anterior, a median and a posterior lobe. The two are fused at their hinder end. They are suspended from the wall with the help of mesovaria. The oviducts of both sides

meet and open outside before the female genital pore just behind the anal opening. During this period, the ovaries become much distended and enlarged, and take on a yellowish colour and give the appearance of a mulberry fruit due to the presence of large ova inside them.

Das and Malhotra (1964) observed the presence of 'corpus luteum' of mammalian ovary in *S. niger.*

The Urinary Bladder :

One ureter from each kidney travels behind for sometime and enters into the median urinary bladder which recieves ureters from both kidneys. The urinary bladder is spindle-shaped ; its wall has fine layers comprising the outer peritoneum, tunica adventitia, outer longitudinal muscles, inner circular muscles, and endothelial linning. Three to five layers of stratified epithelium form the endothelium which contains some secretory goblet cells.

The epithelial cells are closely packed. The urinary bladder opens into the urinogenital duct.

12. FECUNDITY

The fecundity of different species differs from one another ; it differs within the same species depending on the size and weight of the fish. In *S. richardsonii,* it ranges from 1578-14316 in specimens measuring 190-560 mm. total length. The diameter of mature ova, ranges between 2.994 mm. to 3.992 mm. The size of first maturity stage in female is at about 175 mm. total length and for male 140 mm. total length. The fry of this species bears a black longitudinal lateral band which ends in a black spot at the base of the caudal fin. The body is transluscent. The ova of *S. niger* and *S. esocinus* are spherical and covered with a hard shell. They are light creamy in colour. It is mainly 2-3 mm. in diameter. In *S. niger,* in fishes with total length ranging between 158-336 mm., the fecundity of the ovary has been 1554-12414 (Jyoti and Malhotra, 1972). Das and Malhotra (1966) observed diapause in *Schizothorax* and *Schizothoraichthys* in which the ovarian activity is arrested after the completion of vitellogenesis i.e., after the stage IV It could happen due to low environmental temperature from December to April.

13. BREEDING PERIOD AND BEHAVIOUR

S. richardsonii starts breeding during the monsoon period i.e., from June-October. With the approach of the breeding season, the fishes of both sexes begin to show excitement. They leap out of water occasionally and migrate upstream in search of shallow

spawning grounds in quieter sections of the streams. They do not breed in the mid-stream where the flow of water is tremendous and the eggs are liable to be swept away by the swirling waters. The fish spawns several times during the breeding season. The act of breeding takes place on cool and cloudy days accompanied by rain, the former providing protection to fertilised ova from sun rays and the latter stimulating the physiological action in the fish for spawning.

Ovaries enter the resting phase for about two months. From April onwards, the climatic conditions become favourable and final maturation occurs during this period. According to Malhotra (1965 & 1970), *S. niger* breeds during mid April to mid June.

Bhatnagar (1964) has shown that *S. richardsonii* breeds twice in a year for short-periods in Bhakra reservoir, once during July-August (monsoon period) and second probably in winter months of December-January.

Bionomics

The study of bionomics of Schizothoracinae has not been done in detail although the present author made a detailed study of this aspect in *S. richardsonii* and also made some observations on other genera and species.

14. HABITAT

S. richardsonii is an inhabitant of the bottom of streams and rivers with rocky and stony bed in a veriety of streams of Himalaya. This characteristic is shared to some extent, by *Diptichus masculatus* and *Schizopygopsis stoliczkae*. The representatives of *Schizothoraichthys* and *Ptychobarbus* live in the midstream.

Gymnocypris and *Lepidopygopsis* are inhabitants of lakes. The bottom dewelling habit of *S. richardsonii* and *D. maculatus* is evidenced by the presence of a shovel-shaped and scraping type of lower jaw which is reinforced by a horny layer, the horizontal position of paired fins and the reduction of scales on the body especially on the thorax and abdomen which continuously rub against the rocks and stones. The general habitat of the Indian Schizothoracid genera are shown below :

Showing habitat of the Genera of Indian Schizothoracinae.

S. No. Habitat / Genera	Lakes	Large rivers with slow moving side channels	Large rivers	Small rapid stream with algal growth	Rapid stream without algal growth
1. *Schizothorax*	■	■	■	■	
2. *Schizopygopsis*	■	■	■	■	
3. *Diptychus*			■	■	■
4. *Ptychobarbus*		■	■	■	
5. *Gymnocypris*	■	■			
6. *Lepidopygopsis*	■	■			
7. *Schizothoraichthys*		■	■	■	

15. FOOD

S. richardsonii is predominently a vegetable feeder and the following diatoms, algae and macrophytes have been identified from its gut.

(I) Bacillariophyceae

(a) *Cymbella* sp.
(b) *Gomphonema* sp.
(c) *Gyrosigma* sp.
(d) *Navicula* sp.
(e) *Nitzschia* sp.
(f) *Synedra* sp.
(g) *Tabellaria* sp.

(II) Chlorophyceae

(a) *Cladophora* sp.
(b) *Charra* sp.
(c) *Dichotomosiphon* sp.
(d) *Hydrodictyon* sp.
(e) *Oedogonium* sp.
(f) *Pithophora* sp.
(g) *Spirogyra* sp.

(III) Myxophyceae

(a) *Gleotrichis* sp.
(b) *Nostoc* sp.
(c) *Oscillatoria* sp.
(d) *Rivularia* sp.

(IV) Naiadaceae

(a) *Potamogeton* sp.

(V) Polygonaceae

(a) *Polygonum* sp.

The diatoms, which are usually found in abundance, are *Cymbella* sp., *Gyrosigma* sp. *Navicula* sp. and *Synedra* sp. while *Cladophora* sp. and *Hydrodictyon* sp. are the representatives of algae which are abundantly found in the gut of this species. The macrophytes are of rare occurrence.

A more or less uniform rate of feeding is observed in this fish although the intake of food slightly gets increased during autumn months, a period of vitellogenesis. The rate of feeding records a fall during winter months and also during spawning season (July to September). After the spawning period is over, the spent fish feeds voraciously. The rate of feeding is the highest during spring and early summer. The hill streams abound in the vegetable food consisting of diatoms and algae which act as a continuous source of food. The increase in the rate of feeding during vitellogenesis is connected with the making of provision of raw material for the conservation of yolk within the oocytes. The spawning starvation during July to September months is followed by voracious feeding during post spawning period.

Feeding Mechanism :

The sharp horny jaws of *S. richardsonii* are helpful in scraping off algal encrustation from the stones and rocks. It rasps off algae in small installments, making series of crescentic impressions on the rock (Tilak, 1971). *Diptychus maculatus* also feeds in a somewhat similar manner in fast-flowing streams at higher altitudes. The bottom feeding habit of these fishes is evidenced by the position of the mouth which is ventral and lies cansiderably behind the tip of the snout. The mouth is a small transverse slit on the ventral side of the snout. The jaws and the buccal cavity are edentulous.

The buccal cavity is narrow and the presence of efficient sieve-like gill rakers, absence of stomach and presence of long convoluted alimentary canal support the herbivorous nature of these fishes.

The length of the alimentary canal in the size range of 89-560 mm. of *S. richardsonii* ranges between 197-240 mm., the relative length of the gut ranges between 2.213-4.494 times in the total length of the fish.

MORPHOMETRIC MEASUREMENTS AND MERISTIC CHARACTERS

(Fig. 10)

Schizothoracinae are typically cyprinid fishes with a few characteristics as specialities of their own ; the special characters

in the external morphology of these fishes are the varying degree of reduction of scales on the body and a row of enlarged scales along the anal sheath. For the purpose of identification of the fishes of this group, a majority of the taxonomic characteristics of these fishes are similar to those of other cyprinid fishes. The morphological characteristics of these fishes are described under Morphology and Terminology. For correct identification of the genera and species of these fishes, in addition to the general morphological characters, morphometric and meristic characters are largely employed.

The morphometric characters, used for taxonomic descriptions, are given below.

1. TOTAL LENGTH :

It is the entire length of the fish and is measured from the tip of the snout to the tip of the longest ray of caudal fin (Fig. 10).

2. LENGTH OF BODY OR STANDARD LENGTH :

It is measured as the distance between the tip of snout and base of caudal fin. The base of caudal fin is the end of the last vertebral element which is embedded in flesh. It is sometimes difficult to exactly locate this point for measurement but there are two easy methods of determining the end of the last vertebral element (or the hypural plate). Firstly, it may be determined by flexing the caudal fin sideways by holding the fish by its caudal peduncle. In doing so, a vertical groove is formed on the skin of the base of caudal. This groove marks the end of the hypural plate. Alternately, the line joining the bases of the two undivided rays of the lobes of the caudal fin can also serve the same purpose. (Fig. 10).

3. LENGTH OF CAUDAL PEDUNCLE :

It is the narrowest part of the body behind the anal fin. It is measured as the distance between the end of the anal fin or the base of the last anal ray to the origin of the caudal fin.

4. LEAST HEIGHT OF THE CAUDAL PEDUNCLE :

It is a vertical measurement of the height of the caudal peduncle. It is measured at its narrowest point. (Fig. 10)

5. DEPTH OR HEIGHT OF THE BODY :

The height or depth of the body is the measurement of the deepest part of the body which is normally before the dorsal fin.

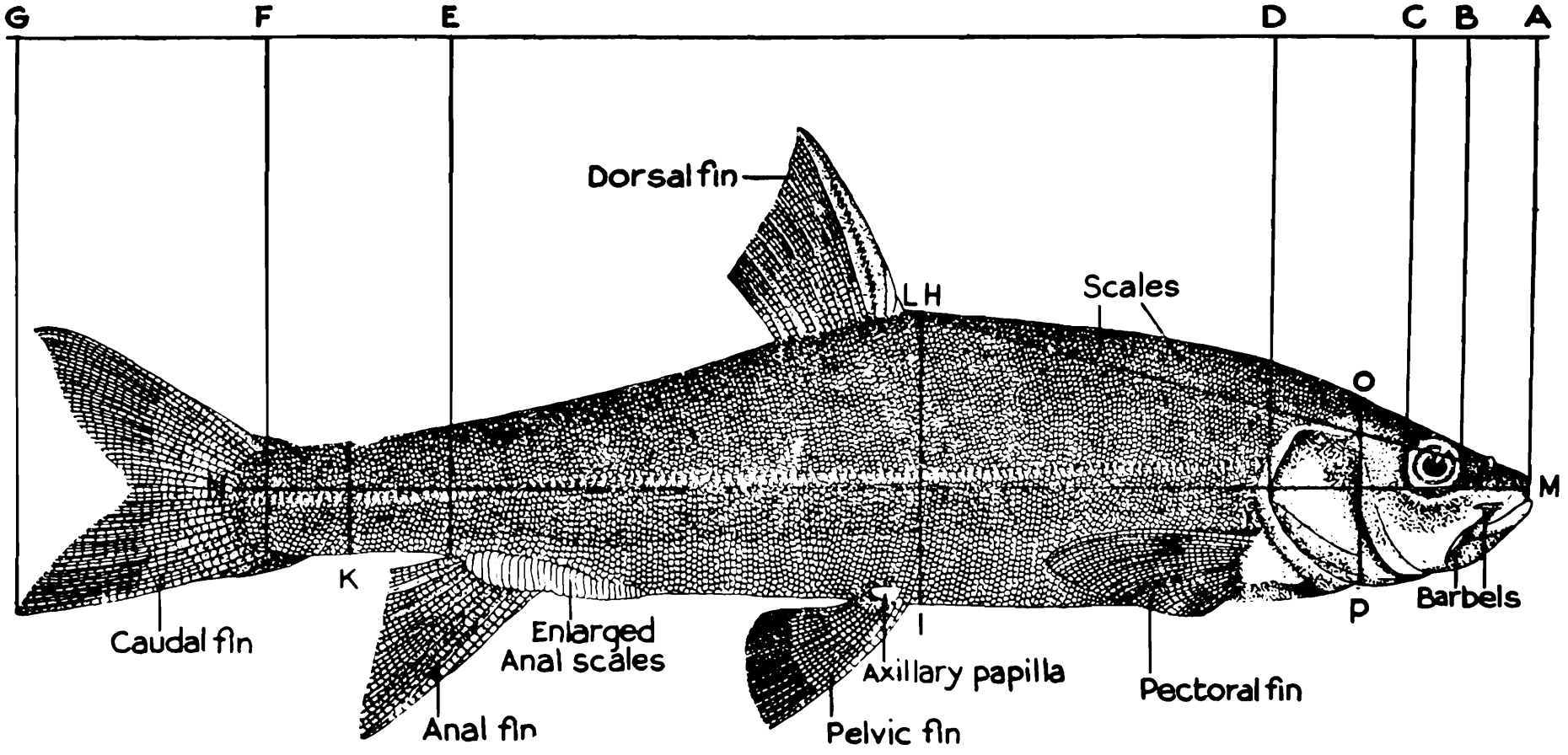


Fig. 10. *Schizothoraichthys curvifrons*, showing the different characters and morphometric measurements. AG, total length ; AF, standard length ; AD, head length ; AB, snout length ; BC, eye diameter ; EF, caudal peduncle ; JK, height of caudal peduncle ; HI, depth of body ; OP, height of head ; LM, line connecting tip of snout and origin of dorsal fin ; MN, line connecting snout tip and centre of base of caudal fin.

(Fig. 10). Since the measurement is made between the back and the belly, and the latter being soft and liable to vary, the depth of body of a fish may differ greatly with different specimens of the same species. If the fish has eaten enough, the gorged intestines extend the belly downward while the same may be normal or shrunken, if the fish feeds normally or is starved. In dead and preserved specimens, the belly gets shrunken if the internal viscera are not properly injected with the preservative fluid and start decaying. Good preservation of the specimens used for taxonomic purposes is, therefore, very essential for correct measurements.

6. WIDTH OF BODY

It is a measurement of the widest part of the body of the fish. It is normally below the dorsal fin. The width of the body, like the depth of body, is subject to variation depending upon such factors as the intake of food, condition of preservation of internal viscera of the body etc. The range of variation of the width of body is reduced because the flesh of this region is reinforced by ribs.

7. PREDORSAL DISTANCE

It is the distance measured between the origin of dorsal and the tip of snout.

8. SNOUT TO BASE OF FINS

In the linear growth of the fish, the distance between the snout and the different fins, when compared separately with the total or standard length, shows differences among the species. The shortest distances from the tip of the snout to the baseof the pectoral fin, pelvic fin or anal fin are measured as shown in fig. 10. Likewise, the distance between the origins of the pectoral to pelvic, pelvic to anal, and anal to caudal is measured in the same manner.

9. LENGTH OF HEAD

The length of the head is measured from the tip of snout to the posteriormost end of the operculum. This measurement is quite reliable because it is based on hard and bony parts joined end to end with the least possibility of variation between a living and a preserved specimen.

10. WIDTH OF HEAD

Width of head is measured at the widest part of the head which is normally in the region of the opercula.

11. HEIGHT OF THE HEAD

It is the maximum height of head, measured vertically almost from the tip of the supraoccipital downwards.

12. POST-ORBITAL LENGTH OF HEAD

It is the shortest distance between the hinder edge of the orbit to the posterior edge of operculum.

13. DIAMETER OF EYE

The eye is not always a complete circle but for taxonomic purposes, the distance between the anterior and posterior edges of the bony orbit denotes the diameter of eye which is sometimes called the "eye".

14. SNOUT

The part of the head anterior to the eye is called the snout while that posterior to it is called the postorbital part of head. The snout is measured from the anterior edge of bony orbit to the tip of snout.

15. INTERORBITAL SPACE

It is the distance between the dorsal edges of the two orbits and is measured from dorsal side of head.

16. GAPE OF MOUTH

It is distance between the angles of the lips. The mouth is transverse, semilunar or '∩' shaped but in all conditions, the shortest distance between the angles of the mouth has been measured as the gape of the mouth.

17. LENGTH OF BARBELS

When barbels are present, they may be a rostral and a maxillary pair. The length of each barbel is measured from its origin to its tip.

18. ISTHMUS

The area between the ventral ends of the branchial cleft is called the isthmus and is measured as such. The gill clefts are quite wide and extend ventrally in Schizothoracinae.

19. LENGTH OF FINS

While measuring the different fins, the length of the longest ray of the fin is taken into account. In the case of dorsal and anal fins, it is called as the height of those fins while in the pectoral, pelvic and caudal fins, it is called as the length of these fins. In the dorsal and anal fins, the length of the base of these fins is measured between the bases of the anteriormost to the posteriormost rays of the same fin.

20. LENGTH OF THE DORSAL SPINE

The length of the dorsal spine is measured from its base to the end of the bony part of the spine. There is normally a cartilaginous or jointed tapering extension of the bony part and that part is not taken into account for measurement because the same is liable to be broken in preserved specimens and causes an error in measurement. The hinder part of the bony dorsal spine is beset with a double row of downwardly directed teeth. Such teeth are firmly fused with the shaft of the spine in its bony part and only such teeth are alone counted because this number has taxonomic significance.

MERISTIC CHARACTERS

These are such characters which can be only counted and they are the following :

1. NUMBER OF BRANCHIOSTEGAL RAYS

Each hyoid cornua is beset with a set of three branchiostegal rays which jointly get applied to the lower edge of the opercular flap and help in increasing the surface of the gill flap. The number of branchiostegal rays is fixed i.e. 3 on each side in all Cyprinidae.

2. THE FIN RAYS

Each fin has undivided and divided rays. The undivided or unbranched rays end in a single point while the branched rays get divided into two or more branches upto their tips. In the pectoral fin, there is only a single unbranched ray which is normally the longest ray of the fin and all other rays are counted as branched rays although the last ones of this series are extremely small and may only be single. In the pelvic fin, there is an unbranched ray which is usually the longest ray of the fin and the rest are all branched rays. Anterior to the unbranched ray of the pelvic fin,

there is another small unbranched ray embedded in skin which is in fact a later trichium, a sickle-shaped bone lying on the lateral side of the basipterygium. In dorsal as well as the anal fins, the last branched ray is usually divided upto the base and apparently gives the impression of two rays but since these branches of the same ray are borne on a single radial, they should be counted as one.

In the caudal fin, the lepidotrichia which are borne on the urohypural complex are only counted as caudal fin rays. The outermost ray of each caudal lobe is the longest and the unbranched. The two unbranched rays of the two lobes and the branched rays inbetween them are counted for this purpose. There are a few small unbranched rays anterior to these rays of the caudal fin but they are usually not taken into account because they are either borne on the epiural on the dorsal side or on the haemal spine on the ventral side.

In writing, the number of rays in the fin formula of these fishes, the unbranched rays, spines or branchiostegal rays are denoted by the Roman numerals while the branched rays are written in Arabic numerals. The spines and branched rays are separated by an oblique stroke (/).

2. THE SCALES

For taxonomic purposes, the number of scales along the lateral line, the transverse series between the base of the dorsal fin and the lateral line and between the latter and the base of pelvic fin, the number of rows around the caudal peduncle and the number of scales along the anal sheath are only considered here. All these counts are sometimes not possible because in some genera, the scales have partly vanished from some parts of the body.

Along the lateral line, the scales which are pierced by the lateral line are counted from the angle of the operculum to the base of the caudal fin.

For the scales on the lateral transverse series, they are counted from the origin of the base of the dorsal fin downwards upto the lateral line and then down upto the base of the pelvic fin and the abdomen.

The rows of scales around the caudal peduncle are counted along the narrowest part of the caudal peduncle.

The enlarged scales along the anal sheath are counted serially from behind forwards and the maximum width of one of the widest scales is taken in the vertical posture.

Systematic List and Description of Indian Schizothoracinae

SYSTEMATIC LIST

Superclass : GNATHOSTOMATA
Class : OSTEICHTHYES
Sub-class : ACTINOPTERYGII
Infra-class : TELEOSTEI
Division : Euteleostei
Super-order : OSTARIOPHYSI
Order : CYPRINIFORMES
Suborder : CYPRINOIDEI
Family : CYPRINIDAE
Sub-family : SCHIZOTHORACINAE

I. Genus : **Schizothorax** Heckel

1. *Schizothorax richardsonii* (Gray)
2. *Schizothorax kumaonensis* Menon

II. Genus : **Schizopygopsis** Steindachner

3. *Schizopygopsis stoliczkae* Steindachner

III. Genus : **Diptychus** Steindachner

4. *Diptychus maculatus* Steindachner

IV. Genus : **Ptychobarbus** Steindachner

5. *Ptychobarbus conirostris* Steindachner

V. Genus : **Gymnocypris** Günther

6. *Gymnocypris biswasi* Talwar

VI. Genus : **Lepidopygopsis** Raj

7. *Lepidopygopsis typus* Raj

VII. Genus : **Schizothoraichthys** Misra

A. Subgenus : *Schizothoraichthys* (*Schizothoraichthys*) Misra

8. *Schizothoraichthys* (*Schizothoraichthys esocinus* (Heckel)
9. *Schizothoraichthys* (*Schizothoraichthys*) *micropogon* (Heckel)

10. *Schizothoraichthys* (*Schizothoraichthys*) *longipinnis* (Heckel)
11. *Schizothoraichthys* (*Schizothoraichthys*) *nasus* (Heckel)
12. *Schizothoraichthys* (*Schizothoraichthys*) *niger* (Heckel)
13. *Schizothoraichthys* (*Schizothoraichthys*) *curvifrons* (Heckel)
14. *Schizothoraichthys* (*Schizothoraichthys*) *planifrons* (Heckel)
15. *Schizothoraichthys* (*Shizothoraichthys*) *hügelii* (Heckel)

B. Subgenus : **Schizothoraichthys** (*Racoma*) McClelland

16. *Schizothoraichthys* (*Racoma*) *progastus* McClelland
17. *Schizothoraichthys* (*Racoma*) *labiatus* McClelland

Genus 1. SCHIZOTHORAX Heckel, 1838

1838. *Schizothorax* Heckel (in part), *Fische aus Caschmir*, pp 11-23, Section 'A' (Type-species : *Schizothorax plagiostomus* Heckel, subsequently designated by Bleeker, *Atl. Ichthyol. Ind. Orient. Neerland.*, 3, p. 26. 1863, logotype).

1839. *Oreinus* McClelland (in part), *Indian Cyprinidae*, p. 273 (Logotype : *Oreinus guttatus* McClelland as fixed by Bleeker, *Atl. Ichthyol. Ind. Orient. Neerland.*, 3, p. 26. 1863, Regarded by Gistl as preoccupied by *Oreina* in Coleoptera).

1843. *Schizopyge* Heckel (in part), in Russegger, *Reisen in Europa Asien und Africa*, p. 285.

1848. *Englottogaster* Gistl, *Naturg. Thierr. hohere Schulen*, Stuttgart, 1848, p. X.

1868. *Oreinus* : Günther, *Cat. Fish. Brit. Mus.*, 7, p. 160.

1877. *Oreinus* : Day, *Fishes of India*, p. 520

1962. *Schizothorax* : Misra, *Rec. Indian. Mus.*, 57, pp. 48, 55, 166.

1964. *Schizothorax* : Tsao (in part), (in Wu et al., *Cyprinid Fishes of China*, vol. 1) Schizothoracinae, p. 139

1971. *Schizothorax* : Menon, *Rec. Zool. Surv. India*, 63, pp. 195-206.

1975. *Schizothorax* : Tilak and Sinha, *Ann. Zool. Warszawa*, 32 (13), p. 293.

Characteristic Features :

The features, by which this genus can be distinguished from all other schizothoracids, are the presence of a strip of hard papillated structure at the chin, margin of the lower jaw having a firm and hard horny covering and a thick lower lip with a free posterior edge.

The body is subcylindrical with both the profiles arched. The ventral surface of the head and anterior part of the body flattish. Snout and abdomen rounded. Upper jaw longer than lower. Head fleshy, short, somewhat cone-shaped and blunt. In younger specimens, the head is proportionately longer. Snout usually smooth, covered with warts in the male. Eyes are, for the most part, in the anterior part of the head and not visible from the ventral side of head. The eyes, too, are proportionately larger in younger specimens. Interorbital space broad and flat. The nostrils much nearer the eyes than the tip of the snout. Mouth wide, transverse, slightly arched and situated on ventral side of head. Lips fleshy and continuous, marginally sharply attenuated. The upper lip simple, covers the jaw, the lower lip papillated, reflected from the jaw. Exposed portion of lower jaw sharp, covered with a firm cartilage and reaches upto the chord of the curved mouth, followed by a fleshy labium with a free posterior edge, not interrupted at the symphysis of the lower jaw. Posterior border of the hard papillated strip may be straight, concave or convex. Barbels 4, a rostral and a maxillary pair. Longitudinal skinny sheaths, covered by tiled row of enlarged scales run on both sides of the anus and enclose a groove. Pharyngeal teeth pointed, hooked, 5-3-2/2-3-5. Scales minute and elliptical. Lepidosis irregular. Lateral line passing to the centre of the base of the caudal fin. Dorsal fin originates opposite the ventral. Dorsal spine strong, serrated posteriorly, shorter than head. The pectorals shorter than the head and separated from the ventrals by a considerable distance. Caudal fin deeply emarginate.

Distribution :

Usually above an altitude of 670 meters in rivers along Himalaya in India, Nepal, Sikkim, Bhutan, Central Asia, Afghanistan and further west.

Two species of this genus, viz. *S. richardsonii* (Gray) and *S. kumaonensis* Menon, in India are recognised.

Inter-Relationship :

In the past, majority of workers on these fishes were greatly confused on the validity of *Schizothorax* Heckel for the fishes with a strip of papillated sturcture at the chin. They (Cuvier and

Valenciennes, 1842 ; Günther, 1861, 1868 ; Day, 1876, 1877, 1889 ; Chaudhuri, 1913 ; Lohrenberger. 1929 ; Mukerji, 1939 ; Fang, 1936 ; Shaw and Shebbeare, 1937 ; Misra, 1949 ; Vijayalakshman, 1952 ; Fowler and Steinitz, 1956 ; Silas, 1960 ; Das and Subla, 1966 ; Talwar, 1978) recognised *Oreinus* McClelland for the fishes with a strip of papillated structure at the chin. Tilak and Sinha (1975) have elucidated the systematic position of *Schizothorax* in relation to *Oreinus* and other genera. The views expressed by Misra (1962) have been upheld by Menon (1971) and Tilak and Sinha (1975). The opinion of Malik (1966) in favour of retention of the generic name *Oreinus* as a valid name is without a solid base and not in line with rules of International Zoological Nomenclature.

The matter regarding the systematic status of the genus *Schizothorax* Heckel, *Oreinus* McClelland and *Schizothoraichthys* Misra has been dealt with in detail by Tilak and Sinha (1975) who found it proper to recognise *Schizothorax* Heckel as a valid genus for the fishes under Heckel's (1838) section "A" (with a strip of papillated structure at the chin) and put *Oreinus* in its synonomy. At the same time, the generic name *Schizothoraichthys* Misra was held valid for the fishes under section "B" and "C" of Heckel (1838) and also the species with the same character described subsequently (without a strip of papillated structure at the chin). This decision was arrived at by Tilak and Sinha (1975) while accepting the designation of *S. plagiostomus* Heckel as the type species of the genus *Schizothorax* Heckel by Bleeker (1863) (Fig. 11).

Talwar (1978) did not agree with the above mentioned view of Tilak and Sinha (1975) on the ground that McClelland (1842) designated *Schizothorax esocinus* Heckel as the type of the genus *Schizothorax* and *Schizothorax plagiostomus* Heckel for the genus *Oreinus* McClelland and that this designation has a chronological priority over that of Bleeker (1863). Talwar (1978) held that the generic name *Schizothorax* should be held valid for the sections "B" and "C" of Heckel (1838) and all other subsequently described species without a strip of papillated structure at the chin. He (Talwar, 1978) also recognised the genus *Oreinus* McClelland for the species having the strip of papillated structure at the chin.

The matter of designation of type species for the genus *Schizothorax* by McClelland (1942), which has been considered as valid designation by Talwar (1978), has been looked into here. McClelland (1842 : 570) had both kinds of fishes of Schizothoracinae with him : with a strip of papillated structure at the chin and those without it. He grouped them under *Oreinus* and *Schizothorax*, the former with and the latter without that structure. At this place, McClelland (1842 : 570), in a bid to anatomically diffrentiate further the two groups of fishes, compared their jaw bones. In doing so. he simply mentioned that the bones at fig. 1 (*S. esocinus*) are of *Schizothorax* type (the connotation "Proprius" meaning

proper) while those of fig. 2 (*S. plagiostomus*) of *Oreinus* type. In doing so, McClelland (1842) did not have the intention of designating a type-species of the genera. In fact, he had only tried to correlate certain osteological structures as 'type' or 'typical' of a group of fishes. Hence, according to article 67 (C, i and ii) of International Rules of Zoological Nomenclature, McClelland's (1842) correlation of morphological characters typical of two groups of Schizothoracinae cannot be treated as a type designation for a genus. McClelland (1838 and 1842) has described many other taxa of the generic level among Cyprinidae and Sisoridae and at no stage he had tried to designate a type for those or other genera unlike that done by Bleeker (1863).

Hence, the view expressed by Tilak and Sinha (1975) regarding the taxonomic status of *Schizothorax* Heckel and *Schizothoraichthys* Misra holds good. The taxonomic importance attached by Talwar (1978) to the unintended remarks of McClelland (1842) is, therefore, unnecessary. Many recent authors (Misra, 1962 ; Menon, 1971, 1974 ; Tilak and Sinha, 1975 ; Jhingran, 1975) recognise the generic name *Schizothorax* Heckel for the Schizothoracine fishes with a strip of papillated structure at the chin and consider *Oreinus* McClelland as its synonym.

1. SCHIZOTHORAX RICHARDSONII (GRAY)

(Fig. 12—24)

1832. *Cyprinus richardsonii* Gray, *Ill. Indian Zool.*, pl., 10 pt. 14, fig. 2. (Type-locality : not mentioned, Illustration only).

1838. *Schizothorax plagiostomus* Heckel, *Fisch. Caschmir*, p. 16, pl. I (Type-locality : Kashmir).

1838. *Schizothorax sinuatus* Heckel, *Fisch. Caschmir*, p. 21, pl 2. (Type-locality : Kashmir).

1839. *Oreinus punctatus* McClelland, *Asiat. Res* , 19, p. 256 (foot-note ; new name for *Cyprinus richardsonii*).

1839. *Oreinus richardsonii* : McClelland, *Asiat. Res.*, 19, p. 273, 335 (Simla).

1839. *Oreinus guttatus* McClelland, *Asiat. Res.*, pp. 273, 344, pl. 39, fig. I. (Type-locality : Bhutan).

1839. *Gonorhynchus petrophilus* McClelland, *Asiat. Res.*, 19, pp. 281, 371 (Type-locality : Kumaon, Simla, Nepal).

1839. *Oreinus maculatus* McClelland, *Asiat. Res.*, 19, pp. 274, 345, pl. 57, fig. 6 (Type-locality : Bhutan).

1842. *Oreinus plagiostomus, maculatus* McClelland, *Calcutta J. Nat. Hist.*, 2, pp, 570, 580, 581 (Helmund river, Cabul river).

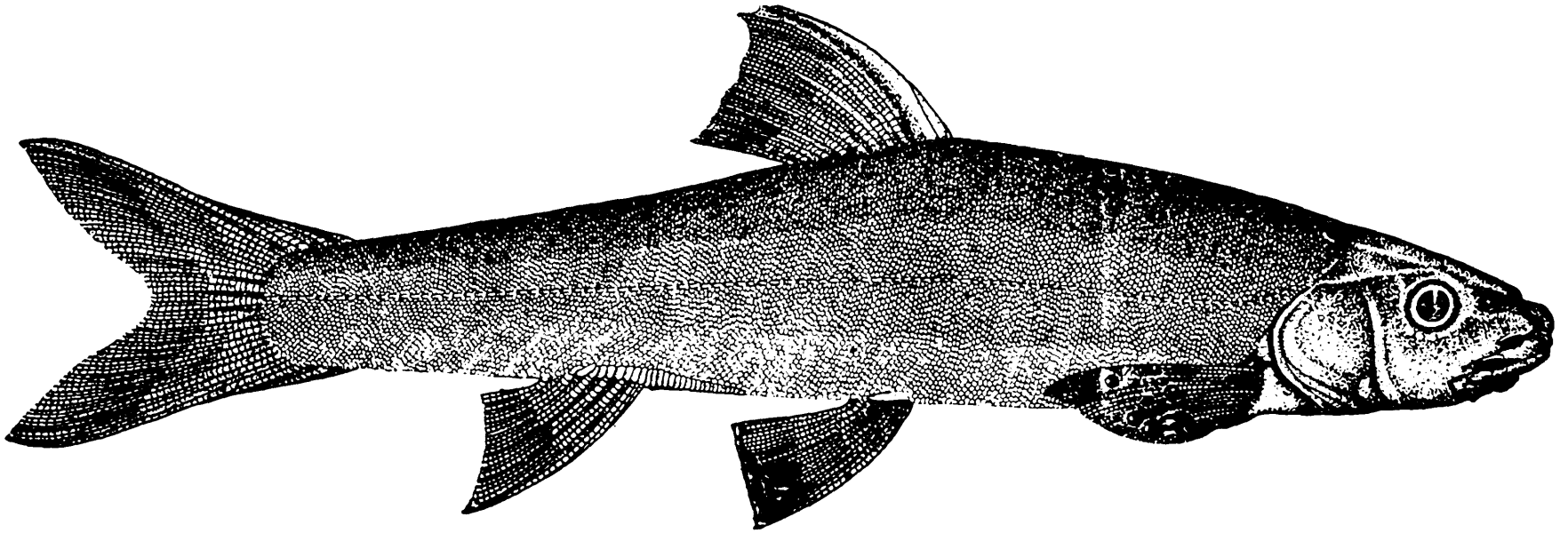


Fig. 12. Lateral view of *Schizothorax richardsonii* (=*Schizothorax plagiostomus* Heckel, Holotype Naturhistoriches Museum, Wien, Austria)

1842. *Schizothorax plagiostomus, sinuatus* : Valenciennes (in Cuvier and Valenciennes), *Hist. Nat. Poiss.*, 16 : 213, 214.

1842. *Oreinus richardsonii* and *maculatus* : Valenciennes (in Cuvier and Valenciennes), *Hist. Nat. Poiss.*, 16, pp. 227, 228.

1842. *Gonorhynchus petrophilus* : Valenciennes (in Cuvier and Valenciennes), *Hist. Nat. Poiss.*, 16, p. 466 (Kumaon).

1844. *Schizothorax plagiostomus* Heckel, *Fisch. Kaschmir* in Hügel's *Reich*, p. 357, text-fig.

1844. *Schizothorax sinuatus* Heckel, *Fisch. Kaschmir* in Hügel's *Reich*, p. 359, text-fig. 2.

1861. *Oreinus maculatus* : Günther, *Proc. Zool. Soc. London*, p. 224. (Nepal).

1868. *Oreinus plagiostomus* and *sinuatus* : Günther, *Cat. Fish. Brit. Mus.*, 7, pp. 160, 161. (Kashmir, Punjab and Afghanistan).

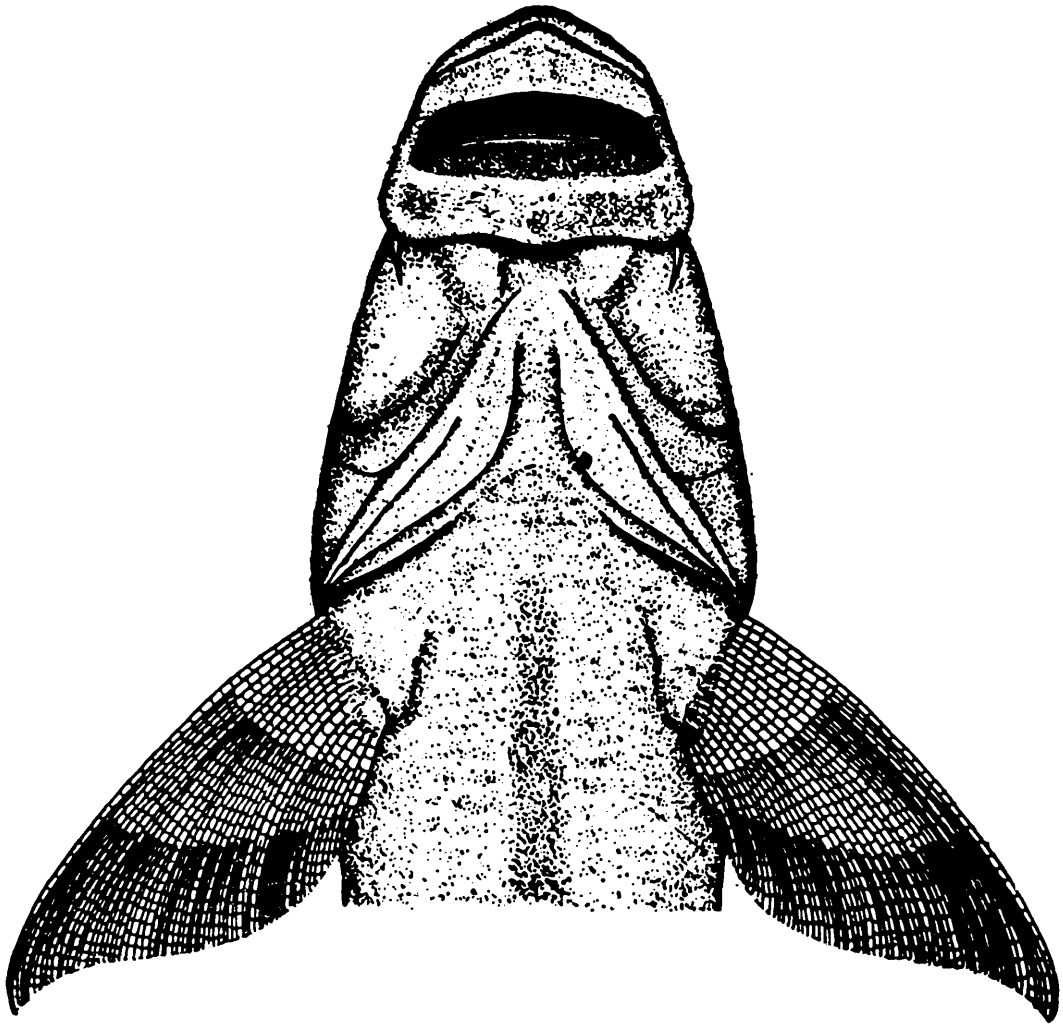


Fig. 13. Ventral view of head and anterior part of body of *Schizothorax richardsonii*

1868. *Oreinus richardsonii* : Günther (in part), *Cat. Fish. Brit. Mus.*, 7, p. 161. (Nepal).

1878. *Oreinus sinuatus, plagiostomus* and *richardsonii* : Day, *Fish. India*, pp. 529, 530, pl. 124, fig. 4, pl. 125, fig. 4. (Description, distribution).

1889. *Oreinus sinuatus, plagiostomus* and *richardsonii* : Day, *Faun. Brit. India Fish*, I, pp. 248, 250, fig. 88. (Description, distribution).

1907. *Oreinus richardsonii* : Regan, *Rec. Indian Mus.*, I, p. 157. (Nepal).

1907. *Diptychus annandalei* Regan, *Rec. Indian Mus.*, I, p. 157. (Type-locality : Nepal).

1913. *Oreinus richardsonii* and *plagiostomus* Chaudhuri, *Rec. Indian Mus.*, 8, p. 247 (Yombung, Abor Hills).

1913. *Oreinus molesworthi* Chaudhuri, *Rec. Indian Mus.*, 8, pp. 247, 248, pl. 7, fig. 2, 2a, 2b, (Type-locality : Yombung, Abor Hills, Alt. 1100 ft.).

1921. *Oreinus molesworthi* : Hora, *Rec. Indian Mus.*, 22, p. 734. (Darjeeling).

1931. *Diptychus annandalei* : Mukerji, *Rec. Indian Mus.*, 33, p. 63.

1935. *Oreinus molesworthi* : Hora, *Rec. Indian Mus.*, 37, p. 391 (Chindwin drainage, Naga Hills).

1936. *Oreinus plagiostomus* and *sinuatus* : Mukerji, *Mem. Conn. Acad. Sci.*, 10, Art. 18, p. 348 (Srinagar and Ladakh).

1937. *Oreinus richardsonii* : Hora, *Rec. Indian Mus.*, 39, p. 44.

1937. *Oreinus* sp. : Hora, *Rec. geol. surv. India*, 72(2) : 182-186, (fossil scales from Karewas of Kashmir).

1937. *Oreinus molesworthi* : Shaw and Shebbeare, *J. Asiat. Soc. Bengal*, 3, p. 17, fig. 9 (North Bengal).

1949. *Oreinus plagiostomus* : Misra, *J. zool. Soc. India*, 1(1) pp. 39-40.

1960. *Oreinus richardsonii* and *Schizothorax* sp. : De Witt, *Stanford Ichth. Bull.*, 7(4), pp. 65, 67, fig. 3 (Nepal).

1960. *Oreinus plagiostomus plagiostomus* : Silas, *J. Bombay nat. Hist. Soc.*, 57, pp. 67, 68, 71, 74. (Kashmir).

1961. *Oreinus plagiostomus* : Chaudhury and Khandelwal, *Annot. Zool. Jap.*, 34, pp. 139-152 (anatomy and histology of alimentary canal).

1964. *Oreinus plagiostomus* : Das and Subla, *Kashmir Sci.*, 1, pp. 27-34 (description of oral valves).

1965. *Oreinus sinuatus* : Das and Kaul, *Kashmir Sci.*, 2, pp. 64-76. (anatomy of gonads and fecundity).

1966. *Oreinus plagiostomus* : Khanna and Pandey, *Proc. All-India Congr. Zool.*, 2 (1962), pp. 206-216 (Visceral skeleton).

1967. *Schizothorax plagiostomus* : Bhatnagar, *Indian J. Fish.*, 11, pp. 485, 492 (spawning and fecundity).

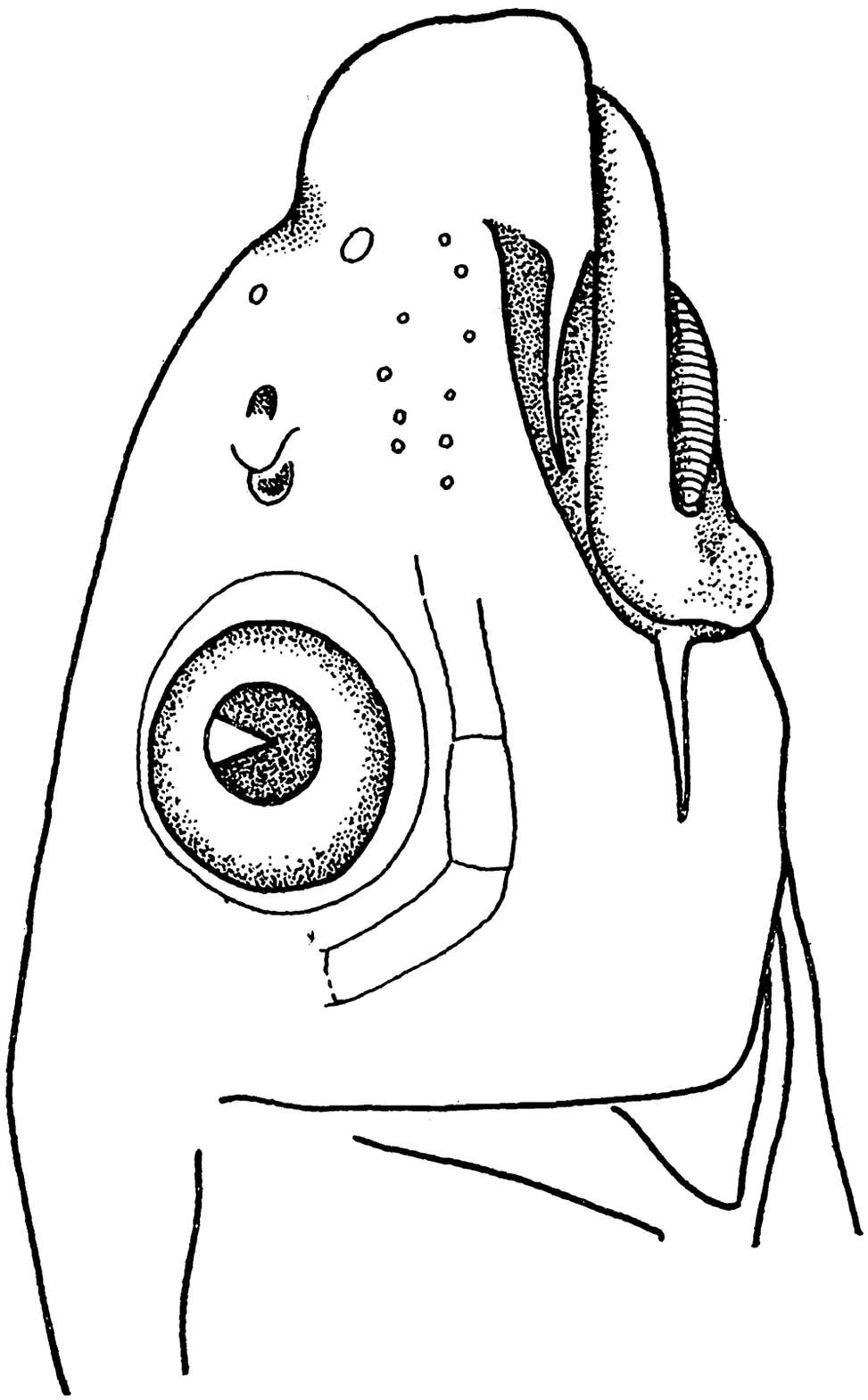


Fig. 14. Lateral view of anterior part of head of *Schizothorax richardsonii*

1967. *Oreinus sinuatus*: Das and Daftari, *Vop. Ikhtiol.*, 7, pp. 1007-1018 (description of skull).

1971. *Schizothorax richardsonii*: Menon, *Rec. zool. Surv. India*, 63 (1-4), p. 203, pl. 1, figs. 1, 2, 4. (description and distribution).

1971. *Schizothorax plagiostomus*: Tilak, *Rec. zool. Surv. India*, 65 (1-4), p. 192, pl. 1, figs. 5, 6. (Tawi river, J & K).

1972. *Oreinus richardsonii*: Banarescu and Nalbant, *Khumbu Himal.*, 4, (2), p. 236. (Nepal).

B. III, D. III/8, P. 1/15-16, V. I/9, A. III/5, C. 17; Lat. l. 85—110, Lat. tr. 25/1/21

The body is streamlined with the dorsal profile somewhat more arched than the ventral. The head length is contained from 4.05-5.05 (4.46) times in standard length and 5.13-54 times in total length. The width of head is contained 1.41-1.85 (1.61) times and height of head 1.03-1.71 (1.47) times in length of head. The eye is situated somewhat in the anterior half of head. The diameter of eye is contained 4.05-5.37 times in length of head, 1.86-3.69 (2.47) times in length of snout and 1.45-2.81 (2.20) times in the interorbital width. The eyes have a free orbital margin. The interorbital space is broad and flat. The nostrils are situated much closer to the orbit than the tip of snout. The snout is fleshy, blunt and covered with warts in the male and smooth in the female. The mouth is inferior, transverse and slightly arched. The width of the mouth is slightly more than half the width of head. The hard ochre-coloured cartilaginous covering below the lower jaw extends between the corners of the mouth, and it is followed by a fleshy and flat lower lip which is covered with a set of raised papillae, forming the sucker.

The posterior edge of the lower jaw is of variable shape and may be straight, concave or convex. There are two pairs of barbels which are smaller than the diameter of the eye. The gill clefts are of moderate size and end in front of the pectoral girdle. The isthmus is wide and its width is contained 16.0—22.0 times in standard length and 4.0– 4.66 times in head length.

The depth of the body is contained 4.12—6.18 (4.76) times in standard length and 5.9—6.1 times in total length

The lateral line in complete and arched. The scales are very small. They cover the dorsal, the lateral and the ventral sides of the body. The scales of the body are elliptical, those of the tail region are somewhat larger than those of the anterior region of the body. There is a tiled row of 22—29 enlarged scales, forming a sort of sheath along either side of the vent and the anal fin. These scales are transversely arranged. The width of enlarged anal scale is contained 3.00—6.00 times in diameter of eye.

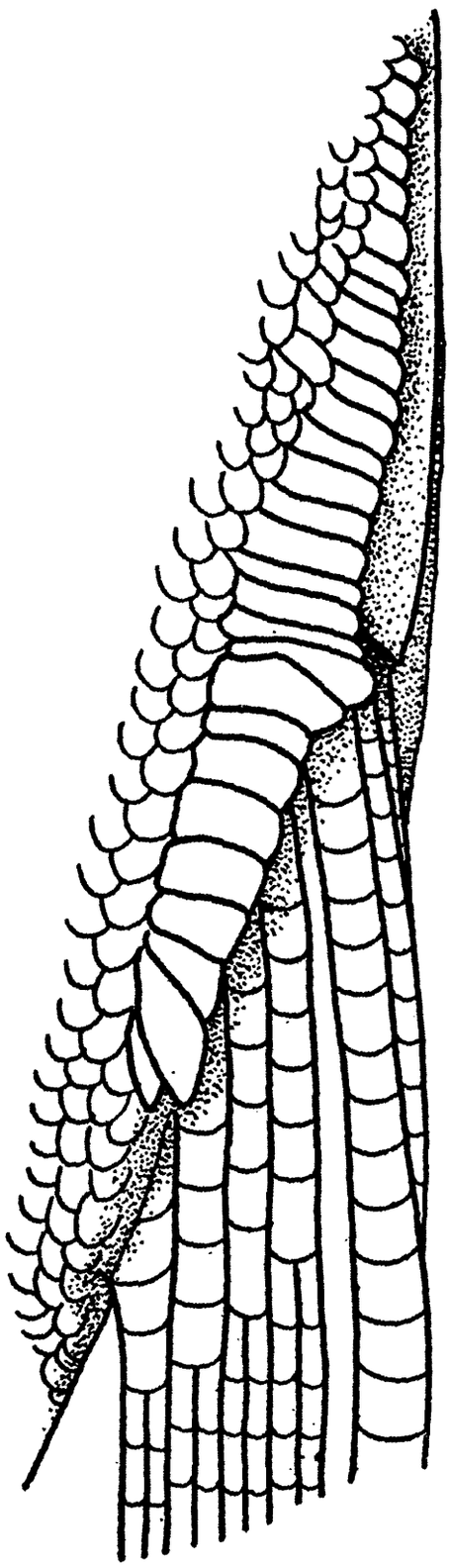


Fig. 15. Anal scales of *Schizothorax richardsonii*

The origin of the dorsal fin is placed slightly anterior to that of the pelvic fin and almost midway between the tip of snout and base of the caudal fin. The length of the base of dorsal fin is more than half the length of head. The upper edge of the dorsal fin is concave. The dorsal spine is bony, strong and serrated behind ; its length is contained 1.07 times in depth of the body.

The pectoral fin is shorter than the head, being 1.10—1.33 (1.21) times in length of head and equal to the length of anal fin. The pelvic fin originates slightly behind the dorsal and its length is contained from 1.21—1.44 (1.31) times in the length of the head. The pelvic fin does not reach the vent. The prepelvic distance is contained 1.79—2.22 (1.93) times in the standard length and 2.3 times in total length. The preanal distance is contained from 1.24—1.90 (1.35) times in the standard length and 1.6—1.7 times in total length. The length of the caudal peduncle is contained from 0.88—1.32 (1.05) times in the length of head.

The least height of the caudal peduncle is contained from 1.54—2.15 (1.86) times in its length.

Colouration : In freshly preserved specimens, the back and sides upto the lateral line are steel-grey ; the lower part of the body becomes gradually lighter. The ventral side is yellowish white. The dorsal and caudal fins are greyish while the pectoral, the ventral and the anal fins are ochre-yellowish. In some populations, the body bears small grey spots.

Size : It grows to a maximum size of 60 cm.

Distribution :

All along Himalaya, from Jammu and Kashmir to Assam, through Sikkim and Bhutan, Nepal, Afghanistan, Pakistan (Fig. 16).

Remarks :

Misra (1949) considered *Schizothorax plagiostomus* Heckel as male and *S. sinuatus* Heckel as female of the same species. The weakly serrated dorsal spine, unequal lobes of caudal fin and tuberculated snout are characters of the male while strongly serrated dorsal spine, longer lower lobe of caudal fin and smooth snout are characters of the female (figs. 17, 18).

The hard papillated strip at the chin of this species develops through a slow and gradual process and in early stages of development, this feature is poorly developed. In young stages, there is hardly any distinction between *Schizothorax* and *Schizothoraichthys* ; this can be clearly seen in the study of early stages of *S. richardsonii* (figs. 19-24).

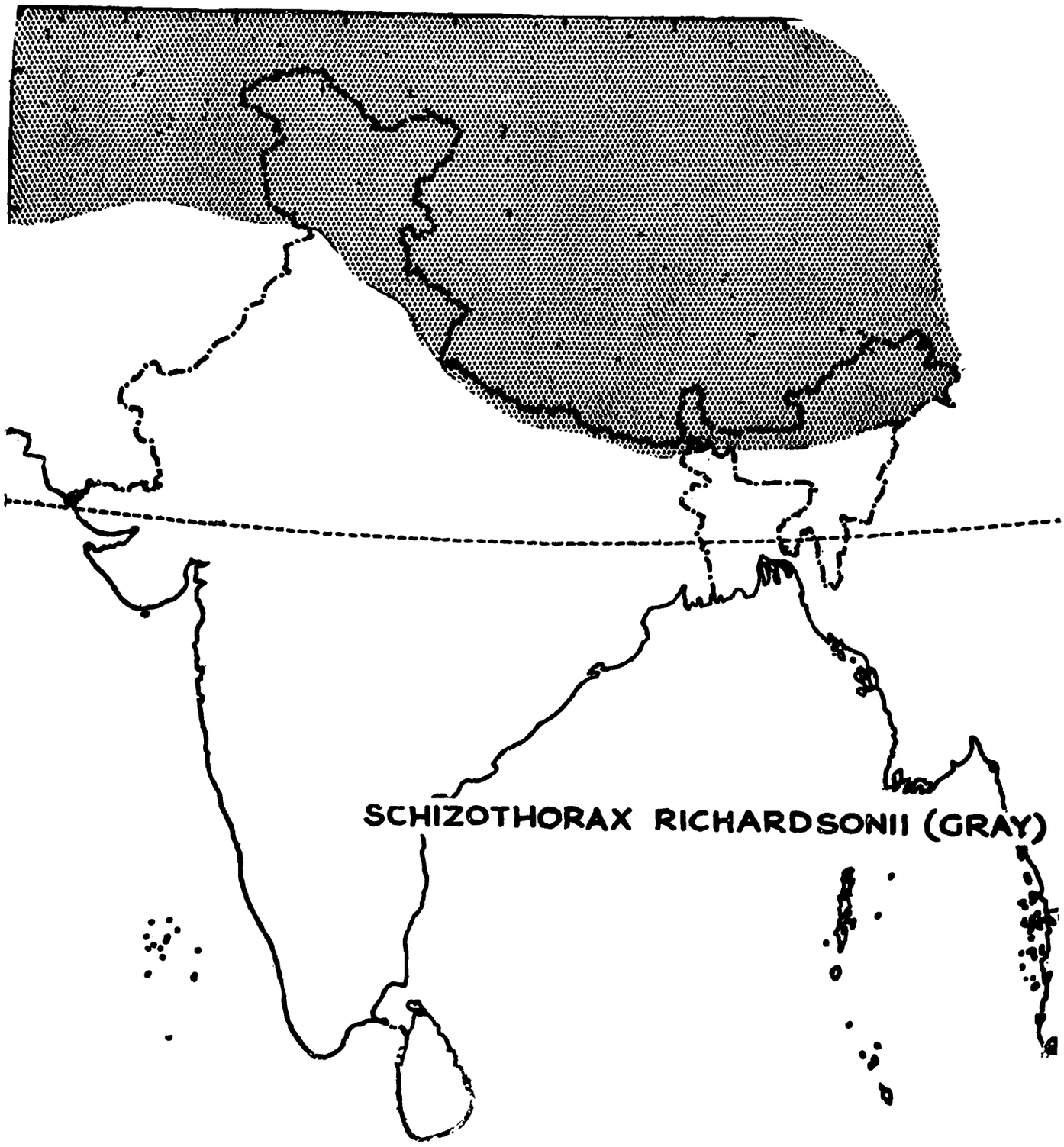


Fig. 16. Map showing the distribution of *Schizothorax richardsonii*

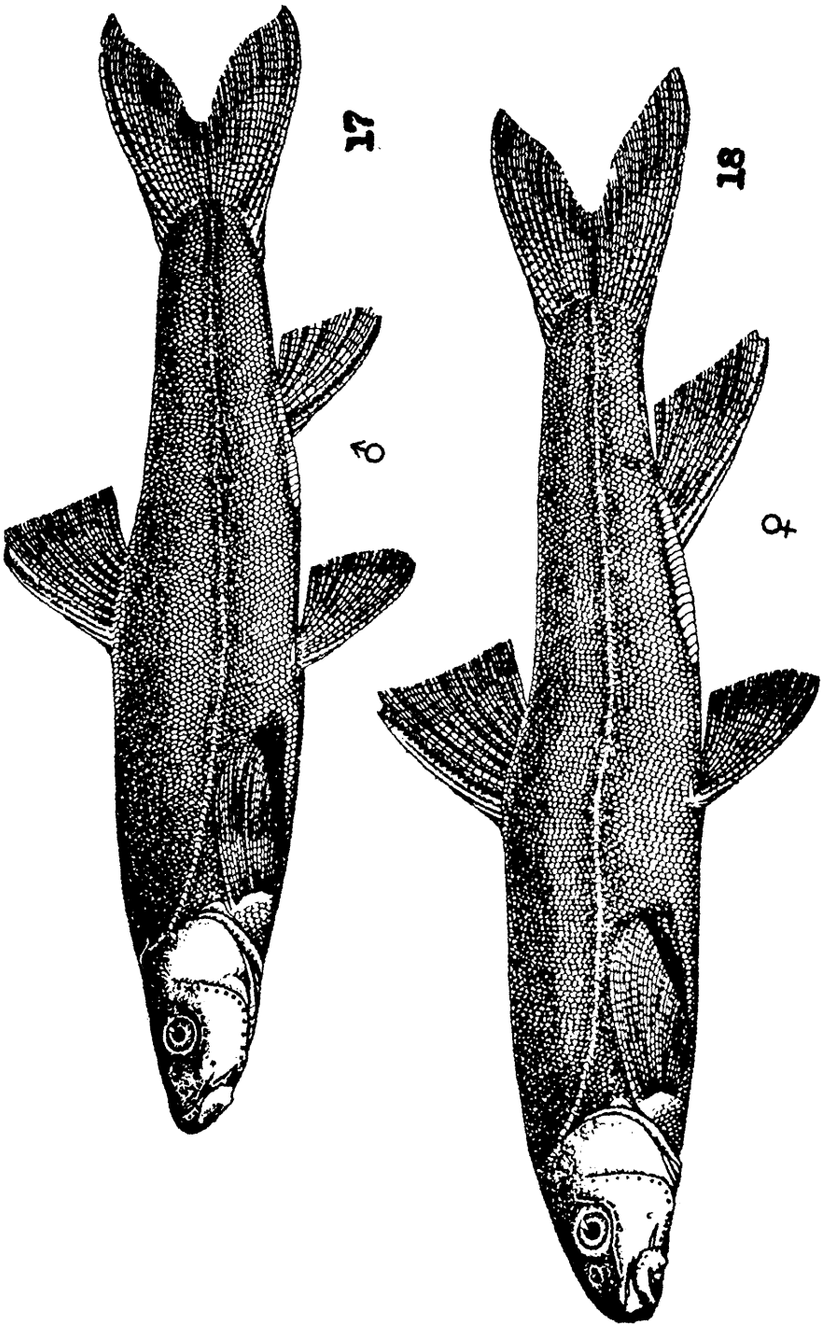


Fig. 17. Mature male of *Schizothorax richardsonii*

Fig. 18. Mature female of *Schizothorax richardsonii*

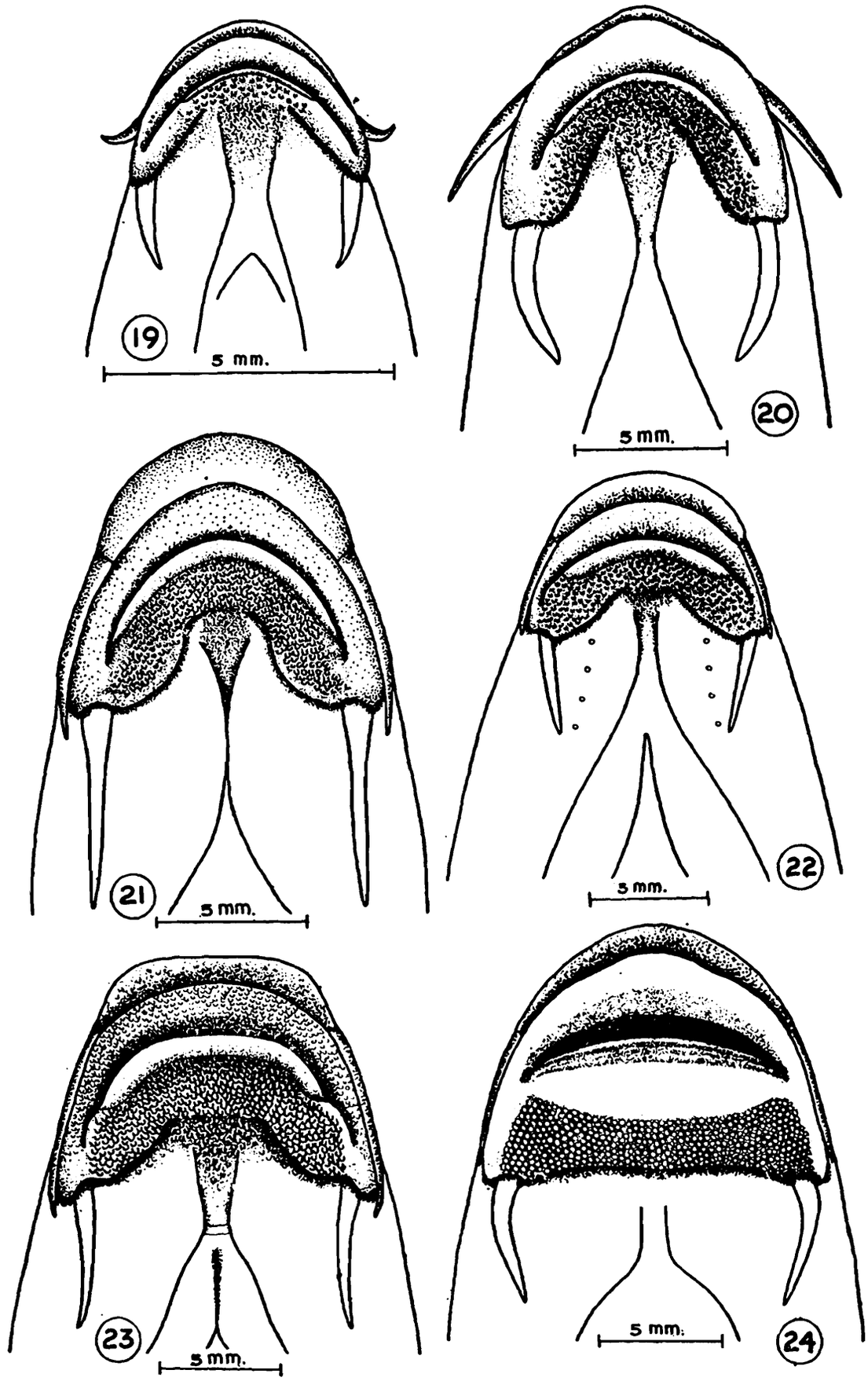


Fig. 19. Ventral view of head of *Schizothorax richardsonii* of a specimen 53.2 mm. total length ; Fig. 20. Ventral view of head of *Schizothorax richardsonii* of a specimen, 109 mm. total length ; Fig. 21. Ventral view of head of *Schizothorax richardsonii* of a specimen, 124 mm. total length ; Fig. 22. Ventral view of head of *Schizothorax richardsonii* of a specimen, 144 mm. total length ; Fig. 23. Ventral view of head of *Schizothorax richardsonii* of a specimen, 179 mm. total length ; Fig. 24. Ventral view of head of *Schizothorax richardsonii* of a specimen, 185 mm. total length.

MATERIAL EXAMINED

Region	Locality	Collector	Date of collection	No. of Exs.	Remarks
N M W 51469	Kashmir	Baron Huegel	1832	1 ex.	Holotype (Natural History Museum, Wien, Austria)
F. 5322/1	Nepal (Labelled as *S. ritchi-anus*	ASB McClelland & Griffith	—	1 ex.	
F. 12258/1	Mastuj river between Koghazi & Mastuj	B. N. Chopra	—		
F. 1552/1	Khatmandu Nepal	R. Hodgart	—	2 exs.	
F. 7740/1	Yambung, Abor Expedition	Dr. S. W. Kemp	—	1 ex.	
F. 1245/1	—	S. J. Duncan	—	2 exs.	
F. 11861/1	River near Emilomi, Naga hills, Assam.	Baini Prashad & B. N. Chopra	22.7.1935	1 ex.	(*O. molesworthi*)
F. 11860/1	Sakhai, Naga hills, Assam.	Baini Prashad & B. N. Chopra	24.2.1935	2 exs.	(*O. molesworthi*)
F. 12284/1	Nagarkot, Nepal	F. M. Bailey	1935	11 exs.	
F. 12282/1	Mangning, Nepal	F. M. Bailey	13.8.1935	5 exs.	
F. 1555/1	Soondrijal, Nepal	R. Hodgert	—	1 ex.	
F. F. 288/1	—	—	—	6 exs.	
F. 13432/1	—	—	—	1 ex.	(*O. molesworthi*)
F. 1226-1227/1	Seistan	A. H. McMohan	—	2 exs.	
F. 11862/1	Sakha, Naga hills	Baini Prashad & B. N. Chopra	15.3.1935	6 exs.	

MATERIAL EXAMINED

Region	Locality	Collector	Date of collection	No. of Exs.	Remarks
F. 11925/1	Lekurra, Naga hills	Baini Prashad & B. N. Chopra	—	1 ex.	
F. 11925/1	Zakwara Naga hills	—	28.1.1936	4 exs.	
F. —	Manawar Tawi river near Rajauri Town (J. & K.)	Dr. R. Tilak	11.10.1978	4 exs.	
—	Rivers Yamuna. Tons, Ganga, Alaknanda, Bhagirithi etc. Uttar Pradesh	Dr. R. Tilak	1972-1981	Several exs.	
—	Rivers Tawi, Indus (Ladakh) Sind, Poonch in J. & K.	Dr. R. Tilak	1964, 1977, 1979	Several exs.	
—	Rivers Sutlej, Beas and Tributaries in Himachal Pradesh	Dr. R. Tilak	1975-1977	Several exs.	

Schizothorax kumaonensis Menon

(Figs. 25-28)

1971. *Schizothorax kumaonensis Menon, Rec. zool. Surv. India,* 63 (1-4), p. 205 (Type-locality : Nainital, Uttar Pradesh).

B. III, D. III/8, P. 1/17, V. 2/9, A. III/5, C. Lat. l. 94-100 Lat. tr. 23/1/31.

This species resembles *S. richardsonii* (Gray) in general faciae. The head is somewhat smaller in this species, its length is contained from 5.14—5.57 (5-4) times in standard length. The width of head is contained from 1.44—1.75 (1.54) times and height of head 1.35—1.4 (1.88) times in the length of head. The eye is situated slightly in the anterior half of head. The diameter of eye is contained from 1.60—2.17 (1.82) times in the length of snout, 1.58-2.17 (1.85) times in interorbital width and 5.12—5.25 times in length of head. The

eye has a free orbital margin. The interorbital space is broad and flat. There are no pores on the snout. The mouth is inferior, transverse and slightly arched. The gape of mouth is more than half the width of head. The nostrils are situated closer to front edge of eye than tip of snout. The lower jaw is covered with hard

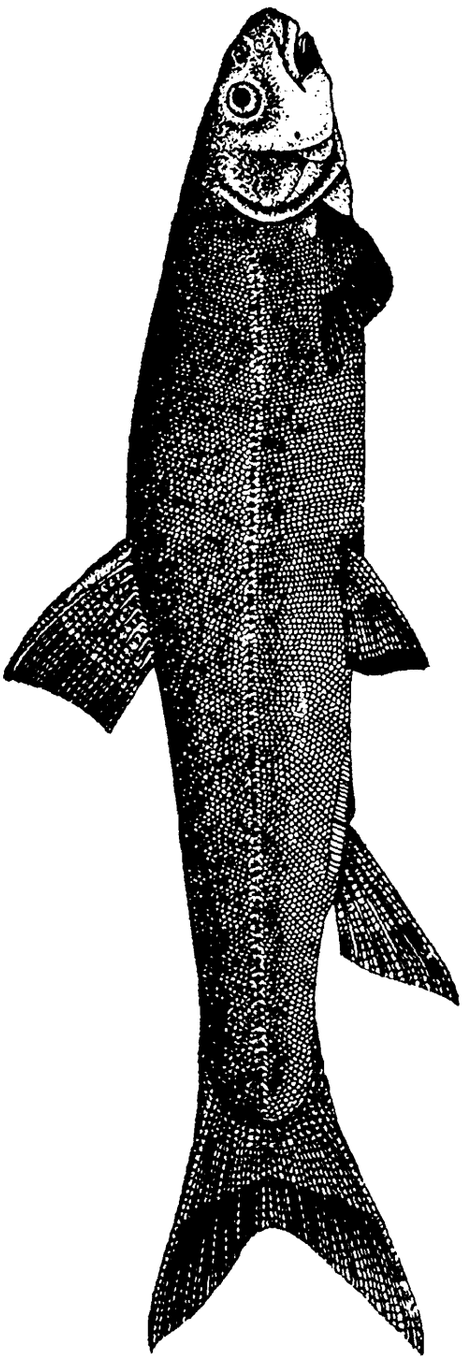


Fig. 25. Lateral view of *Schizothorax kumaonensis* Menon

ochre coloured cartilaginous layer. The lower lip forms the sucker. There are 4 small barbels. The gill clefts are of moderate size. The isthmus is wide and its width is contained 4.08 times in head length.

The depth of the body is contained from 4.55—5.76 (5.00) times in standard length and 5.6—6.00 times in total length.

The lateral line is complete and arched. The scales are small. The tiled row of 24-26 enlarged scales are transversely arranged. The width of anal scale is contained 2.5—3.0 times in the diameter of eye.

The origin of the dorsal fin lies somewhat before that of the pelvic fin or opposite each other and almost midway between the tip of snout and base of caudal fin. The predorsal distance is contained 1.99-2.11 (2.06) times in the standard length and 2.4-2.7 times in total length. The pectoral fin is shorter than the head ; its length is contained 1.17-1.27 (1. 21) times in the length of head. The length of the pelvic fin is contained 1.17-1.29 (1.17) times in the length of head. The pelvic fins do not reach the vent. The prepelvic distance is contained 1.94-2.15 (2.08) times in the

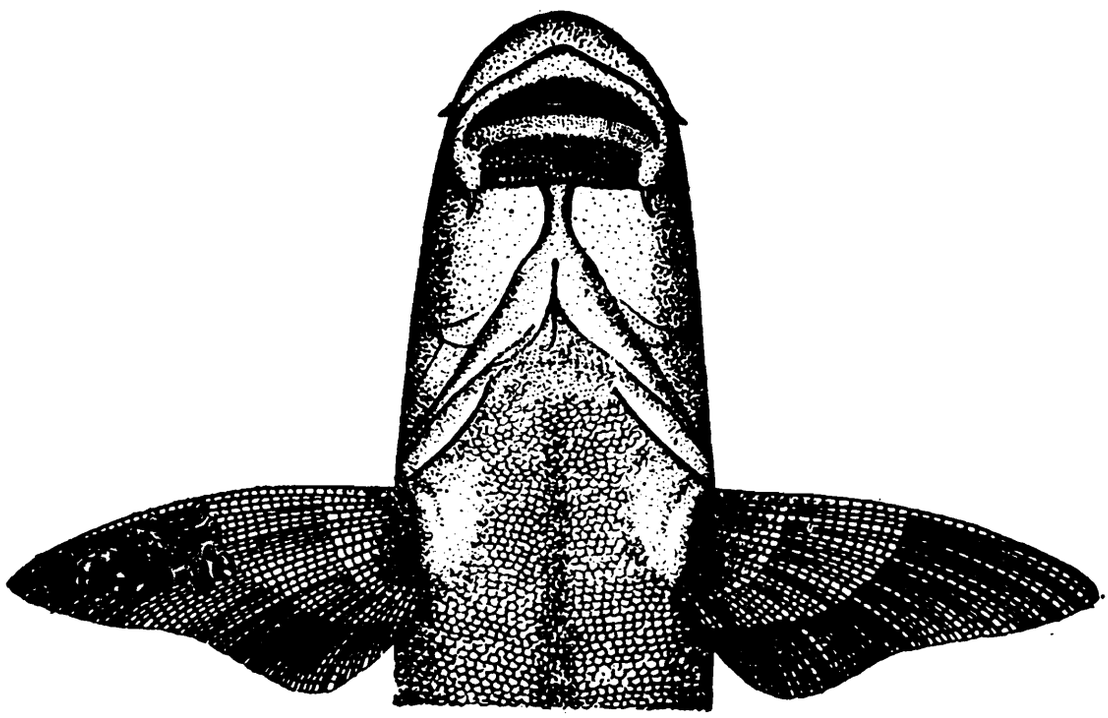


Fig. 26. Ventral view of head and anterior part of body of *Schizothorax kumaonensis* Menon

standard length and 2.45-2.76 times in total length. The preanal distance is contained from 1.34-1.40 (1.35) times in standard length and 1.6 times in total length. The length of caudal peduncle is

contained 0.86-1.0 (0.91) times in length of head. The least height of the caudal peduncle is contained from 1.87-2.21 (2.04) times in its length.

Colouration :

In spirit preserved specimens, the colour of the body is uniformly silvery with the back slightly greyish.

Distribution :

District Chamoli, Nainital and Pithoragarh, Uttar Pradesh, India.

Relationship :

Schizothorax kumaonensis is very close to *Schizothorax richardsonii* (Gray) but differs in having a smaller head which lies more than 5 times in standard length (Versus : less than 5 times in the latter).

MATERIAL EXAMINED

Regd. No.	Locality	Collector	Date of collection	No. of examples	Remarks
E. 2755	Himalaya	Dr. F. Day	—	1 ex.	
F. 2712/1	Nainital, Uttar Pradesh	Capt. R. E. Lloyd	—	1 ex.	Holotype
F. 2714/1	Nainital, Uttar Pradesh	Capt. R. E. Lloyd	—	1 ex.	Paratype
F. 2715/1	Nainital, Uttar Pradesh	Capt. R. E. Lloyd	—	1 ex.	Paratype
—	Nainital, Uttar Pradesh	A. Husain	3.1.1966	1 ex.	—
—	Sonaprayag, Dist. Chamoli U.P.	R. Tilak	10.9.1979	1 ex.	—
—	Kali Nadi near Jauljibi on Darchula–Askot Road Dist. Pithoragarh, U.P.	A. Husain	15.12.1979	4 exs.	Alt. 600 mts.

2. Genus : Schizopygopsis Steindachner, 1866.

1866. *Schizopygopsis* Steindachner *Verh. Zool. -bot. Ges. Wien.* XVI : 785 (Type-species : *S. stoliczkae* Steindachner).

1868. *Schizopygopsis* : Günther, *Cat. Fish. Brit. Mus.*, VII : 170.

1977. *Schizopygopsis* : Day, *Fishes of India* : 531.

1891. *Schizopygopsis* : Herzenstein, *Wiss. Res. Przewalski Central-Asia Reis, Zool. Theil*, iii (2) Fische, Lief 3 : 181.

1964. *Schizopygopsis* : Tsao (in Wu et al., *Cyprinid Fishes of China*) *Schizothoracinae* : 184.

Characteristic Features :

Body elongated. Snout obtusely conical. Mouth transverse, inferior and overhung by the snout. Mandible with a sharp anterior edge, covered with a horny layer. Upper and lower lips continuous with each other. Barbels absent. Pharyngeal teeth spoon-shaped and arranged in two rows (4-3/3-4). Dorsal fin short, with 7-8 branched rays and the last undivided ray of dorsal bony and finely serrated posteriorly. Origin of dorsal fin nearly opposite the ventral fin. Anal fin short, with 5 branched rays. Scales small and present only on the scapular region, along the lateral line and along the anal sheath as enlarged tiled row of scales. Lateral line complete, running to centre of the base of the caudal fin. Caudal fin forked.

Distribution :

Head waters of Indus river, Ladakh and Sutlej river, Himachal Pradesh ; Tibet and eastern Turkestan.

Relationships :

This genus is allied to *Schizothorax* but differs in having the body nearly entirely naked and the pharyngeal teeth arranged in two rows instead of three. The barbels are absent.

Only one species, *S. stoliczkae* Steindachner is represented in Indian waters.

The genus is very close to *Gymnocypris* Günther which has recently been revalidated by Tsao (1964). Both *Schizopygopsis* and *Gymnocypris* are specialised schizothoracine genera (Hora, 1953). *Schizopygopsis* differs from *Gymnocypris* in the following characters (Tchang, Yueh and Hwang, (1964).

(1) The mouth is ventral in *Schizopygopsis* while it is terminal in *Gymnocypris.*

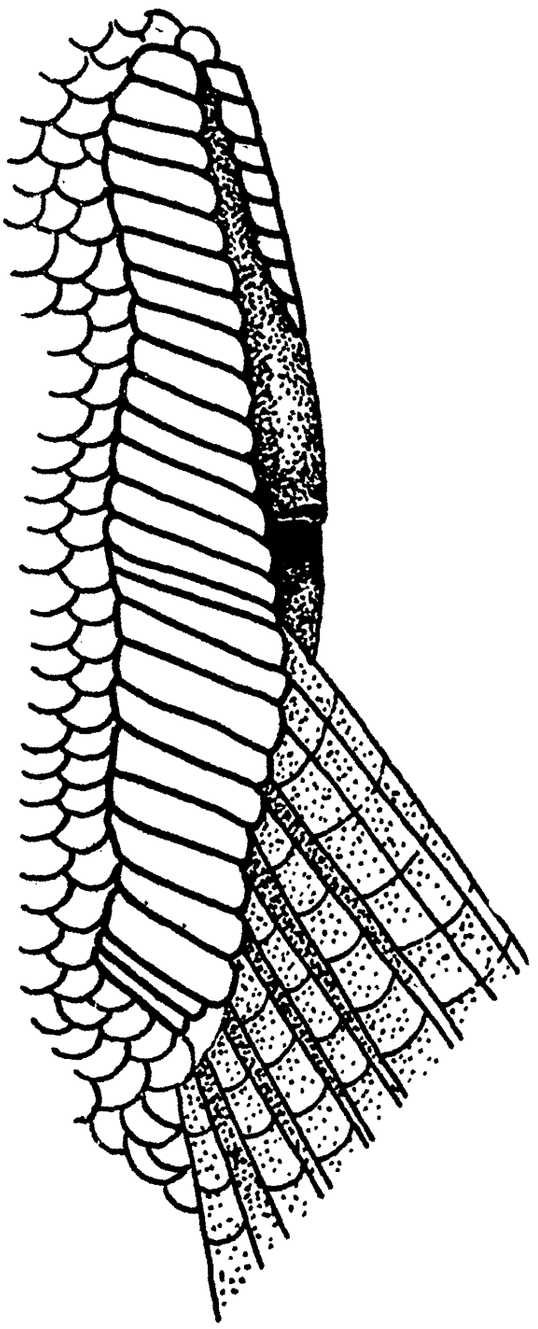


Fig. 27. Anal scale of *Schizothorax kumaonensis* Menon

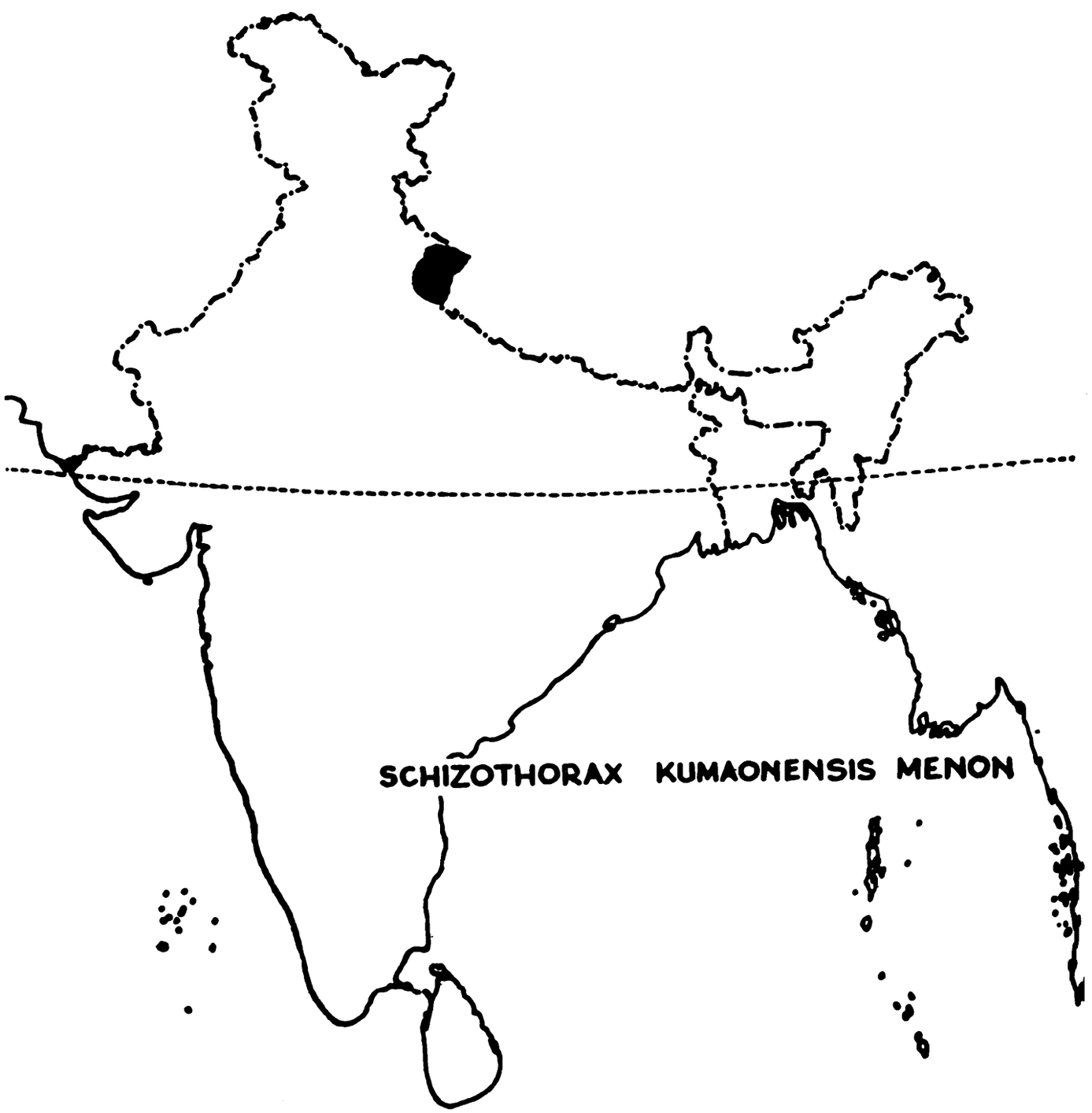


Fig. 28. Map showing the distribution of *Schizothorax kumaonensis*

(2) A horny layer covers the anterior margin of the lower jaw in *Schizopygopsis* while the same is present on the inner side of the lower jaw in *Gymnocypris.*

(3) A sharp horny edge of the lower jaw is visible from below in *Schizopygopsis* while the same is not visible in *Gymnocypris* (fig. 30).

3. Schizopygopsis stolioczkae Steindachner
(Figs. 29-33)

1866. *Schizopygopsis stoliczkae* Steindachner, *Verh, zool.-bot. Ges. Wien,* XVI, p. 785, pl. 16, fig. 2. (Type-locality: Ladakh).

1868. *Schizopygopsis stoliczkae* : Günther, *Cat. Fish. Brit. Mus.*, VII, p. 170.

1876. *Schizopygopsis stoliczkae* : Day, *Proc. Zool. Soc. London*, p. 791.

1877. *Schizopygopsis stoliczkae* : Day, *Fish India*, p. 513, pl. CXXIV, fig. 2.

1889. *Schizopygopsis stoliczkae* : Day, *Fauna. Brit. India, Fishes*, I. p. 251, fig. 89.

1891. *Schizopygopsis stoliczhkae* : Herzenstein *Wiss. Res. Przewalski Central Asia Reis., Zool. Theil*, iii (2) Fische, Lief 3, p. 191, pl. XVI, fig. 3.

1898. *Schizopygopsis stoliczkae* : Alcock, *Report Nat. Hist. Pamir Bound. Comm.*, p. 14.

1907. *Schizopygopsis stoliczkae* : Berg, *Ann. Mus. Zool. Petersb.*, X (1905), p. 323.

1910. *Schizopygopsis stoliczkae* : Zugmayer, *Zool. Jahrb*, (Abt. Syst.), 29, p. 290.

1911. *Schizopygopsis stoliczkae* : Stewart, (In part) *Rec. Indian Mus.*, VI, p. 73, pl. iii, figs. 1, 2, 3.

1914. *Schizopygopsis stoliczkae* : Berg, *Fauna de la Russie, Poissons*, III, p. 702.

1916. *Schizopygopsis stoliczkae* : Berg, *Poiss. des Eaux Douces de la Russie*, p. 290.

1916. *Schizopygopsis stoliczkae* : Vinciguerra, *Ann. Mus. Civ. Stor. Nat. Genova*, XL VII, p. 143.

1920. *Schizopygopsis stoliczkae :* Annandale & Hora, *Rec. Indian Mus.*, 18, p. 173, text—fig. 7 (Seistan).

1932. *Schizopygopsis stoliczkae* : Berg (in part), *Poiss. des Eaux Douces de la U.R.S.S.*, (3rd ed.) pl. i, p. 473.

1935. *Schizopygopsis stoliczkae* : Hora & Mukerji, in Visser's Karakorum, i, p. 434, pl. iii, figs. 1-4.

1936. *Schizopygopsis stoliczkae* : Mukerji, *Mem. Conn. Acad. Sci. Letters*, 10, p. 351.

1946. *Schizopygopsis* sp. : Ahmad, *J. Asiat. Soc. Bengal, Sci.*, 11(2), p. 119.

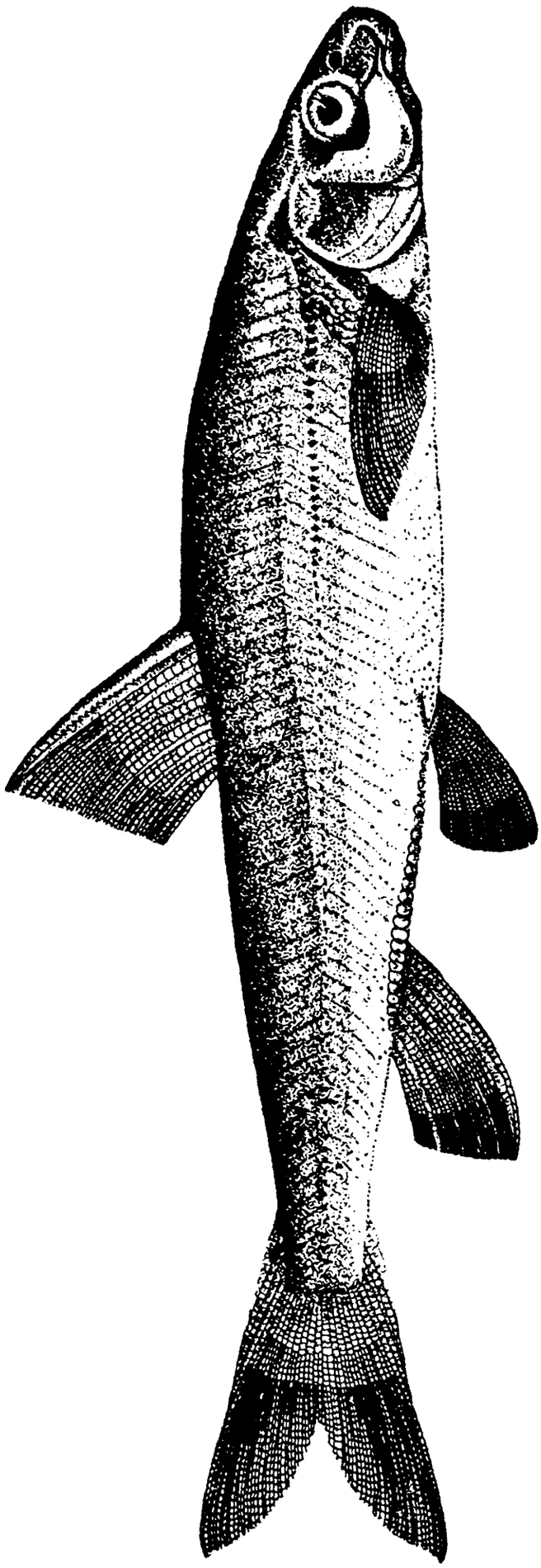


Fig. 29. Lateral view of *Schizopygopsis stoliczkae* Steindachner

B. III, D. II/8, P. 1/18, V. II/9-10, A. II/5, C. 19.

The body is stream-lined with both the dorsal and the ventral profiles slightly arched. The length of head is contained 4.75-5.75 (5.26) times in the total length and 3.61-4.79 (4.13) times in standard length. The height of head is equal to length of head excluding the snout and is contained 6.0-6.95 (6-42) times in standard length

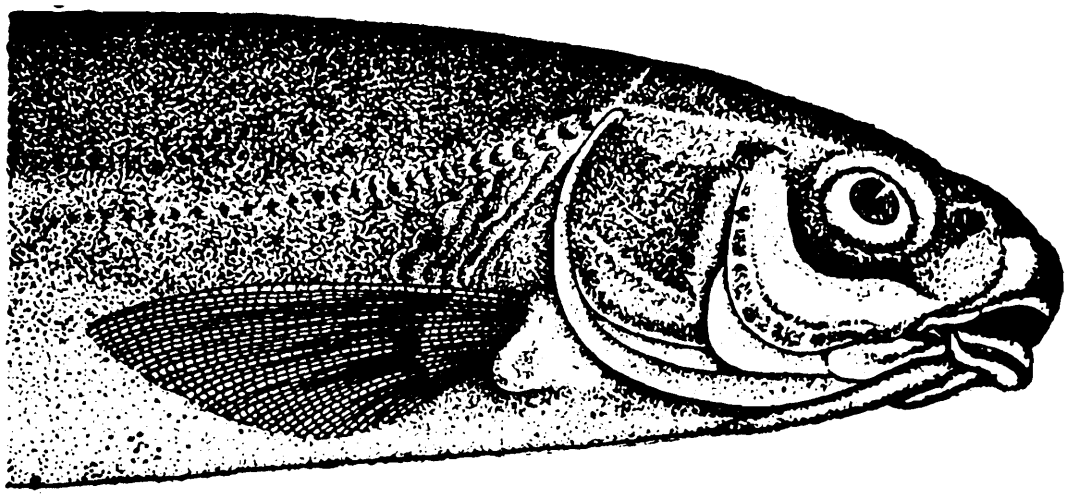


Fig. 30. Lateral view of head and anterior part of body of *Schizopygopsis stoliczkae* Steindachner

and 1.28-1.74 (1.52) times in length of head. The width of head is equal to length of head behind the middle of eyes and is contained 7.09-8.00 (7.63) times is standard length and 1.6-2.03 (1.85) times in length of head. The width of head lies 0.75-0.92 (0.82) times in its height. The postocular part of head goes 1.83-2.23 (2.04) times in the length of head. The whole or a major part of the eye is situated in the anterior half of head. It has a free orbital margin and a small portion of the adipose lid covers only a ventral fringe of the eye ball. The diameter of eye is contained 3.5-5.8 (4.43) times in length of head, 1.0-1.72 (1.33) times in length of snout and 1.14-2.35 (1.45) times in interorbital width. The interorbital width is contained 2.46-3.80 (3.12) times in length of head and 0.8-1.12 (0.91) times in length of snout. The interorbital width is slightly convex. The nostrils lie much nearer the eye than the tip of the snout. The interorbital distance is almost equal to half the interorbital width. The snout is pointed and slightly overhangs

the upper lip. There is a trace of a small lateral lobe. The snout length is contained 12.85-14.88 (13.68) times in standard length, 2.93-3.63 (3.32) times in length of head and 1.5-1.73 (1.6) times in postocular length of head. The mouth is inferior and is overhung by the snout. The posterior extremity of the maxilla reaches to below the front edge of the eye. The lower jaw bears an ochre coloured sharp horny edge which is exposed. The width of the gape of the mouth is contained 14.0-16.0 (14.77) times in standard length, 3.1-4.28 (3.64) times in length of head and 1.0-1.2 (1.09) times in length of snout. The barbels are wanting. The gill clefts are wide and the isthmus is narrow ; the width of the isthmus is contained 27.0-33.76 (29.58) times in standard length and 6.87-8.0 (7.28) times in length of head.

The depth of the body is equal to the length of head without the prenarial part and is contained 4.11-6.11 (5.48) times in standard length and 1.12-1.55 (1.32) times in length of head. The width of body is contained 7.0-8.0 (7.55) times in standard length, 1.5-2.01 (1.83) times in length of head and 1.21-1.53 (1.38) times in depth of body.

The lateral line is prominent, complete and very slightly curved downwards. There are only 6-7 rows of scales in the pectoral region and a few more along the lateral line ; the rest of the body is devoid of scales. The rows of enlarged scales in the anal region are, of course, present. The width of the enlarged anal scale is contained 3.0-4.0 (3.49) times in the diameter of eye. There are 18-22 enlarged scales along the anal sheath. The row of enlarged scales extends forward upto the base of pelvic fin and even beyond. The scales of the anal sheath extend-backwards up to base of the 4th branched ray of the anal fin and there are 8 scales along the base of the fin. Anteriorly, there are 15 scales in a series and those of the opposite sides meet each other at bases of the pelvic fins and extend further anterior to the base of the pelvic fins by 3-4 scales.

The origin of the dorsal fin lies somewhat nearer the tip of snout than the base of the caudal fin. The upper edge of the dorsal fin is straight and oblique and its last undivided ray is osseous and finely serrated. The height of the dorsal fin is contained 4.8-5.95 (5.20) times in standard length and 1.05-1.38 (1.23) times

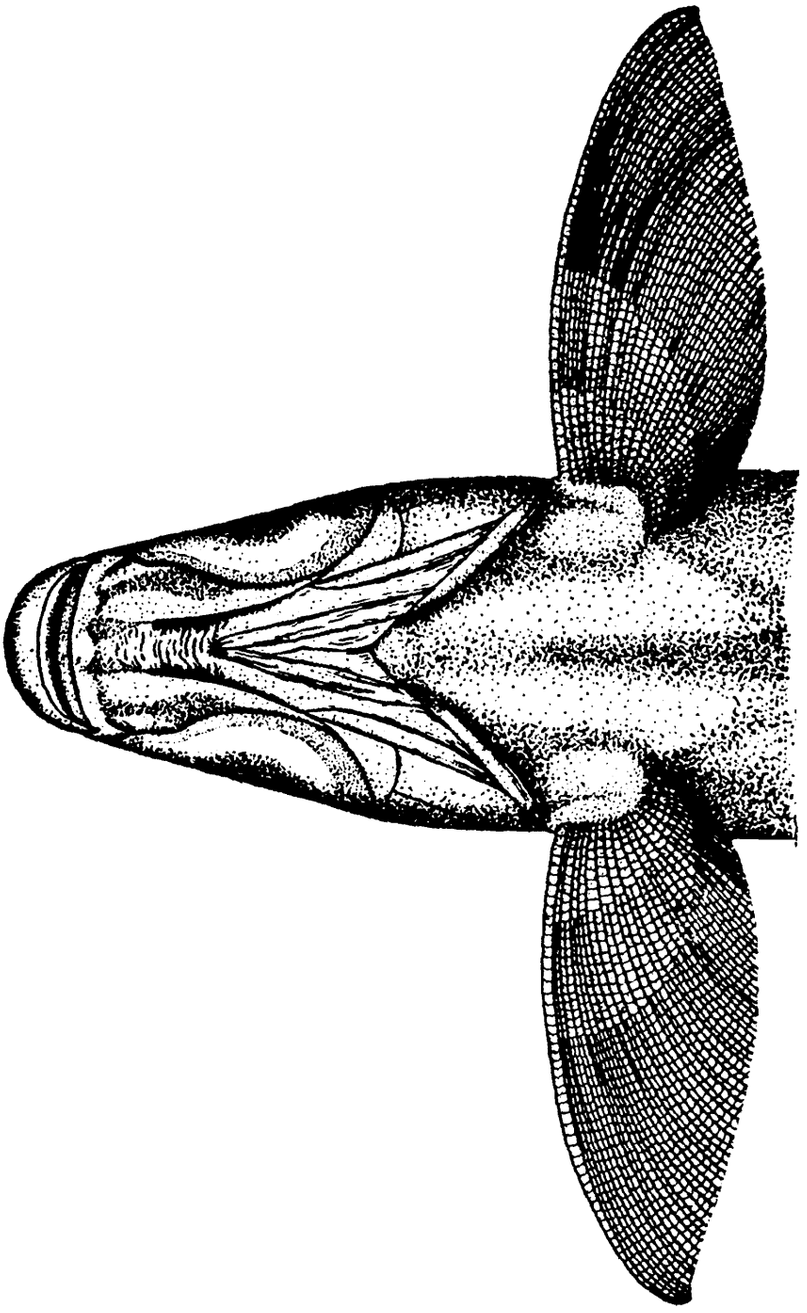


Fig. 31. Ventral view of head and anterior part of body of *Schizopygopsis stoliczkae* Steindachner

in length of head. The length of the base of dorsal is contained 7.05-8.0 (7.53) times in standard length, and 1.5-2.21 (1.81) times in length of head. The length of the base of anal fin is contained 1.4-1.7 (1.54) times in the length of base of dorsal fin. The pectoral fin is smaller than the head and reaches more than half way to the base of pelvic fin. The length of the pelvic fin is contained 5.05-5.96 (5.42) times in standard length, 1.12-1.54 (1.30) times in length of head and 1.3-1.84 (1.46) times in the distance between the bases of

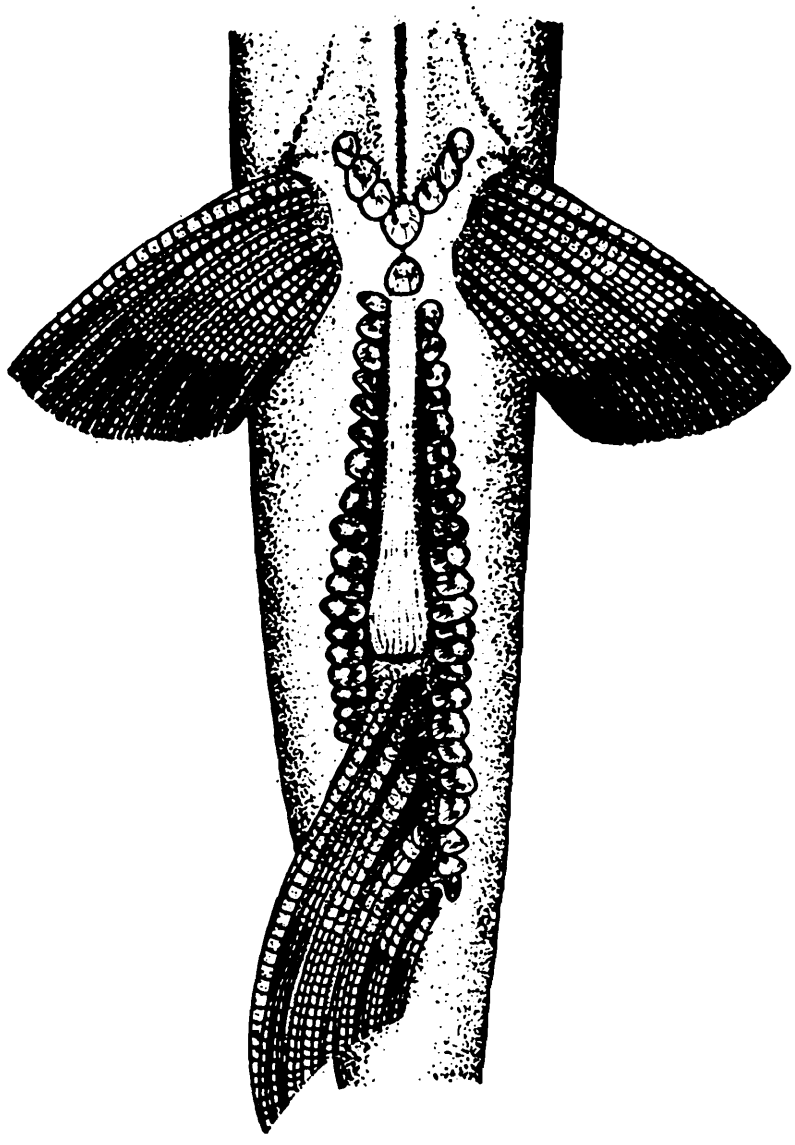


Fig. 32. Ventral view of pelvic and anal regions of *Schizopygopsis stoliczkae* Steindachner

the pectoral and the pelvic fins. The pelvic fin arises below the middle of the dorsal fin. The length of the pelvic fin is contained 6.08-6.88 (6.56) times in standard length, 1.36-1.8 (1.58) times in length of head and 1.64-2.08 (1.85) times in the distance between the bases of the pelvic and anal fins. The anal fin, when laid flat, does

not reach the base of caudal fin. The length of anal fin is contained 5.0-5.82 (5.46) times in standard length and 1.15-1.50 (1.30) times in length of head. The length of the base of anal fin is contained 11.06-12.00 (11.24) times in standard length and 2.43-3.11 (2.76) times in head length. The caudal fin is deeply forked and its length is contained 4.57-4.95 (4.78) times in standard length and 1.03-1.17 (1.09) times in length of head. The caudal peduncle is low and its height goes 1.90-2.26 (2.08) times in its length. The length of the caudal peduncle is contained 5.0-5.94 (5.53) times in standard length and 1.1-1.53 (1.34) times in length of head. The least height of the caudal peduncle is contained 11.0-12.0 (11.62) times in standard length and 2.36-3.20 (2.80) times in length of head.

The distance between tip of snout to origin of dorsal fin is contained 1.86-2.05 (1.96) times, the distance between tip of the snout and base of anal fin 1.22-1.43 (1.33) times, the distance between tip of snout and base of pelvic fin 1.7-1.89 (1.77) times, the distance between tip of snout to base of pectoral fin 3.37-4.60 (3.94) times, the postocular part of head 8.0-9.0 (8.4) times, the distance between bases of pectoral and pelvic fins 3.01-3.77 (3.24) times, the distance between bases of pelvic and anal fins 3.17-3.92 (3.43) times and distance between bases of anal and caudal fins 3.49-4.0 (3.67) times in standard length of body.

Colouration :

Olive gray on the back, becomes lighter on side and beneath. In old collections as well as in freshly preserved ones, there are no blackish spots on the body.

Size :

Grows to a size more than 34 cms. in total length.

Distribution :

Higher reaches of River Sutlej (dist. Kinnaur, H. P.), Indus river at Leh (Ladakh) ; tributaries of Yarkand and Oxus rivers. (fig. 33).

Remarks :

Annandale and Hora (1920) found in Seistan (Helmand River) specimens that there is a regular double row of large scales extending forwards in continuity with the anal sheath as far as the base of the ventral fins. Traces of similar forward extension of the sheath are, however, to be found in certain specimens from high altitudes in the large collections from various localities preserved in the Indian Museum. In the materials from Indus and Sutlej rivers, the double row of scales in the anal sheath is not a regular feature.

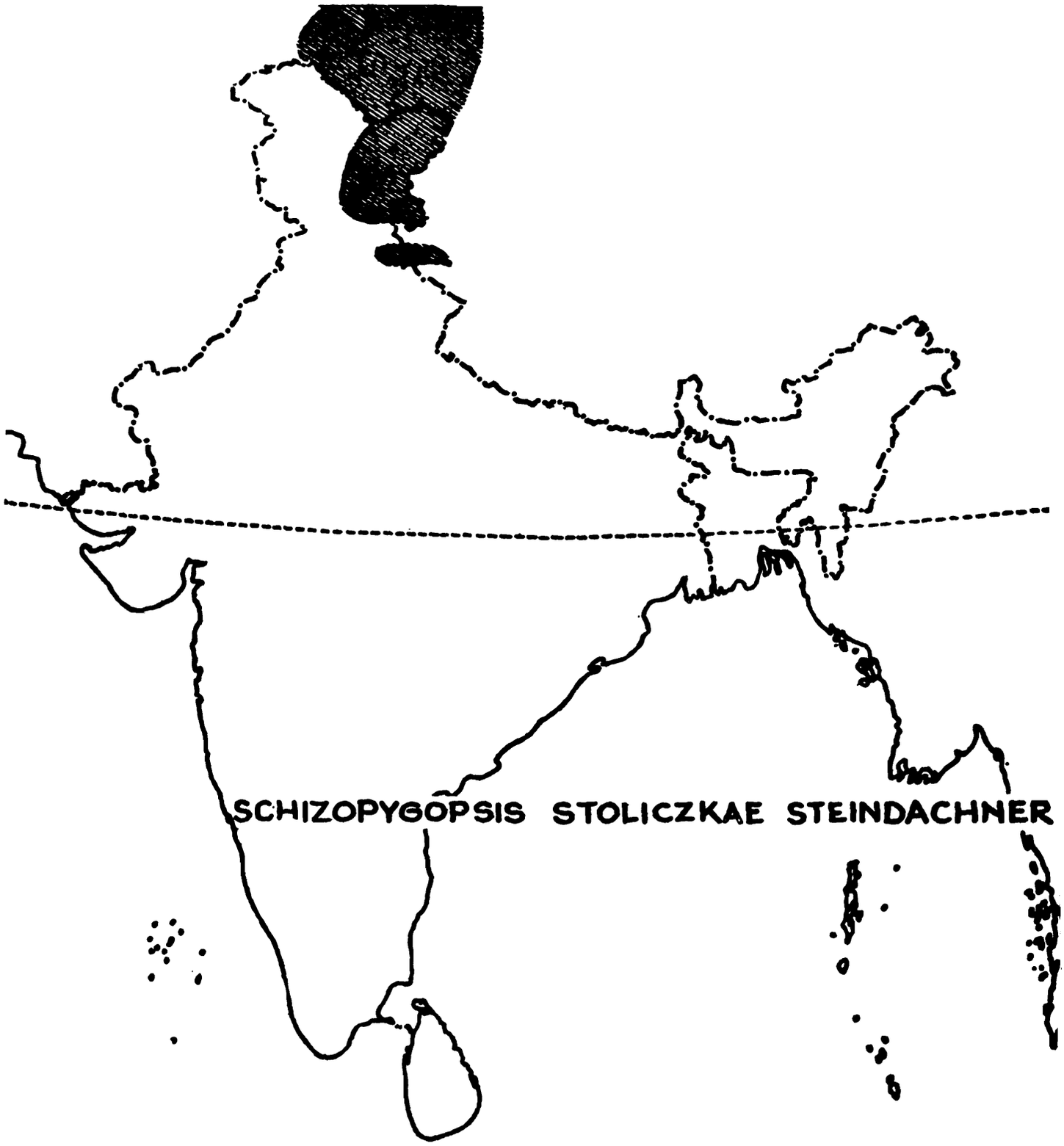


Fig. 33. Map showing the distribution of *Schizopygopsis stoliczkae* Steindachner

Apart from extending upto the base of pelvic fin, the rows of enlarged scales tend to run further to meet each other at the space between the bases of the pelvic fins and extend further anteriad and ultimately each row ending in a patch of 3-4 scales before the pelvic base.

MATERIAL EXAMINED

Regd. No.	Locality	Collector	Date of collection	No. of exs.	Remarks
652	Oxus river	Purchased from F. Day	—	1 ex.	Poor state of preservation.
653	Oxus river	Purchased F. Day	—	1 ex.	
651	Oxus river	Purchased from F. Day	—	1 ex.	Poor state of preservation.
655	,,	,,	—	,,	,,
639	Aktaash	,,	—	,,	,,
1086	?	,,	—	2 exs.	Poor, Original of pl. CXXIV, fig. 2. of Day (1877).
1482	Tankse	,,	—	1 ex.	Partly damaged.
F. 1190/1	Seistan Helmad River	Col. A. H. Macmohan, Seistan Boundary Commission	—	5 exs.	
F. 1194/1	,,	,,	—		
F. 1196/1	,,	,,		16 exs.	
1211/1	,,	,,			
F. 11366/1	Netherland Karakoram Expedition	—	—	16 exs.	
F. 11367/1	Nungstet, Nubra Valley, Alt. 3800 mts.	J. A. Sillem	4.7.1928	9 exs.	
F. 11368/1	Gonpa, Nubra Valley, Alt. 3700 mts.	,,	1.7.1929	5 exs.	

Regd. No.	Locality	Collector	Date of collection	No. of exs.	Remarks
F. 11369/1	Suget Karaual (Karakash River Alt. 3600 mts.)	J. A. Sillem	23-26.ix. 1929	5 exs.	
F. 11370/1	Alenazar Kurghan (Karakash Valley, 3000 mts.)	,,	28.5.1930		
F. 2570/1	Tengma Sang Chumbi Valley	Cap. F. H. Stewart	—	3 exs.	Partly damaged.
2572/1	,,	,,	—	1 ex.	
F. 5245/1	Gyan-Tse	,,	—	1 ex.	
F. 5246/1	Gyan-Tse, Tibet	Capt. F. H. Stewart			
F. 5329/1	Ladakh	Mus. Coll. A.S.B.		1 ex.	
	Sutlej River	R. Tilak	1976		
	,,	,,	,,		
	,,	,,	,,		
F. F. 1067	Chushul, Ladakh ca 4358 m.	Dr. B. Biswas	6.7.1976	1 ex.	
F. 10826/1	Scardu	Dr. Vinciguera		1 ex.	
2866-68/1	Tributary of Nyangchurt (Kangra)			11 exs.	
1516	Balachi	Purchased F. Day		1 ex.	
636	Leh Indus	,,			
624, 627, 640, 2855/1, 2856/1, 2864/1, 2865/1, 5191/2 to 5194/1				11 exs.	

Regd. No.	Locality	Collector	Date of collection	No. of exs.	Remarks
14139 & 14440	River Aksu Little Pamir	A. Alcock Pamir Boundary Commission		2 exs.	
14147 to 14149	,, 13200 ft.	,,		3 exs.	
664	Punja-Oxus.	Purchased F. Day		1 ex.	
2853/1	Lingma Thang	Capt. R. S. Kennedy			
5245/1	Gyang-Tse.	Capt. F. H. Stewart		7 exs.	
5246/1	,,	,,			

Genus : **Diptychus** Steindachner

1866. *Diptychus* Steindachner, *Verh. zool.-bot. Ges. Wien*, XVI : 787 (Type-species : *Diptychus maculatus* Steindachner).
1868. *Diptychus* : Günther, *Cat. Fish. Brit. Mus.*, VII : 171.
1877. *Diptychus* : Day, *Fishes of India* : 534.
1964. *Diptychus* : Tsao (in part) In Wu et al., *Cyprinid Fishes of China*, Schizothoracinae : 169.

Characteristic Features :

The body is elongated and subcylindrical. The abdomen rounded and snout obtuse. Mouth inferior and transverse. Lower jaw with a sharp horny covering. The lower labial fold interrupted across the mandible. A pair of maxillary barbels only present. The pharyngeal teeth spoon-shaped, compressed, biseriate (4-3/3-4). Gill openings narrow. The origin of dorsal fin lies anterior to that of the ventral. The dorsal fin possesses no bony ray. Anal fin short, with 5 branched rays. Caudal fin forked. Body covered with small scales on upper 2/3rd of the lateral sides, on pectoral region and sides of tail. A scaly sheath of enlarged scales present along the anal opening and anal base. Lateral line continuous and runs to the centre of base of caudal fin.

Distribution :

Jammu and Kashmir, Himachal Pradesh ; Tibet, Nepal and Yarkand river.

There is only one species of this genus represented in Indian waters.

Relationships :

This genus resembles all other Schizothoracine genera in the possession of an anal sheath bearing tiled row of enlarged scales but differs in having the pharyngeal teeth in two rows (4-3/3-4). Dorsal spine smooth. Only two maxillary barbels present.

Berg (1914) and Tsao (1964) included *Ptychobarbus* Steindachner and *Gymnodiptychus* Herzenstein as subgenera under the genus *Diptychus*. In view of the differences among these genera in the structure of the mouth, the lower jaw and squammation etc., which have been considered here as of generic importance ; they are treated in the present study as independent genera.

Diptychus maculatus Steindachner

(Figs. 34-37)

1866. *Diptychus maculatus* : Steindachner, *Verh. zool.-bot. Ges. Wien.*, XVI, p. 788, pl. 13, fig. 5. (Type-locality : Tibet, 12000 ft.).

1868. *Diptychus maculatus* : Günther, *Cat. Fish. Brit. Mus.*, VII, p. 171 (Distribution).

1879. *Diptychus maculatus* : Day, *Faun. Brit. India, Fishes* I, p. 255, fig. 92. (Distribution).

1876. *Diptychus maculatus* : Day, *Proc. Zool. Soc. London*, p. 792. (Distribution).

1878. *Diptychus maculatus* : Day, *Fish. India*, p. 534, pl. cxxiv, fig. 3 (Distribution).

1910. *Diptychus maculatus* : Zugmayer, *Zool. Jahrb.*, 19, p. 292.

1914. *Diptychus maculatus* : Berg, *Faune de la Russie, Poissons*, III, p. 677, figs. 133-135 (Distribution).

1916. *Diptychus maculatus* : Berg, *Poiss. des. Eaux. Douces de la Russie*, p. 286. (Distribution).

1916. *Diptychus maculatus* : Vinciguerra. *Ann. Mus. Civ. Stor. Nat. Genova*, Ser. 3a, 7(47), p. 145. (Central Asia).

1931. *Diptychus maculatus* : Berg. *Zool. Anz.*, xcvi, p. 371.

1932. *Diptychus maculatus* : Berg, *Poiss. des Eaux. Douces des l'U.R.S.S.* (3rd ed.) : Part I, p. 466.

1935. *Diptychus maculatus* : Hora & Mukerji, *Wiss Eergeb. Niederl. Exped. Karakorum*, I, p. 435. (Distribution)

1936. *Diptychus maculatus* : Mukerji, *Mem. Conn. Acad. Sci.* and *Arts*, X, p. 354.

1976. *Diptychus maculatus* : Tilak, *Newsl. zool. Surv. India*, 2(3) : 115-116.

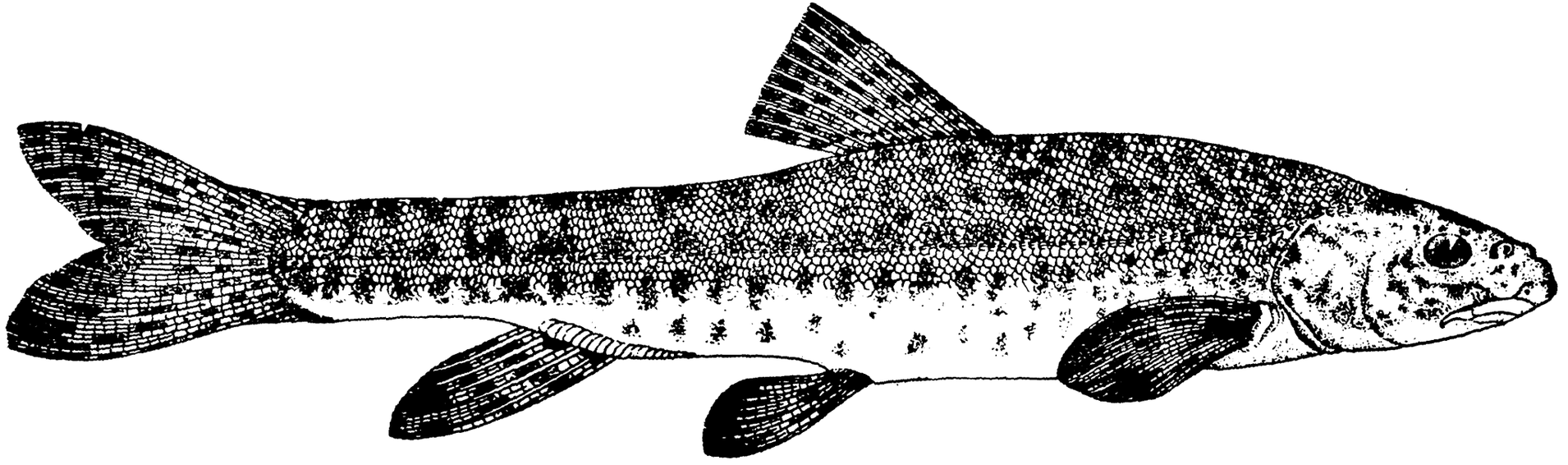


Fig. 34. Lateral view of *Diptychus maculatus* Steindachner

B. III, D. II-III/8-9, P. 1/78, V. II/8, A. 2/5, C. 19. Lat. l. 80-97 (85) (92 perforated and one unperforated in Ladakh material)

Both the profiles of the body are uniformly arched, the deepest part of the body being just in front of the dorsal fin. The length of head is contained from 5.40-5, 65 (5.54) times in total length and 4.08—4.92 (4.45) times in standard length. The height of head is contained 6.22-7.45 (6.88) times and the width of head 6.64-9.00 (7.96) times in standard length. The width of head is contained 1.42-2.08 (1.78) times and height of head 1.41-1.66 (1.54) times in length of head. The width of head lies 0.80-1.07 (0.91) times is its height. The eyes have a free orbital margin and lie entirely in the anterior half of the head. The diameter of the eye is contained 4.00 to 6.66 (5.82) times in the length of the head. The intra-orbital width is contained 3.00-3.56 (3.25) times in the length of head and 1.00 to 1.25 (1.12) times in the length of snout. The eye diameter is contained 1.33 to 2.33 (2.13) times in the length of snout and 1.16 to 2.08 (1.78) times in the inter-orbital width. The nostrils are situated much nearer the front edge of the eye. The length of the snout is contained 1.29 to 1.5 (1.39) times in the postocular length of the head, 2.67 to 3.12 (2.89) times in the length of head and 12.00 to 13.8 (12.95) times in the standard length. The mouth is inferior, transverse and arched. The lower jaw is provided with a sharp horny covering which is visible from the ventral side. The width of mouth is contained 3.00 to 3.63 (3.30) times in the length of head, 1.06 to 1.22 (1.13) times in the length of snout and 13.6 to 15.68 (14.70) times in the standard length.

The lips are fleshy and smooth. The lower labial fold is interrupted in the middle, There is one pair of small maxillary pair of barbels which are nearly equal to the diameter of the eye in length. The gill clefts are wide and isthmus is narrow. The snout tip overhangs the upper lip and forms a lateral lobe. The width of isthmus is contained 6.00 to 7.00 (6.47) times in the length of head.

The depth of the body is contained 1.17-1.60 (1.36) times in the length of head, and 5.52 to 6.73 (6.08) times in the standard length. The width of the body is contained 1.92 to 2.50 (2.21) times in the length of head, 9.37 to 10.91 (10.02) times in the standard length and 1.45-1.8 (1.71) times in the height of the body.

The lateral line is complete and ends at the middle of the base of the caudal fin ; it is slightly curved. The scalss are minute and scattered along the upper two third part of the body. The tiled row of scales, borne on a sheath running on either side of the anal region is bigger than those of the rest of the body. The height of the enlarged anal scale is contained 3.00-3.75 (3.49) times in the diameter of the eye. There are 18-20 scales along the anal sheath.

Other than the tiled row of anal scales, the scales of the body are the largest along the lateral line. Above and below the lateral line, the scales gradually thin out in distribution and reduce in size. They are completely absent on the ventrolateral and the ventral aspects of the body. They are thinly distributed in the predorsal part of body, while the middorsal aspect of the postdorsal part of body is without scales. There are not more than 14 rows of scales between the lateral line and base of dorsal fin.

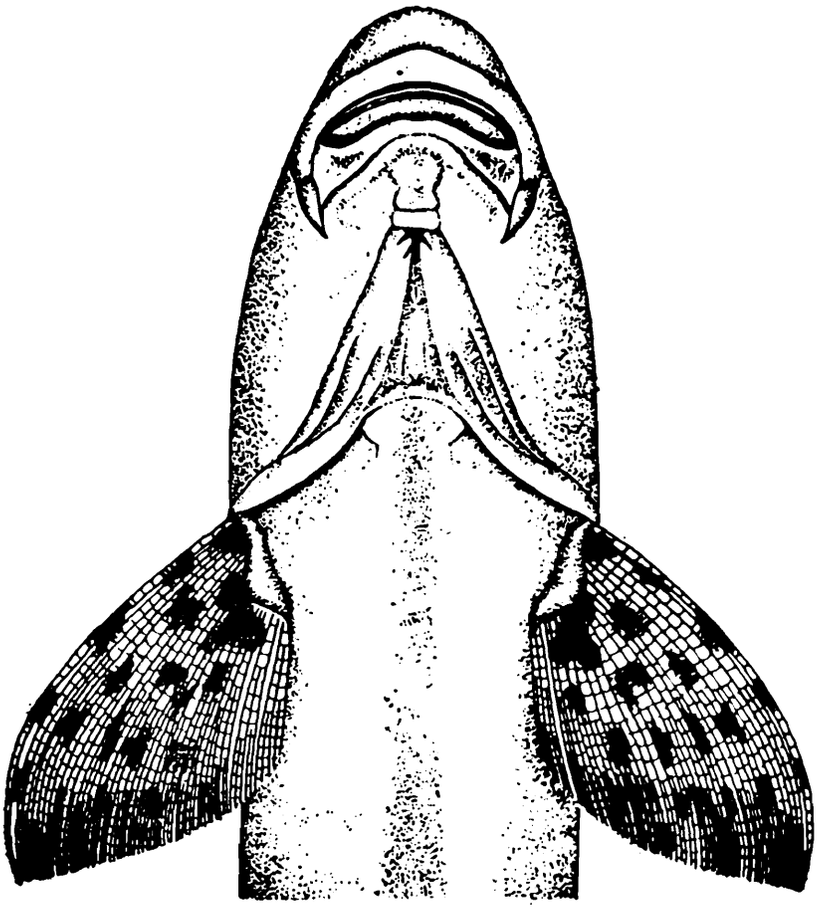


Fig. 35. Ventral view of head and anterior part of body of *Diptychus maculatus* Steindachner

The origin of the dorsal fin lies much anterior to that of the pelvic fin and nearer the snout than the base of the caudal. It is nearly as high as the body below it. The height of the dorsal fin is contained 1.17 to 1.70 (1.31) times in the length of head and 5.1 to 7.12 (5.94) times in the standard length. The length of the base of the dorsal fin is contained 6.57-7.50 (7.12) times in the standard length, 1.33 to 1.81 (1.60) times in the head length and 1.62-1.87 (1.82) times in the length of anal base. The last undivided ray of dorsal fin is articulated.

The length of the pectoral fin is much less than the length of the head. The length of the pectoral fin is contained 5.4 to 6.41 (5.53) times in standard length and 1.11 to 1.38 (1.23) times in the length of head. The pectoral is separated from the ventral by a distance nearly equal to its own length. The length of the pectoral fin is contained 1.57 to 2.09 (1.76) times in the distance between the bases of the pectoral and the pelvic fins.

The origin of the pelvic fin lies below the last ray of the dorsal fin. The length of the pelvic fin is contained 6.03 to 6.96 (6.47) times in the standard length and 1.31 to 1.66 (1.45) times in the length of head. The pelvics do not reach the anal opening. The

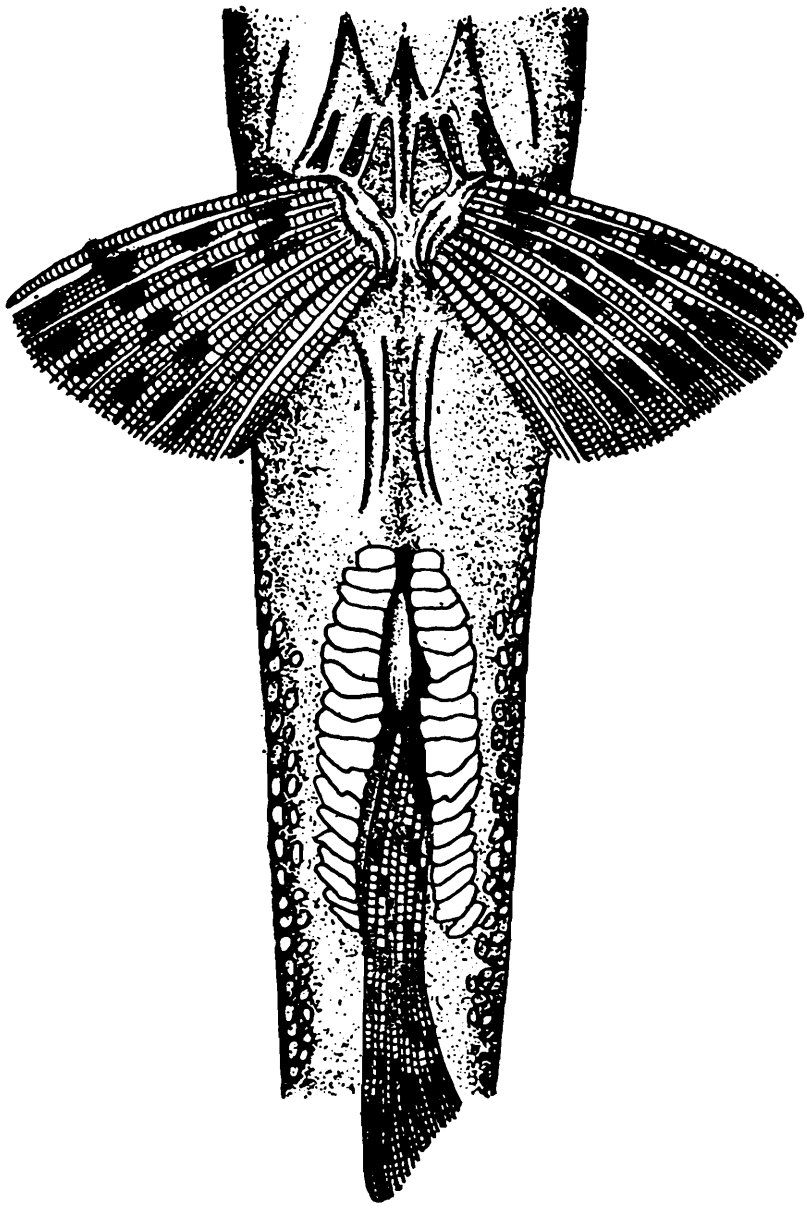


Fig. 36. Ventral view of pelvic and anal regions of body of *Diptychs maculatus* Steindachner

length of the pelvic fin lies 1.72 to 2.10 (1.90) times in the distance between the bases of the pelvic and anal fins.

The anal fin's length is not quite as much as the pectoral fin and is contained 4.85 to 5.15 (4.98) times in the standard length and 1.03 to 11.22 (1.09) times in the length of head. The length of the base of the anal is contained 11.9 to 12.92 (12.40) times in the length of head. When laid flat, the anal does not reach the base of caudal. The anal opening is situated just before the origin of the anal fin. The length of the anal fin is contained 1.26 to 1.50 (1.33) times in the distance between the bases of the anal and caudal fins.

The length of caudal fin is contained 1.05 to 1.22 (1.11) times in the length of head. The caudal fin is deeply forked. The height of the caudal peduncle is contained 2.00 to 2.40 (2.17) times in its length. The length of the caudal peduncle is contained 4.94 to 5.94 (5.33) times in the standard length and height of the caudal peduncle 11.15 – 11.90 (11.53) times in the standard length. The height of the caudal peduncle is contained 2.33 to 2.85 (2.60) times and length of the caudal peduncle 1.01 to 1.40 (1.27) times in the length of head.

The predorsal distance is contained 2.00 to 2.5 (2.21) times, preanal distance from 1.27 to 1.42 (1.33) times, preventral distance from 1.70 to 1.95 (1.81) times and prepectoral distance from 3.92 to 4.63 (4.26) times in the standard length. The postocular length of the head is contained 9.00 to 9.56 (9.27) times, the distance between the pectoral base to ventral base from 3.00 to 3.29 (3.11) times, the distance between the ventral base to anal base from 3.10 to 3.58 (3.39) times and the distance between origin of anal to caudal base from 3.50 to 4.01 (3.74) times in the standard length.

Colouration :

The back is dark with a bluish tinge. The lower half of the body and the ventral side are yellowish. Often, there is a narrow dull band along the lateral line.

The dorsal and the caudal fins are dusky while the pectoral, pelvic and anal fins are yellowish.

In the material from Ladakh, the back and sides of body are covered with bluish blotches which are larger below the lateral line. There is a yellowish band stretching between the angle of the pectoral fin to the lower half of the base of the caudal fin. All the fins bear rows of bluish spots throughout their length. The dorsal side of the head up to tip of snout and stretches along infra-orbital series bears bluish spots. The ventral side of head and belly are yellowish.

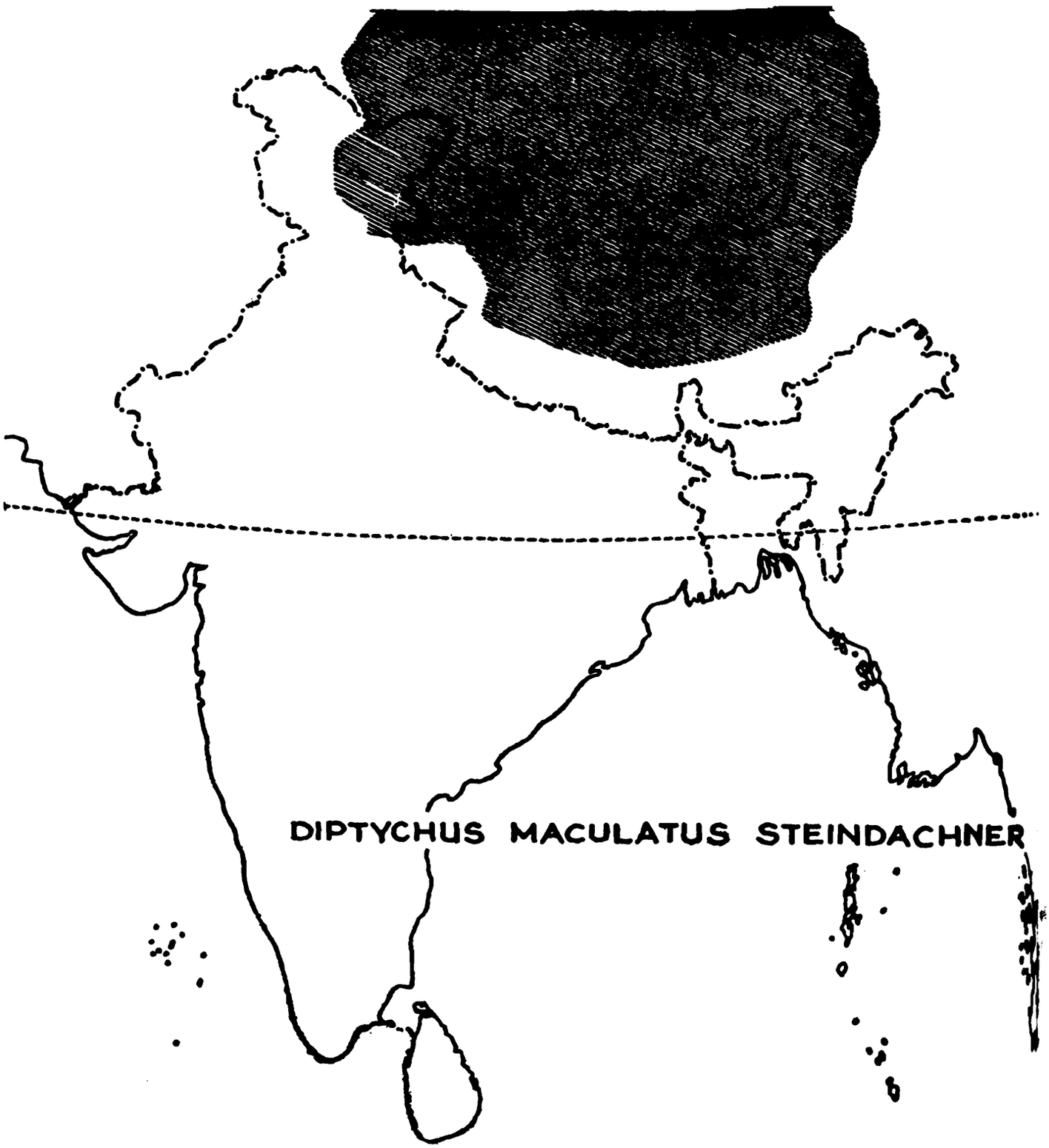


Fig. 37. Map showing the distribution of *Diptychus maculatus* Steindachner

Distribution :

River Indus and its tributaries in Ladakh, Chandra-Bhaga river in Lahaul and Spiti valley, Himachal Pradesh, tributaries of Yarkand river, Tarim river, Tibet and Nepal (fig. 37).

Remarks :

Day (1877) doubtfully synonymised *D. sewerzowi* Kessler with *D. maculatus* Steindachner. Vinciguerra (1916) studied the specimens of this species from Central Asia. He is of the opinion that *D. maculatus* Steindachner and *D. sewerzowi* Kessler are synonymous, their only point of difference lies in scalation. The monograph on *Diptychus* by Anikin (1906) is not available. According to him, *Diptychus annandalei* Regan could be accommodated in a different genus.

Mukerji (1931) explained the systematic position of *Diptychus annandalei* Regan by comparing it with the representatives of the genera *Diptychus*, *Schizothorax*, *Schizopygopsis*, *Schizocypris* and *Gymnodiptychus*. The presance of two pairs of barbels, pharyngeal teeth in 3 rows, denticulated dorsal spine, the general built and the shape of the mouth and lips, indicated that *D. annandalei* belonged to *Schizothorax*.

Mukerji (1931) was, however, not sure of the presence of scales in this specimen and because of this reason, he expressed the opinion that this species may be accommodated in a seperate genus intermediate between *Diptychus* and *Schizothorax*, if future workers find the absence of scales in this species as a uniform feature. The present author has examined the type specimen of *D. annandalei* under high power of the stereomicroscope and observed that very minute scales, embedded in a layer of mucus, are present on the body of the type specimen of *D. annandalei* Regan. This confirms the synonymy of *D. annandalei* with *Schizothorax richardsonii* (Gray).

MATERIAL EXAMINED

Regd. No.	Locality	Collector	No. of Exs.	Date of Collection	Remarks
528	Basgo	Purchased from F. Day	1	—	
533	,,	,,	1	—	
559	Leh Ladakh	,,	1	—	
577, 581	,, ,,	,,	2	—	
593	Pasroat (Forsyth's expedition, 1873-74).	F. stoliczka (Purchased from F. Day)	1	13.5.1874	

Regd. No.	Locality	Collector	No. of Exs.	Date of Collection	Remarks
599	Meema, Burma	Purchased from F. Day	1	—	
6000	,, ,,	,,	1	—	
608	Tankse or Tanktze	,,	1	—	
611	12 miles north of Sirikol	,,	1	—	
612	Basgo	,,	1	—	
614	Chiliscomo	,,	1	—	
617	,,	,,	1	—	
723	Kusba	,,	1	—	
1167	Basgo, 22 miles west of Leh	,,	1	—	
1482	Tankse	,,	1	—	
1513	,,	,,	1	—	
1535/1	Ladakh	Museum	1	—	
5340/1	,,	,,	1	—	
5344/1	,,	,,	1	—	
11371/1	Bodkharbu	Netherland Karakurum expedition	1	— 1929-30	
11373/1	Alenazar, Karakash valley	(Netherland expedition)	1	—	
—	Chandra river at Kokhsar, Lahaul & Spiti valley.	R. Tilak	3	1971	
—	Chandra-Bhage river	M. Chandra & Party,	1	1975	
—	Suru river near Andoo village, Kargil (Ladakh)	Dr. R. Tilak	32	4.9.77	
560, 569	Leh, Ladakh	Purchased, F. day	7		
566, 568	,, ,,	,,	2		
574, 572	,, ,,	,,	2		
584	,, ,,	,,	1		

Regd. No.	Locality	Collector	No. of Exs.	Date of Collection	Remarks
1480, 1481	Tanktze	,,	3		
1483	,,	,,			
1246, 1446	Chagra	,,	2		
1179	W. of Sirikol	,,	1		
582	Leh, Ladakh	,,	1		
11372/1	Leh	Netherland Kashmir Expedition		1929-30	
1181	W. of Sirikol	Purchased F. Day	1		
604	W. of Tarbastu	,,	1		
601, 610	Tanktze	,,			
605, 606	W. of Tarbastu	,,			
1163	Basgo, 22 miles W. of	,,			
5346/1	Ladakh				
53501/1, 5352/1	,,	Mus. collector A. S. B.	2		
594	Pusrohat	Purchased F. Day	1		
5335	Ladakh	Mus. collector			
1165	Basgo, 22 miles W. of Leh	Purchased F. Day	1		
5337/1, 5339/1, 5341/1, 5348/1, 5349/1, 5330/1, to 5333/1	Ladakh	Mus. collector A. S. B.	9		
5329/1	Ladakh	Mus. collector A. S. B.	1		
—	Junction of Suru & Drass rivers, Kargil (Ladakh)	Dr. R. Tilak	1	3.9.1977	
—	Dumkhar nullah (Khalse), Tribuchan & Drass nullahs, Drass (Ladakh)	Dr. R. Tilak	7	16.9.77	
		,,	4	18.9.77	

Genus : **Ptychobarbus** Steindachner

1866. *Ptychobarbus* Steindachner, *Verh. zool.-bot. Ges. Wien.* XVI : 789 (Type-species : *Ptychobarbus conirostris* Steindachner).
1868. *Ptychobarbus* : Günther, *Cat. Fish. Brit. Mus.*, VII : 169.
1877. *Ptychobarbus* : Day, *Fishes of India* : 533.

Characteristic Features :

Body elongated. Snout conical. Mouth inferior and arched. Abdomen rounded. Mouth overhung by the snout. Lower labial fold broad, uniterrupted. One pair of maxillary barbels only present. Pharyngeal teeth compressed, spoon-shaped and biseriate (4-3/3-4). Dorsal fin situated opposite the ventrals and possesses no bony ray. Anal fin short, with 5 branched rays. Caudal fin forked. Scales small all over the body and enlarged scales along the anal sheath. Lateral line continuous upto centre of base of caudal fin.

Distribution :

Jammu and Kashmir ; Tibet and Kashgar.

Relationships :

The genus is allied to *Schizothorax* but differs in the pharyngeal teeth being biserial, dorsal spine absent and arched mouth.

It is treated as a subgenus of *Diptychus* by Berg (1914) and Tsao (1964) but the same has not been found appropriate here. *Ptychobarbus* deserves a generic rank and not subgeneric.

5. **Ptychobarbus conirostris** Steindachner

1866. *Ptychobarbus conirostris* : Steindachner, *Verh. zool.-bot. Ges. Wien.*, XVI, p. 790, pl. 17, fig. 4. (Type-locality : Ladakh, 15,200 ft.).
1868. *Ptychobarbus conirostris* : Günther, *Cat. Fish. Brit. Mus.*, VII, p. 169. (Hanle, Tibet).
1876. *Ptychobarbus conirostris* : Day, *Proc. Zool. Soc. London*, p. 789 (Head waters of Indus, Henle (Ladakh) and Chiliscorus).
1878. *Ptychobarbus conirostris* : Day, *Sci. Res. 2nd Yarkand Miss., Ichthyology*, p. 7, pl. ii, fig. 3. (Head waters of Indus, Henle in Ladakh and Chiliscorus).
1878. *Ptychobarbus conirostris* : Day, *Fish. India*, p. 533. pl. cxxv, fig. 3. (Head waters of Indus and Tibet).
1889. *Ptychobarbus conirostris* : Day, *Faun. Brit. India, Fishes*, I, p. 254. (Head waters of Indus & Tibet).

1898. *Ptychobarbus conirostris* : Alcock, *Rep. Nat. Hist. Pamir Bound. Comm.*, p. 37, pl. 1, figs. 2-3. (Yasin River at 8500 ft.).

1910. *Ptychobarbus conirostris* : Zugmayer, *Zool. Jahrb, Abt. Syst.*, 29, pp. 291-292.

1935. *Ptychobarbus conirostris* : Hora and Mukerji, *Wiss. Eergeb. Niederl. Exped. Karakorum*, 1, p. 427, 436 (Gonpo, Nubra Valley, Ladakh).

1933. *Ptychobarbus conirostris* : Hora, *J. Bombay nat. Hist. Soc.*, 36(3), p. 695.

1936. *Ptychobarbus conirostris* : Mukerji, *Mem. Conn. Acad. Sci.*, X, pp. 356-359. (Kargil, Khalsi, Spitok and Yalapuk, Ladakh).

B. III, D. II/8, P. I/20-21, V. I/9, A. II-IV/5, C. 19 ; Lat. l. 92-96, Lat. tr. 23 ⅛/30½-34½

The body is somewhat laterally compressed with both the dorsal and ventral profiles equally arched. The length of head is contained 4.74-5.00 (4.9) times in total length, and 4.09-4.19 (4.11) times in standard length. The width of head is contained 8.08-8.16 (8.12) times and height of head 7.21-7.55 (7.38) times in standard length. The width of head is contained 1.94-2.0 (1.97) times and height of head 1.78-1.8 (1.79) times in length of head. The postocular length of head is equal to height of head. The width of head is contained 0.89-0.92 (69.05) times in its height.

The eyes are situated almost in the anterior half of the head. The eyes have a free orbital margin. The diameter of eye is contained 4.25-5.25 (4.52) times in length of head, 1.45-2.0 (1.48) times in length of snout and 1.25-1.31 (1.29) times in the interorbital width. The interorbital width is contained 3.42-3.67 (3.49) times in the length of head and 1.14 (1.14) times in length of snout. The length of snout is contained 12.58-12.62 (12.60) times in standard length, 3.0-3.12 (3.06) times in length of head and 1.54-1.56 (1.55) times in the postocular length of head. The snout is seporated from the upper lip. The tip of snout does not overhang the mouth and also forms no lateral lobe. The lips are thick. The lower labial fold is very broad, uninterrupted and with a cleft in the mediam line on the posterior side. The mouth is horse-shoe shaped. The upper jaw is somewhat longer than the lower jaw. The width of the chord of the mouth is contained 20.13-20.20 (20.16) times in snout length. The posterior edge of the maxilla reaches below front edge of the orbit. There is a pair of small barbels at the angle of the mouth ; they extend upto posterior edge of the preoperculum. In young examples, they are still smaller.

The gill cleft is wide and the isthmus is narrow. The width of the isthmus is contained 28.85-29.03 (28.94) times in standard length and 6.92-7.14 (7.03) times in length of head.

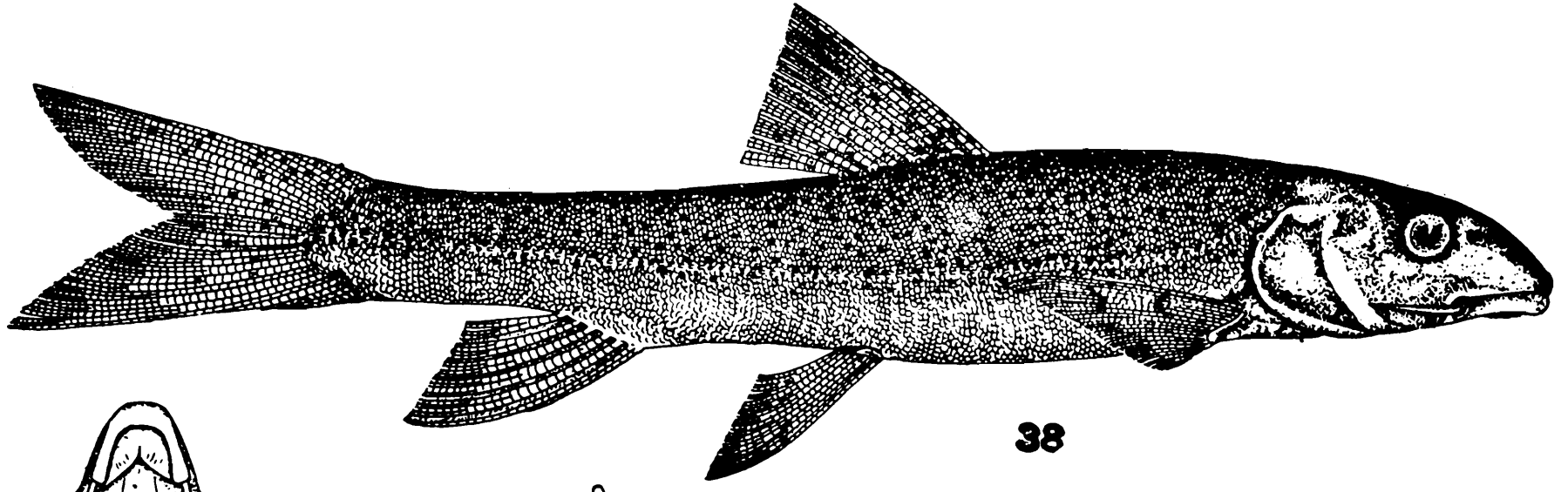
The depth of the body is contained 6.2-6.90 times in total length, 5.59-5.94 (5.81) times in standard length and 1.33-1.74 (1.40) times in length of head. The width of body is contained 9.15-9.18 (9.16) times in standard length, 2.18-2.27 (2.22) times in head length and 1.54-1.63 (1.58) times in height of the body.

The lateral line in continued to the centre of the base of the caudal fin. The scales of the tiled row are small and the width of the widest scale is contained 5.33-5.5 (5.44) times in diameter of eye. There are 19-20 scales on the anal sheath. The pharyngeal teeth are compressed and arranged in two rows (4-3/3-4).

The body is covered with small scales which are well formed and regularly arranged above the lateral line. Those below the lateral line become gradually reduced in size towards the abdomen. On the ventro-lateral aspects of the abdomen, the small and reduced scales are loosely scattered without any arrangement. Ultimately, on the mid-ventral aspect of the abdomen, the scales are completely absent. The scales around the caudal peduncle are, however, normal and number nearly 42. There are 22-23 scales between base of dorsal fin and the lateral line and 17-18 scales between it and the base of pelvic fin. The scales along the base of pelvic fin are somewhat bigger than those of the body but are smaller than the anal scales.

The dorsal fin is situated opposite the ventral and originates in advance of the ventrals and much nearer the snout than the base of the caudal fin. The last undivided ray of the dorsal fin is articulated and nonserrated. The height of the dorsal fin is equal to the depth of body below it. The length of the base of the dorsal fin is contained 8.16-8,41 (8.28) times in standard length and 1.94-2.08 (2.01) times in length of head. The pectoral length is contained 5.77-5.80 (5.78) times in standard length, 1.38-1.42 (1.40) times in length of the head, and 1,51-1.63 (1.51) times in distance between bases of pectoral and pelvic fins. The pelvic fin arises below the middle of the dorsal fin. The length of pelvic fin is contained 6.04-6.12 (6.08) times in standard length, 1.44-1.57 (1.47) times in length of head, and 1.84-1.94 (1.89) times in the distance between the bases of pelvic and anal fins. A well developed thick fleshy appendage is present in the axillae of the ventral fins.

The anal fin, when laid flat, falls slightly short of the base of the caudal fin. The length of the anal fin is contained 5.03-5.31 (5.16) times in standard length, 1.2-1.31 (1.25) times in head length and 1.28-1.36 (1.32) times in the distance between bases of the anal and the caudal fins. The length of the base of anal fin is contained 12.08-12.68 (12.35) times in standard length, 2.48-3.12 (2.88) times in head length, and 1.48-1.50 (1.49) times in length of base of dorsal fin. The height of caudal peduncle is contained 11.61-11.88 (11.74) times in standard length, 2.76-2.94 (2.85) times in head length and 2.0-2.11 (2.05) times in its own length, The length of the caudal



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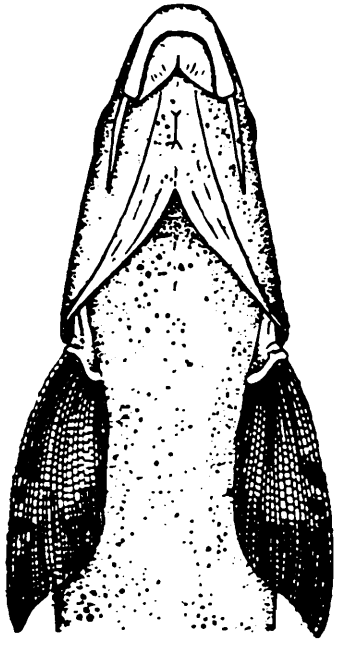

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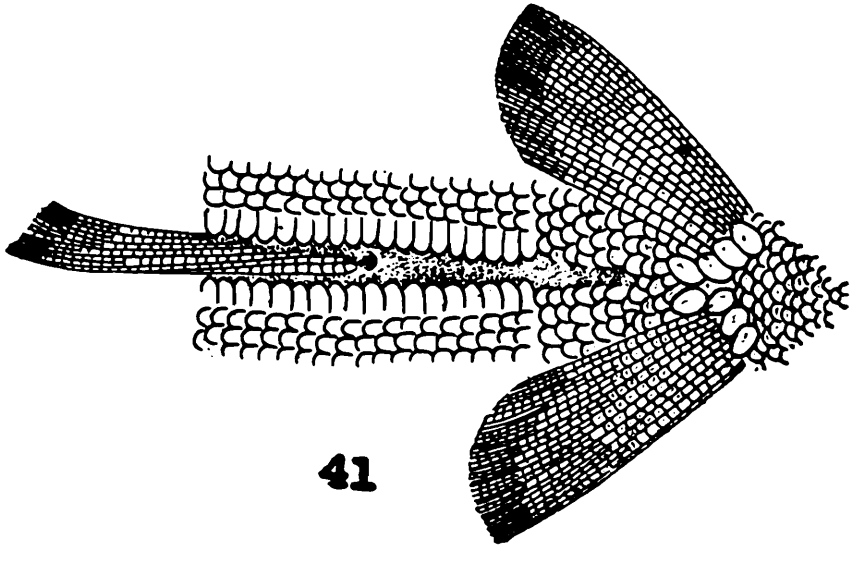

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Fig. 38. Lateral view of *Ptychobarbus conirostris* Steindachner : Fig. 39. Ventral view of head and anterior part of body of *Ptychobarbus conirostris* Steindachner : Fig. 40. Pharyngeal bone and teeth of *Ptychobarbus conirostris* Steindachner : Fig. 41. Ventral view of pelvic and anal regions of *Ptychobarbus conirostris* Steindachner

peduncle is contained 5.61-5.80 (5.70) times in standard length and 1.38 (1.38) times in length of head.

The distance between the tip of snout to origin of dorsal fin is contained 2.14-2.20 (2.17) times, the distance from tip of snout to origin of anal fin 1.27-1.32 (1.29) times, the distance from tip of snout to base of pelvic fin 1.86-1.90 (1.88) times, the distance from tip of snout to base of pelvic fin 1.86-1.90 (1.88) times, the distance from tip of snout to base of pectoral fin 3.88-4.08 (3.96) times, the postocular length of head 8.08-8.16 (8.12) times, the distance between the bases of pectoral and pelvic fins 3.55-3.8 times, the distance between the bases of pelvic and the anal fins 3.11-3.31 (3.21) times and the distance between bases of anal and caudal fins 3.68-3.92 (3.90) times in the standard length.

Swim bladder is elongated, with the posterior chamber much longer than the anterior (nearly 3.5-4 times longer than the anterior chamber). It is similar in shape to that of *Diptychus maculatus*. The pneumatic duct is connected with the gut. The alimentary canal is highly convoluted and its entire length is nearly 1.2-1.5 times the total length of the adult specimens. It feeds on slime, algae mixed with mud and sand, and insect larvae. It is a mixed feeder.

The colour of the body is silvery. The dorsal side of the head and body are dark. The scales on the upper half of the body have dark edges. In spirit preserved specimens, the fins are yellowish.

In freshly preserved specimens the upper surface of the head and the dorsal and lateral sides of the body bear star-shaped dark spots. All the fins are marked with similar dark spots.

Size :

It grows to nearly 30 cm in length.

Sexual Dimorphism :

Alcock (1898) and Mukeji (1936) have observed sexual dimorphism in this species. In the female examples, the upper lip is greatly broadened and thickened and the profile of the snout is conspicuously concave ; this is not so in the males.

Distribution :

Head waters of Indus rives in Ladakh. The fishes inhabit large, deep and rapid flowing rivers. (fig. 42).

Remarks :

Subsequent to the discovery of this species, a specimen of this species from Henle (Tibet) was studied by Günther (1868) who gave a concise description. While studying the fishes collected by

Yarkand Expedition, 1873, Day (1876) described three species *Ptychobarbus conirostris*, *P. laticeps* and *P. longiceps*, the last two being new species.

Tsao (1964) has accommodated *Ptychobarbus laticeps* Day and *P. longiceps* Day under *Aspiorhynchus* Kessler and has put *P. longiceps*, *A. przewalskii* Kessler and *A. sartus* Zugmayer in the synonymy of *P. laticeps*. The present author has no material of these species but does not quite agree with Tsao (1964) that *laticeps* and *longiceps* of Day are conspecific with *A. przewalskii* Kessler because the figures of *laticeps* (Day, 1878, pl. CXXV, (fig. 1) and *przewalskii* (Tsao, 1964, fig. 4.26) do not tally with each other. At the same time, this author is in agreement with Day (1876) and is of the opinion that these two species be accommodated in a new genus but this step would be justified only after a detailed study of long series of a freshly preserved material from the type locality.

Both *laticeps* and *longiceps* do not belong to the genus *Ptychobarbus*; a study of their type material and also probably fresh material from their type locality should decide their systematic position.

Alcock (1898) studied material of this species from Yasin river (8500 ft. Alt.) and observed that the diameter of eye is very small in comparison to size of head. In adult, the diameter of eye is contained 6.5 times in head length in male (10.5 inches long) and 7.5 times in female (13 inches long).

One young specimen (10.5 cm.) of this species, from the collection of the Netherland Karakoram Expedition, collected at Gompa in Nubra Valley, was studied by Hora and Mukerji (1935).

Mukerji (1936) studied 5 specimens of this species in the collection of the Yale North India Expedition, collected from Kargil, Khalsi, Spitok and Yalapuk (Suru & Indus rivers, Ladakh) and described sexual dimorphism in the species.

Berg (1914, Faune de la Russia, *poissons*, III, P. 677) regarded *Ptychobarbus* as a subgenus of *Diptychus* and differentiated it from other subgenera in the following way.

1. Lower jaw provided with sharp horny covering; body densely covered with scales above the lateral line..... *Diptychus* (S. Str.).
2. Lower jaw without sharp, horny covering.
   (a) Body almost naked; scales present along lateral line and base of pectoral fin..... *Gymnodiptychus.*
   (b) Body covered with scales..... *Ptychobarbus*

Mukerji (1936) did not agree with this treatment of Berg (1914) because in the character of the mouth, the lower jaw and

the squamation, *Diptychus* markedly differs from *Ptychobarbus*. *Ptychobarbus* has, therefore, been treated as a separate genus in this work.

MATERIAL EXAMINED

Regd. No.	Locality	Collector	Date of collection	No. of Exs.	Remarks
1515	Leh, Tibet	Purchased from F. Day	20.5.19	1	
F. 11374/1	Gompa, Nubra Valley Netherland Karakoram Expedition	J. A. Sillem	1929-30	1	
—	Khalse, river sind, (Ladakh, J. & K.)	Dr. R. Tilak	15.9.1977	20	
—	Sheh village, river sind, (Ladakh, J. & K.)	,,	10.9.1977	8	
—	Sheh village, river sind, (Ladakh, J. & K.)	,,	8.9.1977	8	
—	Sheh village, river sind, (Ladakh, J. & K.)	,,	8.9.1977	8	
—	Indus river, Chuglamsar, Ladakh	,,	11.9.1977	1	
—	Indus river, Sheh, Ladakh	,,	8.9.1977 10.9.1977 11.9.1977	9 5 2	

Genus : **Gymnocypris** Günther

1868. *Gymnocypris* Günther, *Cat. Fish. Brit. Mus.*, 7 : 169 (Type-species : *Gymnocypris dobula* Günther).

1891. *Gymnocypris* : Herzenstein, *Wiss, Res. Przewalski Central Asia Reis*, Zool. Theil, III (2) Fische, Lief. 3 : 234.

1964. *Gymnocypris* : Tsao (In Wu et al., *Cyp. Fish. China*, 1 : 178)

1964. *Gymnocypris* : Tchang et al., *Acta Zool. Sinica*, 16 : 139.

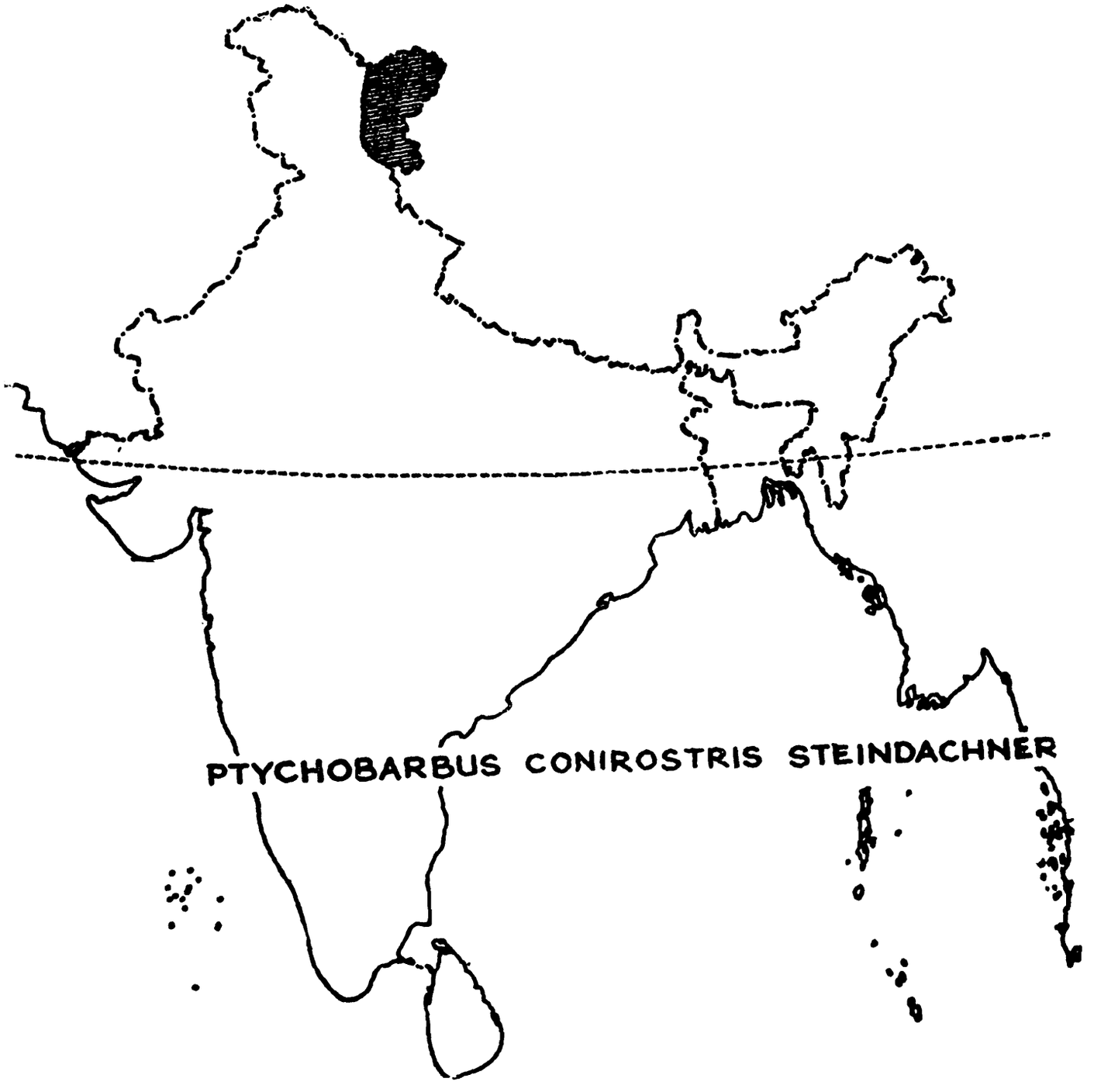


Fig. 42. Map showing the distribution of *Ptychobarbus conirostris* Steindachner

Characteristic Features :

Body long and compressed. Mouth opening large, terminal, slightly ventral. Lower jaw rounded with its inner edge with a horny covering. Lower labial fold interrupted. Barbels absent. Pharyngeal teeth biserial (3-4/4-3). Body scales absent except on anal and shoulder region. Dorsal spine strong and serrated behind.

Distribution :

Ladakh ; Tibet, Western China.

In India, there is only one species, *G. biswasi* Talwar, reported from Chusul, Ladakh (J. & K.).

Relationships :

This genus is very close to *Schizopygopsis* but differs from it in the character of mouth (as mentioned under *Schizopygopsis*).

Tsao (1964) has recognised two subgenera under this genus :

1. *Gymnocypris* (*Gymnocypris*) Günther
2. *Gymnocypris* (*Oxygymnocypris*) Tsao

G. (*Gymnocypris*) is a form with black peritoneum and the pelvic origin behind that of the dorsal fin while in *G.* (*Oxygymnocypris*), the peritoneum is greyish-white and the origin of the pelvic fin lies anterior to that of the dorsal fin. The latter subgenus has been created to accommodate *Schizopygopsis stewarti* Lloyd.

6. **Gymnocypris biswasi** Talwar

(Figs. 43-47)

1978. *Gymnocypris biswasi* Talwar, *J. Bombay nat. Hist. Soc.*, 74(3), p. 501, fig. 1 (Type-locality : Chusul, Ladakh).

B. III, D. III/7-8, P. I/18-19, V. II/9, A. III/5, C. 19. Lat. 1. upto 13 or 14 scales.

The body is elongated and slightly compressed. The length of head is contained 5.0-5.34 times in total length and 4.17-4.44 times in standard length. The width of head is contained 1.8 times in length of head and 8.06 times in standard length. The height of head is contained 0.84 times in its width, 1.52 times in length of head and 6.78-7.8 times in standard length. The postocular length of head is contained 2.03-2.07 times in length of head and 9.0-9.21 times in standard length. Mouth is terminal and transverse.

A horizontal line drawn from the tip of the snout towards the middle of the caudal base passes through the lower half of the eye ball while an oblique line connecting the tip of snout and the origin

of the dorsal fin crosses through upper part of the eye. The eyes are large, rounded and situated on dorsolateral sides of the head and have a free orbital margin. The diameter of eye is contained 3.85-3.86 times in length of head, 1.0-1.1 times in snout and 1.07-1.2 times in interorbital width. The interorbital space is flat.

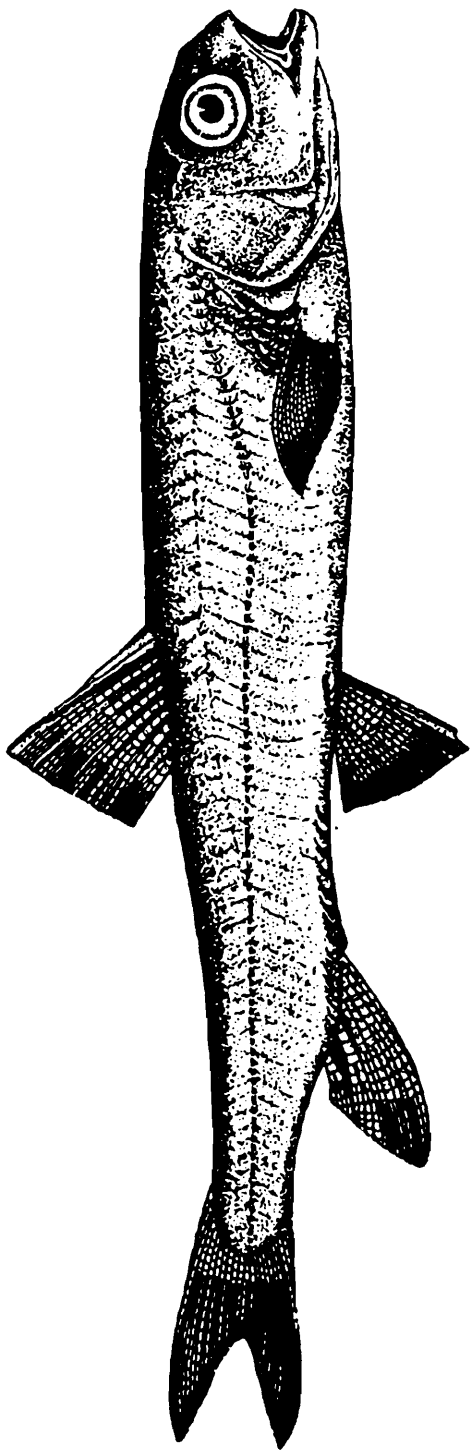


Fig. 43. Lateral view of *Gymnocypris biswasi* Talwar

The interorbital width is contained 3.22-3.6 times in length of head and 0.91-0.93 times in snout. The tip of snout is conical and lies above the level of lower edge of the eye.

The length of snout is contained 15.63-16.7 times in standard length, 3.85-4.64 times in head length and 1.69-1.85 times in the postocular length of head. The mouth is transverse.

The upper jaw is equal in length to the lower jaw. The margin of jaw is rounded and its inner edge is covered with a horny layer. The width of the chord of mouth is contained 16.12-18.0 times in standard length, 3.62-4.15 times in head length and 1.03-1.07 times in length of snout. The posterior edge of the maxilla reaches to a point vertically below anterior edge of eye. The lips are thin. The lower labial fold is interrupted.

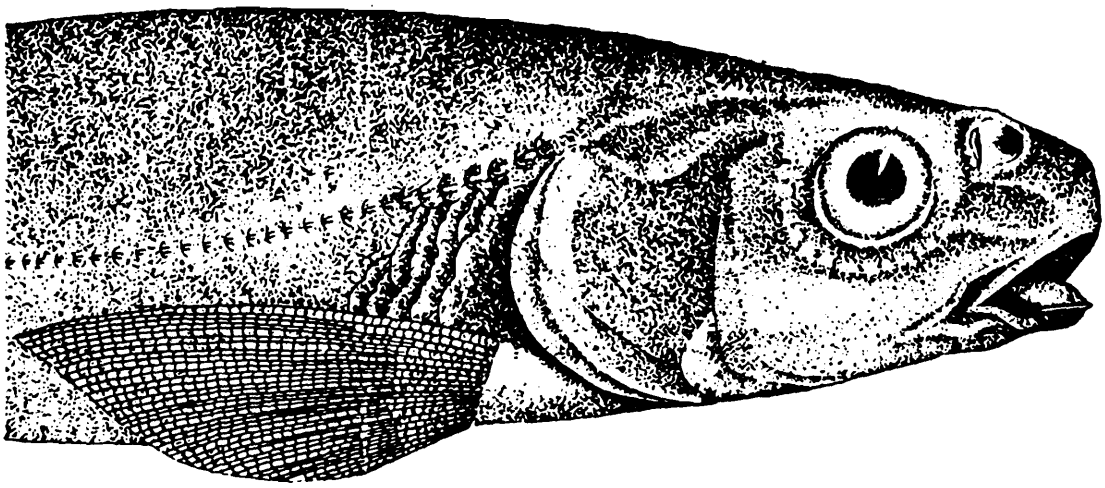


Fig. 44. Lateral view of head and anterior part of body of *Schizopygopsis stoliczkae* Steindachner

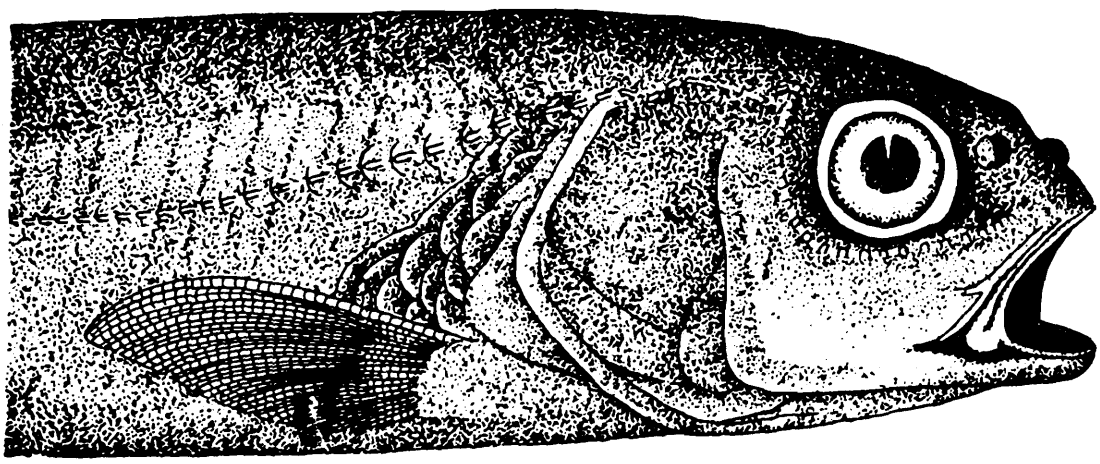


Fig. 45. Lateral view of head and anterior part of body of *Gymnocypris biswasi* Talwar

There are no barbels. The gill cleft is of moderate extent and the isthmus is narrow. The gill membranes are attached to the isthmus opposite the preopercular angle. The width of isthmus is contained 19.84-22.5 times in the standard length and 4.46-5.19 times in head length.

The depth of the body is contained 7.37 times in standard length and 1.65 times in head length. The width of the body is contained 9.75-10.32 times in standard length, 2.25-2.32 times in head length and 1.43-1.52 times in height of head.

The lateral line curves down slightly behind the gill cleft and thereafter gently reascends to the middle of body and runs to the base of the caudal fin.

There are 13-14 scales along the lateral line and thereafter the scales are absent. There are 17-20 scales along the anal sheath. The width of the enlarged scale of the anal sheath is contained from 2.33-2.77 times in the diameter of eye. There is a shoulder patch of 4-5 rows of scales above the pectoral fin. The rest of the body is naked.

There are 13 gill rakers on the lower arm of the first branchial arch. There are 7 pharyngeal teeth, arranged in two rows (4-3/3-4). The tips of the teeth are blunt with broad grinding surfaces.

The origin of the dorsal fin is almost midway between the base of the caudal fin and the tip of snout. The dorsal fin originates much in advance of the pelvic fin. The dorsal fin spine is weak and serrated behind. There are 12-16 teeth on the dorsal spine. The length of the dorsal spine is 1.34-1.42 times in length of head. The longest ray of the dorsal fin is contained 6.0-7.16 times in standard length and 1.38-1.61 times in length of head. The length of base of dorsal fin is contained 7.81-8.23 times in standard length and 1.75-1.9 times in head length.

The pectoral fin does not extend half-way to the base of the pelvic fin. The length of the pectoral fin is contained 6.0-6.45 times in standard length, 1.38-1.45 times in head length and 1.97-2.25 times in the distance between the bases of the pectoral and the pelvic fins.

The pelvic fin arises vertically below the 3rd or 4th ray of the dorsal fin and its length is contained 7.3-7.81 times in standard length, 1.68-1.75 times in head length and 1.39-1.46 times in the distance between the bases of the pelvic and the anal fins. The fleshy appendage in the axil of the pelvic fin is composed of 3 scales.

The anal fin, when laid flat, reaches the base of the caudal fin. The length of the longest ray of the anal fin is contained 5.60-5.85 times in standard length, 1.26-1.35 times in head length and

1.26-1.32 times in the distance between the bases of the anal and the caudal fins. The length of the base of the anal fin is contained 9.55-11.7 times in standard length, 2.14-2.7 times in head length and 1.22-1.42 times in the length of the base of the dorsal fin. The caudal fin is forked.

The height of the caudal peduncle is contained 14.6-16.12 times in the standard length, 3.37-3.62 times in head length and 1.93-2.46 times in its own length. The length of the caudal peduncle is contained 6.54-7.54 times in standard length and 1.47-1.74 times in the head length. The length of the caudal fin is contained 5.37 in standard length and 1.20 times in head length.

The distance between the tip of snout to the origin of the dorsal fin is contained 2.00-2.06 times, the distance between the tip of the snout to origin of the anal fin 1.27-1.29 times, the distance between tip of snout and the origin of pelvic fin 1.67-1.72 times, the distance between the tip of snout and the origin of the pectoral fin 3.96-4.03 times, the distance between the bases of the pectoral and the pelvic fins 2.86-3.03 times, the distance between the bases of the pelvic and anal fins 4.97-5.60 times, and the distance between the bases of the anal and the caudal fins 4.41-4.44 times in the standard length.

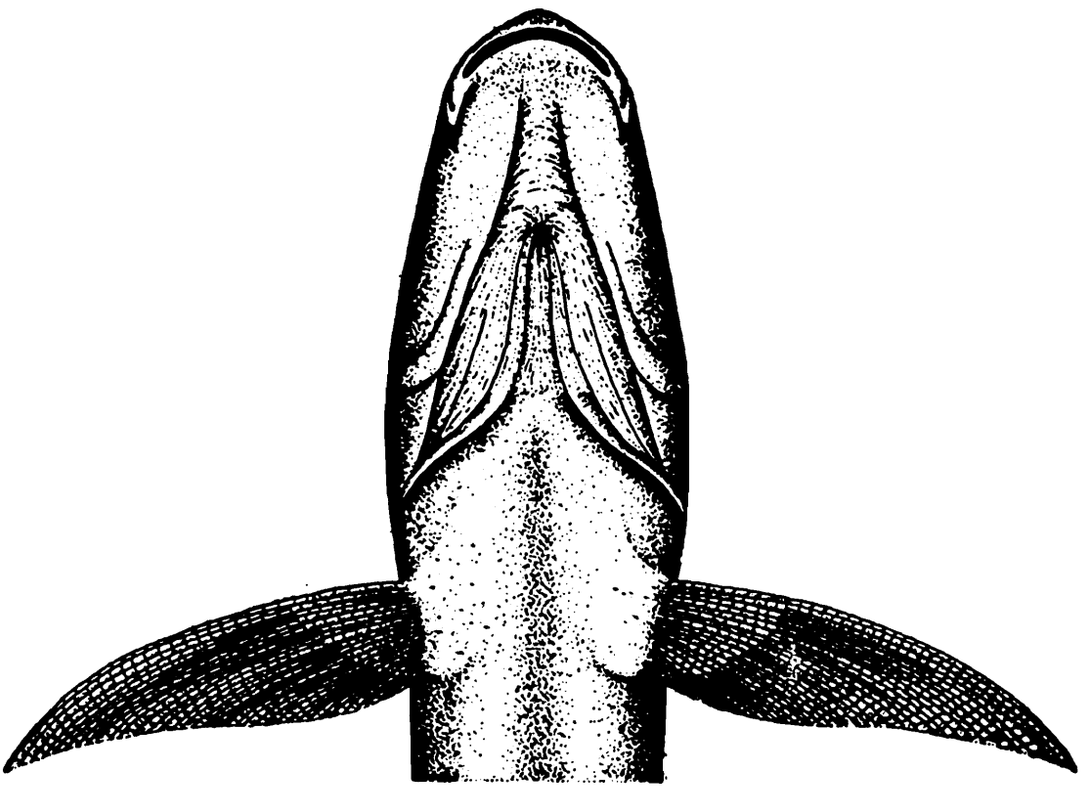


Fig. 46. Ventral view of head and anterior part of body of *Gymnocypris biswasi* Talwar

The colour of the body in spirit preserved specimens is greyish black. The sides of the body and the belly are lighter. The fins are without a marking.

Distribution :

Chusul in Ladakh (J. &. K) (fig. 47).

Remarks :

This is the only species of the genus *Gymnocypris* reported from Indian region. *Gymnocypris* Günther is closely allied to *Schizopygopsis* Steindachner from which it can be distinguished in having a terminal mouth and the presence on the lower jaw of a horny layer on the inner side. In *Schizopygopsis*, the mouth is subterminal and the lower jaw bears a sharp horny covering on the anterior margin. When the mouth is closed, the horny layer of the lower jaw is visible in *Schizopygopsis* but not so in *Gymnocypris* (figs. 44, 45).

The genus *Gymnocypris* has been recorded from the Indian region by Talwar (1978). It is one of the specialised Shizothoracid genera. Jayaram (1974) did not include this genus among those restricted to the palaearctic region of India ; he, on the contrary, included *Cyprinion* among them. *Cyprinion* is, in fact, not distributed in India.

Tsao (1964) has put *G. waddellii* Regan and *Schizopygopsis stewartii* Lloyd from Tibet under this genus and has erected a new subgenus, *Oxygymnocypris* under the genus *Gymnocypris* to accommodate *S. stewartii*. *G. biswasi* falls under *Gymnocypris* (*Gymnocypris*). The two subgenera of *Gymnocypris* are distinguished as under :

G. (*Gymnocypris*)	*G.* (*Oxygymnocypris*)
(1) Peritoneum black	(1) Peritoneum greyish-white
(2) Origin of pelvic fin lies posterior to that of the dorsal fin.	(2) Origin of pelvic fin lies anterior to the base of the dorsal fin.
Species : *Gymnocypris* (*Gymnocypris*) *dobula* Günther	Species : *G.* (*Oxygymnocypris*) *stewartii* (Lloyd)
G. (*G.*) *waddellii* Regan	
G. (*G.*) *potanini* Herzenstein	
G. (*G.*) *przewalskii* Kessler	
G. (*G.*) *eckloni* Herzenstein	
G. (*G.*) *biswasi* Talwar	

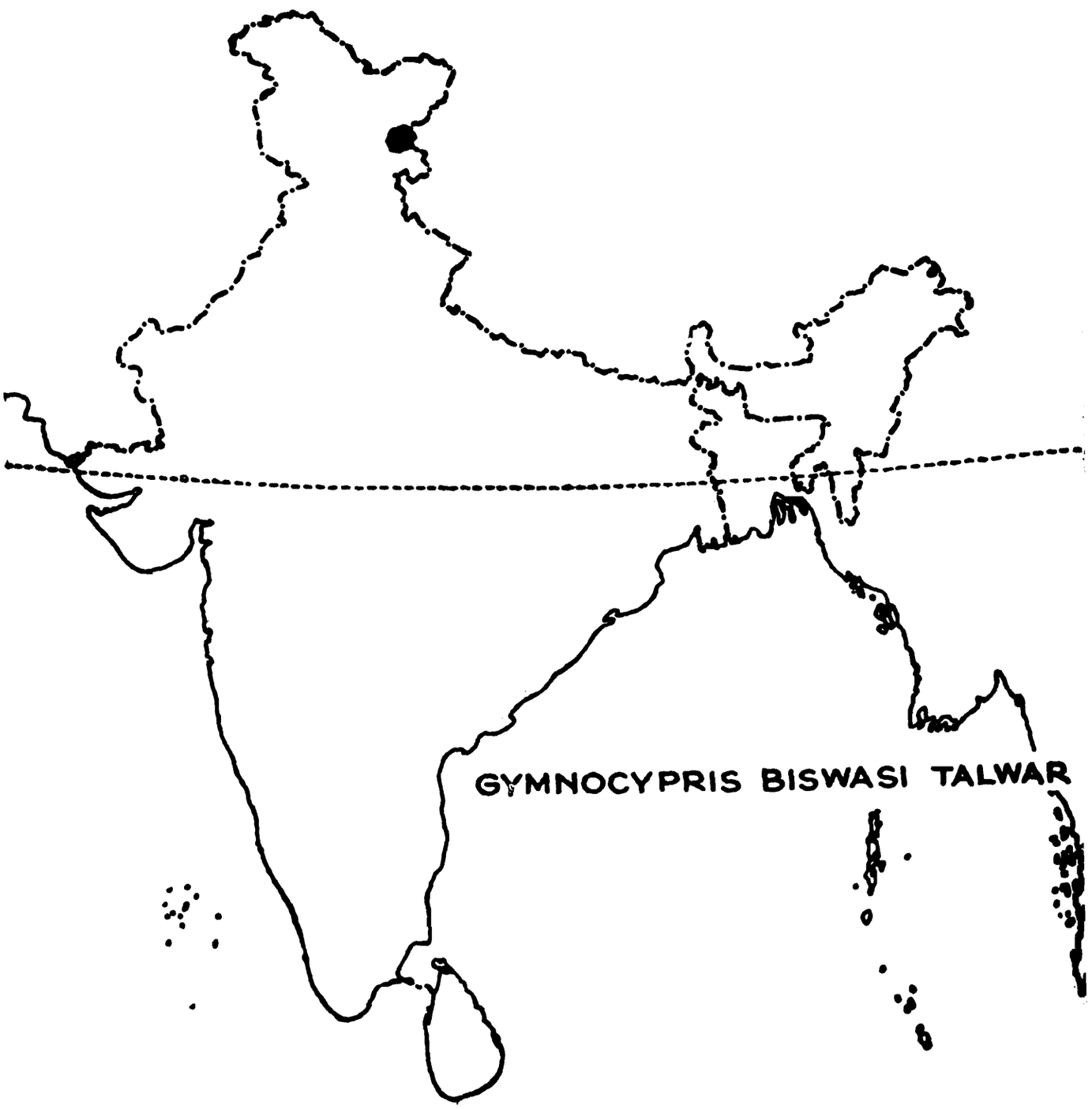


Fig. 47. Map showing the distribution of *Gymnocypris biswasi* Talwar

While describing *G. biswasi*, Talwar (1978) stated that this species is closely allied to *G. waddellii* Regan but differs from it by the absence of "humping" in front of the dorsal fin and the smaller number of pharyngeal teeth (2-3/3-2) versus 4-3/3-4. There are no spots on the body of *G. biswasi*. It has been discovered that the number of pharyngeal teeth is 4-3/3-4 in *G. biswasi* and it resembles *G. weddellii*. The observation of Talwar (op. cit) for this character is, therefore, faulty. The hump on the body in front of dorsal fin in *G. waddellii* is not mentioned by Regan (1905) although this is seen in the figure of this species given by Tsao (1964). Such a hump is normally present in large sized specimens of majority of the fishes due to the development of musculature of that region, such a hump being absent in young or poorly developed examples. The type material of *G. biswasi* is composed of young examples and obviously the musculature of the predorsal region is not developed and therefore, no development of hump. The head and body are covered with dark spots in the type material of *G. biswasi*. Talwar (op. cit.) has mentioned the absence of these spots because the material is in rather a poor state of preservation and spots in such specimens become light although a careful examination of such material under high power of a stereomicroscope reveals the presence of spots. *G. biswasi* Talwar agrees *G. waddellii* Regan in all respects except the larger size of eye which 3.85-3.86 times in head length (Vs. 6-8 times in *G. waddellii*). This has not been mentioned by Talwar (op. cit.). Generally, the eye in the same species of a fish is larger in younger examples and smaller in adult examples when compared with the head length. The four examples of *G. waddellii*, described by Regan (1904), were adults, measuring 300-400 mm. in length and therefore, the eyes in those specimens are smaller in relation to the head length.

G. biswasi is being kept as it is till long series of fresh and nicely preserved material of the same from the type locality is available for study and comparison.

MATERIAL EXAMINED

Regd. No.	Locality	Collector	Date of collection	No. of Exs.	Remarks
FF. 1064	Chushul, Ladakh (J. & K.) (c. 4358 mts.)	B. Biswas	1.7.1976	1	Holotype
FF. 1065	Same as above	,,	,,	1	Paratype

Genus : **Lepidopygopsis** Raj

1941. *Lepidopygopsis* Raj, *Rec. Indian Mus.*, 43 ; 210 (Type-species ; *Lepidopygopsis typus* Raj).

Characteristic Features :

The lateral line is decurved on caudal peduncle, Scales lack basal radii. Scales present along the lateral line, in a patch on the scapular region, extending upto the 6th scale on the lateral line, a row along the base of the dorsal fin. Caudal portion, behind the vent covered with scales. A major part of the lateral and ventral sides of the body without scales. 54-58 scales along the lateral line. Dorsal spine coarsely denticulated behind. Barbels two pairs. Pharyngeal teeth triserial.

Distribution :

Periyar river and lake, Kerala.

Relationships :

This is the first record of a Schizothoracine fish from the tropics. It has been included under Schizothoracinae because of the presence of a sheath of enlarged scales covering the vent and the base of the anal fin, a short anal fin and a serrated dorsal spine. The absence of the basal radii on the scales and far lesser number of scales along the lateral line than any other of the Schizothoracine fish, are the characters which are different from those of the Schizothoracinae and bring it closer to Cyprininae.

The scales of the fishes of the subfamily Cyprininae have been studied and it has been discovered that the basal radii are present in the scales of almost all genera studied here (Fig. 2). According to Chu (1935), the basal radii are confined to Cyprininae, Schizothoracinae and some genera of Leuciscinae. In *Opsariichthys* and *Zacco* (Leuciscinae) and *Metzia* (Abramidinae), some scales on the front part of the trunk only, occasionally, have one or two short and irregular basal radii while they are absent in other representatives of Leuciscinae and Abramidinae (Chu, 1935). The basal radii are absent in Chondrostomatinae, Abramidinae (except *Metzia*), Acheilognathinae, Hypophthalmichthyinae and Gobioninae (Chu, 1935). Thus, *Lepidopygopsis* differs both from Schizothoracinae and Cyprininae in the absence of basal radii, contrary to that mentioned by Raj (1941). Among the fishes with the absence of basal radii in the scales, only Abramidinae is represented in India. *Brachydanio rerio* (Hamilton), a representative of Indian Abramidinae, shares the character of the absence of basal radii in scales with *Lepidopygopsis typus*. *B. rerio* has a wide distribution in India and is confined to slow-moving to stagnant and standing bodies of water, particularly rice fields. The resemblance of *Lepidopygopsis* to Abramidinae and other cyprinoid subfamilies mentioned above rather than to Cyprininae and Schizothoracinae is peculiar and interesting. A thorough analysis of the various other morphological features of this peculiar genus is required to be done to

evaluate the exact systematic position of this aberrant genus. A study on this genus, therefore, is in progress and the results will be published in a separate paper.

This genus resembles *Schizopygopsis* Steindachner but differs from it in the presence of scales on the caudal portion of the body, a coarsely denticulated dorsal spine, four barbels and triserial pharyngeal teeth. It differs from *Gymnocypris* in all these characters.

The shape and number of rows of pharyngeal teeth and the caudal portion of the body being covered with imbricate scales are primitive characters while the loss of scales on the rest of the body is a specialised feature. *Lepidopygopsis* lies somewhere between *Schizothorax* and *Schizothoraichthys* on the one hand and the specialised genera *Schizopygopsis* and *Gymnocypris* on the other. The latter genera are distributed in the Sutlej, Indus and the Oxus river systems.

There is only one species, *L. typus* Raj, of this genus in India.

Zoogeographical Remarks :

Schizothoracinae are distributed mostly in the palaearctic region and their introduction into the Oriental region on the southern face of Himalaya conveys a meaningful connotation from a zoogeographical point of view.

The existence of *Lepidopygopsis* Raj in peninsular India is a landmark in the dispersal of the Himalayan and trans-Himalayan fish stock and this is a solitary instance of the existence of a schizothoracine fish in the tropical region. Medlicott and Blanford (1893) state that on many isolated hill ranges of Nilgiris, Anamalai and other isolated plateaux in southern India and mountains of Ceylon, there is found the temperate fauna and flora which does not exist in the plains of peninsular India but is closely akin to the temperate fauna and flora of Himalaya. Taxonomically, the animals of peninsular Indian hills are different, specifically or generically from those of Himalaya. The existence of a Schizothoracine genus, *Lepidopygopsis*, in the hills of peninsular India is a parallel instance of the existence of allied fauna on the hills of peninsular India and Himalaya. The presence of himalayan fauna on the hills of peninsular India is probably due to the dispersal of fauna from the former to the latter. According to Medlicott and Blanford (1893), such a dispersal could have occurred due to the depression of temperature during glaciation. The dispersal of these palaearctic elements took place from the palaearctic region into the southern face of Himalaya. The fossil record of these fishes are known from the lower Karewas beds of Kashmir belonging to the second interglacial period of the Pleistocene era (Hora, 1937). The dispersal of a solitary palaearctic element into the peninsular India also probably

took place during one of the inter-glacial periods and due to long isolation and changed ecological conditions, they taxonomically evolved into a new form.

7. Lepidopygopsis typus Raj

(Figs. 48-53)

1941. *Lepidopygopsis typus* Raj, *Rec. Indian Mus.*, 43, p. 210. (Type-locality : Periyar lake, Kerala). (Type in Z.S.I., Calcutta, Regd. No. F. 13510/1).

1941. *Lepidopygopsis typus* : Hora and Law, *Rec. Indian Mus.*, 43 : 236, 237.

B. III, D. 4/7, P. I/13-14, V. II/8, A. III/5, C. 19. Lat. 1. 54-60, gill rakers 10-12.

The body is elongate and compressed. Its greatest depth, which is below the commencement of the dorsal fin, is contained 4.1-4.66 times in the standard length and 1.08 times in head length. The dorsal profile ascends obliquely from the snout to the base of the dorsal fin almost in a straight line, whence it descends more gently also in a straight line to the base of the caudal fin. The ventral profile is curved up to the base of the anal fin but runs more or less straight along the caudal peduncle. The caudal peduncle is more than twice as long as broad at its narrowest part. The head is conical, moderately large and somewhat compressed ; its length is contained 4.3-4.9 times in the standard length ; and 5.57 times in total length ; its width 8.0 times in standard length and 1.85-2.0 times in length of head ; its height 6.22 in standard length and 1.4-1.44 times in length of head. The height of head is contained 0.77 times in width of head.

The eyes, which are moderately large, round and almost lateral in position, are situated more or less in the anterior half of the head. The diameter of the eye is contained 2.8-4.4 times in the length of the head. The eyes are proportionately large in the young, The interorbital space is curved and is 0.88-1.8 times the diameter of the eye.

The interorbital width is contained 3.25 times in length of head. The eye is bigger than the snout and contained 0.88 times in its length. the interorbital width is as wide as the length of snout.

The anterior and posterior nasal apertures are close together and are situated dorsally on either side of the snout midway between the tip of the snout and the anterior margin of the eye.

The snout, 1.2-1.25 times as broad as long, is swollen, bluntly rounded, and overhangs the mouth. Its anterior border is sharp and entire and forms a deep rostral fold with small lateral lobes.

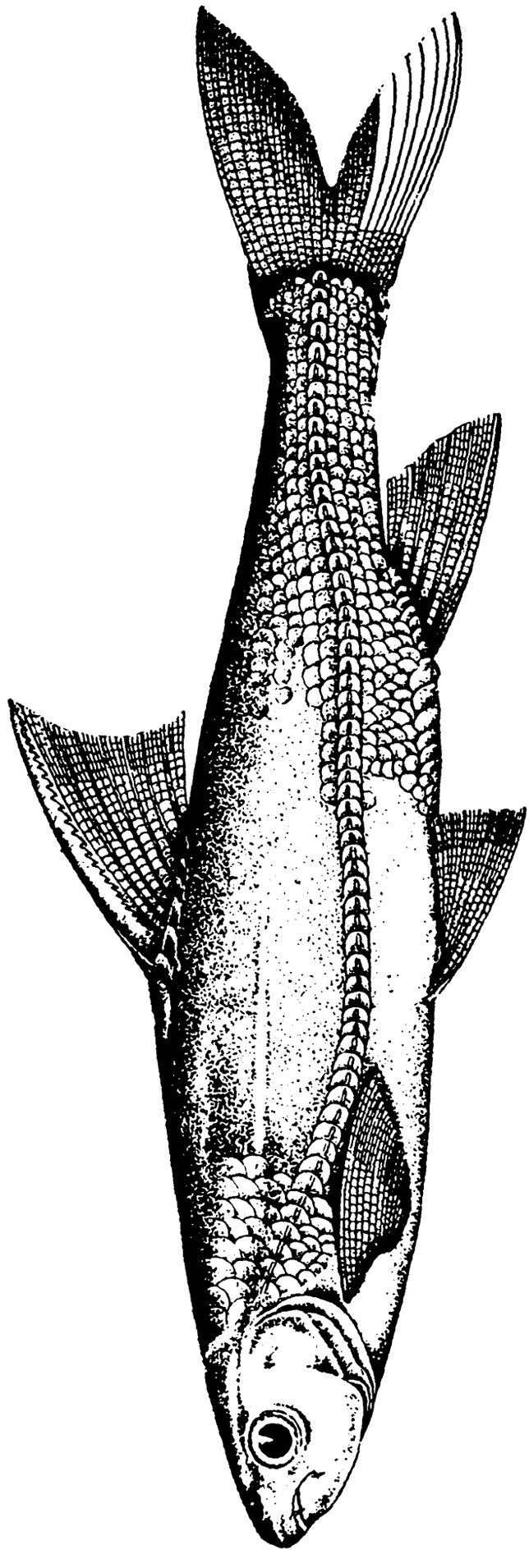


Fig. 48. Lateral view of *Lepidopygopsis typus* Raj (figure of type material, redrawn after Raj, 1941)

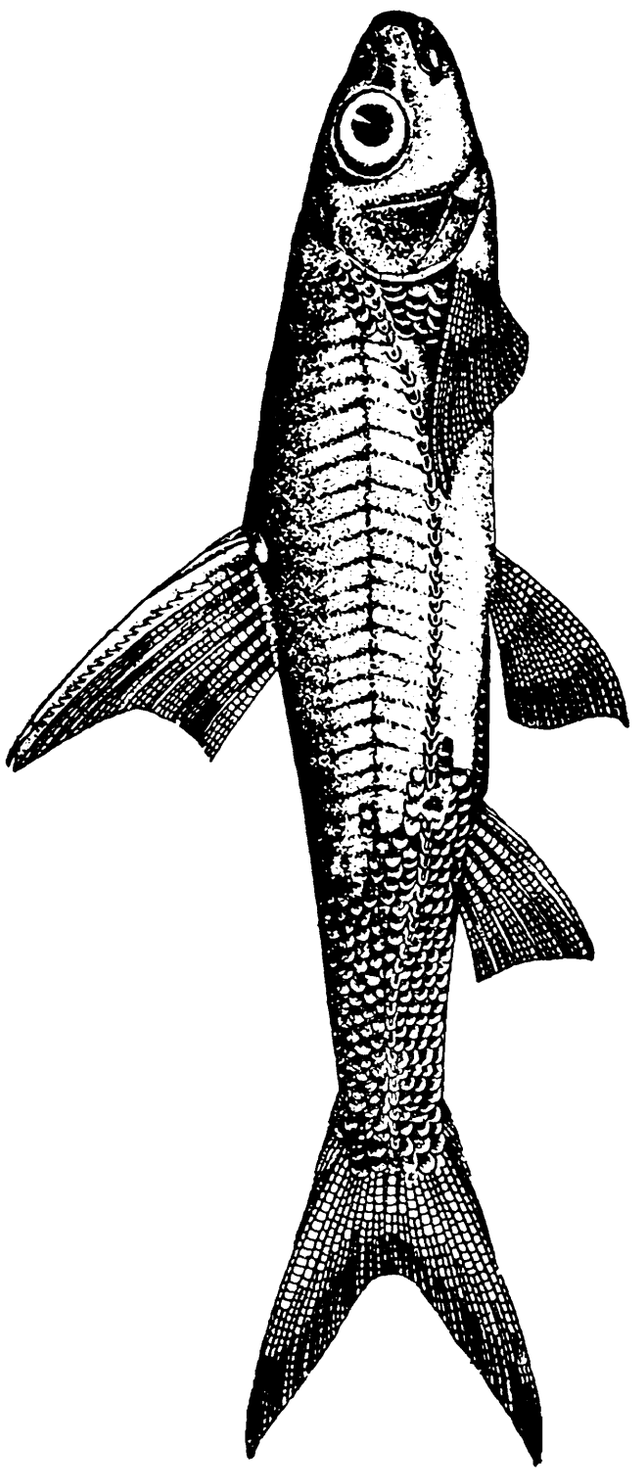


Fig. 49. Lateral view of *Lepidopygopsis typus* Raj

The large preorbitals extend on either side of the snout and end anteriorly in rounded, vertical borders concealing the lateral lobes of the snout. In one of the paratypes there are pearl organs on the snout. Two small rostral and two maxillary barbels are present. The rostral barbels arise from the lateral lobes of the snout and the maxillary barbels are at the corners of the mouth.

The length of snout is contained 14.00 times in standard length, 3.25 times in length of head and 1.25 times in postocular length of head.

The mouth is inferior, moderately broad and transverse, but curved at the angles. Its cleft is shallow and nearly horizontal. The jaws are feebly protractile. The concealed maxillary does not reach below the anterior border of the eye. The upper lip, which is thin and loosely invests the upper jaw is continuous with the lower lip, which is developed only laterally at the curved corners of the mouth. The postlabial groove is broadly interrupted medially. The lower jaw is covered internally by the thin deciduous horny covering with a sharp anterior edge.

In some examples, the lower jaw is uncovered by the lip and is visible from the ventral side. The width of the mouth is contained 18.66 times in the standard length, 4.33 times in the length of the head and 1.33 times in the length of the snout. The isthmus is very narrow and its width is contained 37.33 times in standard length and 2.66 times in the length of head. The postocular length of head is contained 11.2 times in the standard length and 2.6 times in the length of head.

The width of the body is contained 8.00 times in the standard length, 1.85 times in the length of head, 1.71 times in the height of the body and 1.28 times in the height of the head.

The gill opening is wide. It starts dorsally on a level with the upper border of the eye and extends forward ventrally to below the posterior margin of the preoperculum. The gill membranes are confluent with the skin of the isthmus. The 10-12 short and pointed gill rakers are often curved and are hardly 1/5 as long as the gill filaments which measure half the diameter of the eye. The pseudobranchiae are well developed and are provided with filaments.

The pharyngeal teeth are pointed and hooked and are in three rows (4 or 5-3-2/2-3-4 or 5). The anterior edentulous process of the pharyngeal is about 2/3 as long as the posterior, and the pitted surface is moderately broad.

The alimentary canal is short, about 2.3 times as long as the standard length of the fish. The stomach contents in the specimen dissected consisted of insects, crustacea, diatoms and vegetable matter. The swim-bladder is of the usual cyrpinoid type and

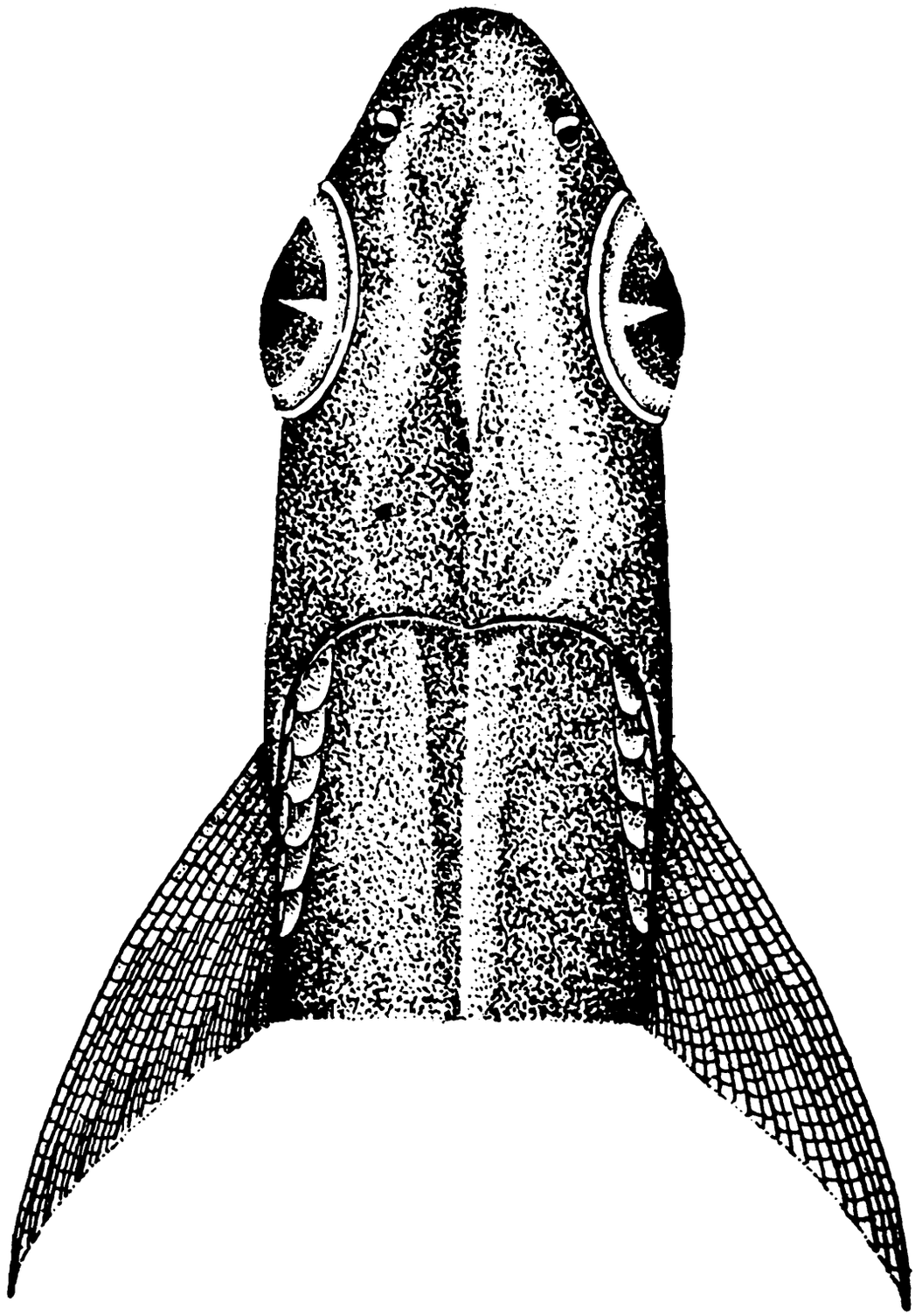


Fig. 50. Dorsal view of head and anterior part of body of *Lepidopygopsis typus* Raj

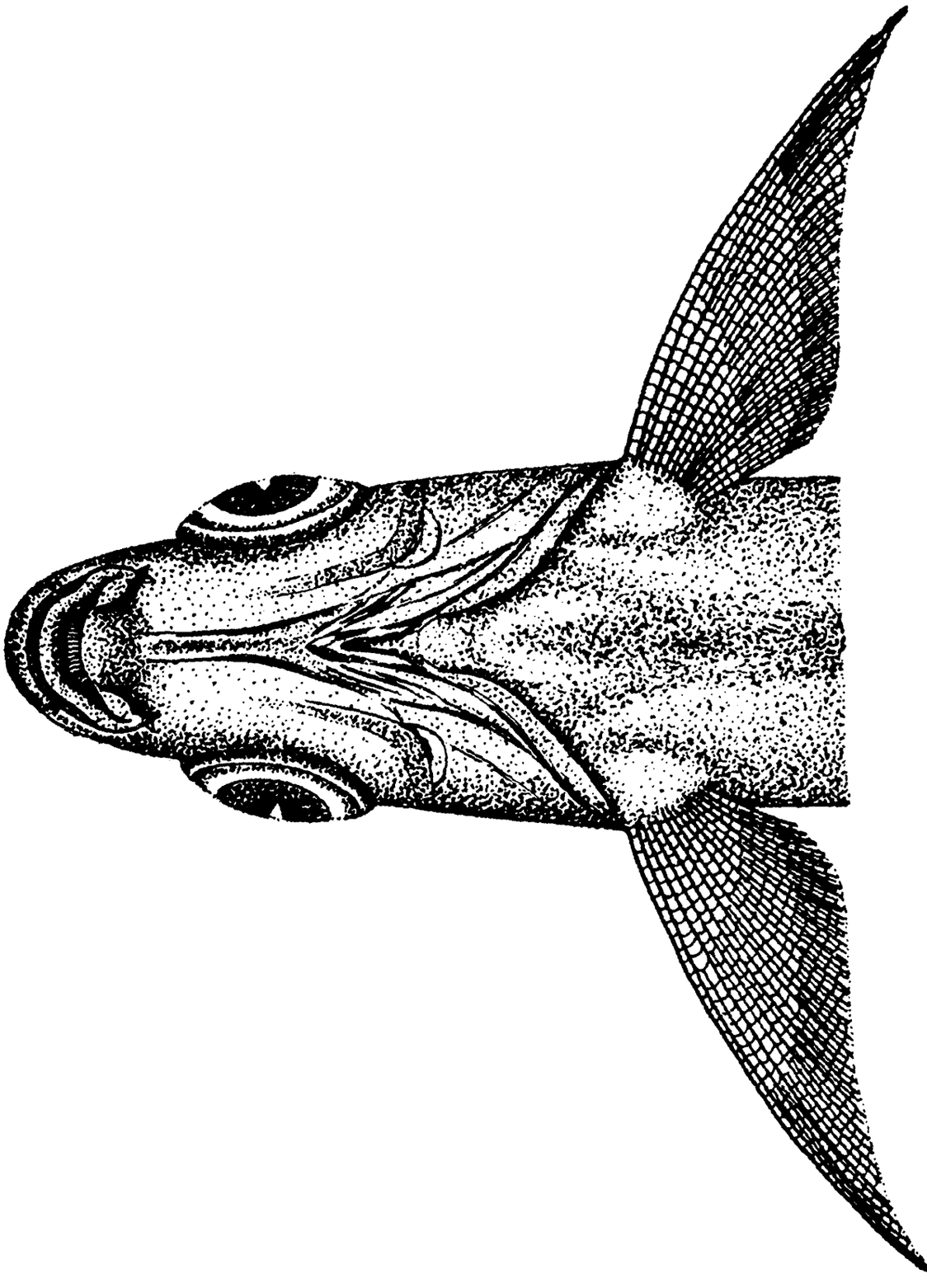


Fig. 51. Ventral view of head and anterior part of body of *Lepidopygopsis typus* Raj

occupies almost the whole of the body cavity. The peritoneum is brown in colour.

The scales are thin, cycloid, imbricate, and firmly adherent; their greatest diameter being that of the eye. There are no scales on the head, and only a few on the anterior part of the body consisting of a patch on the scapular region extending as far the 6th scale on the lateral line, a few scattered scales on the base of the dorsal spine, a continuous row of enlarged scales along the lateral line and an another along the midventral line starting from the base of the ventral fins. This latter at the end of the ventral fins constitutes a row of elongated tile-like scales forming a sheath to the vent and the base of the anal fin. The caudal portion of the body behind the dorsal and ventral fins is completely covered by an even, longitudinal series of scales. There are 26 rows of scales round the caudal peduncle and 54-58 on the lateral line, with two more on the base of the caudal fin. The scales are oval, broader than long in the scapular region, more or less rounded on the caudal peduncle and elongate in the anal sheath. A typical scale from the scapular region is oval and has a broad gently convex base, rounded side with obsolescent basilateral angles and an obtusely pointed apex. The focus is basal in position. Numerous fine circuli cover the whole scale. They are circular and are packed closely at the base, and more distinctly spaced and somewhat indistinct on the apical field. Unlike other Schizothoracinae only apical radii, about 28 in number, are present. They are fine, weak, and more or less parallel lines running up and causing the apical margin to be crenulate. Only a few radii reach the nucleus.

The lateral line is complete and decurved. It runs concurrently with the ventral profile as far as the middle of the caudal peduncle and thence in a straight line along the midlateral line of the body to the base of the caudal fin. The curvature of the lateral line on the caudal peduncle is a feature peculiar to this genus.

The dorsal fin is short and is situated opposite the ventral fin. The length of its base equals the length of the head without the snout. Its origin is closer to the tip of the snout than to the base of the caudal fin. Its free margin is concave. The last undivided dorsal ray, which is almost as high as the body, is osseous, stout, and strongly denticulated along the two sides of its posterior margin. When depressed, the first branched ray, which is the longest reaches well beyond the tip of the last ray and almost half way to the base of the caudal fin. The anal fin is also short ; its base is only 0.75 as long as that of the dorsal fin, and has an obtusely straight free margin. It is inserted about midway between the bases of the ventral and caudal fins. The anal fin is shorter in young specimens. The pectoral fin is roughly falciform, nearly as long as the head (shorter in the young), and when depressed reaches three-quarters of the way to the base of the ventral fin which originates about

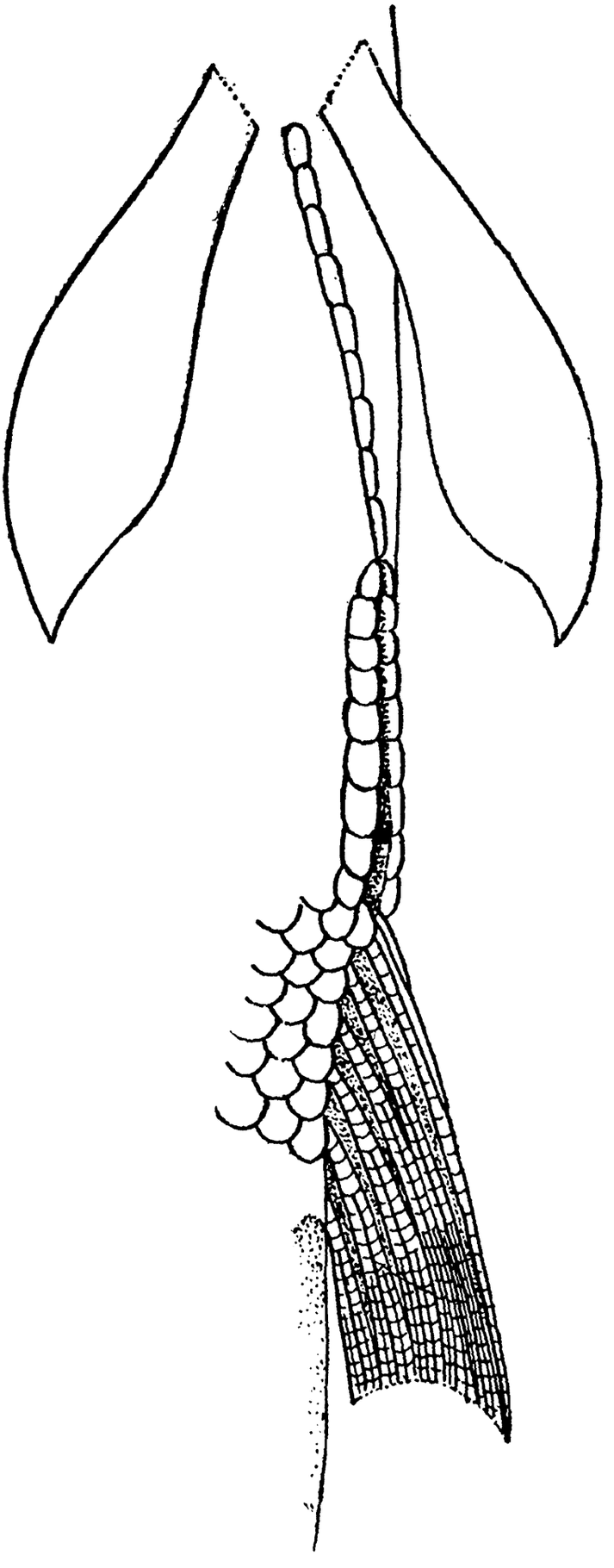


Fig. 52. Pelvic and anal regions of *Lapidopygopsis typus* Raj

midway between the bases of the pectoral and anal fins. The ventral fin has a slightly concave free margin and shorter than the pectoral fins. When depressed, it reaches about three-fourths of the way to the anal fin. The caudal fin is as long as the distance between the bases of the ventral and anal fins, and is deeply forked with subequal pointed lobes.

The longest ray of the dorsal fin is contained 3.56 times in standard length and 0.82 times in length of head. The length of base of dorsal is contained 7.46 times in standard length and 1.73 times in head length. The length of pectoral fin is contained 4.86 times in standard length, 1.13 times in head length and 1.21 times in the distance between the bases of the pectoral and pelvic fins. The length of pelvic fin is contained 5.09 times in standard length, 1.18 times in head length and 1.09 times in the distance between the bases of the pelvic and anal fins. The longest ray of the anal fin is contained 6.22 times in standard length, 1.44 times in head length and 2.05 times in the distance between the bases of the anal and caudal fins. The length of anal base is contained 1.36 times in the length of dorsal base, 10.18 times in standard length and 2.36 times in head length.

The length of caudal fin is contained 3.39 times in standard length and 0.78 times in head length. The length of caudal peduncle is contained 2.54 times in its own length, 10.98 times in standard length and 2.54 times in head length. The length of caudal peduncle is equal to head length and is contained 4.30 times in standard length.

The distance between the tip of the snout to the origin of dorsal fin is contained 2.15 times, the distance between tip of snout and origin of anal fin 1.43 times, the distance between tip of snout to the origin of pelvic fin 2.07 times, the distance between the snout and origin of pectoral fin 4.30 times, the distance between the bases of the pectoral and pelvic fins 4.0 times, the distance between the bases of pelvic and anal fins 4.66 times and the distance between the bases of the anal and the caudal fins 3.02 times in the standard length.

The anus is situated on a short papilla.

In fresh specimens, the back is olive brown and the sides and ventral surface of the head and body silvery, the dorsal, the caudal, and the distal half of the anal fin olive green. The terminal half of the dorsal fin has a broad, indistinct dusky band. The caudal lobes and the anterior margin of the anal fin are dusky. The pectoral and ventral fins are hyaline. The iris is silvery.

Distribution :

Periyar river and lake, Kerala (fig. 53).

Local Name :

"Brahmana Kendai" (Tamil).

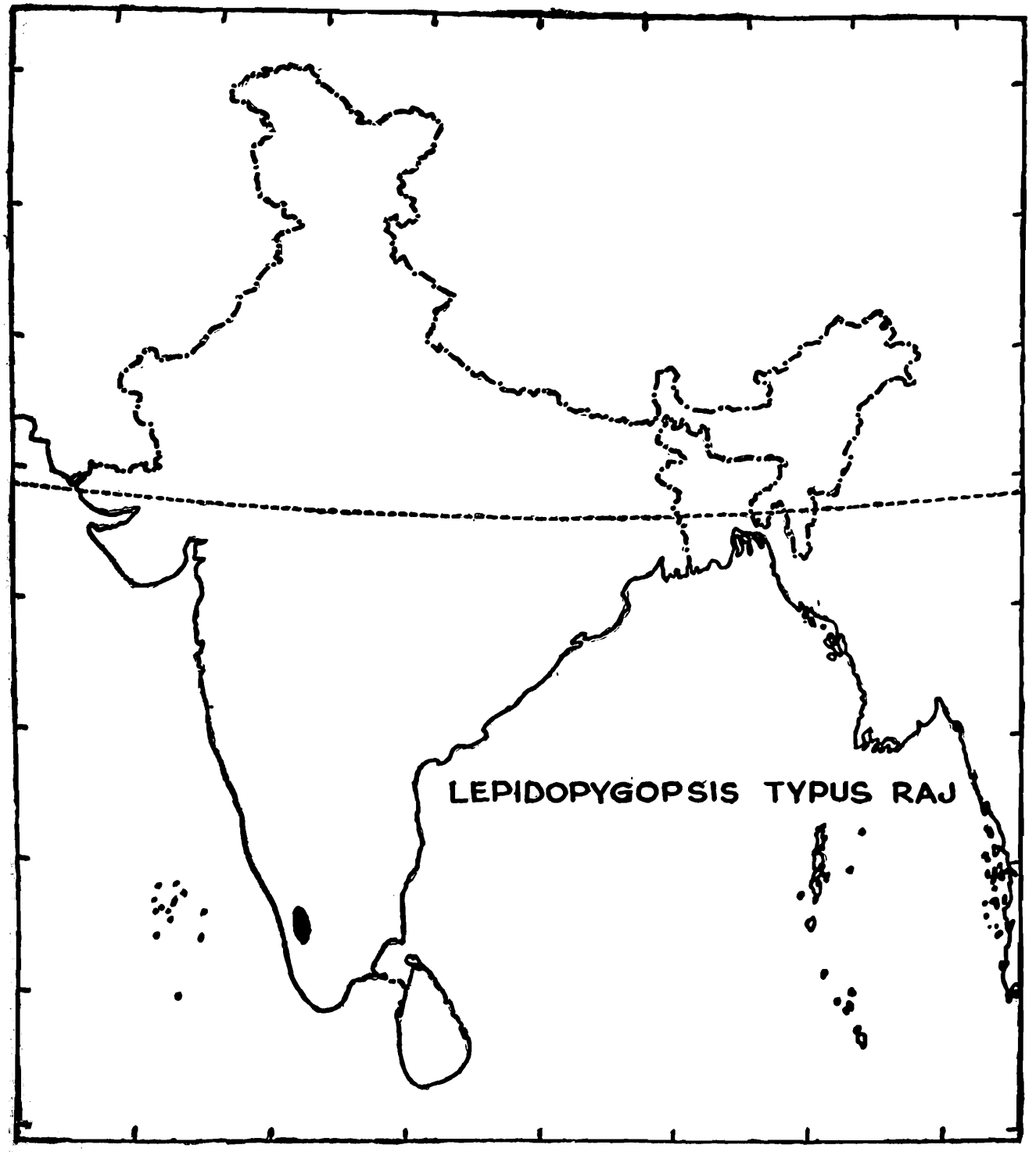


Fig. 53. Map showing the distribution of *Lepidopygopsis* typus Raj

MATERIAL EXAMINED

Regd. No.	Locality	Collector	Date of Collection	No. of Exs.	Remarks
F. 13510/1	Periyar lake Kerala	B. S. Raj	—	1	Holotype
—	Dhani Kudi, Periyar lake, Kerala.	Dr. R. Tilak	26.3.1979	1	

7. Genus : Schizothoraichthys Misra

1838. *Schizothorax* Heckel (in part), *Fische aus Caschmir*, Divisions B & C : 23—48.

1839. Oreinus McClelland (in part), *Asiat. Res.*, XIX, p. 273.

1860. *Opistocheilus* Bleeker, *Nat. Tijdschr. Ned. Ind.*, 20 : 425 (proposed for *Schizothorax* proprius of McClelland, 1842).

1897. *Apiostoma* Nikolskii, *Ann. Mus. St. Petersb.* : 345 (Typespecies : *Apiostoma zarudnyi* Nikolskii).

1897. *Apiorhynchus* Nikolskii, *Ann. Mus. St. Petersb.* : 345 (Typespecies : *Apiorhynchus zarudnyi* Nikolskii).

1962. *Schizothoraichthys* Misra, *Rec. Indian Mus.*, 57 : 48 (Typespecies : *S. esocinus* Heckel).

1964. *Schizothorax (Schizopyge)* : Tsao (in Wu et al., *Cyp. Fish China*, 1 : 139).

1975. *Schizothoraichthys* : Tilak and Sinha, *Ann. Zool.* Waraszawa, 32 (13) : 293.

Characteristic Features :

A strip of hard papillated structure on the chin absent. Mouth arched, inferior or subinferior. The lower labial fold interrupted or uninterrupted in the middle. Barbels two pairs. Scales small, with 95-190 scales along the lateral line. Anal sheath of enlarged tile-like scales present.

Relationships:

This genus is closely allied to *Schizothorax* from which it can be readily distinguished by the absence of a strip of hard papillated structure on the chin (so-called sucker).

Distribution :

Freshwater along Himalaya ; Nepal, Pakistan and Afghanistan.

Remarks :

Misra (1962) thought it appropriate to create a new generic name, *Schizothoraichthys*, for the Schizothoracine species described by Heckel (1838) under his Divisions B & C. All these fishes are without a strip of hard papillated structure at the chin. Bleeker (1863) designated *Schizothorax plagiostomus* Heckel as the type of the genus *Schizothorax* Heckel. Jordan (1919) confirmed this designation. The designation of *Schizothorax curvifrons* as the type species for the genus *Schizothorax* Heckel by Günther (1868) is, therefore, invalid. The genus *Oreinus* McClelland becomes a synonym of *Schizothorax* Heckel because the genera deal with fishes with similar characters. Hence, the fishes without a strip of hard papillated structure at the chin remained without a generic name. Misra (1962) created, therefore, a new generic name *Schizothoraichthys* for these fishes. A detailed explanation on this is given by Tilak and Sinha (1975) and also under the genus *Schizothorax* in this work.

Tsao (1964) treated the genus *Schizothorax* in a very broad sense and included two subgenera, *Schizothorax* (*Schizothorax*) and *Schizothorax* (*Schizopyge*) under it, based on the presence (Section 'A' of Heckel, 1838) or absence (Section 'B & C' of Heckel, 1838) of a strip of hard papillated structure on the chin. Tsao's (1964) treatment of the genus *Schizothorax* makes it a composite genus. Further, the recognition of *Schizopyge* is invalid. Mirza (1975) has also treated *Schizothorax* in the composite sense and recognised three subgenera under it viz. *Schizothorax* (*Schizothorax*), *Schizothorax* (*Racoma*) and *Schizothorax* (*Schizopyge*). In addition to the 8 species (under Sections 'B & C' of Heckel, 1838), McClelland (1839 & 1842) described a few Schizothoracine fishes without a strip of hard papillated structure at the chin and the labial fold uninterrupted, making the lower lip trilobed. These characters described by McClelland (1839 & 1842) have been recognised here under a subgenus of the genus *Schizothoraichthys* Misra. The subgenera of *Schizothoraichthys* recognised here are :

1. *Schizothoraichthys* (*Schizothoraichthys*) Misra (Typespecies: *S. esocinus* Heckel),

2. *Schizothoraichthys* (*Racoma*) McClelland (Type-species: *S. labiatus* McClelland).

Schizothoraichthys (*Schizothoraichthys*) is recognised by the presence of an interrupted lower labial fold and absence of a strip of hard papillated structure at the chin. The following Indian species are covered under this subgenus.

1. *S.* (*Schizothoraichthys*) *curvifrons* Heckel

2. *S.* (*Schizothoraichthys*) *longipinnis* Heckel

3. *S.* (*Schizothoraichthys*) *niger* Heckel
4. *S.* (*Schizothoraichthys*) *nasus* Heckel
5. *S.* (*Schizothoraichthys*) *hügellii* Heckel
6. *S.* (*Schizothoraichthys*) *micropogon* Heckel
7. *S.* (*Schizothoraichthys*) *planifrons* Heckel
8. *S.* (*Schizothoraichthys*) *esocinus* Heckel

Schizothoraichthys (*Racoma*) is characterised by the presence of an uninterrupted lower labial fold and the absence of a strip of hard papillated structure at the chin. The following Indian species fall under this subgenus.

1. *S.* (*Racoma*) *labiatus* McClelland
2. *S.* (*Racoma*) *progastus* McClelland

8. Schizothoraichthys (Schizothoraichthys) curvifrons (Heckel)

(Figs. 54-59)

1838. *Schizothorax curvifrons* Heckel, *Fische aus Caschmir*, p. 25, pl. iii (Type-locality : Kashmir).
1842. *Schizothorax curvifrons* : Valenciennes (in Cuvier & Valenciennes), *Hist. Nat. Poiss.*, XVI, p. 216.
1844. *Schizothorax curvifrons* : Heckel, *Fische Kaschmir's* in *Hügel's Reise*, p. 361, 3 figs.
1868. *Schizothorax curvifrons* : Günther, *Cat. Fish. Brit. Mus.*, 7, p. 164 (Distribution).
1877. *Schizothorax curvifrons* : Day, *Fish. India*, p. 532 (foot-note).
1889. *Schizothorax curvifrons* : Day, *Faun. Brit. India, Fishes*, i. p. 252. (foot-note) (Distribution).
1916. *Schizothorax curvifrons* : Vinciguerra, *Ann. Mus. Civ. Stor. Nat. Genova*, Ser. 3a, 7(47), p. 141, table.
1936. *Schizothorax curvifrons* : Mukerji, *Mem. Conn. Acad. Sci.*, 10, art. XVIII, pp. 346-347.
1975. *Schizothoraichthys curvifrons* : Tilak and Sinha, *Ann.* Zool., 32 (13), p. 292.

B. III, D. II/7, P. I/18, V. II/9, A. III/5, C. 19. Lat. 1. 115-125, Lat. tr. 20/1/15-16

The body is stream-lined and somewhat laterally compressed. The length of head is contained 5.4 times in total length and 4.27—4.66 times in standard length. The width of head is contained 1.40—1.60 in length of head and 7.57—8.14 times in standard length. The height of head is contained 0.92—0.96 times in its width, 1.53—1.75 times in head length, and 6.2—6.65 times in

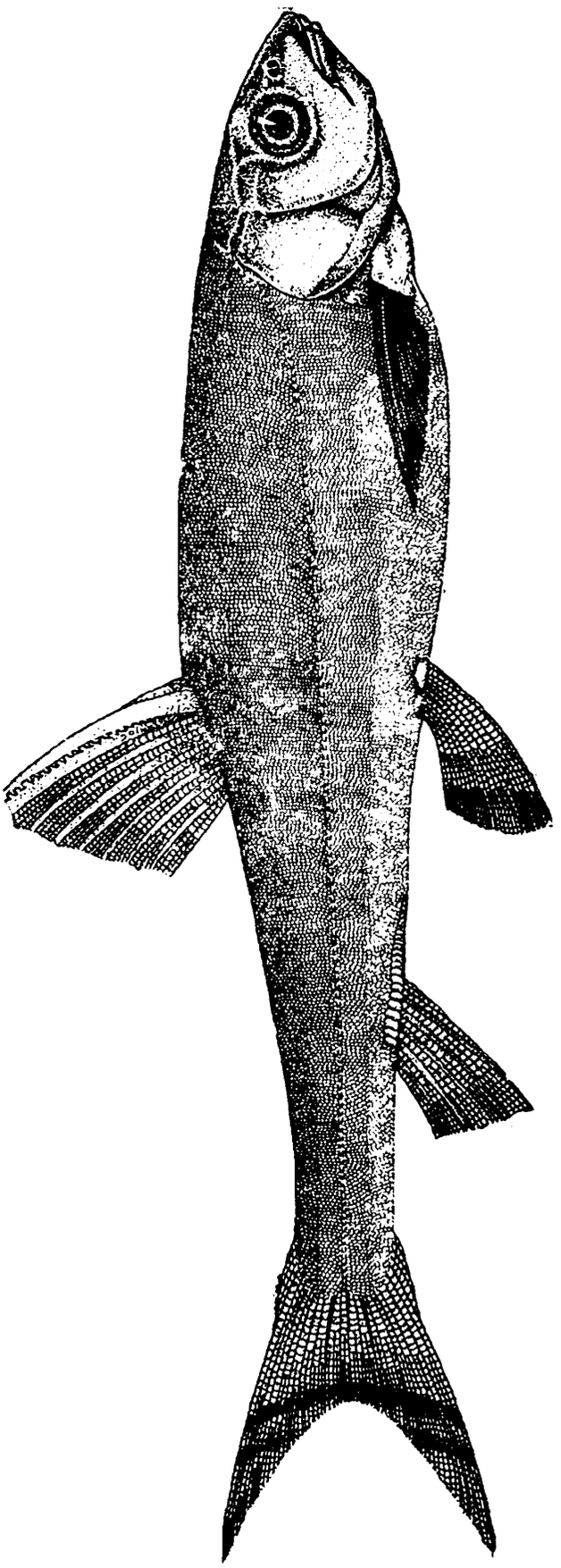


Fig. 54. Lateral view of *Schizothoraichthys curvifrons* (Heckel) (from the Holotype Regd. No. NMW 9020, Natural History Museum, Vienna, Austria)

standard length. The postocular length of head is contained 1.97—2.0 times in length of head and 8.65—8.85 times in standard length.

A horizontal line, drawn from the tip of the snout towards the middle of the caudal base, passes through the lower half of the eye while an oblique line connecting the tip of the snout and origin of the dorsal fin crosses through middle of the eye. The eyes are situated entirely in anterior half of the head and have free orbital margin. The diameter of eye is contained 4.429 times in head length, 1.1—1.29 times in snout and 1.35—1.57 times in interorbital width. The interorbital space is slightly convex and is marked by a longitudinal ridge formed by the sutural union of two frontal bones. Interorbital width is contained 2.8—2.96 times in length of head and 0.8—0.84 times in snout. The tip of snout is narrow and rounded. The snout neither overhangs the mouth nor forms a lateral lobe. The length of snout is contained 15.27—15.72 times in standard length, 3.31—3.36 times in head length and 1.72—1.81 times in postocular half of head. The mouth is horseshoe shaped. The upper jaw is slightly longer than the lower.

The lower jaw is covered with a horny layer and has a sharp edge. The width of the chord of the mouth is contained 19.22-1.37 times in length of snout. The posterior edge of the maxilla reaches below the posterior nostril and falls short of the anterior edge of the eye. The lips are fleshy and smooth. The lower labial fold is interrupted.

There are two pairs of barbels. The rostral pair is smaller than the maxillary. Both the pairs are smaller than the eye, the maxillary nearly equal to half the diameter of eye while the rostral shorter than that.

The gill cleft is wide and the isthmus is narrow. The width of isthmus is contained 27.55-28.83 times in standard length and 6.08-6.66 times in head length.

The depth of the body is contained 5.08-5.79 times in standard length and 1.17-1.34 times in head length. The width of body is contained 8.43-9.51 times in standard length. 1.95-2.23 times in head length and 1.61-1.65 times in height of body.

The lateral line curves down slightly behind the gill cleft and thereafter it runs straight to the base of the caudal fin. There are 115-125 scales along the lateral line. There are nearly 24-25 scales between the lateral line and the base of dorsal fin. The scales on anal sheath are somewhat larger than those of the other parts of the body but not well demarcated. There are 23-24 scales along this sheath. The width of enlarged scale of the anal sheath is contained from 5.0-5.83 times in diameter of eye. The scales on the upper part of the body are regularly arranged while those on the abdomen are extremely reduced and thinned out.

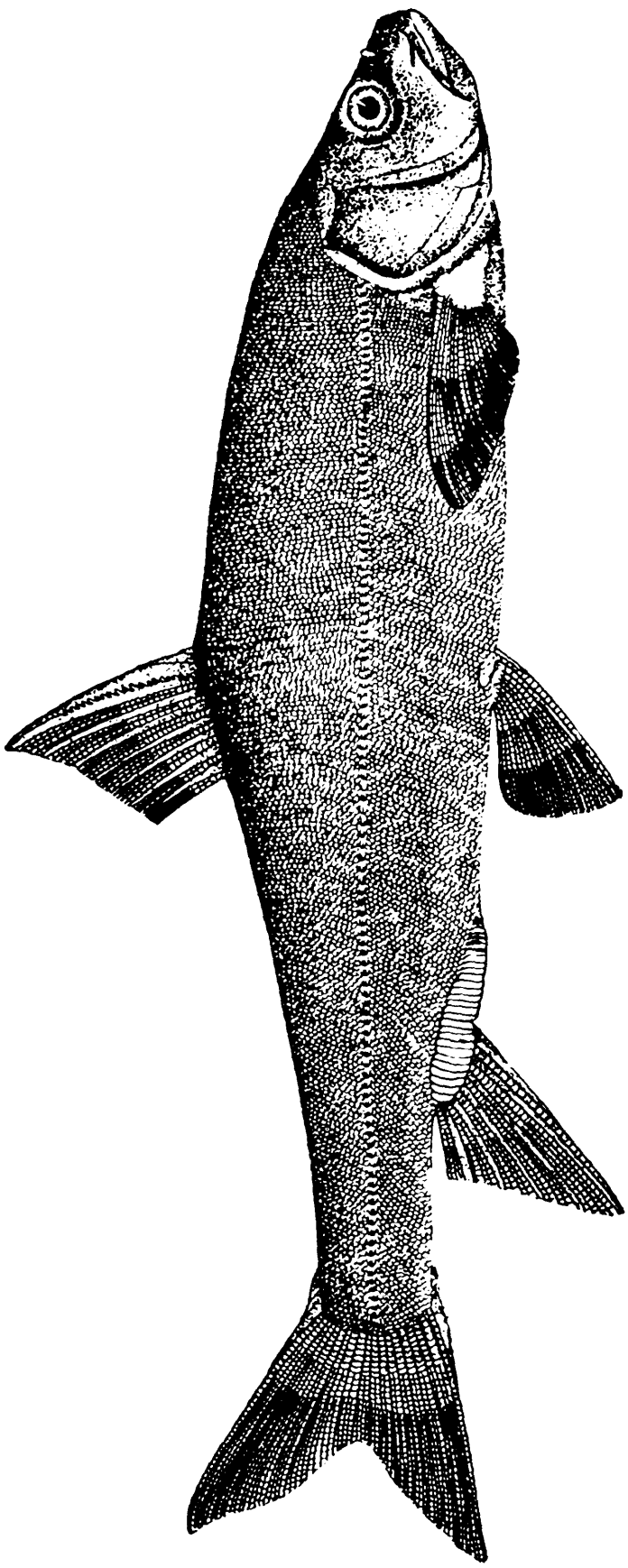


Fig. 55. Lateral view of *Schizothoraichthys curvifrons* (Heckel)

There are 20 gill rakers on the lower arm of the first branchial arch. There are 10 pharyngeal teeth, arranged in three rows (5-3-2/2-3-5). The tips of the teeth are pointed and curved. The origin of dorsal fin lies much nearer the base of the caudal fin than the tip of snout, although in some examples it lies mid-way between the two. The dorsal originates almost opposite the origin of pelvic fin. The dorsal fin spine is bony and serrated on the posterior border. There are 19 teeth on the dorsal spine. The length of the dorsal spine is equal to the length of head without snout. The longest ray of the dorsal fin is equal to that of the pelvic fin and is contained 4.86-5.86 times in standard length and 1.13-1.35 times in head length. The length of base of dorsal fin is contained 8.25-9.61 times in standard length and 1.82-2.22 in head length.

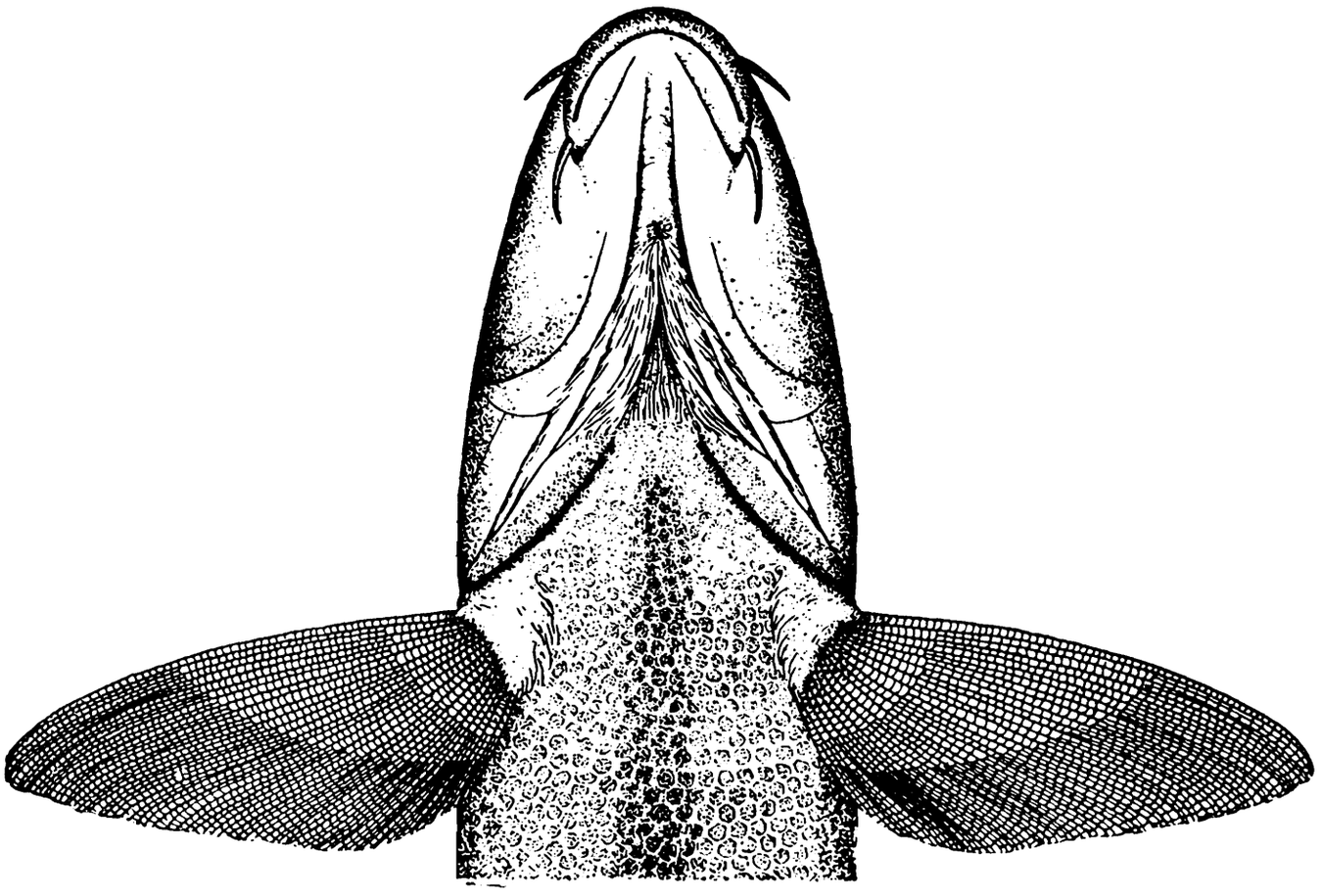


Fig. 56. Ventral view of head and anterior part of body of *Schizothoraichthys curvifrons* (Heckel)

The pectoral fin extends more than half way to the base of the pelvic fin. The length of the pectoral fin is contained 5.58-6.22 times in standard length, 1.29-1.41 times in head length and 1.65-1.77 times in the distance between the bases of the pectoral and pelvic fins.

The pelvic fin arises opposite the dorsal fin and its length is contained 5.86-6.58 times in standard length, 1.35-1.53 times in head length and 1.52-2.05 times in the distance between the bases of the pelvic and anal fins. The fleshy appendage in the axil of the pelvic fin is reduced.

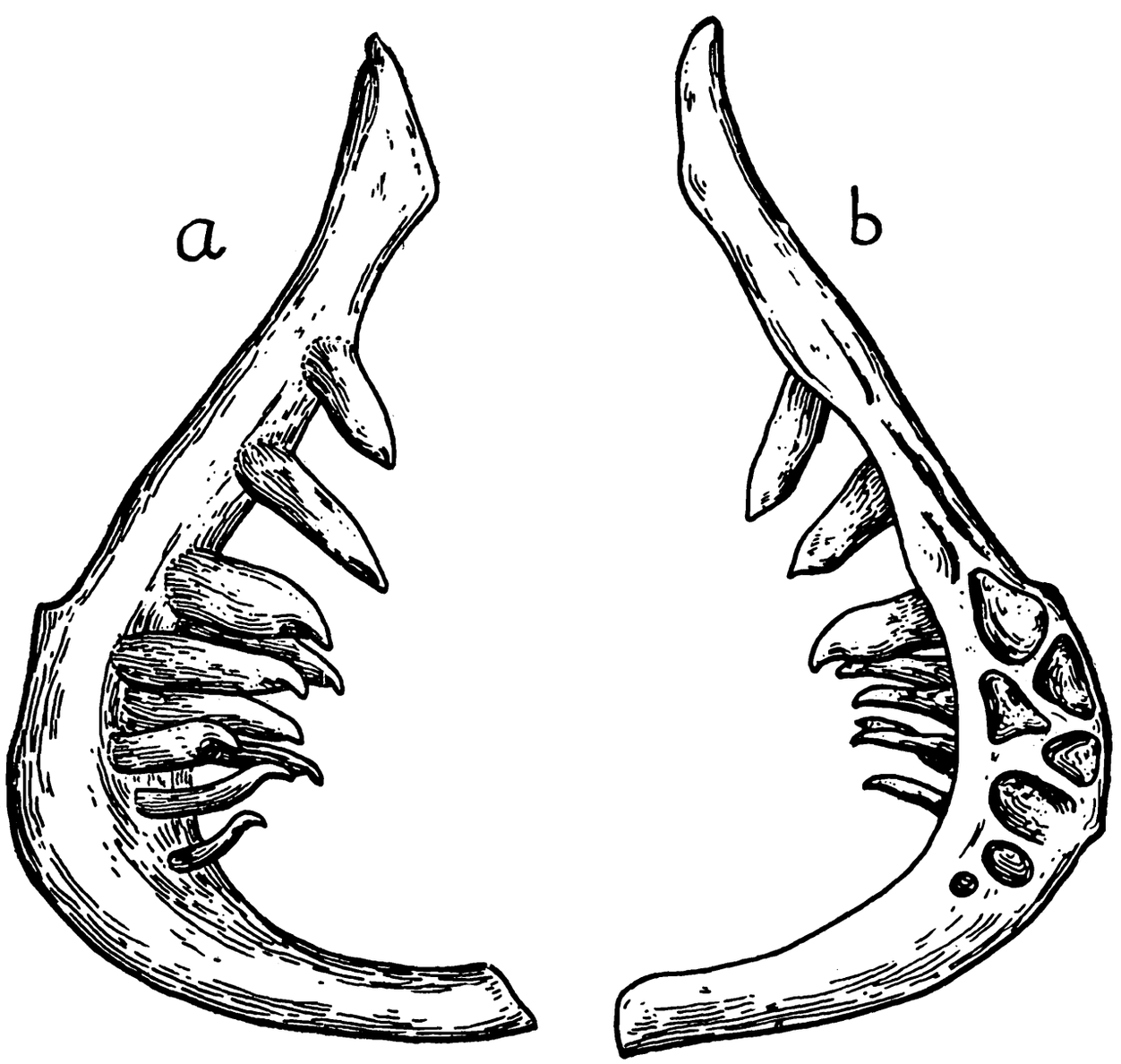


Fig. 57. Pharyngeal bone and teeth of *Schizothoraichthys curvifrons* (Heckel) (dorsal and ventral aspects)

The anal fin, when laid flat, does not reach the base of caudal fin. The length of longest ray of anal fin is contained 6.33-7.36 times in standard length, 1.37-1.70 times in head length and 1.74-1.77 times in the distance between the bases of the anal and caudal fins. The length of base of the anal fin is contained

13.05-14.41 times in standard length, 2.8-3.33 times in head length, 1.5-1.57 times in the length of base of dorsal fin. The caudal fin is forked.

The height of the caudal peduncle is contained 9.86-12.35 times in standard length, 2.14-2.32 times in head length and 2.0-2.07 times in its own length. The length of the caudal

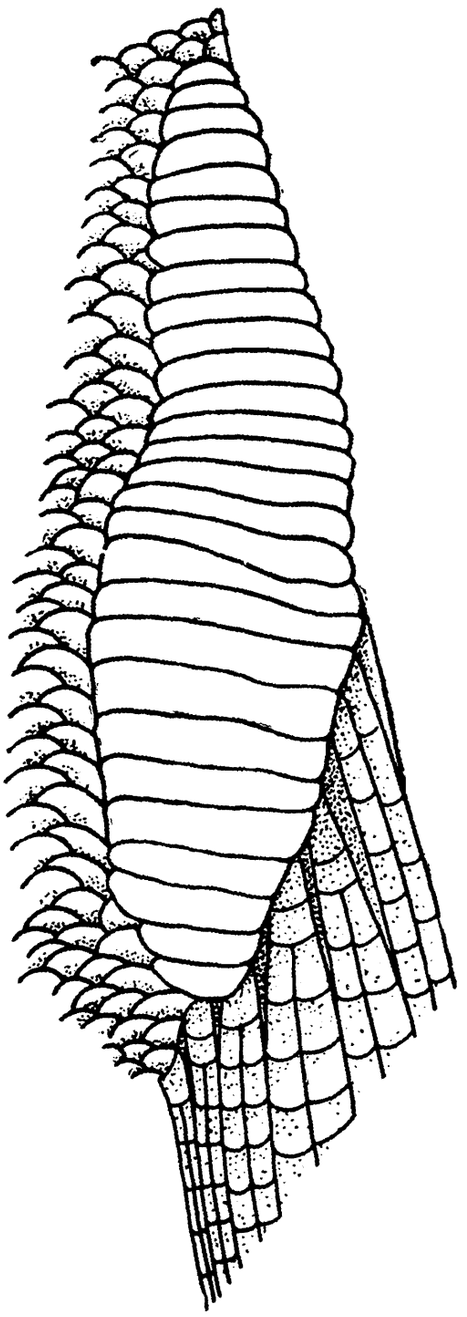


Fig. 58. Anal sheath of scales of *Schizothoraichys curvifrons* (Heckel)

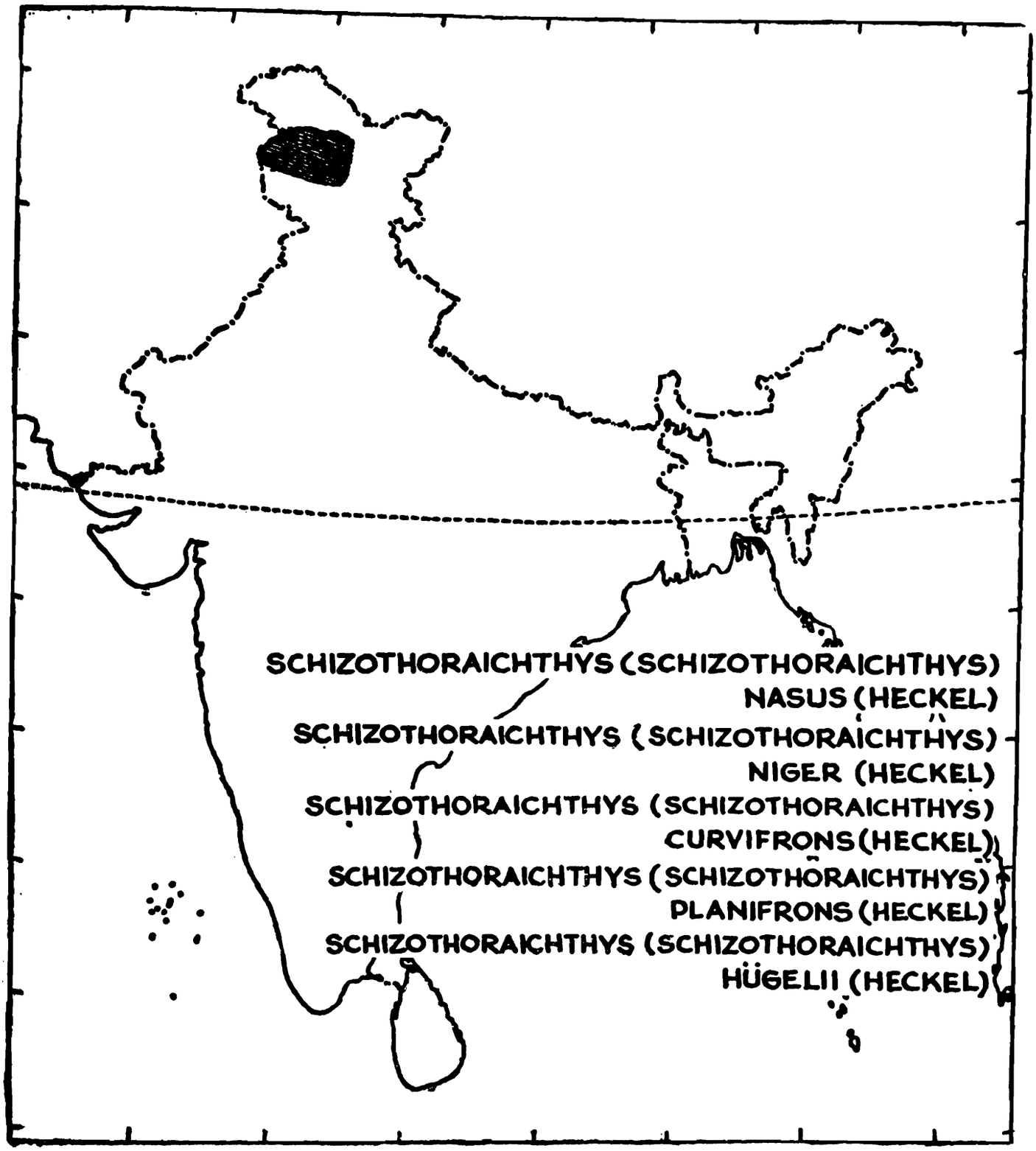


Fig. 59. Map showing the distribution of *Schizothoriachthys curvifrons* (Heckel), *Schizothoraichthys niger* (Heckel), *Schizothoraichthys nasus* (Heckel), *Schizothoraichthys hügelii* (Heckel), *Schizothoraichthys planifrons* (Heckel)

peduncle is contained 4.94-5.96 times in standard length and 1.07-1.37 times in head length. The length of caudal fin is contained 0.93 times in head length.

The distance between the tip of the snout to origin of dorsal fin is contained 1.88-2.03 times, the distance between tip of snout to origin of anal fin 1.32-1.37 times, the distance between tip of snout to origin of pelvic fin 1.89-1.93 times, the distance between tip of snout to origin of pectoral fin 4.05-4.11 times, the distance between the bases of the pectoral and pelvic fins 3.35-3.64 times, the distance between the bases of the pelvic and anal fins 3.17-3.84 times, and the distance between the bases of the anal and caudal fins 3.67-4.21 times in standard length.

The colour of the body is light brownish. The belly is silvery. The body as well as the fins are without any colour markings.

DISTRIBUTION :

Kashmir Valley (J. & K.)

LOCAL NAME :

The local fishermen in Kashmir name this fish as 'Zotteer' or 'Sattar'. It grows to a good size weighing nearly 1.25 kgs. It feeds on insects and algal slime.

MATERIAL EXAMINED

Regd. No.	Locality	Collector	Date of collection	No. of examples	Remarks
NMW 9020	Kashmir	Baron Huegel	1832	1	paratype (Natural History Museum, Vienna)
F.4341/2	,,	Major F. M. Bailey	—	2	—
—	Dal lake,	Dr. R. Tilak	—	3	—
—	Dal Gate, Srinagar				
—	Fish Farm, Harwan, Srinagar (J. & K.)	,,	7.11.1979	2	—
—	Fish Farm, Harwan Srinagar (J. & K.)	,,	8.11.1979	3	—
—	Telbal nullah, Srinagar (J. & K.)		8.11.1979	3	—
—	Dal lake, Srinagar (J. & K.)	,,	18.11.1979	4	—

9. Schizothoraichthys (Schizothoraichthys) longipinnis (Heckel)

(Figs. 60-64)

1838. *Schizothorax longipinnis* Heckel, *Fische aus Caschmir*, p. 27, pl. iv (Type-locality : Kashmir).

1842. *Schizothorax longipinnis* : Valenciennes (In Cuvier and Valenciennes), *Hist. Nat. Poiss.*, XVI, p. 216.

1844. *Schizothorax longipinnis* Heckel, *Fische Kaschmir's* in *Huegel's Reise*, p. 362.

1868. *Schizothorax longipinnis* : Günther, *Cat. Fish. Brit. Mus.*, VII, p. 166.

1878. *Schizothorax longipinnis* : Day, *Fish. India*, p. 532 (foot-note).

1889. *Schizothorax longipinnis* : Day, *Faun. Brit. India, Fishes*, 1, p. 252 (foot-note).

1916. *Schizothorax longipinnis* : Vinciguerra, *Ann. Mus. Civ. Stor. Nat. Genova*, Ser 3a, 7(47), p. 141 (Central Asia).

1936. *Schizothorax longipinnis* : Mukerji, *Mem. Conn. Acad. &* Sci., X, p. 334.

1937. *Schizothorax longipinnis* : Hora, *Rec. geol. Surv. India*, 72 (2), p. 181 (fossil scale).

B. III, D. IV/7, P. 1/18, V. II/10, A. III/5, C. 19 ; Lat. 1. 108, Lat. tr. 28/1/32 (upto base of pelvic)

The body is laterally compressed and stream-lined. The length of head is contained 5.38 times in total length and 4.34 times in standard length. The width of head is contained 1.72 times in length of head and 7.49 times in standard length. The height of head is contained 0.94 times in its width, 1.62 times in length of head and 7.49 times in standard length. The postocular length of head is contained 1.91 times in length of head and 8.30 times in standard length.

A horizontal line drawn from the tip of the snout towards the middle of the caudal base passes through the lower half of the eye while an oblique line connecting the tip of snout and the origin of the dorsal fin crosses through middle of the eye. The eyes are situated in the anterior half of the head and have a free orbital margin. The diameter of eye is contained 4.29 times in length of head, 1.17 times in snout and 1.60 times in interorbital width. The interorbital space is flat and bears longitudinal ridges, formed as a result of sutural union of frontal bones and raised lateral edges of these bones. The interorbital width is contained 2.66 times in length of head and 0.72 times in snout. The tip of snout is pointed and bears a groove across it. The snout does not cover the upper jaw. The length of snout is contained 11.57 times in standard length, 3.66 times in head length and 1.91 times in the postocular length of head. The mouth is horse-shoe shaped. Both

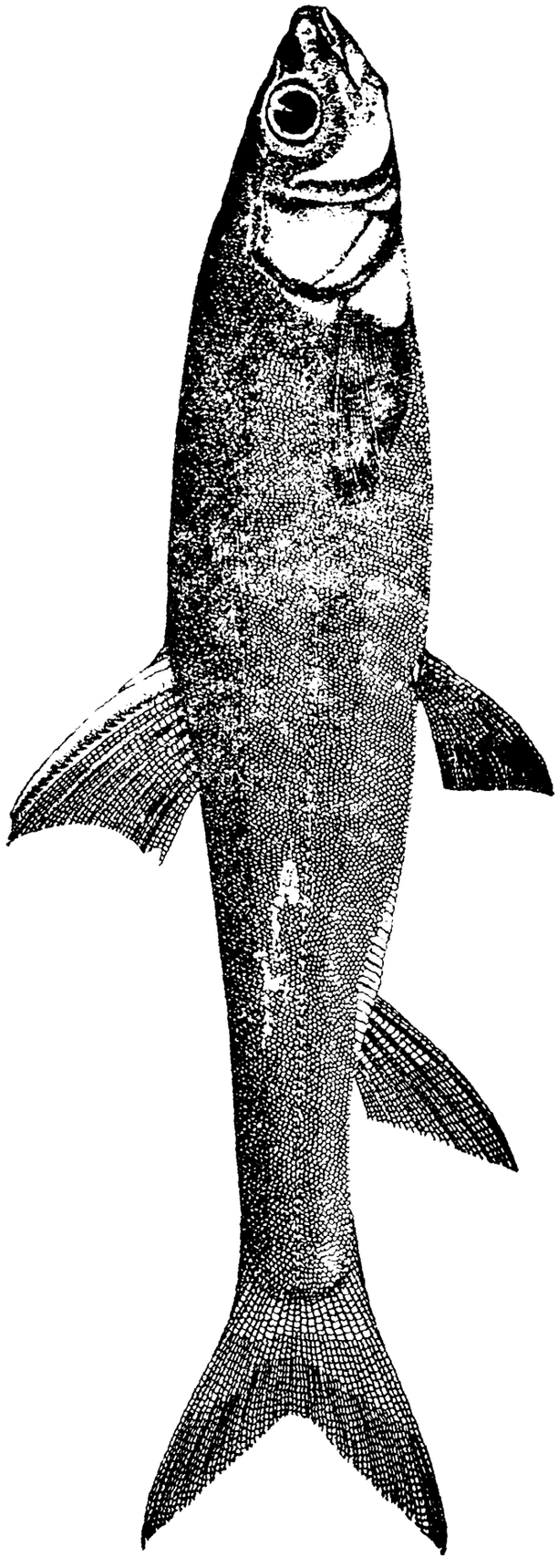


Fig. 60. Lateral view of *Schizothoraichthys longipinnis* (Heckel) (Holotype, Regd. No. NMW 9118, Natural History Museum, Vienna, Austria)

jaws are equal in length. Both jaws are covered with a thin horny layer. The width of the chord of mouth is contained 20.10 times in standard length, 4.63 times in head length and 1.26 times in length of snout. The posterior edge of the maxilla reaches the front edge of the orbit. The lips are thin and smooth. The lower labial fold is interrupted.

There are two pairs of barbels. Both barbels are of equal length and are smaller than the eye. The maxillary barbel hardly extends to below the middle of eye.

The gill cleft is wide and the isthmus is narrow. The width of the isthmus is contained 20.10 times in the standard length and 4.63 times in head length.

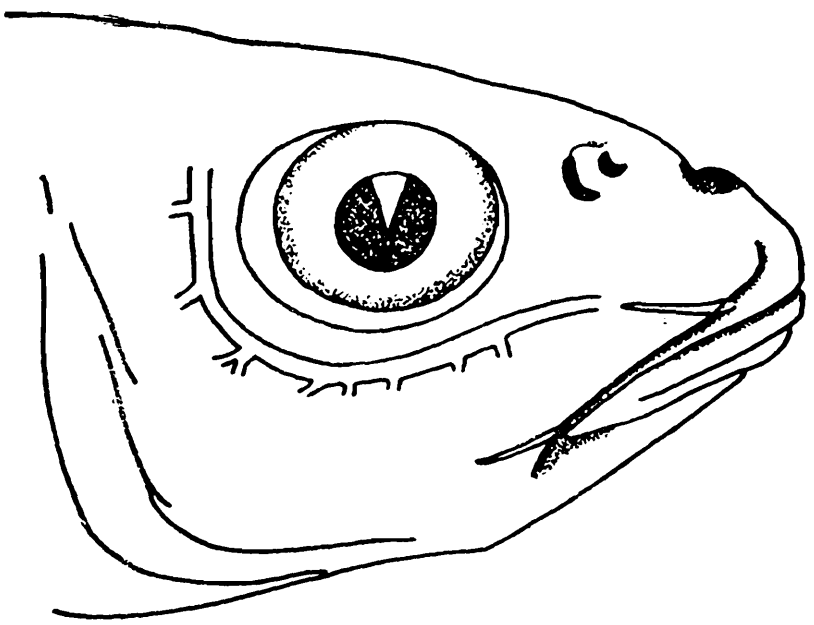


Fig. 61. Lateral view of head of *Schizothoraichthys longipinnis* (Heckel) (Holotype)

The lateral line curves down slightly behind the gill cleft and thereafter it runs straight to the base of the caudal fin. There are 108 scales along the lateral line. There are 28 scales between the lateral line and the base of dorsal fin and 22 scales between the lateral line and the base of the pelvic fin. The scales on the anal sheath are somewhat larger than the other scales of the body and the sheath of enlarged scales extends back upto the base of 4th

anal ray. There are 23 scales along the sheath of anal. The width of the enlarged scale of the anal sheath is contained 2.92 times in the diameter of eye. The scales on the upper part of the body are regularly arranged while those on the abdomen are extremely reduced and thinned out. One or two rows of scales along the base of the dorsal fin are larger than the scales on the body but smaller than those of anal sheath.

There are 20 gill rakers on the lower arm of the first branchial arch. There are 10 pharyngeal teeth, arranged in three rows (5-3-2/2-3-5). The tips of the teeth are pointed and crotchet shaped.

The origin of the dorsal fin is slightly nearer the base of the caudal fin than the tip of snout. The dorsal fin originates opposite to or a little behind the pelvic fin. The dorsal fin spine is bony

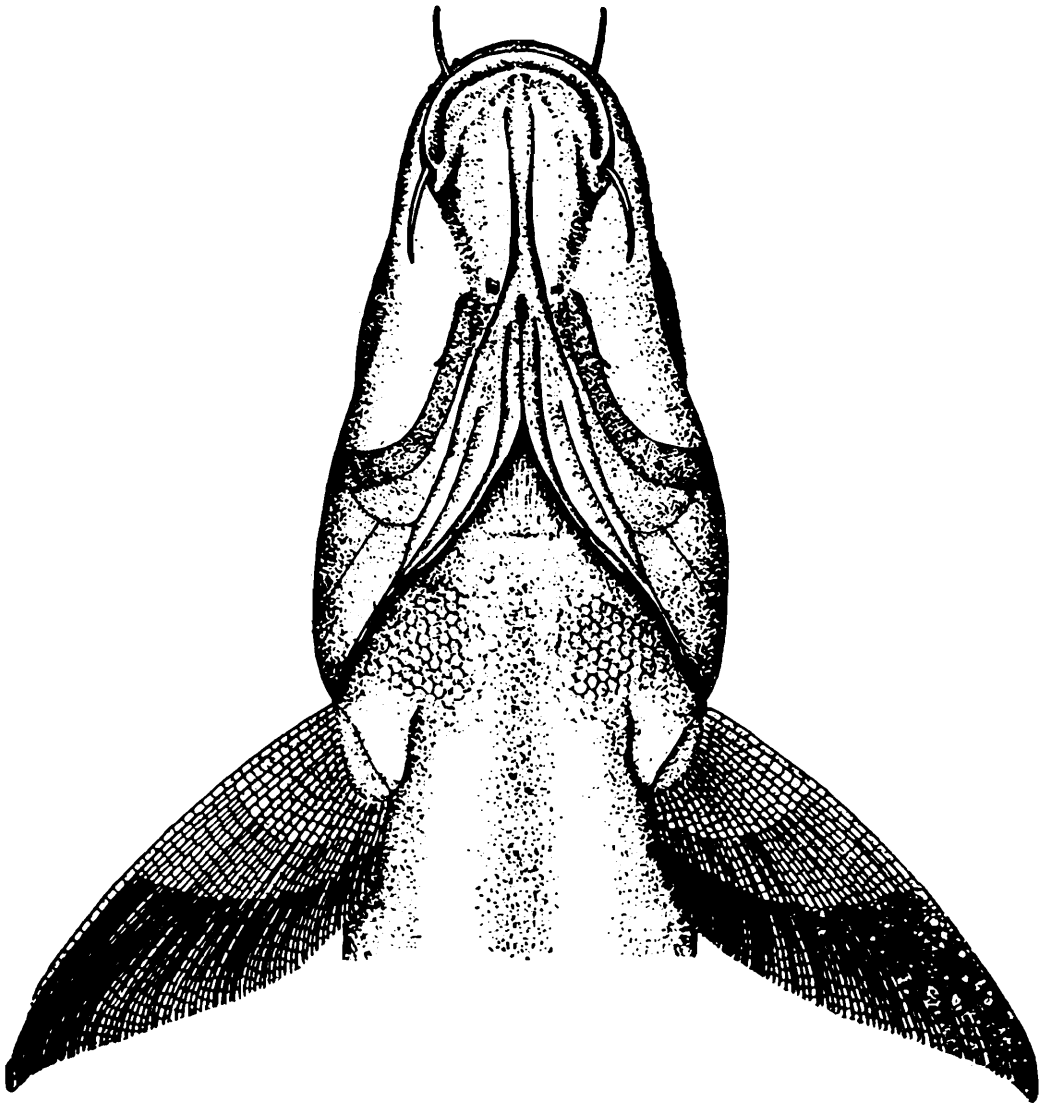


Fig. 62. Ventral view of head and anterior part of body of *Schizothoraichthys longipinnis* (Heckel) (Holotype)

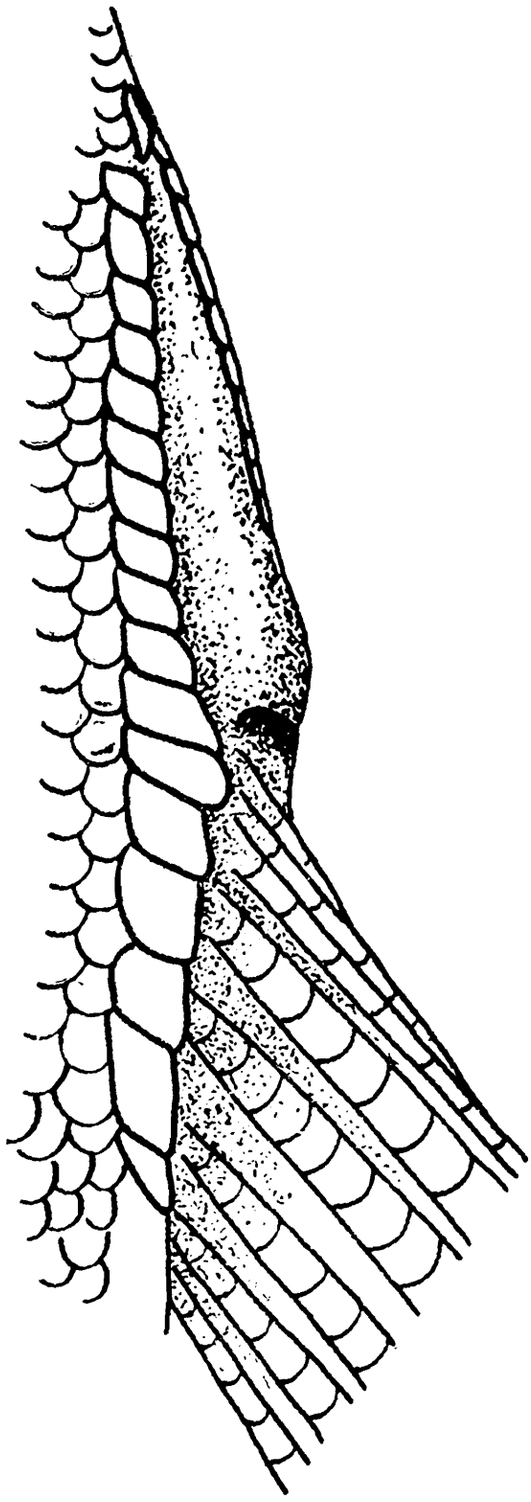


Fig. 63. Anal sheath of scale of *Schizothoraichthys longipinnis* (Holotype)

and serrated behind. There are 22 teeth on the dorsal spine. The length of the dorsal spine is contained 1.35 times in head length. The longest ray of the dorsal fin is contained 5.78 times in standard length and 1.33 times in length of head. The length of base of dorsal fin is contained 8.88 times in standard length and 2.04 times in head length.

The pectoral fin extends more than half way to the base of the pelvic fin. The length of the pectoral fin is contained 5.78 times in standard length, 1.33 times in head length and 1.69 times in the distance between the bases of the pectoral and the pelvic fins.

The pelvic fin arises opposite or a little before the dorsal fin and its length is contained 6.58 times in standard length, 1.51 times in head length and 1.72 times in the distance between the bases of the pelvic and the anal fins. The fleshy appendage in the axil of the pelvic fin is small and covered with scales. The anal fin, when laid flat, reaches the base of anterior undivided rays of the caudal fin. The length of the longest ray of the anal fin is contained 5.96 times in standard length, 1.37 times in head length and 1.31 times in the distance between the bases of the anal and the caudal fins. The length of the base of the anal fin is contained 15.65 times in standard length, 3.6 times in head length and 1.76 times in the length of the base of the dorsal fin. The caudal fin is forked. The height of the caudal peduncle is contained 11.23 times in the standard length, 2.58 times in head length and 1.76 times in its own length. The length of the caudal peduncle is contained 6.36 times in standard length and 1.46 times in the head length.

The distance between the tip of snout to the origin of the dorsal fin is contained 1.87 times, the distance between the tip of the snout to origin of the anal fin 1.26 times, the distance between tip of snout and the origin of the pelvic fin 1.89 times, the distance between the tip of snout and the origin of the pectoral fin 4.24 times, the distance between the bases of the pectoral and pelvic fins 3.41 times, the distance between the bases of the pelvic and anal fins 3.82 times, and the distance between the bases of the anal and the caudal fins 4.54 times in the standard length.

The colour of the body in spirit preserved specimens is dark brown on the back. It becomes lighter down the sides. The under side of the body is yellowish white to silvery. The fins are without any colour markings.

DISTRIBUTION :

Kashmir valley and Indus river at Skardu.

LOCAL NAME :

The local fishermen in Kashmir call this fish by the name "Dapeghat". It grows to 0.24 mts. in length, weighing 0.2 kgs.

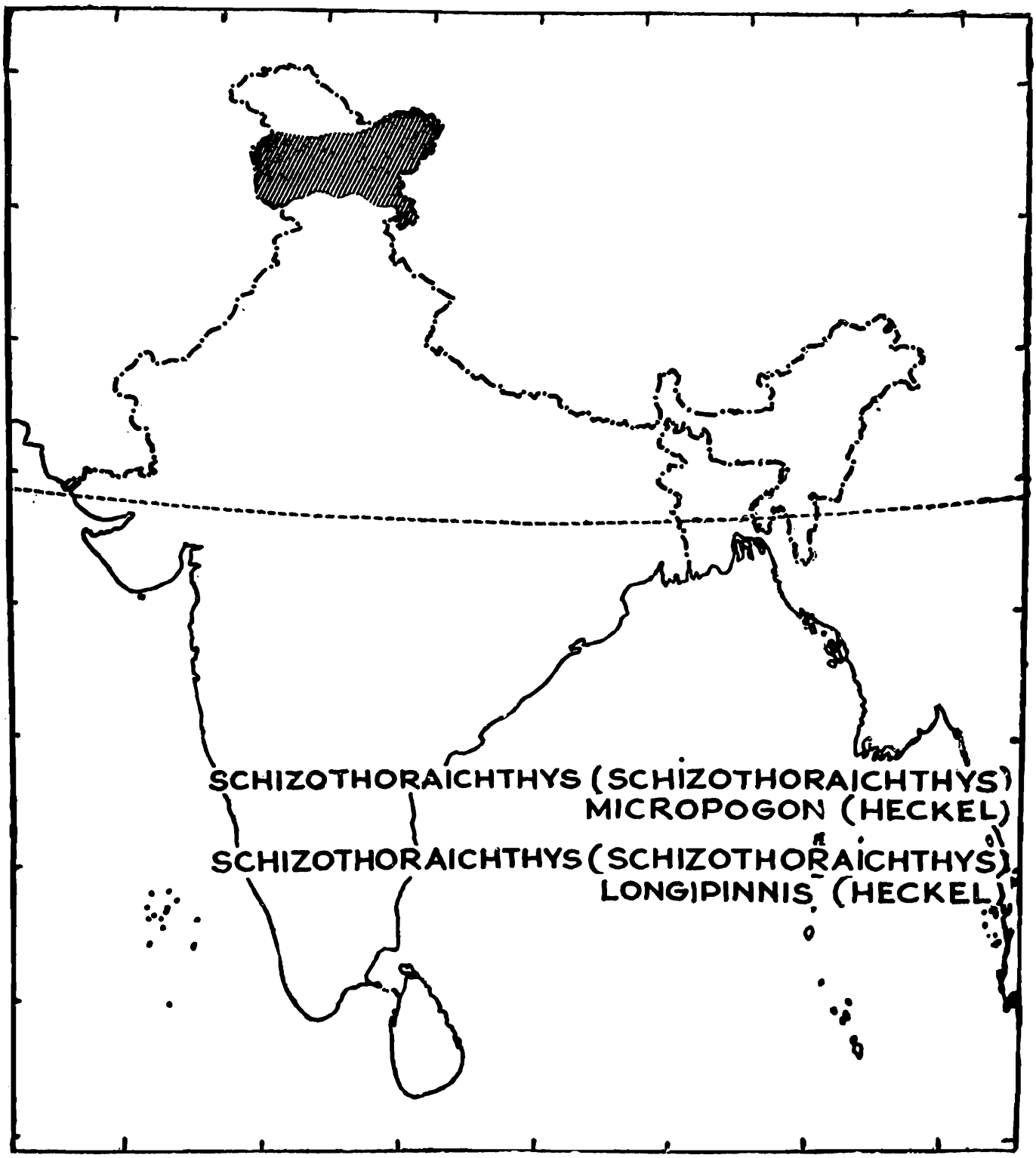


Fig. 64. Map showing the distribution of *Schizothoraichthys longipinnis* and *Schizothoraichthys micropogon*

There is an other Kashmiri local name, "Dibgaad" for those specimens of *S. curvifrons* in which the anal fin is long. In case, "Dapeghat", as mentioned by Heckel (1838), is deformed from "Dibgaad", a local name still prevalent in Kashmir valley, *S. longipinnis* may only be a variant of *S. curvifrons*. No material of *S. longipinnis* could be available from Kashmir valley inspite of the vast collections of Schizothoracids made there. There is no material of this species in Zoological Survey of India, Calcutta also. Hence, a redescription and figures of the type material from Vienna Museum is presented here. The single specimen from Manasbal lake, described by Mukerji (1936) is probably not *S. longipinnis* and is only *S. curvifrons*; that specimen is not available for examination.

MATERIAL EXAMINED

Regd. No.	Locality	Collector	Date of collection	No. of examples	Remarks
NMW-9118	Kashmir	Baron Huegel	1832	1	Holotype (Natural History Museum, Vienna)

10. Schizothoraichthys (Schizothoraichthys) niger (Heckel)

(Figs. 59, 65-69)

1838. *Schizothorax niger* Heckel, *Fische aus Caschmir*, p. 29, pl. V (Type-locality : Kashmir).

1842. *Schizothorax niger* : Valenciennes (In Cuvier & Valenciennes), *Hist. Nat. Poiss.*, XVI, p. 217.

1844. *Schizothorax niger* : Heckel, *Fische Kaschmir's in Huegel's Reise*, p. 364.

1868. *Schizothorax niger* : Günther, *Cat. Fish. Brit. Mus.*, VII, p. 164.

1877. *Schizothorax niger* : Day, *Fish India*, p. 531(foot-note).

1889. *Schizothorax niger* : Day, *Faun. Brit. India, Fishes*, i, p. 252 (foot-note).

1936. *Schizothorax niger* : Mukerji. *Mem. Conn. Acad. Sci. & Arts*, X (XVIII), p. 343.

1975. *Schizothoraichthys niger* : Tilak and Sinha, *Ann. Zool.*, 32 (13), p. 292.

B. III, D. III/7, P. 1/17, V. II/9, A. III/5, C. 19; Lat. l. 97-99, Lat. tr. 26/1/37

The body is laterally compressed with dorsal profile arched. The length of head is contained 4.94—5.14 times in total length

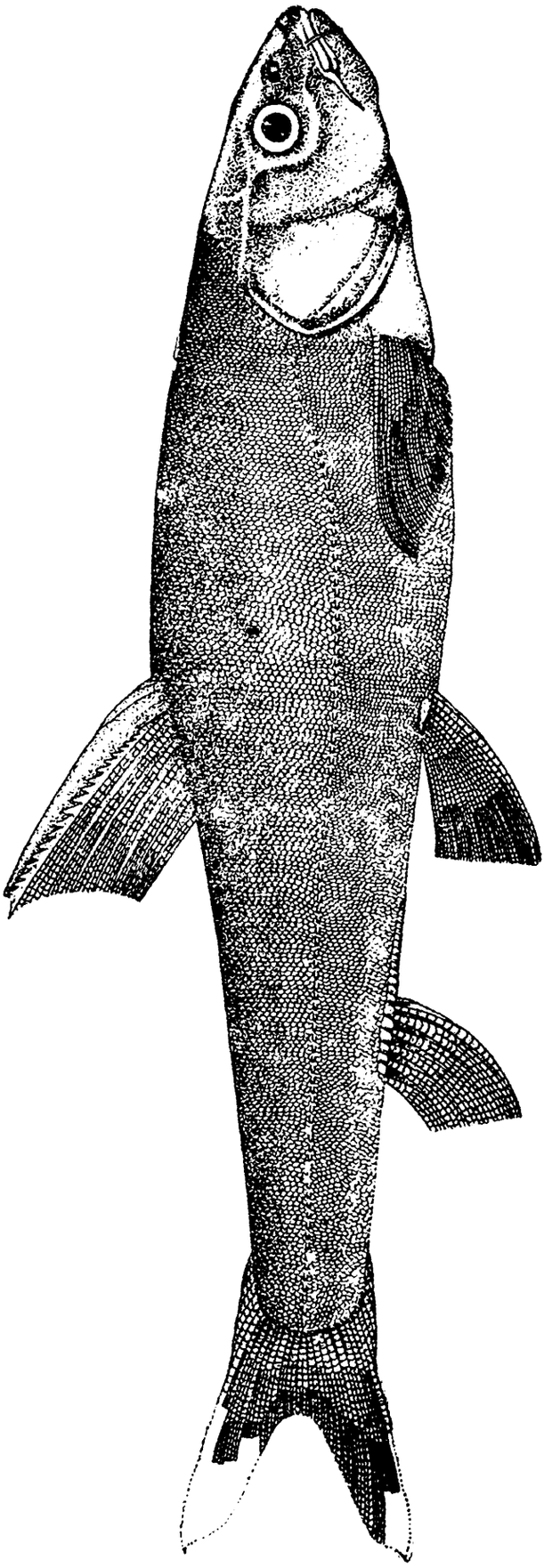


Fig. 65. Lateral view of *Schizothoraichthys niger* (Heckel) (Holotype, Regd. No. NMW 9013, Natural History Museum, Vienna, Austria)

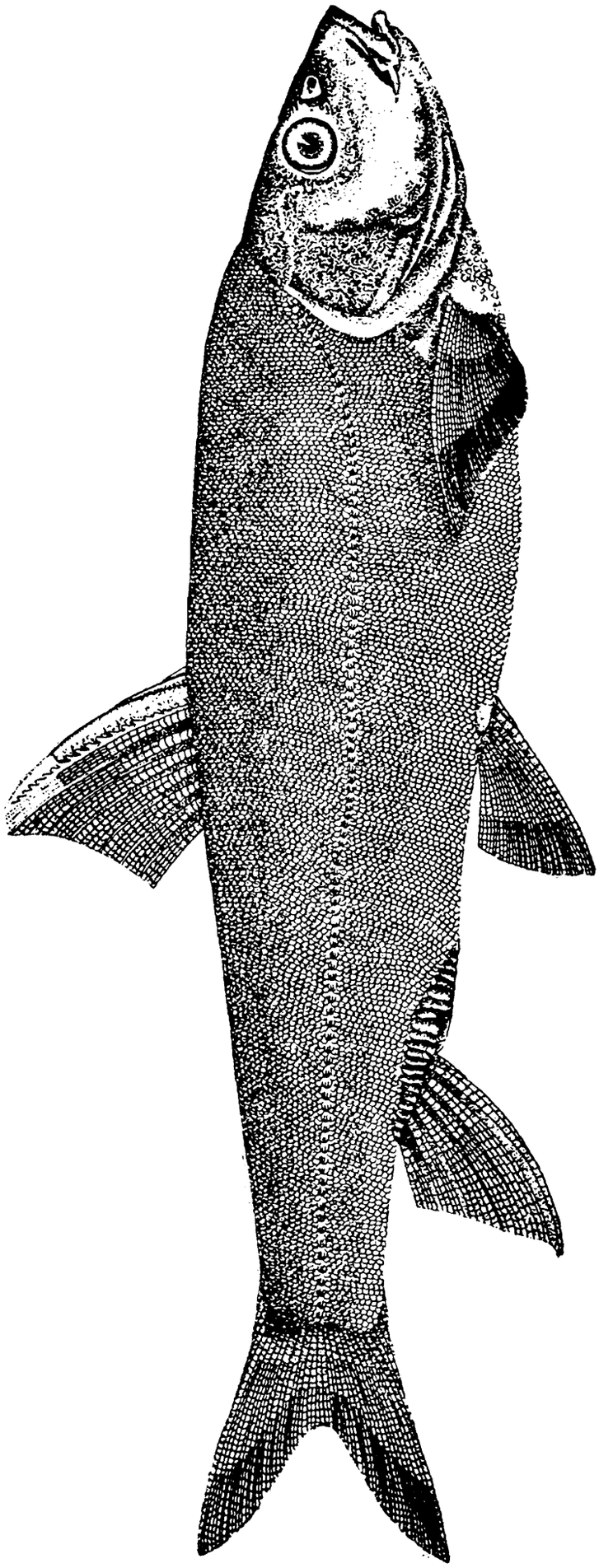


Fig. 66. Lateral view of *Schizothoraichthys niger* (Heckel)

and 4.15—4.33 times in standard length. The height of head is contained 0.78—0.97 times in its width, 1.36—1.45 times in length of head and 5.88—6.03 times in standard length. The postocular length of head is contained 1.89 times in length of head and 7.87 —8.21 times in standard length.

The horizontal line drawn from the tip of the snout towards the middle of the caudal base passes through the lower half of the eye while an oblique line connecting the tip of snout and the origin of the dorsal fin crosses through the upper half of the eye. The eyes are situated entirely in the anterior half of the head and have a free orbital margin.

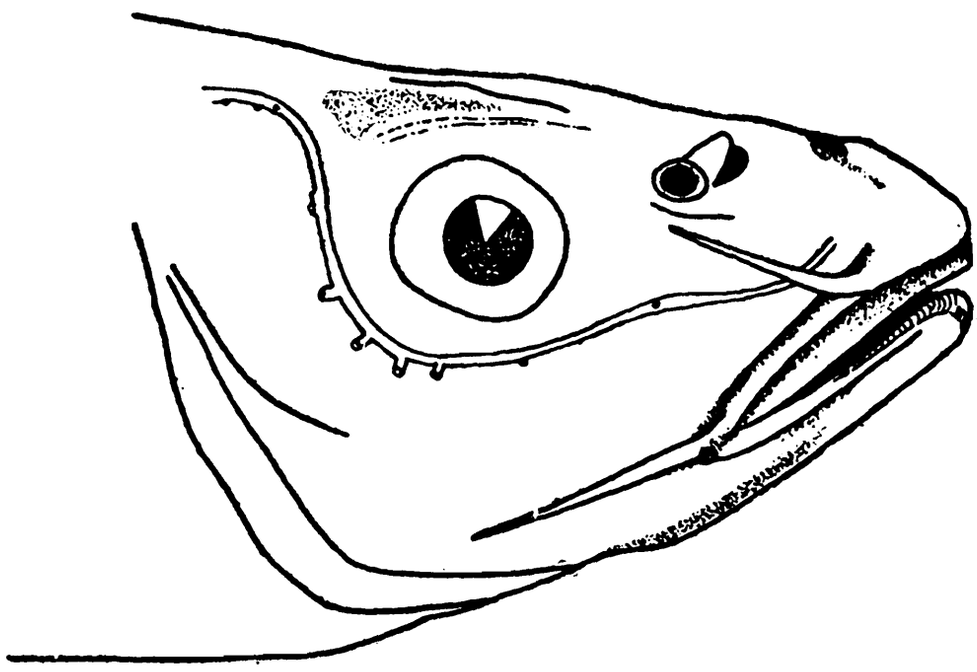


Fig. 67. Leteral view of head of *Schizothoraichthys niger* (Heckel)

The diameter of eye is contained 5.56—5.86 times in length of head, 1.75—1.92 times in snout and 1.92—1.94 times in interorbital width. The interorbital space is flat; the sutural ridge of frontal is very prominently raised. The supraorbital ridges, formed by lateral sides of frontals, are prominent but less raised than the median ridge. The interorbital width is contained 2.88—3.00 times

in length of head and 0.9—1.0 times in snout. The tip of snout is pointed. The snout bears a groove across the space in front of internarial space. The lateral groove on snout, formed by the underlying lacrymal is prominent and is continuous with the labial

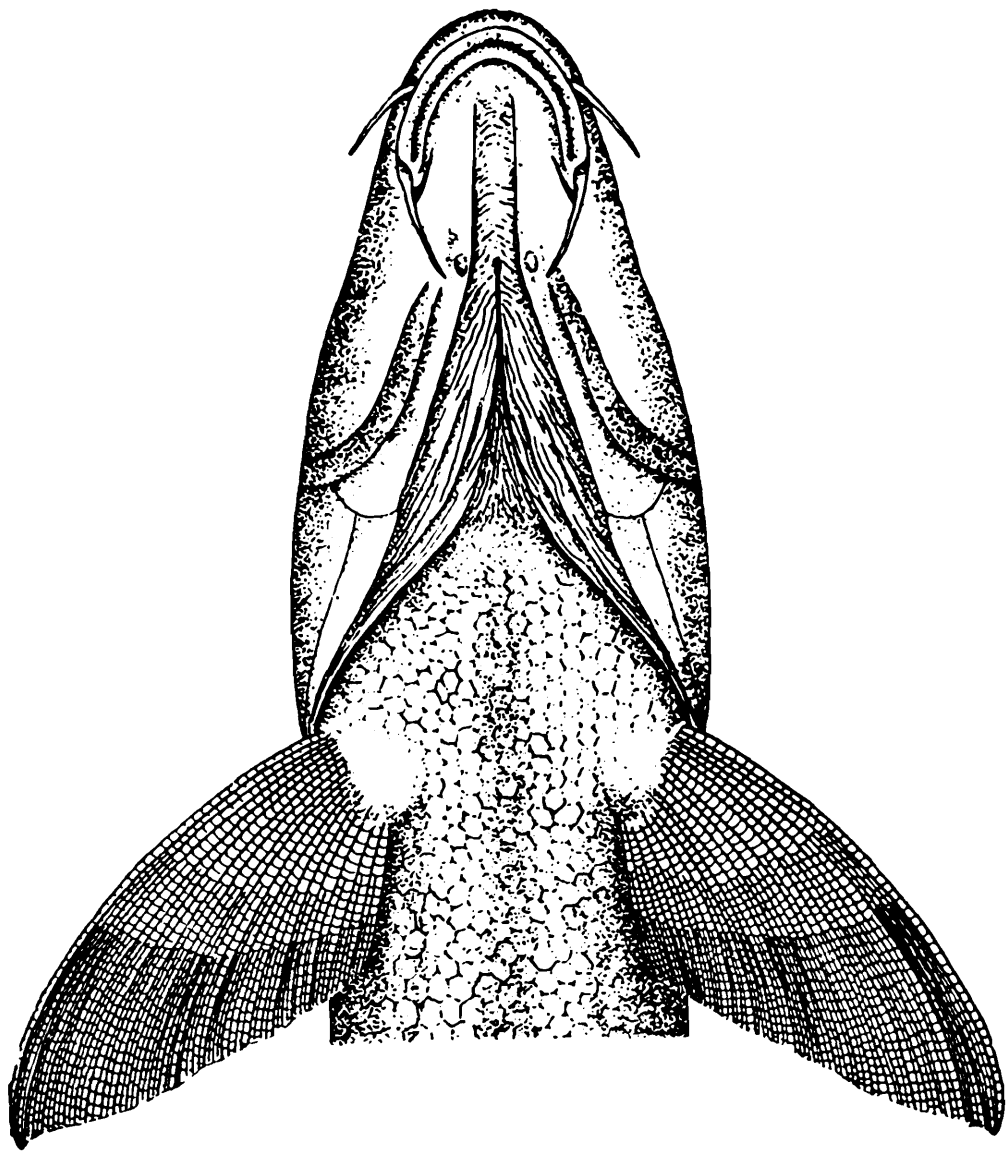


Fig. 68. Ventral view of head and anterior part of body of *Schizothoraichthys niger* (Heckel)

fold at corner of mouth. The length of snout is contained 12.53—13.78 times in standard length, 2.88—3.32 times in head length and 1.52—1.75 times in the postocular length of head. The mouth is horse-shoe shaped. The width of the chord of mouth is contained 13.31—17.54 times in standard length, 3.06—4.22 times in head length and 1.06—1.27 times in length of snout. The posterior edge of the maxilla reaches opposite the nostrils and falls short of the anterior edge of eye. The lips are thick. The lower labial fold is

interrupted, and the groove extends anteriorly, falling short of tip of jaw by a short distance. There are two pairs of barbels. The rostral and the maxillary pairs are smaller than the eye. The maxillary barbel extends to below the middle of eye.

The gill cleft is wide and the isthmus is narrow. The width of the isthmus is contained 19.3—24.12 times in the standard length and 5.56—6.65 times in head length.

The depth of the body is contained 4.12—4.54 times in standard length and 0.95—1.09 times in head length. The width of the body is contained 5.15—8.39 times in standard length, 1.18—2.02 times in head length and 1.39 times in height of head.

The lateral line curves down slightly behind the gill cleft and thereafter it runs straight up to the base of the caudal fin. There are 97—99 scales along the lateral line. There are 26 scales between the lateral line and the base of dorsal fin and 21 scales between the lateral line and the base of the pelvic fin.

The scales on the anal sheath are somewhat larger than the other scales of the body. There are 20 scales along the anal sheath. The width of the enlarged scale of the anal sheath is contained from 1.53—2.66 times in the diameter of eye. The scales on the upper part of the body are regularly arranged while those on the abdomen are externally reduced and thinned out. The scales along the base of the dorsal fin are larger than the scales on the body.

The origin of dorsal fin is nearer the base of the caudal fin than the tip of snout. The distance between origin of dorsal and base of caudal, when carried forward, falls on the posterior nostril. The dorsal fin originates slightly anterior to the origin of pelvic fin. The dorsal fin spine is bony and serrated behind. There are 17 teeth on the dorsal spine. The longest ray of the dorsal fin is contained 5.43— 6.22 times in standard length and 1.30—1.39 times in length of head. The length of base of dorsal fin is contained 8.31— 8.77 times in standard length and 1.91—211 times in head length.

The pectoral fin extends more than half way to the base of the pelvic fin. The length of the pectoral fin is contained 5.51—5 84 times in standard length, 1.27—1.40 times in head length and 1.65—1.67 times in the distance between the pectoral and the pelvic fins.

The pelvic fin arises slightly posterior to the origin of dorsal fin and its length is contained 6.43—6.54 times in standard length,

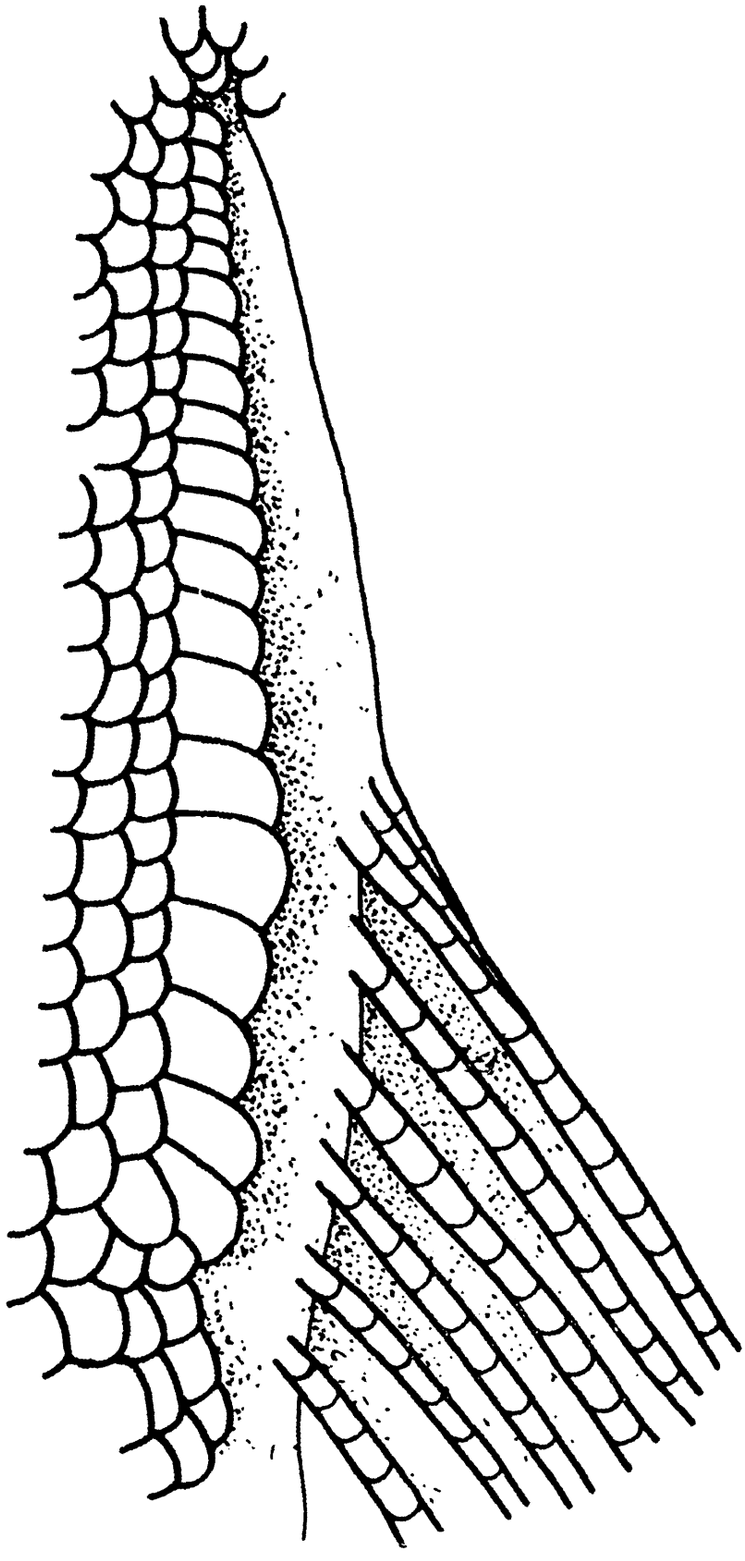


Fig. 69. Anal sheath of scales of *Schizothoraichthys niger*

1.48—1.57 times in head length and 1.59—1.78 times in the distance between the bases of the pelvic and the anal fins. The fleshy appendage in the axil of the pelvic fin does not reach the base of the caudal fin. The length of the longest ray of the anal fin is contained 6.54—7.72 times in standard length, 1.50—1.86 times in head length and 1.45—1.92 times in the distance between the bases of the anal and the caudal fins. The length of the base of the anal fin is contained 13.78—14.84 times in standard length, 3.17—3.67 times in head length and 1.65—1.69 times in the length of the base of the dorsal fin. The caudal fin is forked.

The height of the caudal peduncle is contained 9.89—10.15 times in the standard length, 2.28—2.44 times in head length and 1.48—1.89 times in its own length. The length of the caudal peduncle is contained 5.36—6.65 times in standard length and 1.29—1.53 times in the head length The length of the caudal fin is contained 1.23—1.25 times in head length.

The distance between the tip of snout to the origin of the dorsal fin is contained 1.89—1.93 times, the distance between the tip of the snout to origin of the anal fin 1.22—1.31 times, the distance between tip of snout and the origin of pelvic fin 1.84—1.86 times, the distance between the tip of snout and the origin of the pectoral fin 3.86—4.19 times, the distance between the bases of the pectoral and the pelvic fins 3.29—3.54 times, the distance between the bases of the pelvic and anal fins 3.60—4.10 times, and the distance between the bases of the anal and the caudal fins 4.02—4.48 times in the standard length.

The colour of the body in spirit preserved specimens is dark brown on back, becoming lighter on sides. The under-side of the body is pale yellowish. The fins are brownish. There are spots on upper part of body.

Distribution :

Kashmir Valley.

Local Name :

The local fishermen in Kashmir call this fish by the name of "Alghad" It grows to 2.7 kgs.

Remarks :

As the name suggests, the fish has a much darker colour than other species of this genus. The eyes are large but the anal and the barbels are short. Mukerji (1936) mentioned that *S. planifrons* and *S. niger* are probably the same species.

MATERIAL EXAMINED

Regd. No.	Locality	Collector	Date of collection	No. of examples	Remarks
NMW–9013	Kashmir	Baron Huegel	1832	1	Holotype (Natural History Museum, Vienna)
–	Telbal nullah, Dal lake, Srinagar (J. & K.)	Dr. R. Tilak	8.11.1977	1	
F. 273/2	Srinagar, Kashmir	–	–	1	

11. Schizothoraichthys (Schizothoraichthys) nasus (Heckel)

(Figs. 59, 70-73)

1838. *Schizothorax nasus* Heckel, *Fische aus Caschmir*, p. 32, pl. VI (Type-locality : Kashmir).

1842. *Schizothorax nasus* : Valenciennes (In Cuvier & Valenciennes), *Hist. Nat. Poiss.*, XVI, p. 218.

1844. *Schizothorax nasus* Heckel, *Fische Kaschmir's* in *Huegel's Reis*, p. 367.

1868. *Schizothorax nasus* : Günther, *Cat. Fish. Brit. Mus.*, VII, p. 166.

1877. *Schizothorax nasus* : Day, *Fish India*, p. 532 (foot-note).

1889. *Schizothorax nasus* : Day, *Faun. Brit. India, Fishes*, i, p. 252 (foot-note).

1898. *Schizothorax nasus* : Alcock, *Nat. Hist. Pamir. Bound. Comm.*, p. 37 (Yasin R.).

1975. *Schizothoraichthys nasus* : Tilak and Sinha, *Ann. Zool.*, 32 (13), p. 292.

B. III, D. III/7, P. 1/17, V. II/9, A. III/5, C. 19 ; Lat. 1. 105, Lat. tr. 27/1/31

The body is laterally compressed with dorsal profile much arched. The length of head is contained 5.36 times in total length and 4.44 times in standard length. The width of head is contained 1.63 times in length of head and 7.27 times in standard length. The height of head is contained 1.22 times in its width, 1.51 times in length of head and 6.72 times in standard length. The postocular length of head is contained 1.85 times in length of head and 8.22 times in standard length.

A horizontal line drawn from the tip of the snout towards the middle of the caudal base passes below the eye, clearly off its

border, while an oblique line connecting the tip of snout and the origin of the dorsal fin crosses through middle of the eye. The eyes are situated entirely in the anterior half of the head and have a free orbital margin. The diameter of eye is contained 5.55 times in length of head, 1.55 times in snout and 2.05 times in interorbital width. The interorbital space is flat and marked with three longitudinal ridges, formed by the union of frontals and their outer raised sides. The interorbital width is contained 2.70 times in length of head and 0.75 times in snout. The tip of snout is pointed with a slight groove across it. The snout tends to cover the upper jaw to a slight extent. The anterior end of the lacrymal below the skin formes a groove on the side of the snout comparable with the lateral lobe of snout in other fishes. The length of snout is contained 15.85 times in standard length, 3.57 times in head length and 1.92 times in the postocular length of head. The mouth is arc-shaped. The upper jaw is slightly longer than the lower jaw. Both jaws are covered with a deciduous horny layer which is of chestnut colour. The width of the chord of mouth is contained 21.14 times in standard length, 4.76 times in head length and 1.33 times in length of snout. The posterior edge of the maxilla reaches below posterior nostrils and falls short of the anterior edge of eye. The lips are soft and thin. The lower labial fold is interrupted. The lower lip bears small beaded structures around the mandibular symphysis. The edge of lower jaw is sharp and helpful in scrapping off algal encrustation from stones. There are two pairs of barbels. The rostral pair is smaller than the maxillary and both are smaller than the eye. The maxillary barbel extends to below the middle of eye.

The gill cleft is wide and the isthmus is narrow. The width of the isthmus is contained 24.66 times in the standard length and 5.55 times in head length.

The depth of the body is contained 4.87 times in standard length and 1.09 times in head length. The width of the body is contained 8.22 times in standard length, 1.85 times in head length and 1.22 times in height of head.

The lateral line curves down slightly behind the gill cleft and thereafter it runs almost straight up to the base of the caudal fin. There are 105 scales along the lateral line. There are 27 scales between the lateral line and the base of dorsal fin and 21 scales between the lateral line and the base of the pelvic fin.

The scales on the anal sheath are somewhat larger than the other scales of the body and the sheath extends back up to end of base of anal fin. There are 21 scales along the sheath of anal. The width of the enlarged scale of the anal sheath is contained 3.0 times in the diameter of eye. The scales on the upper part of the body are regularly arranged while those on the abdomen are

extremely reduced and thinned out. One row of scales along the base of the dorsal fin is larger than the scales on the body but smaller than those of anal sheath.

There are 10 pharyngeal teeth, arranged in three rows (5-3-2/2-3-5). The tips of the teeth are pointed and curved.

The origin of the dorsal fin is nearer the base of caudal than tip of snout. The distance between origin of dorsal and base of caudal fin, when carried forward, falls on anterior edge of nostrils. The dorsal fin originates opposite the pelvic fin. The dorsal fin spine is bony and serrated behind. There are 22 teeth on the dorsal spine. The length of the dorsal spine is contained 1.56 times in length of head. The longest ray of the dorsal fin is contained 6.16 times in standard length and 1.38 times in length of head. The length of base of dorsal fin is contained 8.88 times in standard length and 2.0 times in head length.

The pectoral fin extends more than half way to the base of the pelvic fin. The length of the pectoral fin is contained 5.34 times in standard length, 1.20 times in head length and 1.49 times in the distance between the bases of the pectoral and the pelvic fins.

The pelvic fin arises opposite the dorsal fin and its length is contained 6.0 times in standard length, 1.35 times in head length and 1.48 times in the distance between the bases of the pelvic and the anal fins. The fleshy appendage in the axil of the pelvic fin is covered with 2-3 enlarged scales. The anal fin, when laid flat, does not reach the base of the caudal fin. The length of the longest ray of the anal fin is contained 7.16 times in standard length, 1.61 times in head length and 1.58 times in the distance between the bases of the anal and the caudal fins. The length of the base of the anal fin is contained 16.44 times in standard length, 3.70 times in head length and 1.85 times in the length of the base of the dorsal fin. The caudal fin is forked.

The height of the caudal peduncle is contained 11.1 times in the standard length, 2.5 times in head length and 1.9 times in its own length. The length of the caudal peduncle is contained 5.84 times in standard length and 1.31 times in the head length. The length of the caudal fin is contained 1.08 times in head length.

The distance between the tip of snout to the origin of the dorsal fin is contained 1.91 times, the distance between the tip of the snout to origin the anal fin 1.30 times, the distance between tip of snout and the origin of pelvic fin 1.96 times, the distance between the tip of snout and the origin of the pectoral fin 4.14 times, the distance between the bases of the pectoral and the pelvic fins 3.58 times and the distance between the bases of the anal and the caudal fins 4.53 times in the standard length.

The colour of the body in spirit preserved specimen is dark brown on the back which becomes lighter on the sides of body. The under side of the body is yellowish white. The fins are dusky brown.

Distribution :

Kashmir Valley.

Local Name :

The local fishermen in Kashmir call this fish by the name of "Dongu".

MATERIAL EXAMINED

Regd. No.	Locality	Collector	Date of collection	No. of examples	Remarks
NMW 9008	Kashmir	Baron Huegel	?	1	Holotype (Natural History Museum, Vienna)

12. Schizothoraichthys (Schizothoraichthys) hügelii Heckel (Figs. 59, 74-76)

1838. *Schizothorax hügelii* Heckel, *Fische aus Caschmir*, p. 36, pl. VII (Type-locality : Kashmir).

1842. *Schizothorax hügelii* : Valenciennes (in Cuvier & Valenciennes), *Hist. Nat. Poiss.*, 16, p. 219.

1844. *Schizothorax hügelii* Heckel, *Fische Kaschmir's* in *Hugel's Reiche*, p. 367.

1868. *Schizothorax hügelii* : Günther, *Cat. Fish. Brit. Mus.*, 7 : 164.

1877. *Schizothorax hügelii* : Day, *Fish India*, p. 532 (foot-note)

1889. *Schizothorax hügelii* : Day, *Faun. Brit. India, Fishes*, I, p. 252 (foot-note).

1960. *Schizothorax hügelii* : Silas, *J. Bombay nat. Hist. Soc.*, 57 (1), p. 71 (Kashmir).

1962. *Schizothoraichthys hügelii* : Misra, *Rec. Indian Mus.*, 57, p. 48.

1975. *Schizothoraichthys hügelli* : Tilak and Sinha, *Ann. Zool.*, 32, (13), p. 290.

B. III, D. II/7, P. I/17, V. 1/9, A. III/5, C. 19. Lat. tr. 28/1/21 (up to base of pelvic fin).

The body is laterally compressed. The predorsal part of the body is most prominent and both dorsal and ventral profiles of the

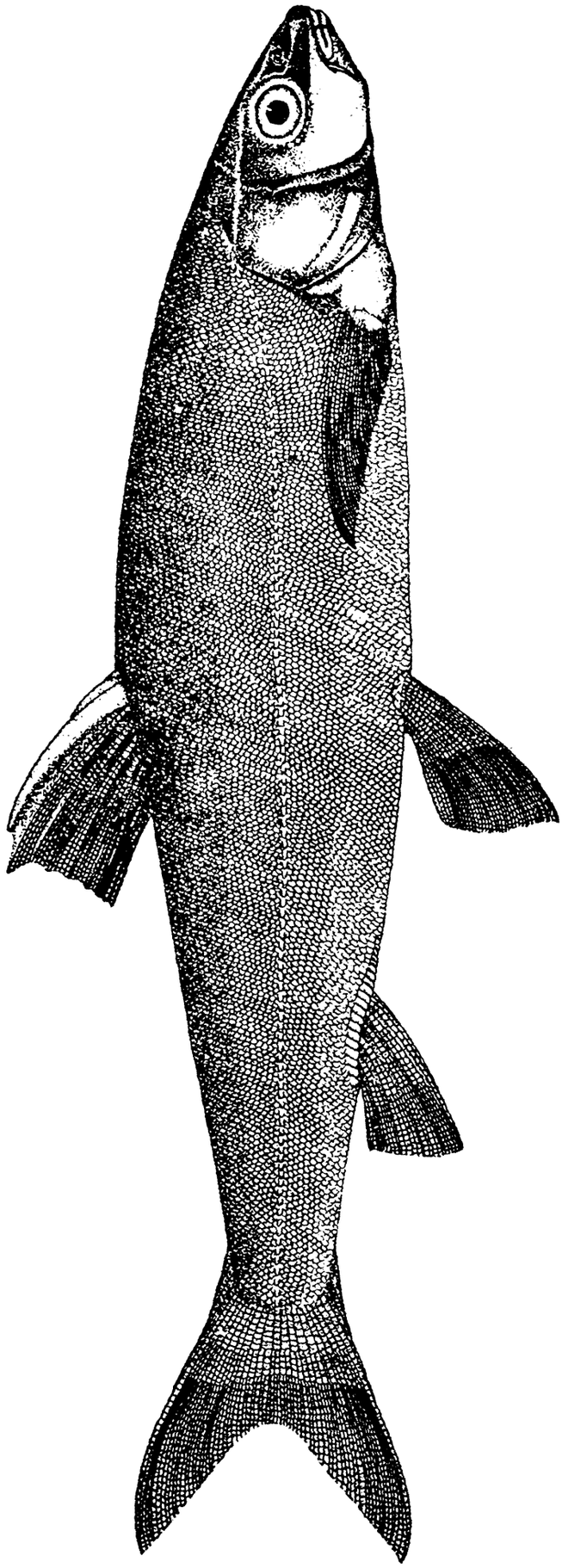


Fig. 70. Lateral view of *Schizothoraichthys nasus* (Heckel) (Holotype, Regd. No. NMW 9008, Natural History Museum, Vienna, Austria)

body are equally arched. The length of head is contained 4.19 times in standard length and 5.04 times in total length. The postorbital length of head equals the width of body. The height of head is contained 1.46 times in the length of head. The width of head is contained 6.8 times and height of head 6.12 times in the standard length. The eye is situated entirely in the anterior half of head. The orbital margin is free. The diameter of eye is contained 6.08 times in length of head, 1.9 times in length of snout and 2.33 in interorbital width.

The length of snout is contained 13.3 times in standard length, 3.17 times is length of head and 1.6 times in the postocular length of head. The snout and upper lip are separated by a groove but

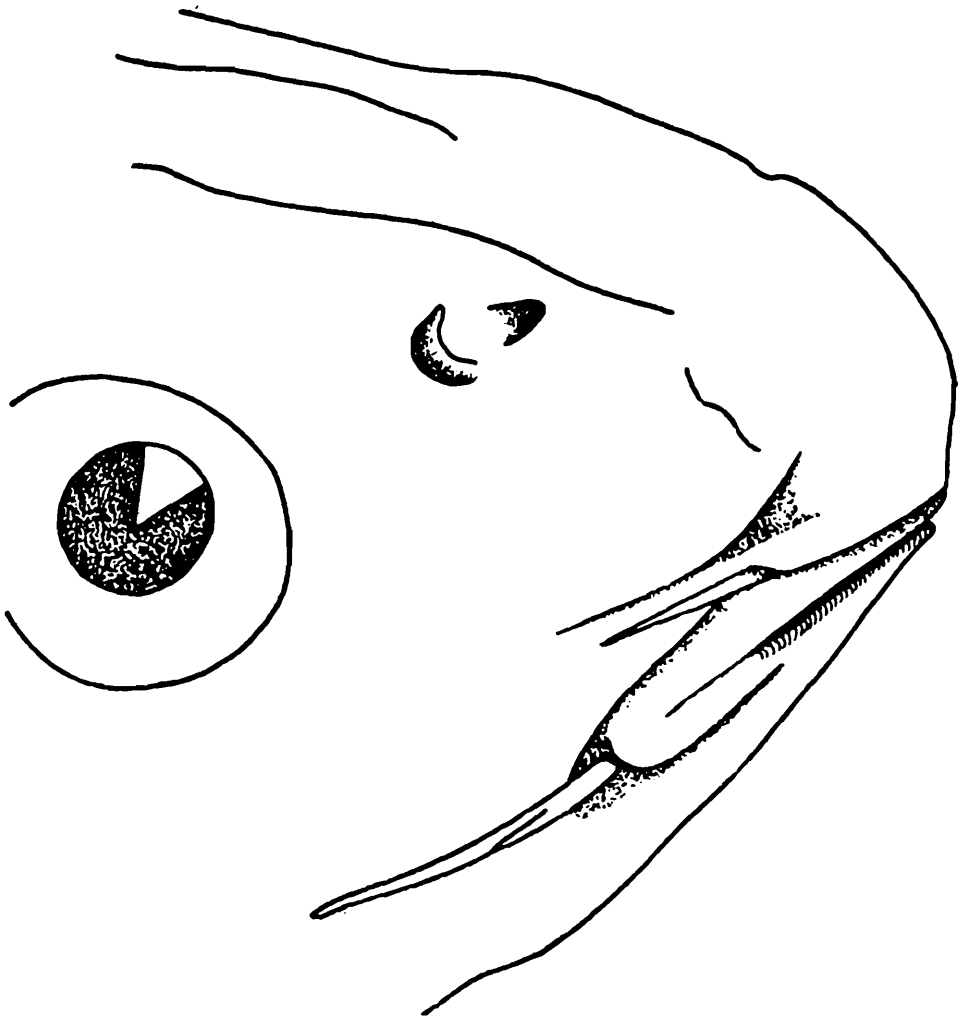


Fig. 71. Lateral view of head of *Schizothoraichthys nasus* (Heckel)

no side lobe of snout is formed. The tip of snout lies below the axis of the body. The lips are thick, fleshy and blunt. The labial fold behind the lower lip is interrupted by a wide interspace.

The mouth is horse-shoe shaped, obliquely ascending forward. The upper jaw is slightly longer than the lower. Margin of the

lower jaw rounded. There is an inner symphyseal knob on the lower. Jaws are without a horny covering. The width of chord of the mouth is contained 20.4 times in standard length, 4.86 times in head length and 1.53 times in length of snout. The posterior edge of the maxilla does not quite reach the front edge of the orbit. The lower labial fold is interrupted in the middle.

There are two pairs of barbels, the rostral and the maxillary, both are smaller than the eye.

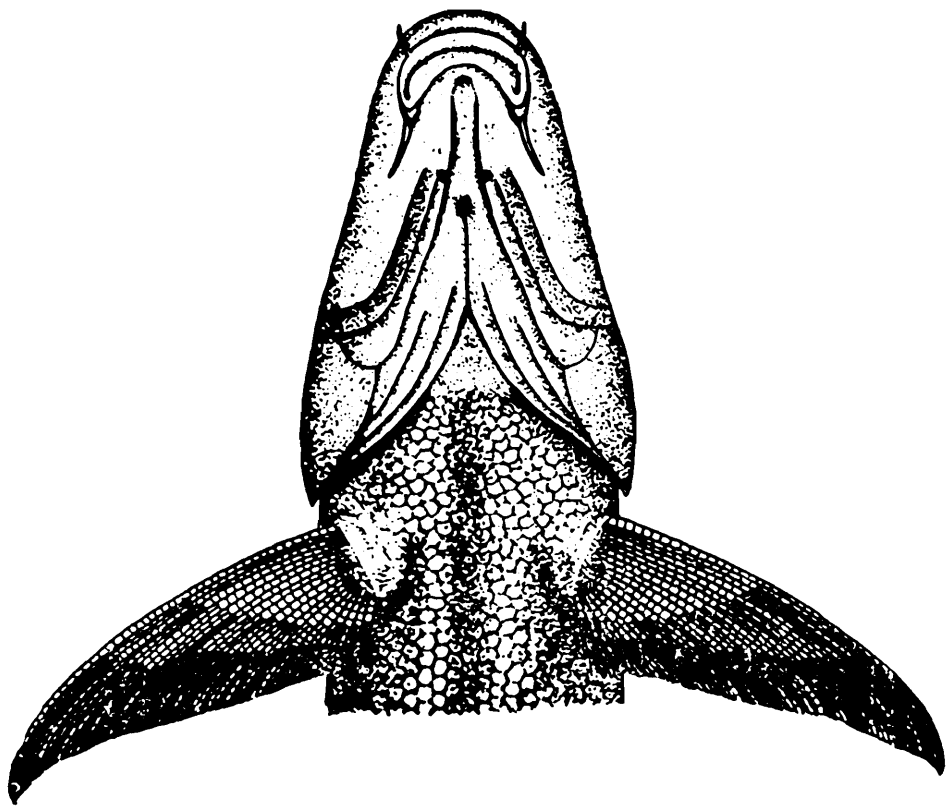


Fig. 72. Ventral view of head and anterior part of body of *Schizothoraichthys nasus* (Heckel)

The gill clefts are wide and the isthmus is narrow. The width of the isthmus is contained 30.6 times in the standard length and 7.3 times in length of head.

The depth of the body, in a long preserved specimen, is less than the head length and is contained 5.66 times in total length, 4.70 times in standard length and 1.12 times in length of head. The width of body is contained 8.27 times in standard length, 1.97 times in head length and 1.75 times in height of body.

The lateral line is curved downwards in the middle of the body and is continued to the centre of the base of the caudal fin. There are 120 scales along the lateral line and 28 rows between it and the base of dorsal fin. There are 21 rows between the lateral line and the base of pelvic fin. The tiled row of scales on the

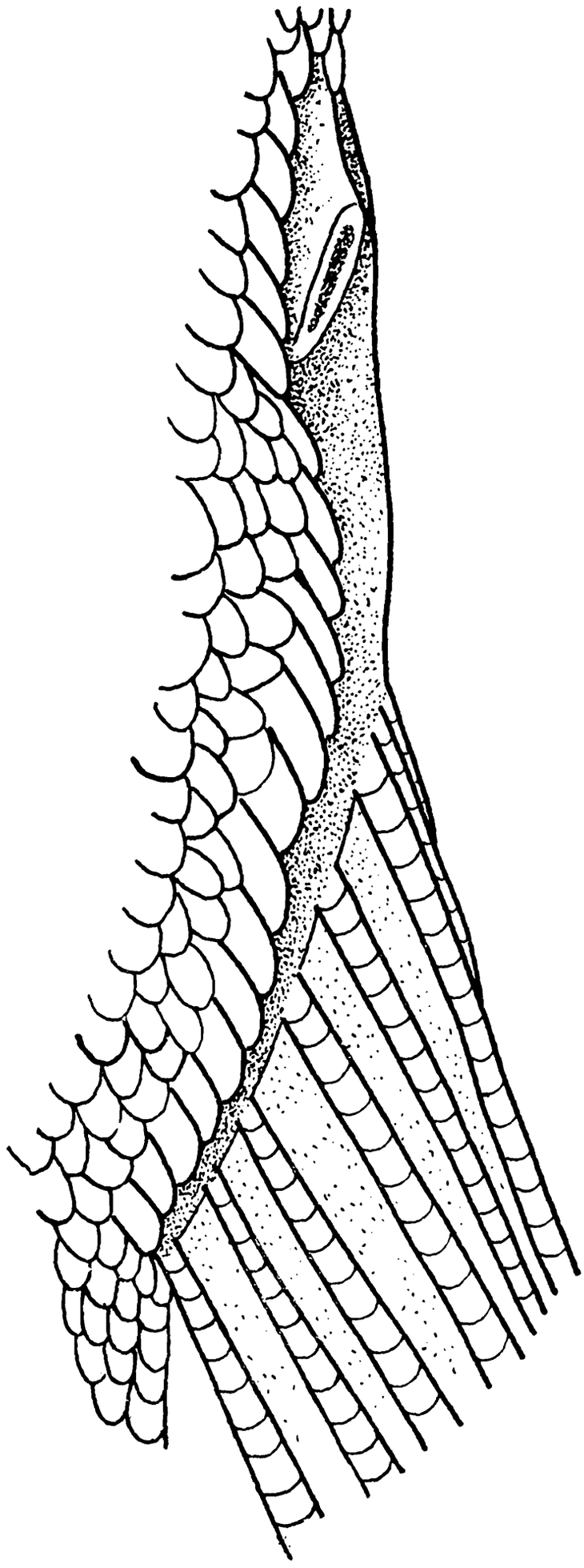
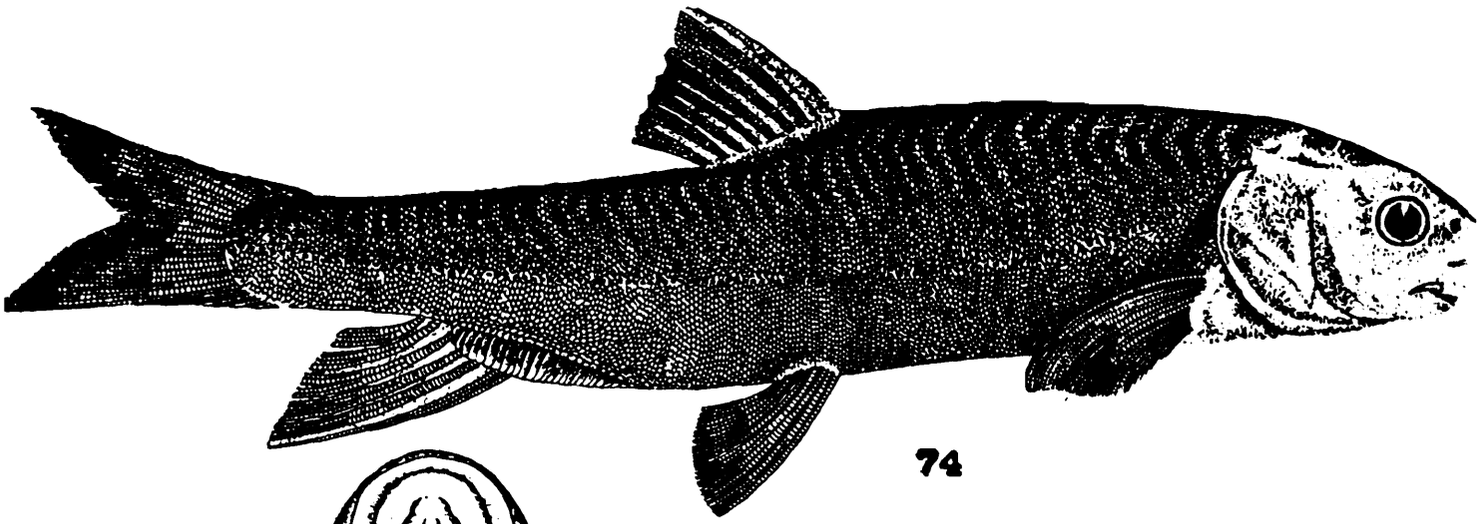
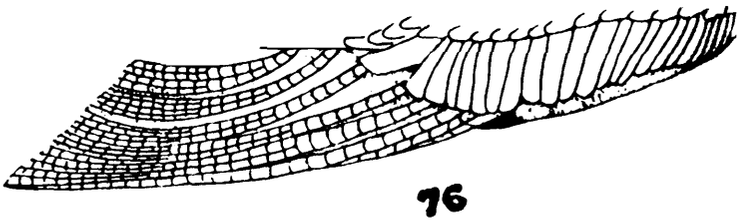


Fig. 73. Anal sheath of scales of *Schizothoraichthys nasus* (Heckel)





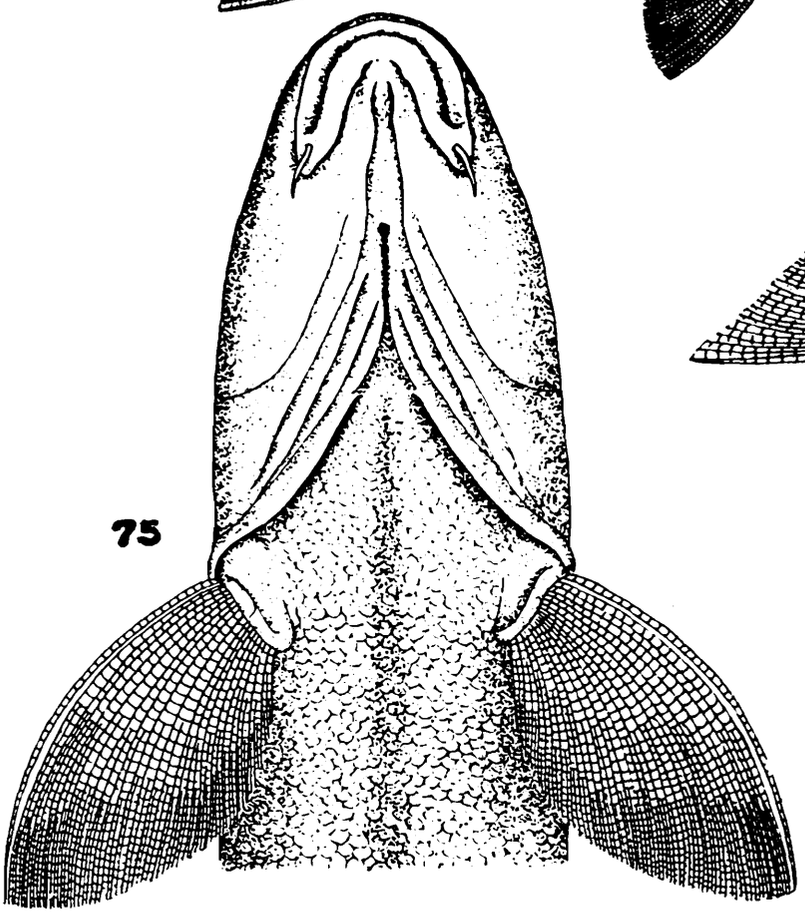


Fig. 74. Lateral view of *Schizothoraichthys hugelii* (Heckel) (Holotype, Regd. No. NMW 9014, Natural History Museum, Vienna, Austria)

Fig. 75. Ventral view of head and anterior part of body of *Schizothoraichthys hugelii* (Heckel)

Fig. 76. Anal sheath of scales of *Schizothoraichthys hugelii* (Heckel)

anal sheath are very prominent and much bigger than the other scales of the body. The width of enlarged anal scale is equal to or slightly less than the eye diameter. There are 27 enlarged anal scales along the anal sheath which covers only 2/3 of the anal base.

The origin of the dorsal fin is distinctly nearer the base of the caudal fin than the tip of the snout and lies opposite the base of the ventral fin. The last undivided ray of the dorsal fin is strong, bony and posteriorly serrated in its upper half. The height of the dorsal fin is much smaller than the depth of the body below it and is smaller than the length of the remaining fins of the body. The length of the base of the dorsal fin is contained 8.74 times in standard length and 2.08 times in head length. The upper border of the dorsal fin is wavy with the tips of the branched rays forming sharp projections.

The length of pectoral fin is contained 6.12 times in standard length, 1.46 times in head length and 1.95 times in the distance between the bases of the pectoral and pelvic fins.

The pelvic fin arises below the origin of dorsal fin and its length is contained 6.8 times in standard length, 1.62 times in head length and 1.82 times in the distance between bases of the pelvic and anal fins. No fleshy appendage exists in the axil of the pelvic fin.

The anal fin, when laid flat, reaches the base of the caudal fin. The length of the anal fin is contained 5.56 times in the standard length, 1.32 times in the head length and 1.21 times in the distance between the bases of the anal and the caudal fins. The length of the base of the anal fin is contained 11.76 times in standard length, 2.80 times in head length and 1.34 times in the length of base of dorsal fin.

The height of the caudal peduncle is contained 10.92 times in standard length, 2.60 times in head length and 1.66 times in its own length. The length of the caudal peduncle is contained 5.58 times in standard length and 1.56 times in head length.

The caudal fin is deeply emarginate. The distance between the tip of snout to the origin of the dorsal fin is contained 4.70 times, the distance between snout tip to base of pectoral fin 4.08 times, the distance between snout tip to base of pelvic fin 4.70 times, the distance between snout tip to base of anal fin 1.22 times, the distance between bases of pectoral and pelvic fins 3.13 times, the distance between bases of pelvic and anal fins 3.73 times and distance between bases of anal and caudal fins 4.56 times in the standard length.

The colour of the body is dark greyish on the back, becoming lighter on the sides and yellowish white on the under side. The fins are without any colour markings.

Distribution :

Kashmir Valley.

Local Name :

GROT in Kashmiri.

Remarks :

The type-specimen of *S. hügelii* Heckel (NMW—9014), preserved at Natural History Museum, Vienna, Austria is 368 mm long (14.48 inches), Günther (1868) examined a 14½ inches long specimen which could have been the type specimen or another specimen of similar length because he does not make a specific mention in this regard. According to Günther (1868), the diameter of eye is contained 6.5 times in the length of the head while it is 6.08 times in the type specimen. Further, Günther (1868) has mentioned 190 scales along lateral line in this species while there are not more than 120 in the type specimen. The number of scales mentioned by him is too high and could be due to a mistake. It appears, however, that Günther (1868) had a specimen other than the type-specimen before him. Day (1877) mentioned the eye diameter to be 6 times in head length.

Both Günther (1868) and Day (1877) mentioned that the tiled row of anal scales are wider than diameter of eye. In fact, in the type specimen, they are either equal or slightly smaller than the eye diameter which agrees with the description of Heckel (1838).

According to Silas (1960), the origin of dorsal fin lies midway between or nearer to tip of snout than the base of caudal fin in this species which is clearly a mistake because the origin of dorsal fin in this species is distinctly nearer the caudal base than the tip of snout.

Material Examined

Regd. No.	Locality	Collector	Date of collection	No. of examples	Remarks
NMW 9014	Kashmir	Baron Huegel	1832	1	Holotype (Natural History Museum, Vienna.)

13. Schizothoraichthys (Schizothoraichthys) micropogon (Heckel)

(Figs. 64, 77-79)

1838. *Schizothorax micropogon* Heckel, *Fische aus Caschmir*, p. 41, pl. VIII, fig. 1 (Type-locality: Kashmir).

1842. *Schizothorax micropogon* : Valenciennes, (In Cuvier and Valenciennes), *Hist. Nat. Poiss.*, XVI, p. 220.

1844. *Schizothorax micropogon* : Heckel, *Fische Kaschmir's* in *Huegel's Reiche*, p. 369, 3 figs.

1868. *Schizothorax micropogon* : Günther, *Cat. Fish Brit. Mus.*, 7, p. 163.

1877. *Schizothorax micropogon* : Day, *Fish India*, p. 532 (foot-note).

1889. *Schizothorax micropogon* : Day, *Faun. Brit. India, Fishes*, I, 252 (foot-note).

1936. *Schizothorax micropogon* : Mukerji, *Mem. Conn. Acad. Sci. & Letters*, 10, p. 343.

1975. *Schizothoraichthys micropogon* : Tilak and Sinha, *Ann. Zool.*, 32(13), p. 292.

B. III, D. II/7-8, P. I/16-18, V. II/9-10, A. III/5, C. 19 ; Lat. l. 101-107, Lat. tr. 25/1/38 ; Lat. 1. to base of pelvic fin 24 scales.

The body is elongated and stream-lined. The length of head is contained 4.58-5.81 times in total length and 3.8-4.8 times in standard length. The width of head is contained 1.62-1.72 times in length of head and 6.55-7.8 times in standard length. The height of head is contained 0.85-0.92 times in its width, 1.38-1.58 times in length of head and 6.05-6.63 times in standard length. The postocular length of head is contained 1.96-2.21 times in length of head and 8.42-9.45 times in standard length.

A horizontal line drawn from the tip of the snout towards the middle of the caudal base passes along the lower edge of the orbit while an oblique line connecting the tip of snout and the origin of the dorsal fin crosses through upper half of the eye. The eyes are situated entirely in the anterior half of the head and have a free orbital margin. The diameter of eye is contained 4.64-5.63 times in length of head, 1.45-2.0 times in snout and 1.72-1.78 times in interorbital width. The interorbital space is flat and marked with a median raised ridge formed by the union of frontals. The interorbital width is contained 2.6-3.26 times in length of head and 1.15-1.81 times in snout. The tip of snout is narrow. The snout is smooth and its length is smaller than the postorbital part of head.

The length of snout is contained 10.72-15.29 times in standard length, 2.81-3.18 times in head length and 1.27-1.61 times in the postocular length of head. The mouth is crescentic. The upper jaw is slightly longer than the lower jaw. Both jaws are covered with a striated horny layer. The width of the chord of mouth is contained 11.8-16.42 times in standard length, 3.1-3.42 times in head length and 3.1-3.42 times in length of snout. The posterior edge of the maxilla reaches below the nostrils and falls short of the anterior edge of eye. The lips are moderately thick. The lower labial fold is interrupted.

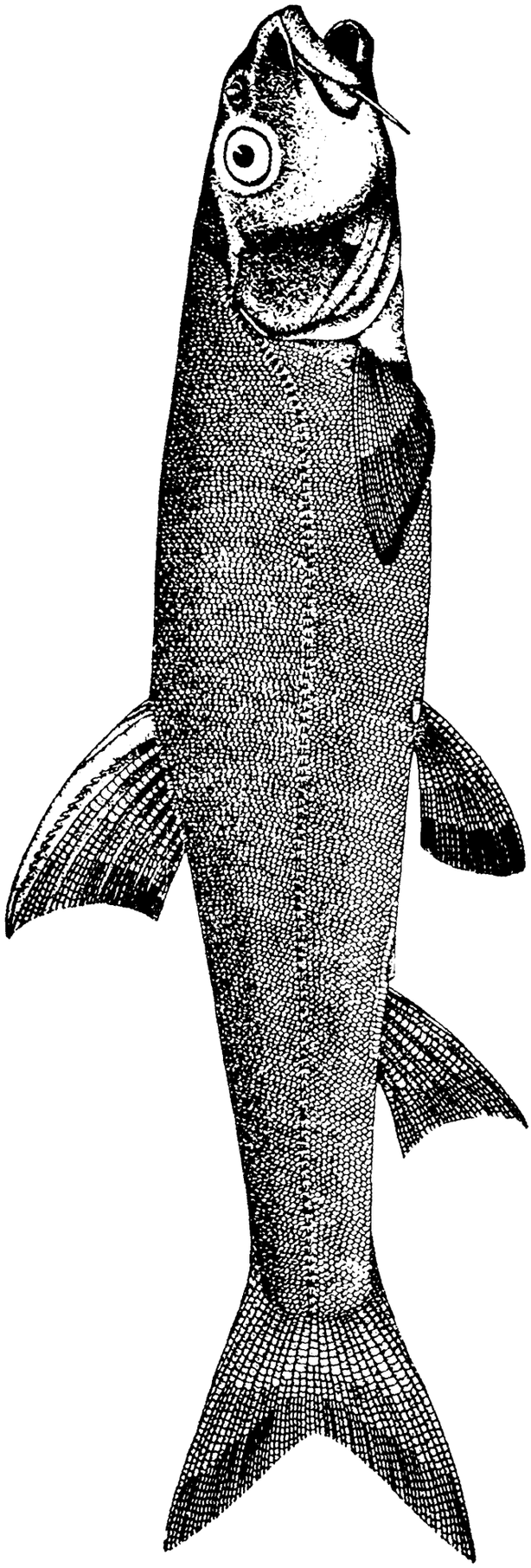


Fig. 77. Lateral view of *Schizothoraichthys micropogon* (Heckel)

There are two pairs of barbels. The rostral pair is longer than the maxillary barbel as well as the eye. The maxillary barbel is equal to eye diameter.

The gill cleft is wide and the isthmus is narrow. The width of the isthmus is contained 22.28-26.22 times in the standard length and 4.64-6.88 times in head length.

The depth of the body is contained 4.27-4.62 times in standard length and 6.89-1.21 times in head length. The width of the body is contained 7.37-12.0 times in standard length, 1.93-2.5 times in head length and 1.21 times in height of head.

The lateral line curves down slightly behind the gill cleft and thereafter it runs straight up to the base of the caudal fin. There are 101-107 scales along the lateral line. There are 25 scales between the lateral line and the base of the dorsal fin, 24 scales between the lateral line and the base of the pelvic fin. The scales on the anal sheath are somewhat larger than the other scales of the body. There are 9 + 12 (21) scales along the sheath of anal. The width of the enlarged scale of the anal sheath is contained from 4-5.5 times in the diameter of eye. The scales on the upper part of the body are regularly arranged while those on the abdomen are extremely reduced and thinned out. The scales along the base of the dorsal fin are larger than the scales on the body. There are 64 scales around the caudal peduncle.

There are 10 pharyngeal teeth, arranged in three rows (5-3-2/ 2-3-5). The tips of the teeth are pointed and curved.

The origin of the dorsal fin is much nearer the base of the caudal fin than the tip of snout. The dorsal fin originates slightly in front of the pelvic fin. The distance from origin of dorsal to base of caudal fin, when taken in front, reaches upto the posterior edge of nostrils. The dorsal fin spine is bony and serrated behind. There are 16-20 teeth on the dorsal spine. The length of the dorsal spine is equal to the length of head without snout. The length of the longest ray of the dorsal fin is contained 5.34-5.36 times in standard length and 1.11-1.4 times in length of head. The length of base of dorsal fin is contained 7.1-8.4 times in standard length and 1.62-2.21 times in head length.

The pectoral fin extends more than half way to the base of the pelvic fin. The pectoral fin is smaller than head. The length of the pectoral fin is contained 5.77-6.05 times in standard length, 1.20-1 58 times in head length and 1.61-1.76 times in the distance between the bases of the pectoral and the pelvic fins.

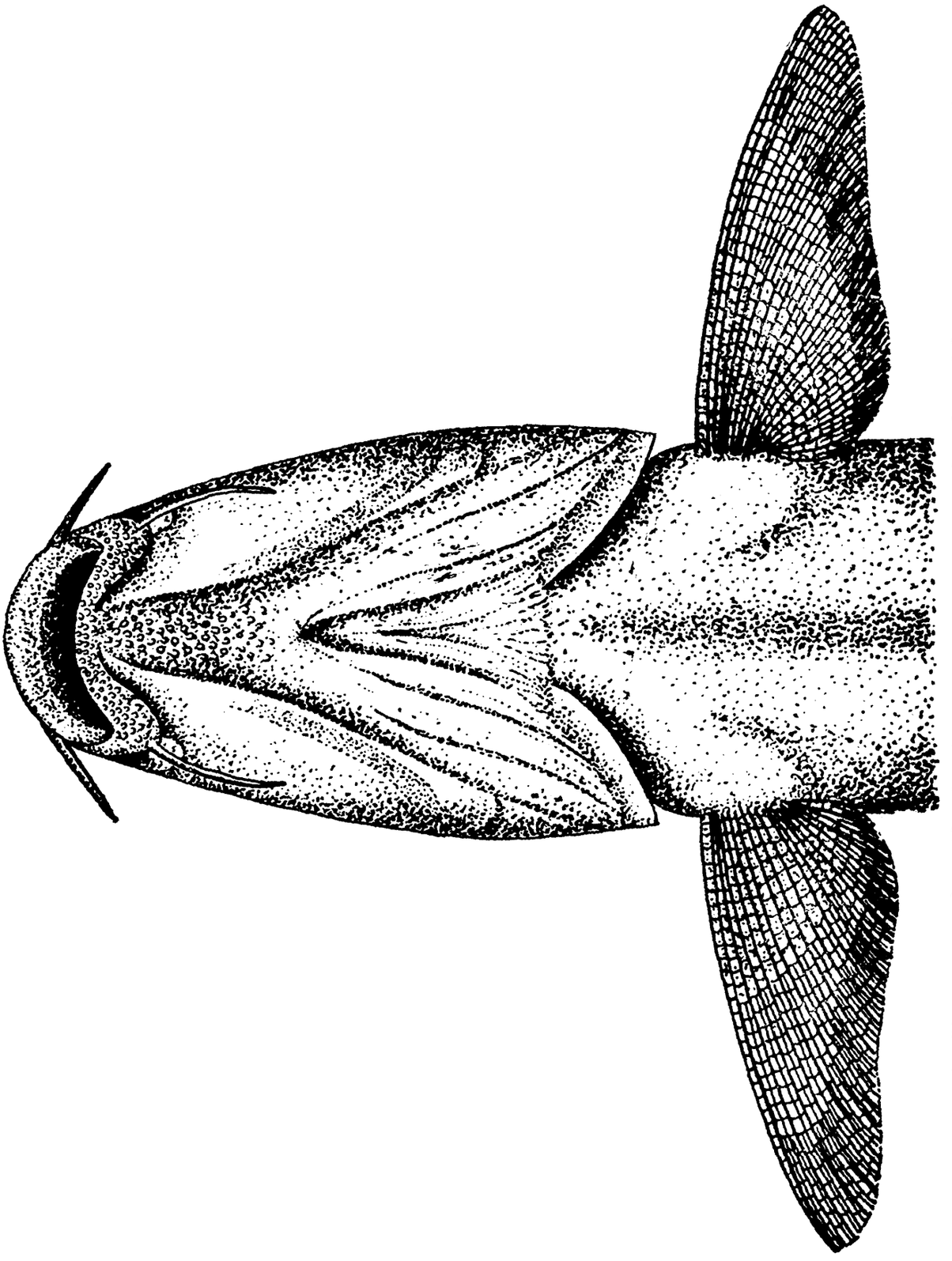


Fig. 78. Ventral view of head and anterior part of body of *Schizothoraichthys micropogon* (Heckel)

The pelvic fin arises slightly behind the dorsal fin and its length is contained 6.11-6.55 times in standard length, 1.27-1.72 times in head length and 1.33-1.61 times in the distance between the bases of the pelvic and the anal fins. The fleshy appendage in the axil of the pelvic fin is scaly and small.

The anal fin, when laid flat, does not reach the base of the caudal fin. The length of the longest ray of anal fin is 6.55-6.93 times in standard length, 1.44-1.72 times in head length and 1.55-1.75 times in the distance between the bases of anal fin and caudal fin. The length of the base of the anal fin is contained 14.18-14.75 times in standard length, 2.95-3.87 times in head length and 1.75-1.81 times in the length of the base of the dorsal fin. The caudal fin is forked.

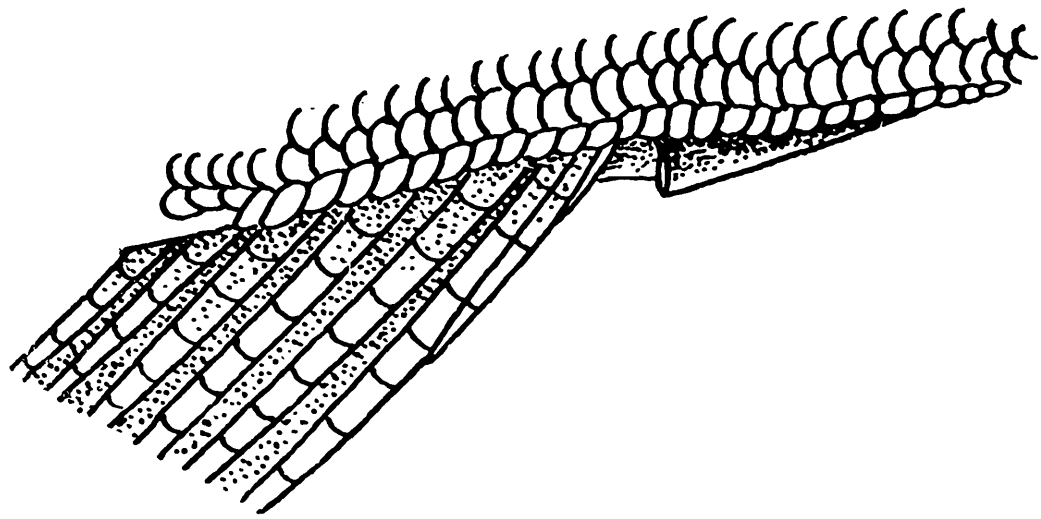


Fig. 79. Anal sheath of scales of *Schizothoraichthys micropogon* (Heckel)

The height of the caudal peduncle is contained 10.26-10.4 times in the standard length, 1.38-2.69 times in head length and 1.50-1.90 times in its own length. The length of the caudal peduncle is contained 5.47-5.90 times in standard length and 1.14-1.55 times in the head length. The length of caudal fin is contained 0.98-1.29 times in head length.

The distance between the tip of snout to the origin of the dorsal fin is contained 1.82-1.97 times, the distance between the tip

of the snout to origin of the anal fin 1.31-1.35 times, the distance between tip of snout and the origin of pelvic fin 1.82-1.98 times, the distance between the tip of snout and the origin of the pectoral 3.47-3.48 times, the distance between the bases of the pectoral and pelvic fins 3.42-3.56 times, the distance between the bases of the pelvic and anal fins 4.27-4.91 times, and the distance between the bases of the anal and the caudal fins 3.94-4.21 times in the standard length.

The colour of the body in spirit preserved specimens is uniformly silvery with back somewhat darker. The underside of the body is lighter. The fins are without any markings.

Distribution :

Kashmir Valley and Ladakh.

Local Name :

The local fishermen in Kashmir, according to Heckel (1838), call this fish by the name of "Ramgarhi". It is strange that the name "Ramgarhi" is almost non-existent in the vocabulary of fish names among the present day fishermen. The maximum size of specimens in the present collection is 189 mm. It is one of the smaller species of Schizothoracinae in Kashmir and Ladakh.

Remarks :

The peritoneum is black. The swim bladder is built on the same pattern as that of other schizothoracid fishes of this genus. It is a mixed feeder and its alimentary canal is contained nearly 1.5-2.0 times in the standard length of the fish. It feeds on algae and mostly insects.

The fish probably breeds during March-May, when the female specimens bear mature ova in the ovaries.

Subsequent to its description, this species was not studied much and various authors have referred to the description given by Heckel (1838). It was Mukerji (1936) who studied 10 examples of this species from the collection of Yale North India Expedition, all of them were from Kashmir valley. Thus, it has so far been recorded only from the Kashmir valley. This species is being recorded here for the first time from Indus river near Sheh (Ladakh).

MATERIAL EXAMINED

Regd. No.	Locality	Collector	Date of collection	No. of examples	Remarks
———	Indus river Sheh (Ladakh).	Dr. R. Tilak	8.9.1977	1	
———	,,	,,	10.11.1977	1	
———	Talbal stream, Dal lake, Srinagar (J. & K.)	,,	8.11.1979	1	

14. Schizothoraichthys (Schizothoraichthys) planifrons (Heckel)

(Figs. 59, 80-83)

1838. *Schizothorax planifrons* Heckel, *Fische aus Caschmir*, p. 44, pl. VIII, Fig. 2 (Type-locality : Kashmir).

1842. *Schizothorax planifrons* : Valenciennes (in Cuvier & Valenciennes), *Hist. Nat. Poiss.*, XVI, p. 224.

1844. *Schizothorax planifrons* : Heckel, *Fische Kaschmir's* in *Huegel's Reiche*, p. 370, 3 figs.

1868. *Schizothorax planifrons* : Günther, *Cat. Fish. Brit. Mus.*, VII, p. 163.

1877. *Schizothorax planifrons* : Day, *Fish. India*, p. 532 (foot-note).

1889. *Schizothorax planifrons* : Day, *Faun. Brit. India, Fishes*, I. p. 252 (foot-note).

1910. *Schizothorax planifrons* : Zugmayer, *Zool. Jb. Ab. Syst.*, XXIX, p. 278.

1936. *Schizothorax planifrons* : Mukerji, *Mem. Conn. Acad. Sci.*, X. (18), p. 340.

1937. *Schizothorax planifrons* : Hora, *Rec. Geol, Surv. India*, 72, (2), pp. 181-184.

1962. *Schizothoraichthys planifrons* : Misra, *Rec. Indian Mus.*, 56, p. 48.

1975. *Schizothoraichthys planifrons* : Tilak and Sinha, *Ann. Zool.*, 32 (13), p. 292.

B. III, D. III/7, P. I/16-17, V. II/8, A. III/5, C. 19 ; Lat. l. 100-102, Lat. tr. 30/1/27.

The body is somewhat laterally compressed with the dorsal profile somewhat more arched than the ventral. The length of head is contained 4.51-5.04 times in total length and 3.62-4.08 times in standard length. The width of head is contained 6.09-7.93 times and height of head 5.89-6.33 times in the standard length. The width of head is contained 1.57-2.0 times and height of head 1.48-

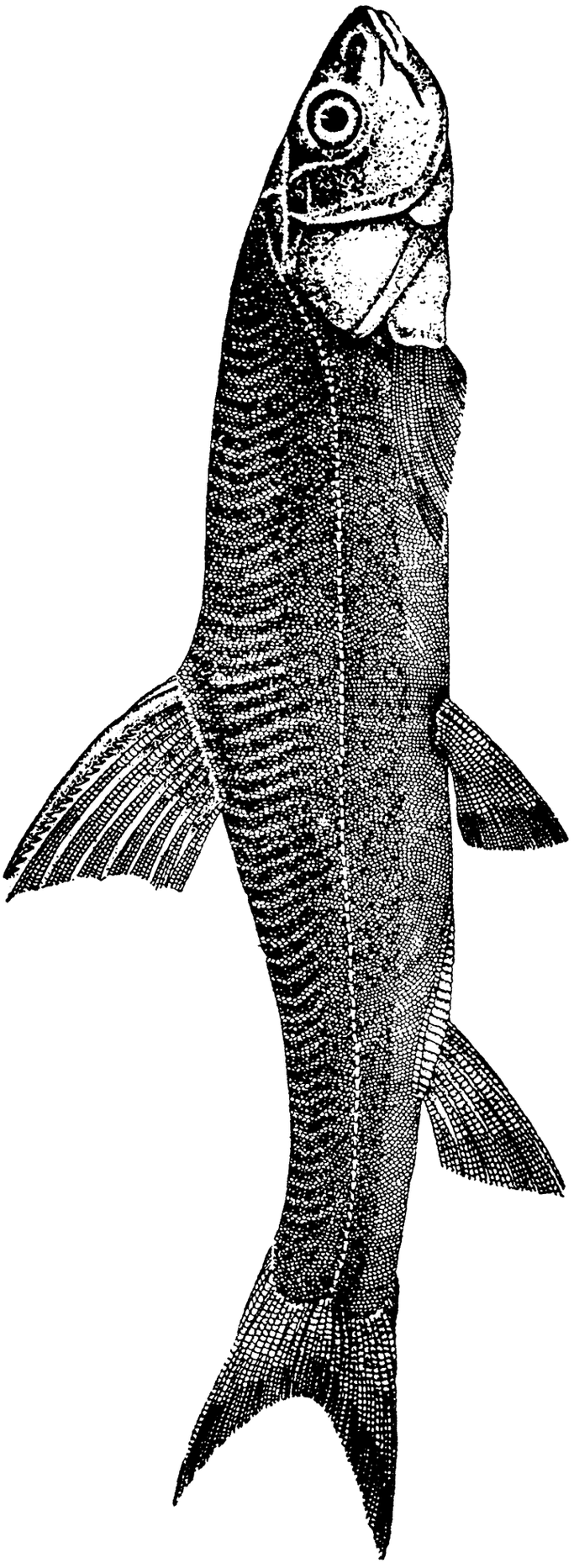


Fig. 80. Lateral view of *Schizothoraichthys planifrons* (Paratype, Regd. No. NMW 50419, Natural History Museum, Vienna, Austria)

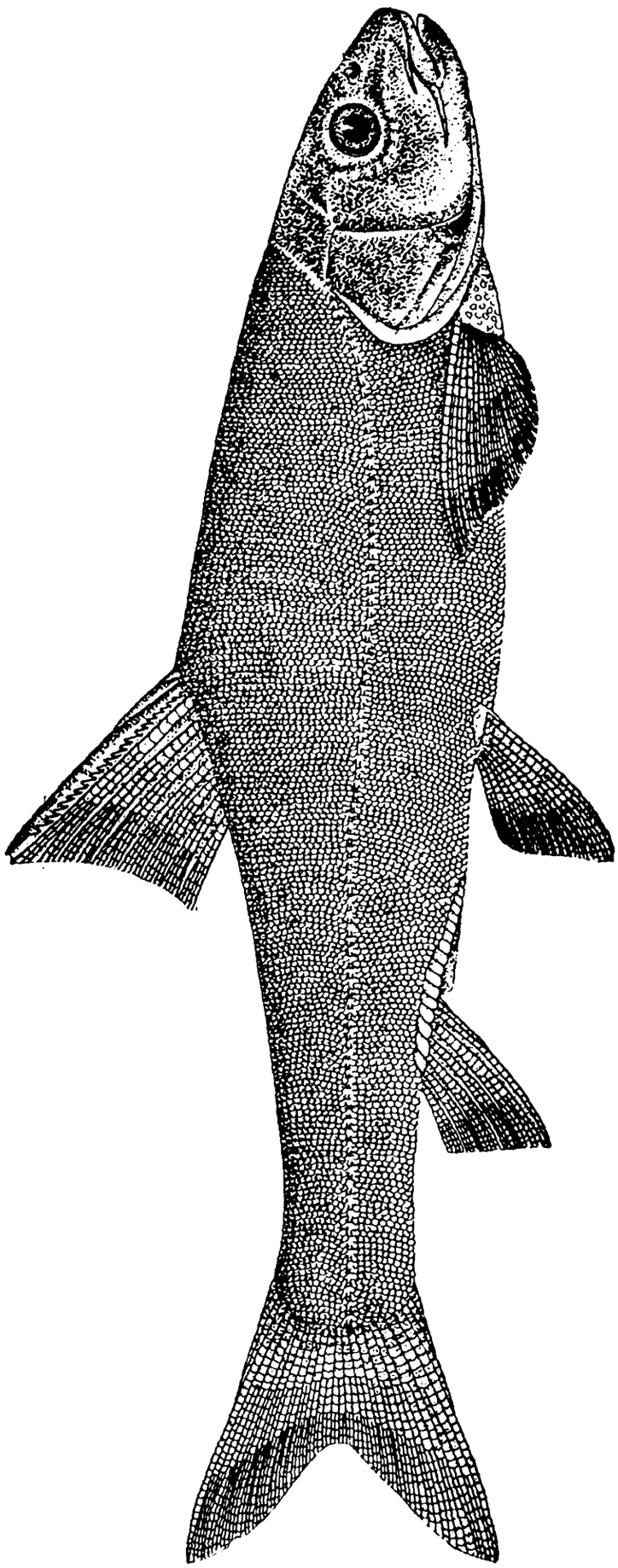


Fig. 81. Lateral view of *Schizothoraichthys planifrons* (Heckel)

1.8 times in length of head. The postocular length of head is nearly equal to width of head which is contained 1.11-1.40 times in its height. The horizontal line drawn from the tip of the snout towards the posterior side of the body passes along the lower border of the eye while an oblique line connecting the tip of snout and origin of dorsal fin passes through the middle of the eye.

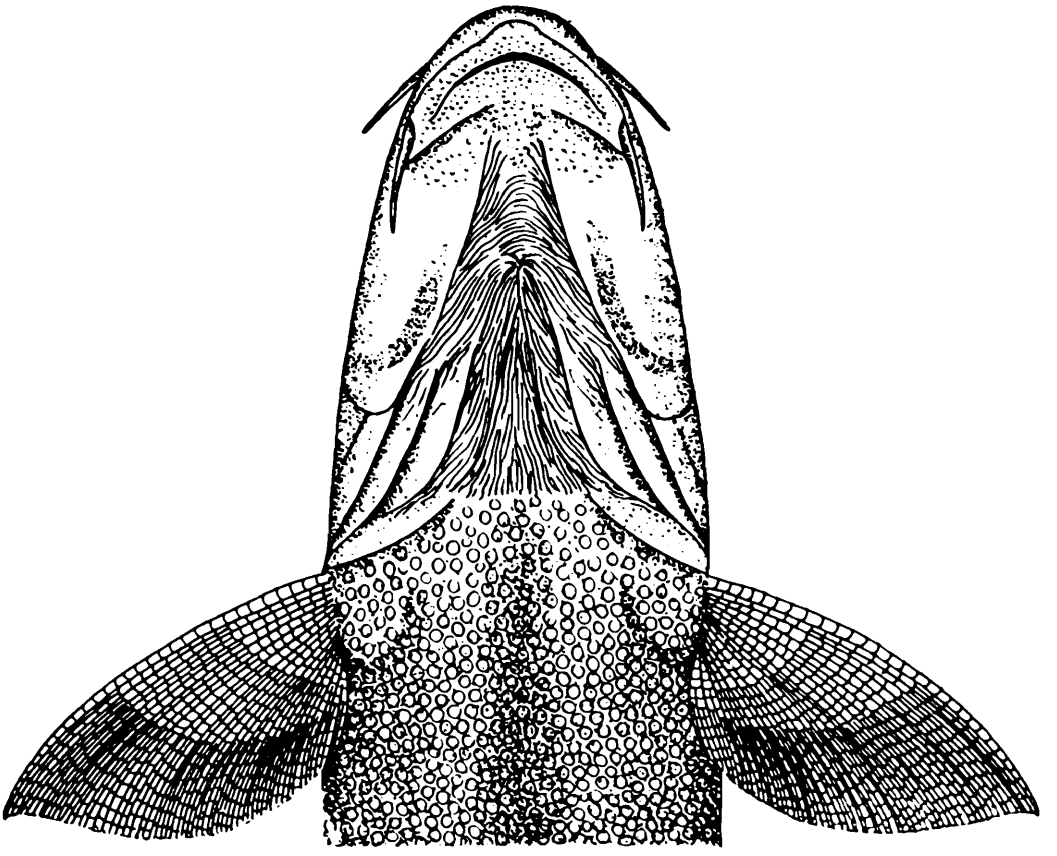


Fig. 82. Ventral view of head and anterior part of body of *Schizothoraichthys planifrons*

The eyes are situated entirely in the anterior half of the head. The eyes have a free orbital margin. The diameter of eye is contained 3.83-5.5 times in length of head, 1.16-1.83 times in length of snout and 1.28-1.83 times in interorbital width. The interorbital width is contained 2.87-3.44 times in length of head and 0.81-1.12 times in length of snout. The snout is pointed because the median rostral bone is raised up below the skin. The length of the snout is contained 11.63-14.66 times in standard length, 3.0-3.76 times in length of head and 1.50-2.03 times in postocular length of head. The tip of the snout neither overhangs the mouth nor forms a lateral lobe. The mouth is directed obliquely upwards and is terminal. It is horse-shoe shaped. The jaws are of equal length and covered with a deciduous cartilaginous layer which is extremely

reduced in some cases. The width of the chord of the mouth is contained 13.47-20.5 times in standard length, 3.47-5.16 times in head length and 1.06-1.28 times in snout length. The posterior edge of the maxilla reaches below the posterior nostrils and falls short of the anterior edge of the eye. The lips are thick and smooth. The lower labial fold is interrupted.

There are two pairs of barbels. The rostral barbels are somewhat smaller than the maxillary. All the barbels are smaller than or equal to the eye diameter.

The gill cleft is wide and the isthmus is narrow. The width of the isthmus is equal to the length of the maxillary barbel and is contained 18.28-31.33 times in standard length and 4.71-7.66 times in head length.

The depth of the body is contained 4.94-6.42 times in total length, 4.06-6.25 times in standard length and 1.05-1.58 times in length of head. The width of the body is contained 5.33-10.69 times in standard length, 1.37-2.69 times in head length and 1.31-1.81 times in height of body.

The lateral line curves down in the anterior part of the body and thereafter it runs almost straight up to the middle of the base of caudal fin. There are 100-102 scales along the lateral line. There are nearly 30 scales between the base of the dorsal and the lateral line and almost 27 between the latter and the mid-ventral line of the abdomen. There are 60-62 scales around the caudal peduncle. The scales in the pectoral origin are slightly larger than those on the rest of the part of the body. There are 21-22 enlarged scales on the anal sheath which covers whole of anal base. The width of the enlarged anal scale is contained 2.0-2.9 times in the diameter of eye. The scales on the body are regularly arranged while those on the abdomen are partly reduced and thinned out.

There are 10 pharyngeal teeth, arranged in three rows (5-3-2/2-3-5). The tips of the teeth are pointed and crochet shaped. They bear flat grinding surfaces which stand obliquely downwards from the dorsal fin lies much nearer the base of caudal than the tip of snout and may be somewhat in front, opposite or behind the origin of pelvic fins. The dorsal fin spine is bony and most prominent, and bears 18-21 well developed teeth on its posterior border. The length of the dorsal spine is contained 1.3-1.66 times in head length. The longest ray of the dorsal fin is equal to the height of the body below it. The length of base of the dorsal fin is contained 7.82-9.46 times in standard length and 1.84-2.38 times in head length.

The pectoral fin extends more than half way to the base of pelvic. The length of the pectoral fin is contained 1.31-1.60 times in head length and 1.40-1.75 times in distance between bases of pectoral and pelvic fins.

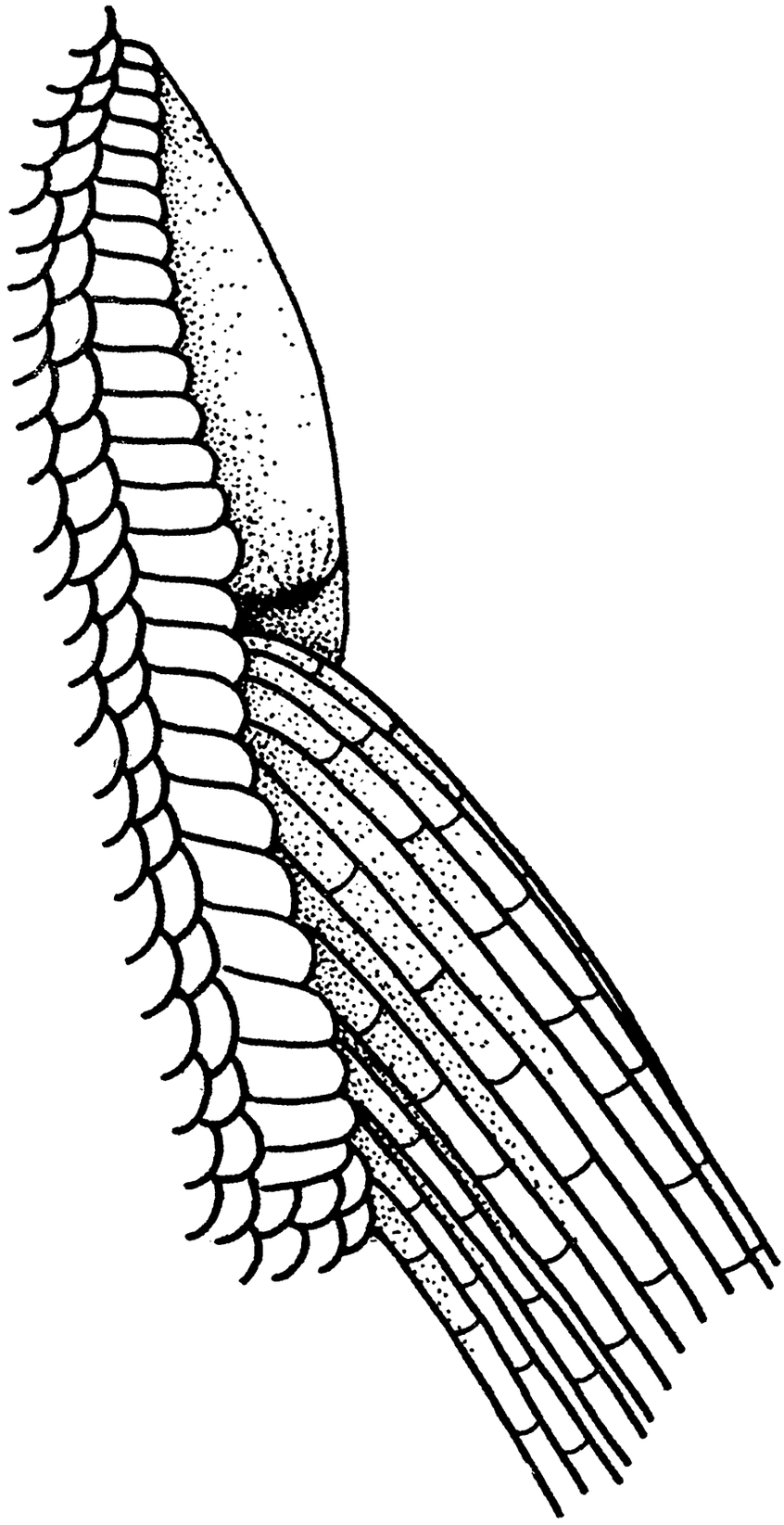


Fig. 83. Anal sheath of scales of *Schizothoraichthys planifrons*

The pelvic fin arises somewhat in front of the dorsal. The length of the pelvic fin is contained 5.76-6.83 times in standard length, 1.48-1.72 times in head length and 1.38-1.92 times in the distance between the bases of the pelvic and anal fins. There is a well-developed thick fleshy appendage which is covered over by 3-4 elongated enlarged scales in the axil of the pelvic fin.

The anal fin, when laid flat, does not reach the base of the caudal fin although Mukerji (1936) mentions that it reaches the caudal base in well-developed specimens. The length of the anal fin is contained 5.68-7.23 times in standard length, 1.46-1.92 times in head length, and 1.44-1.93 times in length of base of dorsal fin. The caudal fin is forked.

The height of the caudal peduncle is contained 10.66-13.66 times in standard length, 2.53-3.44 times in head length and 1.61-2.11 times in its own length. The length of the caudal peduncle is contained 5.6-6.47 times in standard length and 1.43-1.63 times in head length.

The distance between the tip of snout to origin of dorsal fin is contained 1.76-1.91 times, the distance between tip of snout to origin of anal fin 1.24-1.34 times, the distance between tip of snout to origin of pelvic fin 1.82-1.91 times, the distance between tip of snout to origin of pectoral fin 3.69-4.08 times, the postocular length of head 7.16-8.54 times, the distance between the bases of the pectoral and pelvic fins 3.44-3.82 times, the distance between the bases of the pelvic and anal fins 3.51-4.30 times and the distance between the bases of the anal and caudal fins 3.91-4.47 times in standard length.

The colour of the body is reddish brown in freshly preserved material and slightly lighter in long preserved ones. The back and sides bear deep colour while the lower sides of the body and ventral aspect are light to silvery. All the fins are dusky.

Distribution :

Kashmir Valley (J. & K.).

Remarks :

The local fishermen in Kashmir call this fish by the name "Chush". It is very commonly found in the lake and irrigation channels and forms a bulk of the fish catches sold in markets. According to Mukerji (1936), *S. niger* is same as this species. The presence of a deciduous layer of cartilage on the inner side of the jaws in this species induced Mukerji (1936) to believe that *S. planifrons* is a hybrid between *Schizothoraichthys* and *Schizothorax* although he subsequently mentions that this character could have

developed as a result of scrapping and scooping mode of feeding. The cartilaginous layer on the jaws of this species has in fact similarity with that of *Schizothorax*.

MATERIAL EXAMINED

Regd. No.	Locality	Collector	Date of collection	No. of examples	Remarks
NMW—50419	Kashmir	Baron Huegel	25.9.1977	4	Paratype (Natural History Museum, Vienna)
5860/2	Dal lake, Srinagar	Yale N. India Expedition	26.3.1932	3	
—	Telbal nullah, Harwan (Srinagar)	Dr. R. Tilak	25.9.1977	4	
—	,,	,,	8.11.1979	3	

15. Schizothoraichthys (Schizothoraichthys) esocinus (Heckel) (Figs. 84-89)

1838. *Schizothorax esocinus* Heckel, *Fische aus Caschmir*, p. 48, pl. IX (Type-locality : Kashmir).

1842. *Schizothorax esocinus* : Valenciennes (in Cuvier and Valenciennes), *Hist. Nat. Poiss.*, XVI, p. 221.

1842. *Schizothorax esocinus* : McClelland, *Calcutta J. Nat. Hist.*, 2, p. 579.

1844. *Schizothorax esocinus* Heckel, *Fische Kaschmir's* in *Hügel's Das Reiche*, 4(2), p. 372, fig. 3.

1868. *Schizothorax esocinus* : Günther, *Cat. Fish. Brit. Mus.*, 7, p. 166.

1876. *Schizothorax punctatus* Day, *Proc. Zool. Soc. London*, p. 785 (Type-locality : Kashmir).

1876. *Schizothorax esocinus* : Day, *Proc. Zool. Soc. London*, p. 785.

1877. *Schizothorax esocinus* : Day, *Fish. India*, p. 533, pl. CXXIII, fig. 4.

1877. *Schizothorax punctatus* : Day, *Fish. India*, p. 532, pl. CXXIII, fig. 3 (foot-note).

1878. *Schizothorax esocinus* : Day, *Sci. Res. 2nd Yarkand Miss., Ichthyol.*, p. 4, pl. I, fig. 4.

1878. *Schizothorax punctatus* : Day, Ibid, p. 4, pl. I fig. 3.
1889. *Schizothorax esocinus* : Day, *Faun. Brit. India, Fish* I, p. 254.
1889. *Schizothorax punctatus* : Day, Ibid, p. 252 (foot-note).
1910. *Schizothorax esocinus* : Zugmayer, *Zool. Jahrb.*, XXIX, p. 277.
1916. *Schizothorax esocinus* : Vinciguerra, *Ann. Mus. Civ. Stor. Nat. Genova*, (3), VII, p. 142.
1934. *Schizothorax esocinus* : Hora, *Rec. Indian Mus.*, 36, p. 297.
1936. *Schizothorax esocinus* : Mukerji, *Mem. Conn. Acad. Sci.*, X(XVIII), p. 335.
1960. *Schizothorax esocinus* : Silas, *J. Bombay nat. Hist. Soc.*, 57(1), p. 71.
1962. *Schizothoraichthys esocinus* : Misra, *Rec. Indian Mus.*, 57, p 167 fig. 88.
1975. *Schizothoraichthys esocinus* : Tilak & Sinha, *Ann. Zool.*, 32(13), pp. 290-293.

B. III, D. IV/8, P. I/19, V. II/9-11, A. II/5, C. 19 ; Lat. 1. 104-112.

The body is stream-lined and elegant. The length of head is contained 4.00-4.51 times in total length and 3.18-3.90 times in standard length. The width of head is contained 1.65-2.26 times in length of head and 5.28-7.97 times in standard length. The height of head is contained 0.8-1.06 times in its width, 1.65-1.92 times in length of head and 6.63-6.96 times in standard length. The postocular length of head is contained 1.8-2.10 times in length of head and 6.37-7.24 times in standard length.

A horizontal line, drawn from the tip of the snout towards the middle of the caudal base, passes along the lower edge of the eye, while an oblique line, connecting the tip of snout and the origin of the dorsal fin, crosses through middle of the eye. The eyes are situated clearly in the anterior half of the head and have a free orbital margin. The diameter of eye is contained 4.5-7.6 times in length of head, 1.81-2.40 times in snout and 1.5-1.9 times in interorbital width. The interorbital space is flat or else slightly convex in some cases. The interorbital width is contained 3.45-3.85 times in length of head and 1.17-1.28 times in snout. The tip of snout is bluntly pointed and obtuse although narrower than the rest of the head. The snout bears a vertical groove across it between its tip and the nostrils. The length of snout is contained 9.65-10.93 times in standard length, 2.81-3.2 times in head length and 1.45-1.56 times in the postocular length of head. The mouth is horse-shoe shaped. The upper jaw is longer than the lower jaw while in a few cases, the lower jaw is longer. The lower jaw is covered with a thin horny layer. The width of the chord of mouth is contained 9.38-11.21 times in standard length, 2.94-4.30 times in head length and 0.97-1.46 times in length of snout. The mouth opening is wide. The posterior edge of the maxilla reaches opposite the posterior edge of the nostrils and falls short of the anterior edge of eye. The

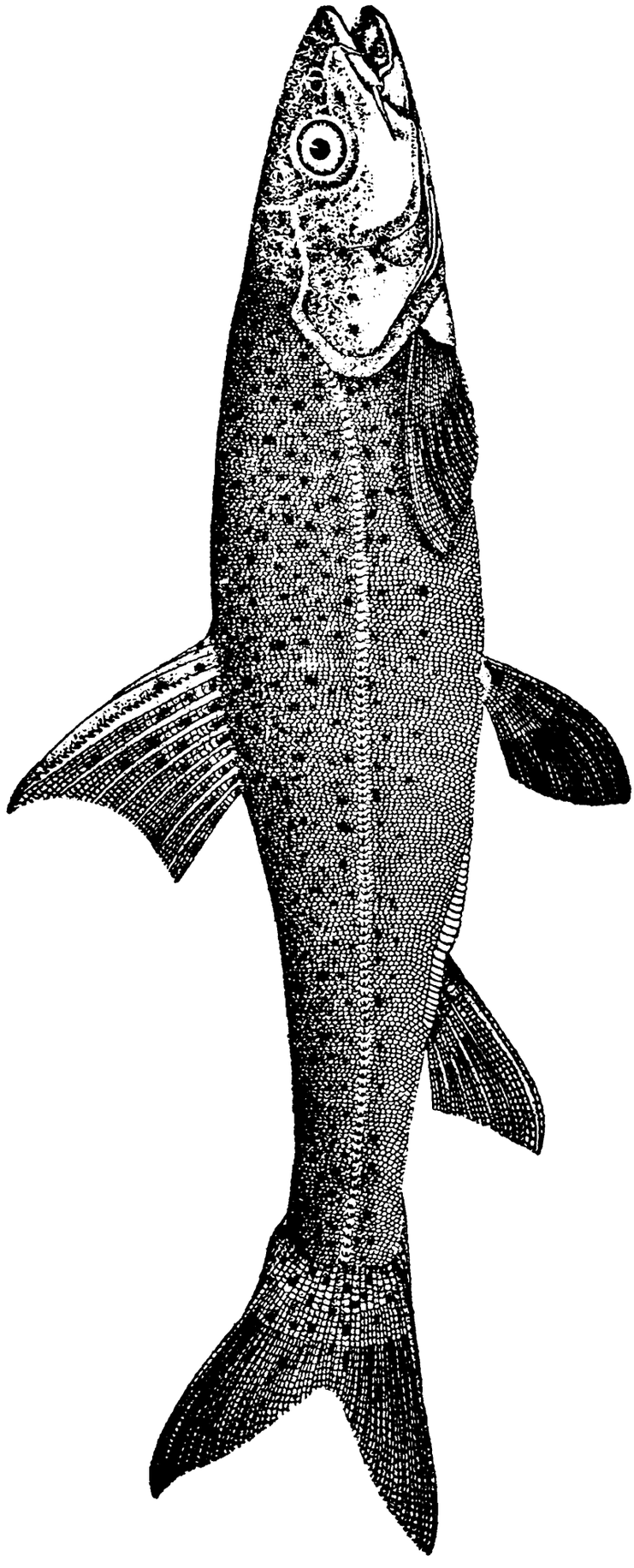


Fig. 84. Lateral view of *Schizothoraichthys esocinus* (Heckel)

lips are thick and fleshy. The lower labial fold is uninterrupted. The nostrils lie much nearer the eye than the tip of snout.

There are two pairs of barbels. The rostral pair is slightly smaller than the maxillary ; the former is smaller and the latter is longer than the eye. The maxillary barbel extends to a point opposite the posterior half of the eye.

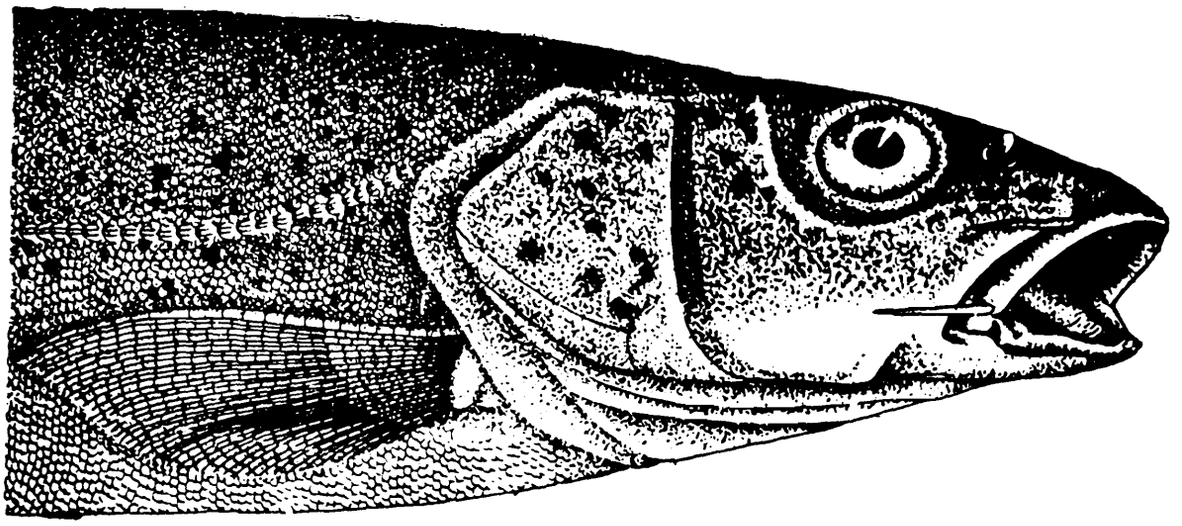


Fig. 85. Lateral view of head of *Schizothoraichthys esocinus*

The gill cleft is wide and the isthmus is narrow. The width of the isthmus is contained 26.92-45.83 times in the standard length and 9.5-13.16 times in head length.

The depth of the body is contained 4.0-5.9 times in standard length and 1.36-1.76 times in head length. The width of the body is contained 6.29-7.68 times in standard length and 1.36-2.4 times in head length.

The lateral line curves down slightly behind the gill cleft and thereafter it runs straight up to the base of the caudal fin. There are 110-115 scales along the lateral line. There are 30-32 scales between the lateral line and the base of the dorsal fin and 25-26 scales between the lateral line and the base of the pelvic fin. The scales on the anal sheath are somewhat larger than the other scales of the body. There are 25-29 scales along the sheath of anal of which 11-13 lie along base of anal and 14-16 anterior to anal base. The anal sheath extends back upto the base of 4th branched anal

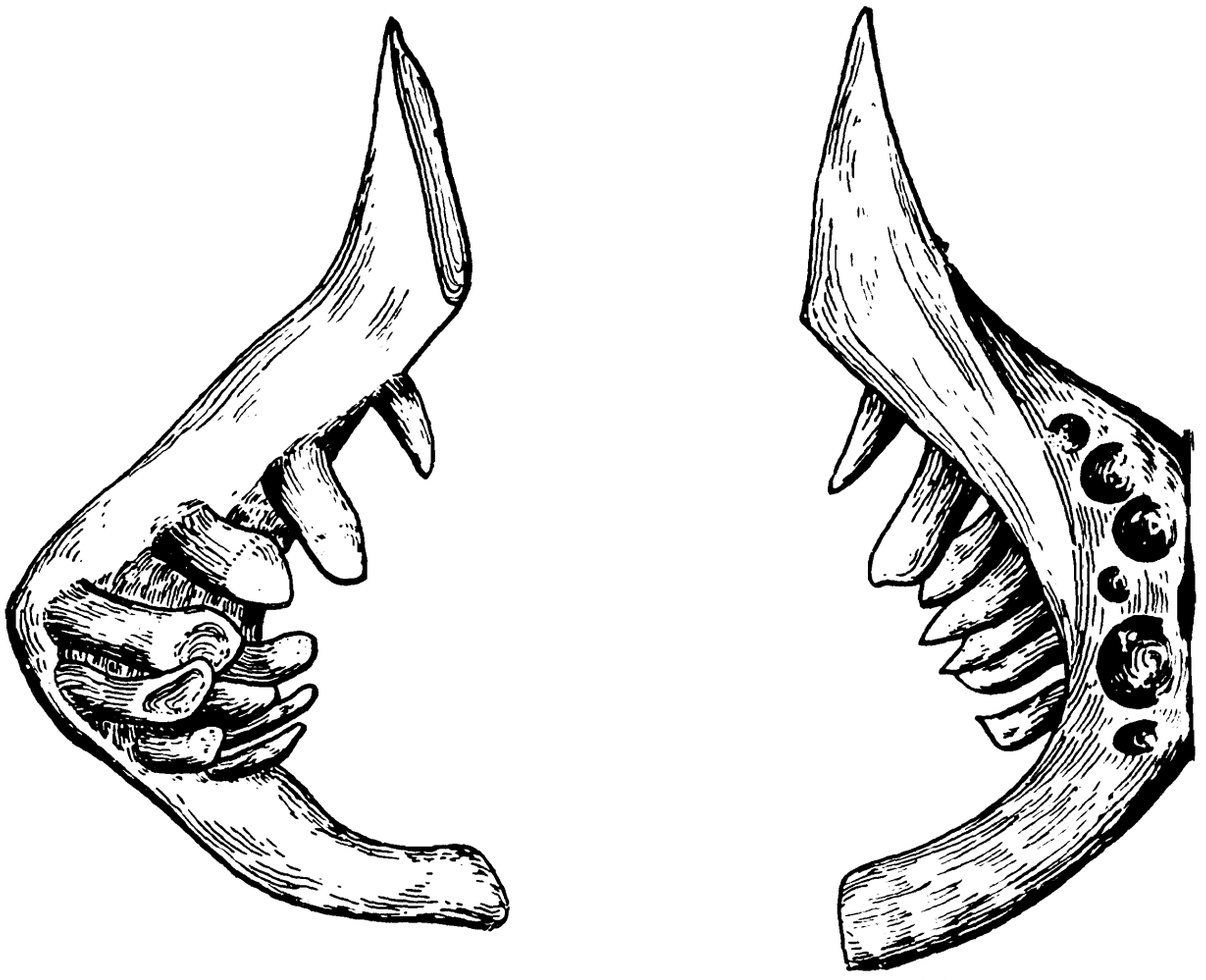


Fig. 86. Pharyngeal bone and teeth of *Schizothoraichthys esocinus*

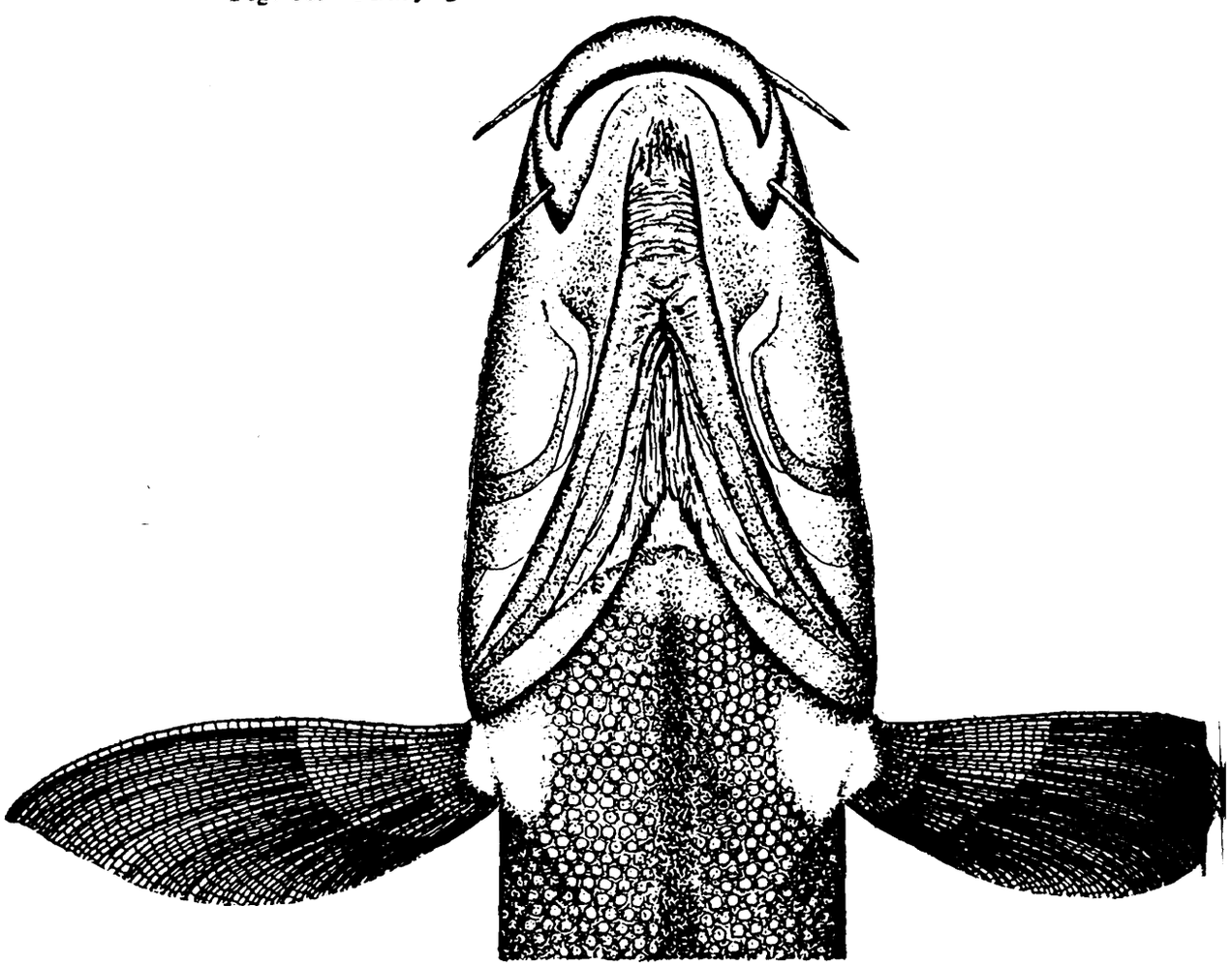


Fig. 87. Ventral view of head and anterior part of body of *Schizothoraichthys esocinu*

ray. The width of enlarged scale of the anal sheath is contained from 2.85-3.25 times in the diameter of eye. In exceptionally large specimens, and scale may be almost equal to eye diameter. The scales on the upper part of the body are regularly arranged while those on the abdomen are extremely reduced and thinned out and absent along the midventral edge of abdomen. The scales along the base of the dorsal fin are larger than the scales on the body.

There are 8-9 gill rakers on the lower arm of the first branchial arch. There are 10 pharyngeal teeth, arranged in three rows (5-3-2/2-3-5). The tips of the teeth are crochet shaped with the tip of beak pointed. The teeth of the outer row are the largest and those of the innermost row smallest, as in all other cyprinoids.

The origin of the dorsal fin is somewhat nearer to the base of the caudal fin than the tip of snout. The dorsal fin originates opposite or slightly in advance of the origin of the pelvic. The

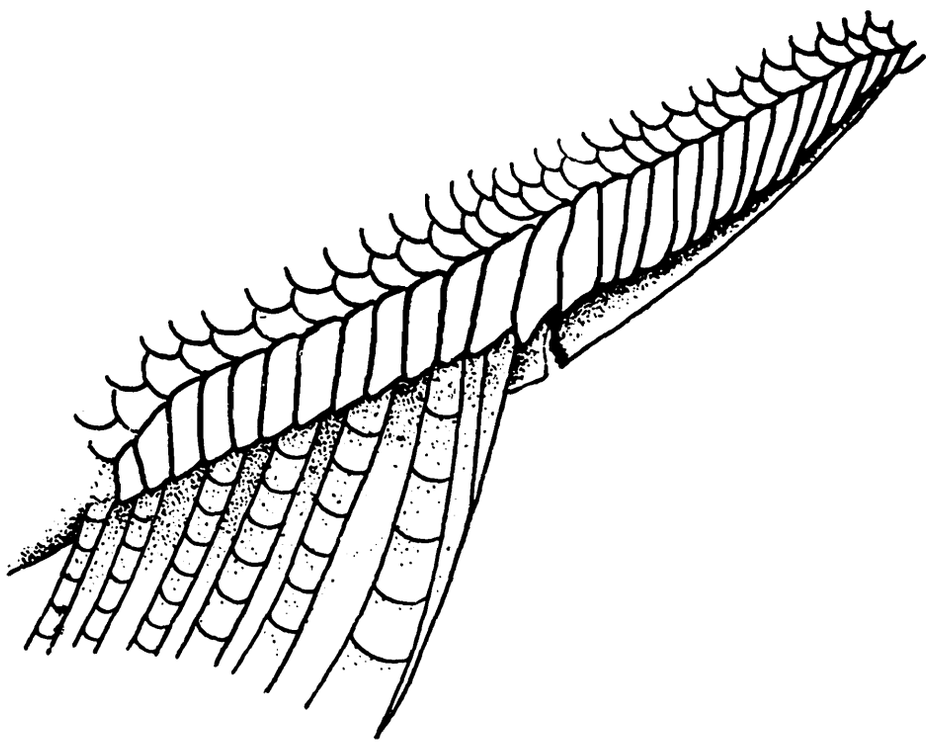


Fig. 88. Anal sheath of scales of *Schizothoraichthys esocinus*

dorsal fin spine is bony and serrated behind. There are 22-24 teeth on the dorsal spine. The length of the dorsal spine is more than the length of head behind the middle of eye. In young examples, the dorsal spine is longer and is equal to the head behind the nostrils. The longest ray of the dorsal fin is equal to the length of head behind nostrils and is contained 5.05-5.10 (exceptionally 9.06) times in standard length and 1.47-1.58 (exceptionally 2.3) times in

length of head. The length of base of dorsal fin is contained 8.6-8.89 (exceptionally 8.5) times in standard length and 2.50-2.78 (exceptionally 2.2) times in head length.

The pectoral fin extends more than half way to the base of the pelvic fin. The length of the pectoral fin is contained 5.12-6.00 times in standard length, 1.56-1.65 times in head length and 1.25-1.77 times in the distance between the bases of the pectoral and the pelvic fins.

The pelvic fin arises behind the origin of the dorsal fin and its length is contained 5.45-6.0 times in standard length, 1.7-2.02 times in head length and 1.13-1.27 times in the distance between the bases of the pelvic and the anal fins. The fleshy appandage in the axil of the pelvic fin is covered with a scale and is about half the length of the eye. The anal fin, when laid flat, does not reach the base of caudal fin while in young examples, it may just miss or rarely reach the base of the caudal fin.

The length of the longest ray of the anal fin is contained 5.36-6.00 times in standard length, 1.63-1.98 times in head length and 1.25-1.70 times in the distance between the bases of the anal and the caudal fins. The length of the base of the anal fin is contained 13.55-14.41 times in standard length, 3.94-4.41 times in head length and 1.58-1.81 times in the length of the base of the dorsal fin. The caudal fin is forked.

The height of the caudal peduncle is contained 9.25-11.26 times in the standard length, 2.5-3.55 times in head length and 1.69-1.90 (exceptionally 1.5) times in its own length. The length of the caudal peduncle is contained 5.28-6.25 times in standard length and 1.42-1.93 times in the head length. The length of the caudal fin is contained 1.23-1.93 times in head length.

The distance between the tip of snout to the origin of the dorsal fin is contained 1.86-1.98 times, the distance between the tip of the snout to origin of the anal fin 1.24-1.37 times, the distance between tip of snout and the origin of pelvic fin 1.79-1.94 times, the distance between the tip of snout and the origin of the pectoral fin 2.93-3.76 times, the distance between the bases of the pectoral and the pelvic fins 3.66-4.15 times, the distance between the bases of the pelvic and anal fins 3.13-5.16 times, and the distance between the bases of the anal and the caudal fins 3.86-4.26 times in the standard length.

The colour of the body in spirit preserved specimens is steel grey. The underside of the body is much lighter. The sides of the body bear a larger number of small dark blotches. The fins also bear similar dark blotches which are more numerous towards their bases.

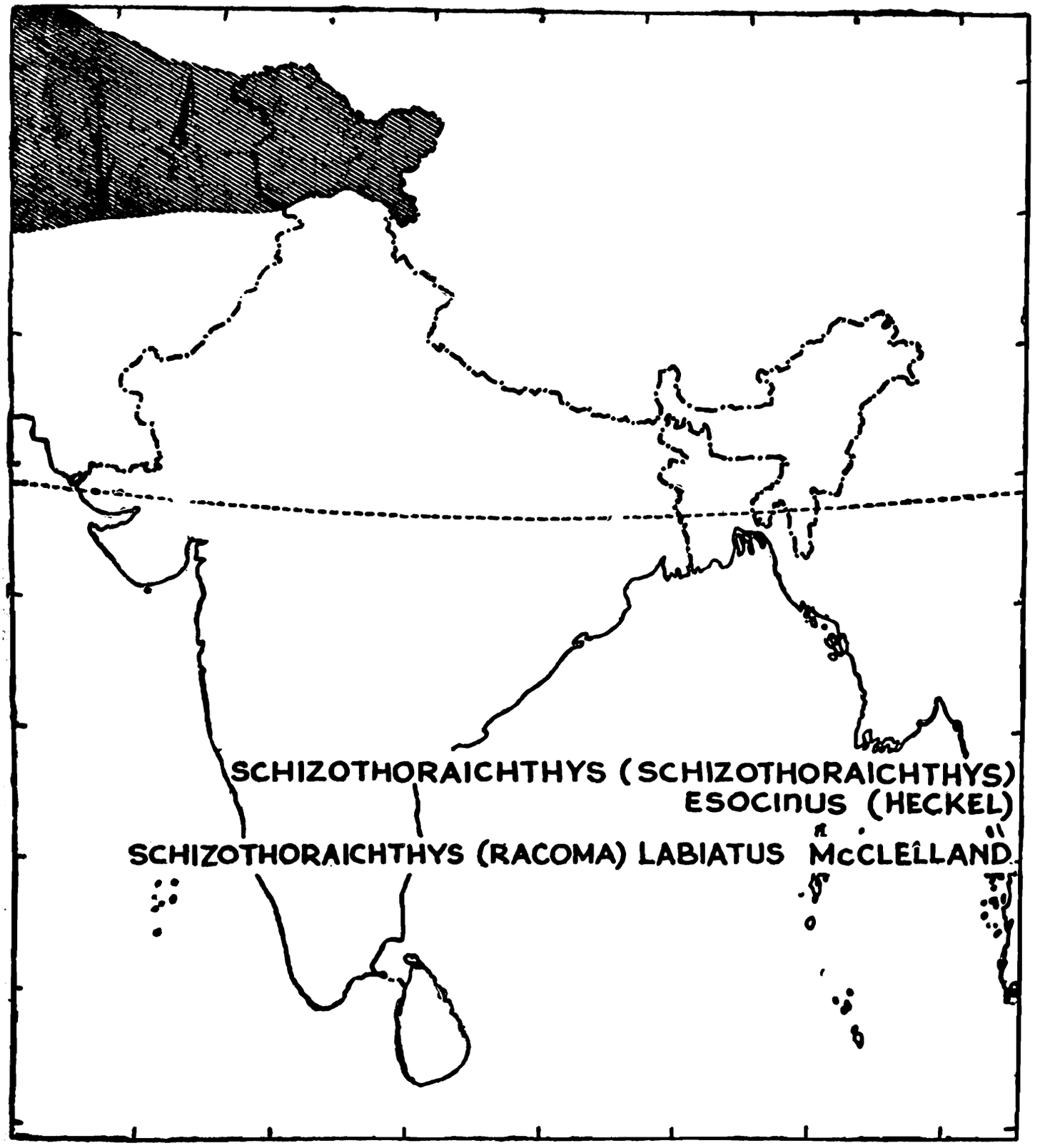


Fig. 89. Map showing the distribution of *Schizothoraichthys esocinus*, and *Schizothoraichthys labiatus*

Distribution :

Sind river and its tributaries in Ladakh and streams and lakes of Kashmir valley ; Pakistan, Afghanistan (fig. 89).

Local Name :

The local fishermen in Kashmir call this fish by the name of "Chhiruh". It grows to good size of 78.4 cms., weighing upto 9 kgs.

Remarks :

It is a foul feeder and feeds on young fishes, insects, rooted vegetation, gravel and dead animal matter. The jaws of this species are protrusible and can feed on mud and suck up food mixed with sand and gravel as in other cyprinoids in general. The length of the alimentary canal is nearly 1.5 times in standard length and suggests predominently animal or mixed type of diet. In lakes, this species acts as a scavenger but not so in running streams.

The peritoneum is black. The swim bladder is divided into anterior and posterior chambers ; the latter is much longer than the former (being 1.5-2.0 times longer).

It breeds during April-June when the snow melts and rivers have plenty of water.

S. esocinus (Heckel) is a variable species in various body proportions, structure of jaws and lips, position of eye in head and its relative position, length of fins and colouration of body (Mukerji, 1936). Day's drawing of this species has been faulty and therefore, the description of the species by the same author has discrepancies (Zugmayer, 1910 ; Vinciguerra, 1916 ; Hora, 1934 ; Mukerji, 1936). Mukerji (1936) has shown that the differences between *S. esocinus* and *S. punctatus*, in the length of upper jaw, length of serrated part of dorsal spine and the length of anal fin as shown by Day (1877), are not valid ; when long series of this species are studied, it becomes clear that the so-called differences between these two species are only variations within the same species and difference with age.

MATERIAL EXAMINED

Regd. No.	Locality	Collector	Date of collection	No. of examples	Remarks
F. 11315/1 to 11318/1	—	—	—	4	
511 687	—	—	—	1	
—	Indus River, Sheh (Ladakh)	Dr. R. Tilak	8.9.1977	11	
—	Achhabal stream near Anantnag (Kashmir)	,,	14.11.1979	3	
—	Irrigation Canal, Indus river near Sheh (Ladakh).	Dr. R. Tilak	7.9.1977	1	
—	Isthabal nala, 1.5 kms. east of Kulgham (Kashmir)	,,	27.9.1977	1	
—	Indus river, Sheh (Ladakh)	,,	13.9.1977	2	
F. 5858/2	Jhelum river, Srinagar.	—	—	1	
—	Fish Farm, Harwan, Srinagar (J. & K.)	Dr. R. Tilak	7.11.1979	2	
—	Telbal nullah, Dal lake, Srinagar (J. & K.)	,,	8.11.1979	1	
—	Indus river, Chuglamsar, Ladakh	,,	11.9.1977	1	
—	Indus river, Sheh (Ladakh).	,,	12.9.1977	1	

16. Schizothoraichthys (Racoma) progastus (McClelland)

[Figs. 90-93]

1839. *Oreinus progastus* McClelland, *Asiat. Res.*, 19, pp. 274, 343, pl. 40, fig. 4 (Type-locality : Upper Assam).

1842. *Oreinus progastus* : Valenciennes (in Cuvier & Valenciennes), *Hist. Nat. Poiss.*, XVI, p. 325.

1861. *Oreinus hodgsonii* Günther, *Proc. Zool. Soc. London*, p. 224 (Type-locality : Nepal).

1868. *Schizothorax hodgsonii* Günther, *Cat. Fish. Brit. Mus.*, 7, p. 167.

1877. *Schizothorax progastus* : Day, *Fish. India*, p. 532, pl. CXXII, fig. 7.

1889. *Schizothorax progastus* : Day, *Faun. Brit. India, Fishes*, I, p. 253, fig. 90.

1898. *Schizothorax hodgsonii* : Alcock, *Nat. Hist. Pamir Bound. Comm.*, p. 37 (Yasin R., 7000-8000 ft.).

1913. *Schizothorax progastus* : Chaudhari, *Rec. Indian Mus.*, 8, p. 248 (Abor hills, Assam).

1937. *Schizothorax progastus* : Shaw & Shebbeare, *J. Asiat. Soc. Bengal*, 3, p. 18, fig. 10 (N. Bengal).

1972. *Schizothorax progastus* : Banarescu and Nalbant, *Khumbu Himal.*, 4(2), p. 237 (Nepal).

1974. *Schizothoraichthys progastus* : Menon, *Check-list Fish Himalaya Indo-gangetic Plains*, p. 45.

1975. *Schizothoraichthys progastus* : Tilak & Sinha, *Ann. Zool.*, 32(13), p. 292.

B. III, D. III/8, P. I/16, V. II/10, A. III/5, C. 19 ; lat. l. 104-114, Lat. tr. 20-21/1/30

The body is somewhat deeper than that of other species. The length of head is contained 4.95-5.89 times in total length and 4.03-4.71 times in standard length. The width of head is contained 1.63-1.67 times in length of head and 7.9 times in standard length. The height of head is contained 0.94-1.00 times in its width, 1.5-1.68 times in length of head and 6.4-7.09 times in standard length. The postocular length of head is contained 2.06-2.13 times in length of head and 8.48-9.97 times in standard length.

A horizontal line, drawn from the tip of the snout towards the middle of the caudal base, passes along the lower edge of the orbit while an oblique line connecting the tip of snout and the origin of the dorsal fin crosses along the upper half of the orbit. More than half of the eye is situated in the anterior half of the head and has a free orbital margin. The diameter of eye is contained 4.91-6.63 times in length of head. 1.75-2.81 times in snout and 1.61-2.54 times in interorbital width. The interorbital space is flat.

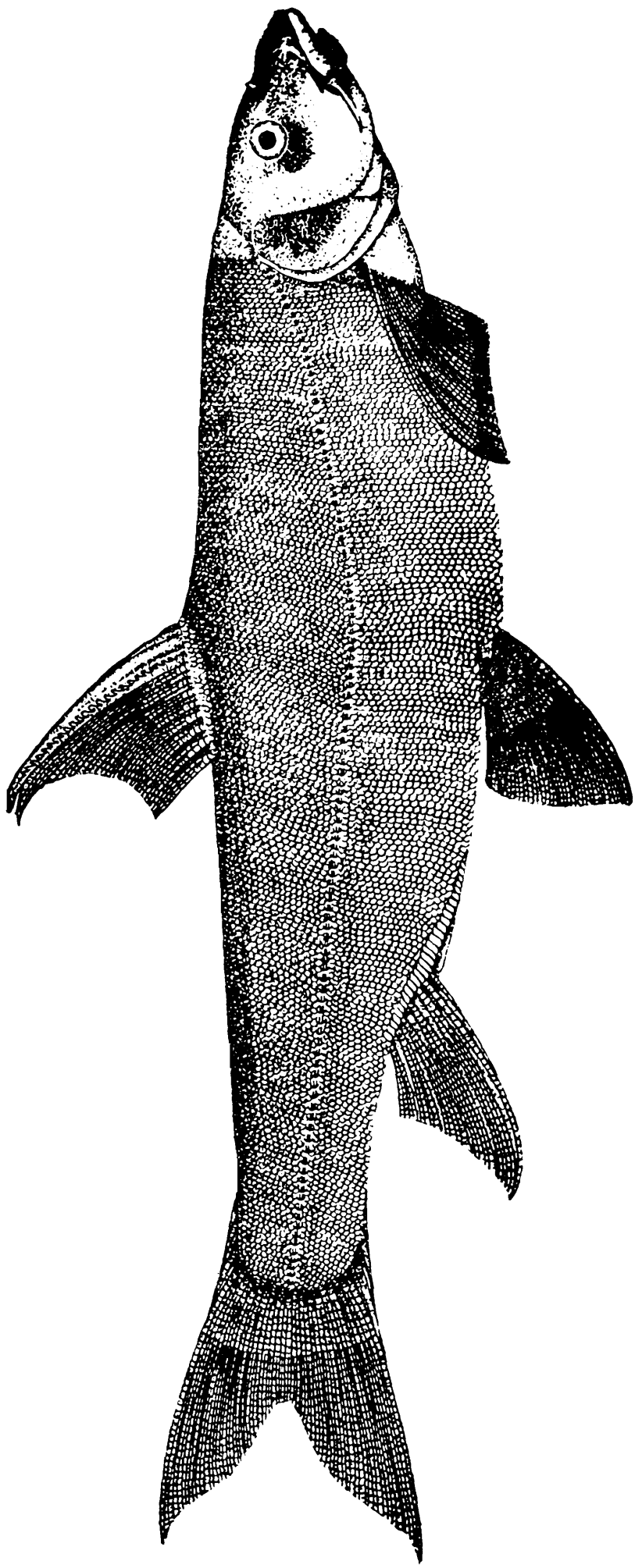


Fig. 90. Lateral view of *Schizothoraichthy sprogastus* (McClelland)

The interorbital width is contained 2.6-3.05 times in length of head and 1.0-1.41 times in snout. The tip of snout is narrow.

The length of snout is contained 10.66-12.99 times in standard length, 2.35-2.94 times in head length and 1.11-1.42 times in the postocular length of head. The mouth is horse-shoe shaped. The upper jaw is longer than the lower jaw. Both the jaws are covered

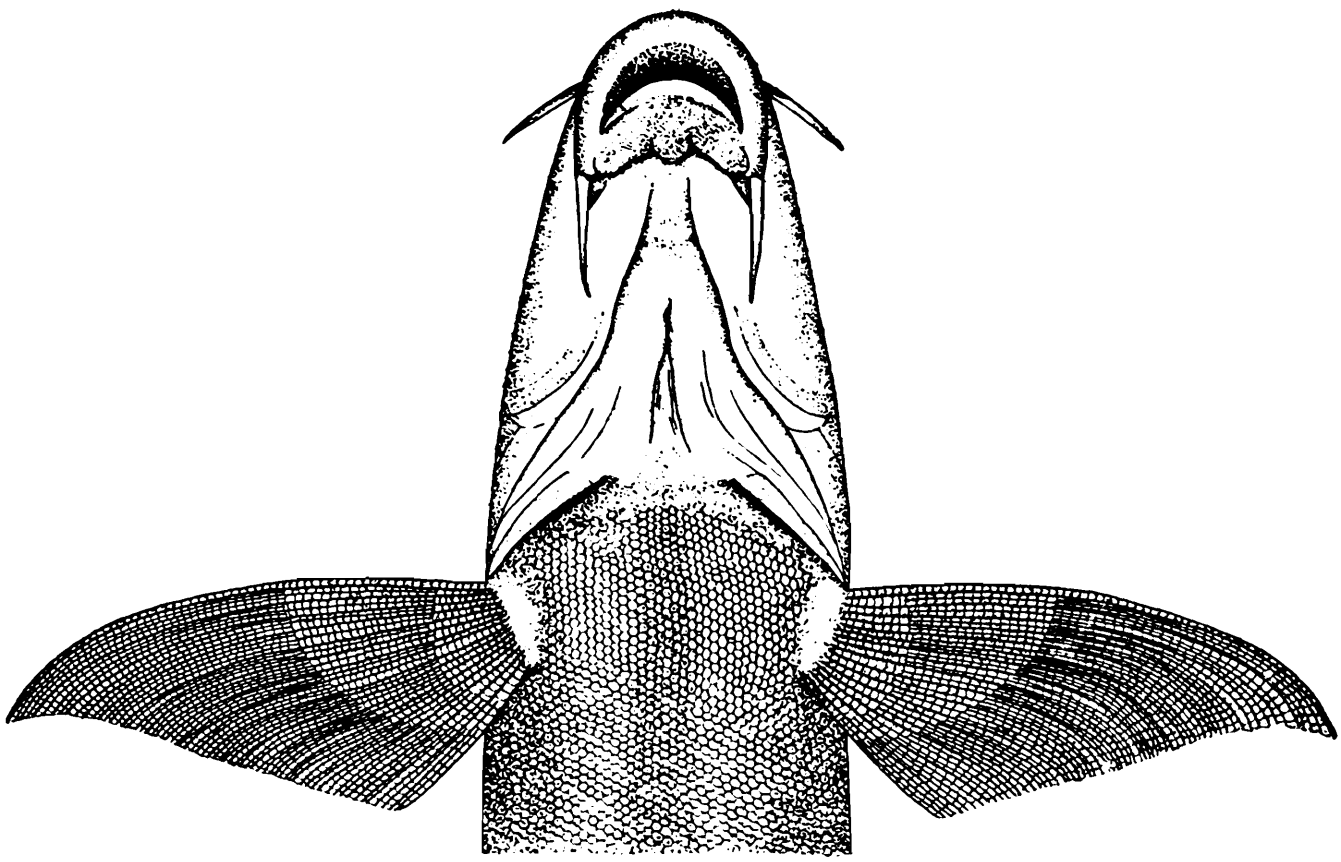


Fig. 91. Ventral view of head and anterior part of body of *Schizothoraichthys progastus*

with a horny layer which is striated. The width of the chord of mouth is contained 15.05-18.92 times in standard length, 3.36-4.35 times in head length and 1.16-1.58 times in length of snout. The posterior edge of the maxilla reaches opposite the nostrils and falls short of the anterior edge of eye. The lips are very thick and fleshy. The lower labial fold is uninterrupted.

There are two pairs of barbels which are almost of the same length and are much longer than the diameter of eye. The maxillary barbel extends to a point below the middle of eye.

The gill cleft is wide and the isthmus is narrow. The width of the isthmus is contained 18.92-30.32 times in the standard length and4.69-6.77 times in head length.

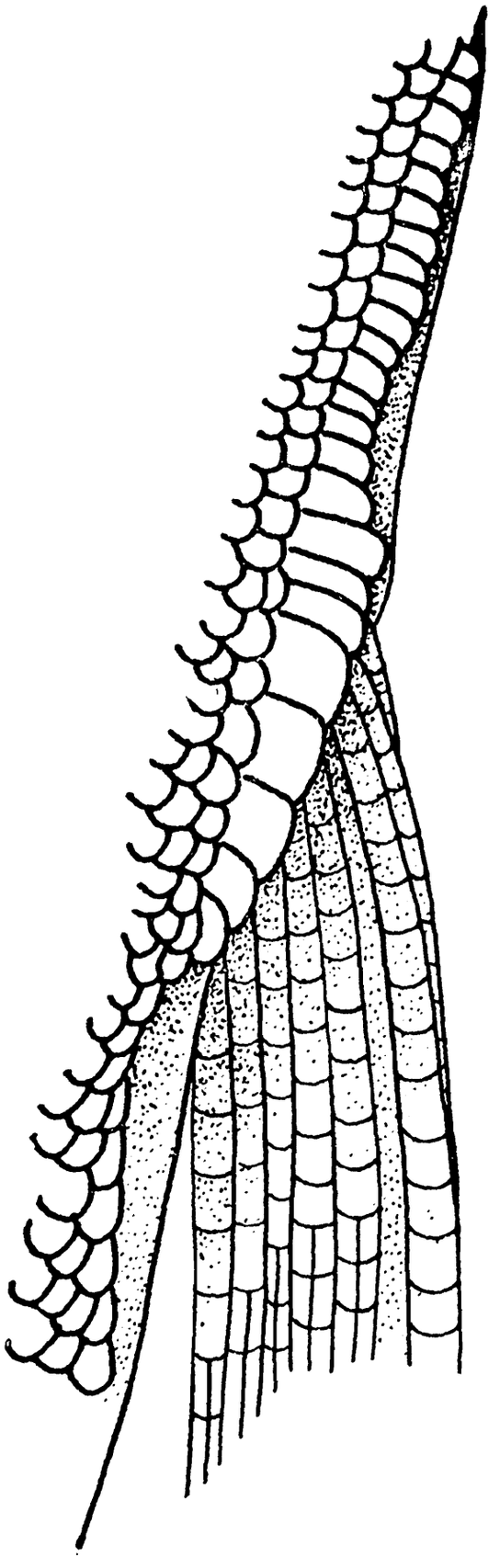


Fig. 92. Anal sheath of scales of *Schizothoraichthys progastus*

The lateral line curves down slightly behind the gill cleft upto the point opposite the dorsal and thereafter it runs straight up to the base of the caudal fin. There are 104-114 scales along the lateral line. There are 20-21 scales between the lateral line and the base of the dorsal fin, and 16-17 scales between the lateral line and the base of the pelvic fin. The scales on the anal sheath are some-what larger than the other scales of the body.

There are 64 scales around the caudal peduncle. There are 11-12 gill rakers on the lower arm of the first branchial arch. There are 10 pharyngeal teeth, arranged in three rows (5-3-2/2-3-5). The tips of the teeth are pointed.

The origin of the dorsal fin is either nearer snout or midway between base of the caudal fin and tip of snout. The dorsal fin originates in advance of the pelvic fin. The dorsal fin spine is bony and serrated behind. There are 25 teeth on the dorsal spine. The length of the dorsal spine is less than the length of head and equal to that of pelvic fin. The longest ray of the dorsal fin is shorter than the head and is contained 4.98-6.06 times in standard length and 1.87-1.35 times in length of head. The length of base of dorsal fin is contained 7.90-8.95 times in standard length and 1.82-2.10 times in head length.

The pectoral fin extends more than half way to the base of the pelvic fin. The length of the pectoral fin is contained 5.33-5.87 times in standard length, 1.13-1.43 times in head length and 1.56-1.77 times in the distance between the bases of the pectoral and the pelvic fins.

The pelvic fin arises behind the dorsal fin and its length is contained 5.73-5.90 times in standard length, 1.21-1.52 times in head length and 1.43-1.61 times in the distance between the bases of the pelvic and the anal fins. The fleshy appendage in the axil of the pelvic fin is slightly longer than diameter of eye.

The anal fin, when laid flat, does not reach the base of the caudal fin. The length of longest ray of the anal fin is contained 5.13-7.38 times in standard length, 1.08-1.77 times in head length and 1.26-1.86 times in the distance between the bases of the anal and the caudal fins. The length of the base of the anal fin is contained 13.25-16.28 times in standard length, 2.7-3.91 times in head length and 1.5-1.89 times in the length of the base of the dorsal fin. The caudal fin is forked.

The height of the caudal peduncle is contained 9.29-11.18 times in the standard length, 1.97-2.77 times in head length and 1.63-2.0

times in its own length. The length of the caudal peduncle is contained 5.18-5.87 times in standard length and 1.20-1.38 times in the head length. The length of the caudal fin is contained 0.86-1.12 times in head length.

The distance between the tip of snout to the origin of the dorsal fin is contained 1.84-2.02 times, the distance between the tip of the snout to origin of the anal fin 1.26-1.33 times, the distance between tip of snout and the origin of pelvic fin 1.84-2.02 times, the distance between the tip of snout and the origin of the pectoral fin 3.93-4.46 times, the distance between the bases of the pectoral and the pelvic fins 3.21-3.72 times, the distance between the bases of the pelvic and anal fins 3.54-4.47 times, and the distance between the bases of the anal and the caudal fins 3.82-4.56 times in the standard length.

The colour of the body in spirit preserved specimens is uniformly gray without any markings. The underside of the body is pale to whitish. The fins are immaculate.

Distribution :

Jammu and Kashmir Valley, Ganges in Uttar Pradesh, Brahmaputra in Assam (Fig. 93).

Local Name :

The local fisherman along Ganges in Himalaya call this fish by the name of "Dinnawah". It grows to more than 60 cms. in length, weighing nearly 2 kgs.

Remarks :

It feeds on algae and insects. It is prominently a carnivorous fish. It migrates in Ganges between Hardwar and Uttarkashi in Bhagirathi river and upto Chamoli in Alakananda river.

It breeds in higher reaches of this river and travels down after breeding. Fry and fingerlings of this species are normally found in the tributaries of Alakananda and Bhagirathi rivers and never in the Ganges or its branches below Deoprayag. In Jammu and Kashmir, it is found in small streams of the valley, west of Srinagar. Its flesh is liked by the people and it is a game fish.

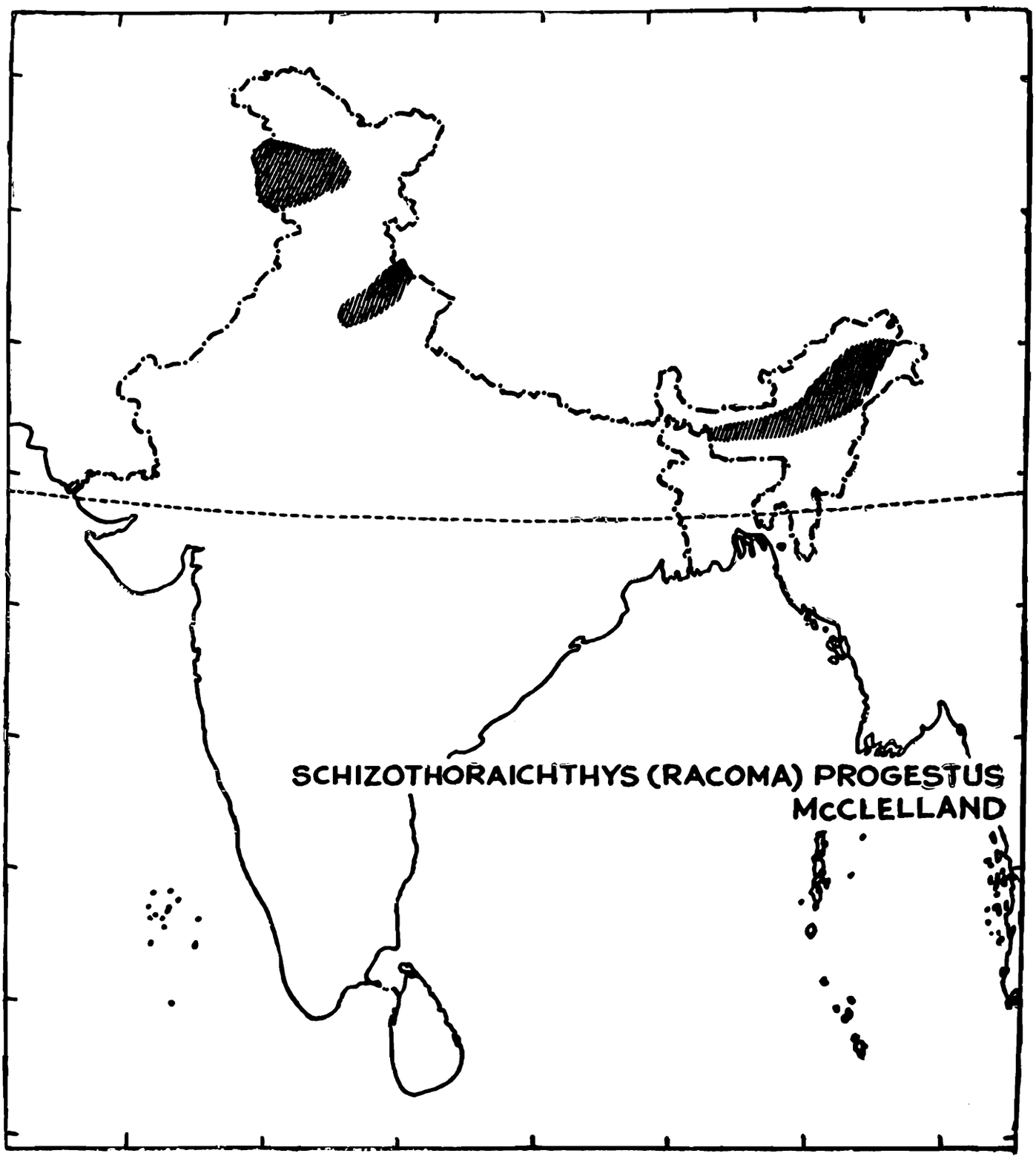


Fig. 93. Map showing the distribution of *Schizothoraichthys progastus*

MATERIAL EXAMINED

Regd. No.	Locality	Collector	Date of collection	No. of examples	Remarks
F7724/1	Egau stream between Rhuging & Rotung Abor Country	S. W. Kemp	1972	1	
–	Ganges near Gaurighat, Dist. Dehra-Dun.	Dr. R. Tilak	1978	3	
–	Tulamulla nullah, Srinagar	„	21.9.1978	12	
F. 7903/1	Siyrm river	Dr. S. W. Kemp	—	1	
1511	Hardwar	Purchased from F. Day	—	1	
14156	Gilgit river	Col. A. Alcock	—	1	
F. 5327/1	Hardwar	Purchased from F. Day	—	1	

17. Schizothoraichthys (Racoma) labiatus (McClelland)

(Figs. 89, 94-96)

1842. *Racoma labiatus* McClelland, *Calcutta J. Nat. Hist.*, 2, p. 578, pl. XV, fig. 1 (Type-locality : Kunar river near Jallalabad).

1842. *Schizothorax ritchiana* : McClelland, *Calcutta J. Nat. Hist.* 2, p. 580 (Type-localily : Afghanistan).

1868. *Racoma labiatus* : Günther, *Cat. Fish. Brit. Mus.*, 7, p. 162 (foot-note),

1868. *Schizothorax ritchianus* : Günther, *Cat. Fish. Brit. Mus.*, 7, p. 168.

1877. *Schizothorax ritchianus* : Day, *Fish. India*, p. 531 (foot-note).

1877. *Schizothorax labiatus* : Day, *Fish. India*, p. 532 (foot-note).

1934. *Schizothorax labiatus* : Hora, *Rec. Indian Mus.* 36, p. 292, text, Fig. 1 (Chitral).

1936. *Schizothorax labiatus* : Mukerji, *Mem Conn. Acad. Sci.*, X (18), p. 333 (Ladakh).

1975. *Schizothoraichthys labiatus* : Tilak & Sinha, *Ann. Zool.*, 32 (13), p. 292.

B. III, D. III/8, P. I/17, V. II/10, A. II/5, C. 19; Lat. l. 100-110, Lat. tr. 30-35/1/26-27

The body is narrow, elongated and subcylindrical with both profiles slightly arched. The length of head is contained 5.36-5.59 times in total length and 3.7-4.8 times in standard length. The width of head is contained 1.58-1.91 times in length of head and 6.92-8.00 times in standard length. The height of head is contained almost 1.00 times in its width, 1.41-1.66 times in length of head and 6.0-7.0 times in standard length. The postocular length of head is contained 2.0-2.55 times in length of head and 9.5 – 9.93 times in standard length. Ventral surface of head and anterior part of body are somewhat flat. The head is narrow anteriorly.

A horizontal line drawn from the tip of the snout towards the middle of the caudal base passes through the lower rim of the orbit while an oblique line, connecting the tip of snout and origin of the dorsal fin, crosses through middle of the eye. The eyes are placed laterally but not visible from ventral side of head and are situated in the middle of head or slightly nearer the tip of snout than posterior margin of operculum. They have a free orbital margin. The diameter of eye is contained 1.14-2.07 times in snout and 1.14-1.92 times in interorbital width. The interorbital space is somewhat flat and marked with a short longitudinal bony ridge, formed by the union of frontals and two lateral ridges, formed by edges of frontals. The interorbital width is contained 2.5-3.0 times in length of head and 0.87-1.14 times in snout. The snout is smooth and studded with pores in some specimens. The snout is pointed.

The length of snout is contained 11.0-12.05 times in standard length, 2.48-3.0 times in head length and 1.12-1.42 times in the postocular length of head. The mouth is subterminal, horizontal and arch-shaped and bordered by thick and fleshy lips. The upper jaw is longer than the lower jaw. The lower jaw is covered with a thin horny layer and is shovel-shaped. The width of the chord of mouth in contained 17.32-19.00 times in standard length, 3.9-4.81 times in head length and 1.3-1.8 times in length of snout. The posterior edge of the maxilla reaches below nostrils and falls short of the anterior edge of eye. The lips are greatly enlarged and thickened. The lower labial fold is uninterrupted and trilobed. The median lobe is well developed and free at its tip. There is lot of variation in the size of the middle lobe which may be small in young examples. There are two pairs of barbels. The rostral pair is slightly smaller than the maxillary and both barbels are longer than the eye. The maxillary barbel extends upto end of orbit or slightly beyond.

The gill cleft is wide and the isthmus is narrow. The width of

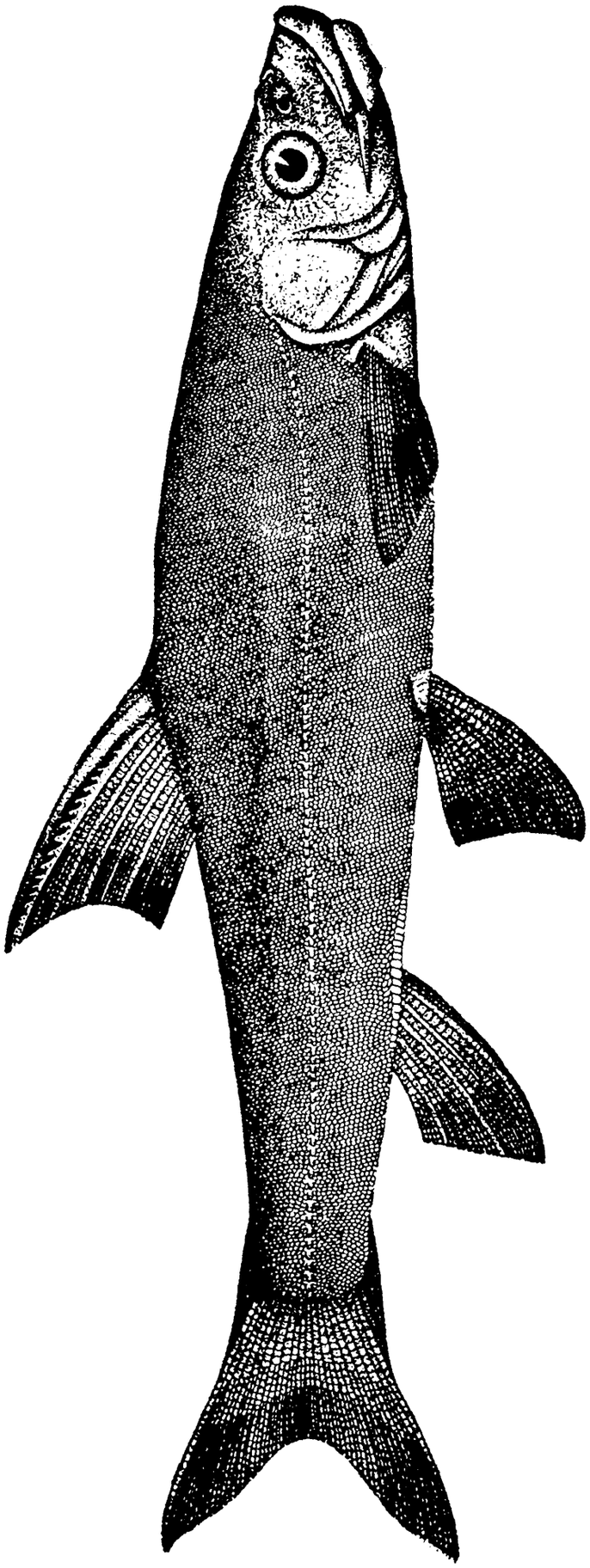


Fig. 94. Lateral view of *Schizothoraichthys labiatus* (McClelland)

the isthmus is contained 26.26-32.5 times in the standard length and 5.83-7.0 times in head length.

The depth of the body is less than the length of head and is contained 4.05-5.11 times in standard length and 0.88-1.37 times in head length. The width of the body is contained 6.55-7.45 times in standard length and 1.42-1.84 times in head length.

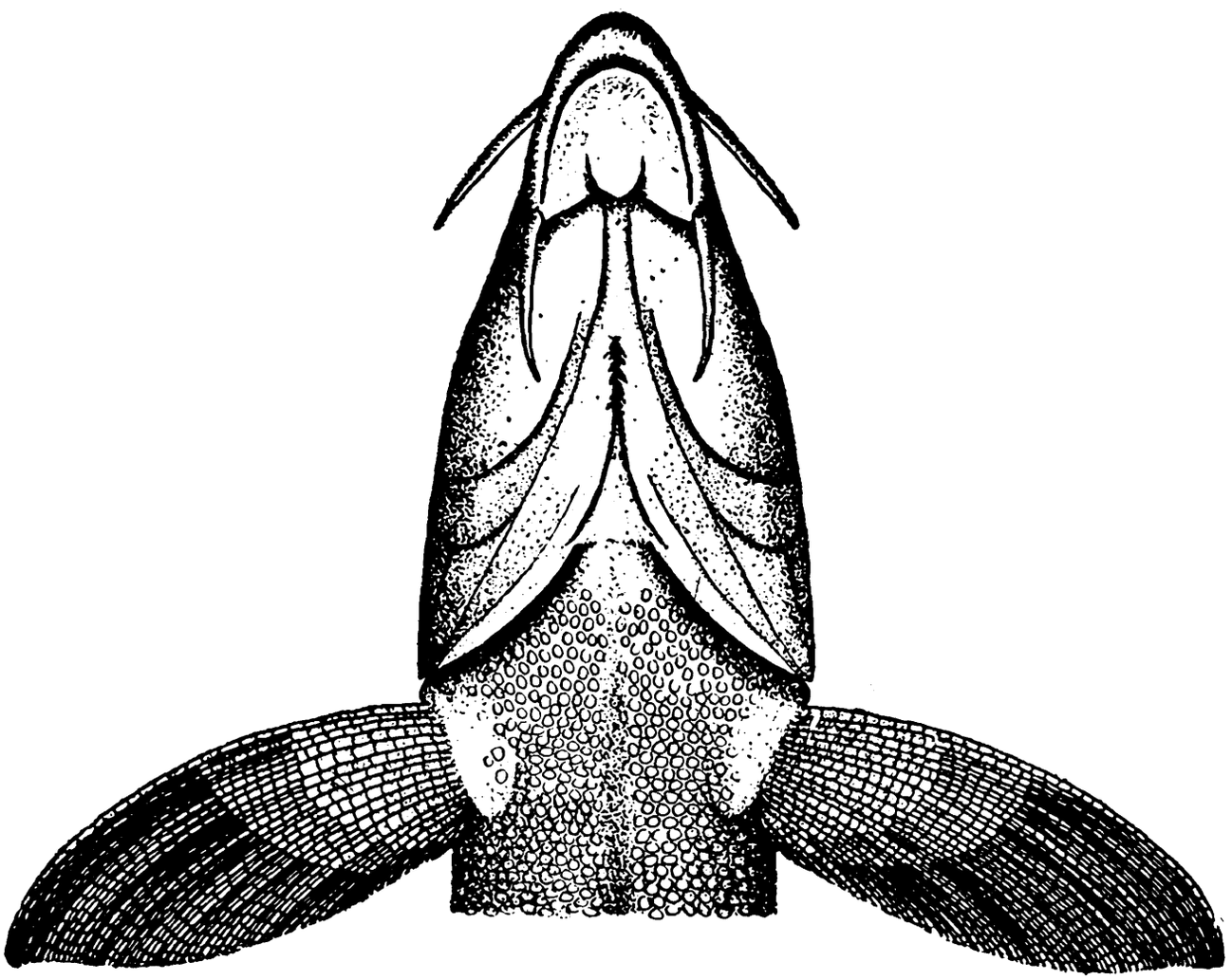


Fig. 72. Ventral view of head and anterior part of body of *Schizothoraichthys labiatus*

The lateral line curves down slightly behind the gill cleft and thereafter it runs straight up to the base of the caudal fin. There are 100-110 scales along the lateral line. There are 30-35 scales between the lateral line and the base of the fin and 25-27 scales between the lateral line and the base of the pelvic fin. The scales on the anal sheath are somewhat larger than the other scales of the body. There are 23-26 scales along the sheath of anal. The width of the enlarged scale of the anal sheath is contained from 5.0-5.66 times in the diameter of eye. The scales on the upper part of the body

are regularly arranged while those on the abdomen are extremely reduced and thinned out. The scales along the base of the dorsal fin are larger than the scales on body.

There are 15 gill rakers on the lower arm of the first branchial arch. There are 10 pharyngeal teeth, arranged in three rows (5-3-2/2-3-5). The tips of the teeth are pointed and curved.

The origin of the dorsal fin is either equidistant between the base of the caudal fin and the tip of snout or nearer the former. The dorsal fin originates almost opposite the pelvic fin. The dorsal fin spine is bony and serrated behind. There are 22 teeth on the dorsal spine. The length of the bony part of the dorsal spine is smaller than the length of head and is equal to its length behind nostrils or even smaller in larger specimens. The longest ray of the dorsal fin is contained 4.35-5.09 times in standard length and 1.01-1.17 times in length of head. The length of base of dorsal fin is contained 8.0-9.0 times in standard length and 1.75-2.1 times in head length.

The pectoral fin extends more than half way to the base of the pelvic fin. The length of the pectoral fin is shorter than the head and is contained 5.06-5.75 times in standard length, 1.15-1.28 times in head length and 1.30-1.72 times in the distance between the bases of the pectoral and the pelvic fins.

The pelvic fin arises opposite the dorsal fin and its length is contained 5.26-6.19 times in standard length, 1.20-1.39 times in head length and 1.50-1.92 times in the distance between the bases of the pelvic and the anal fins. The fleshy appendage in the axil of the pelvic fin is present. The pelvic fins do not reach the anal opening. The anal fin, when laid flat, does not reach the base of the caudal fin. The length of the longest ray of the anal fin is contained 4.80-5.70 times in standard length, 1.02-1.31 times in head length and 1.20-1.62 times in the distance between the bases of anal and caudal fins. The length of the base of the anal fin is contained 12.74-13.85 times in standard length, 2.80-3.33 times in head length and 1.50-1.66 times in the length of the base of the dorsal fin. The caudal fin is forked.

The height of the caudal peduncle is contained 9.00-10.00 times in the standard length, 1.97-2.38 times in head length and 1.6-2.0 times in its own length. The length of the caudal peduncle is contained 4.75-5.57 times in standard length and 1.02-1.37 times in head length.

The distance between the tip of the snout to the origin of the dorsal fin is contained 1.76-2.02 times, the distance between the tip of the snout to origin of the anal fin 1.27-1.50 times, the distance between tip of snout and the origin of pelvic fin 1.85-2.05 times, the distance between the tip of snout and the origin of the pectoral

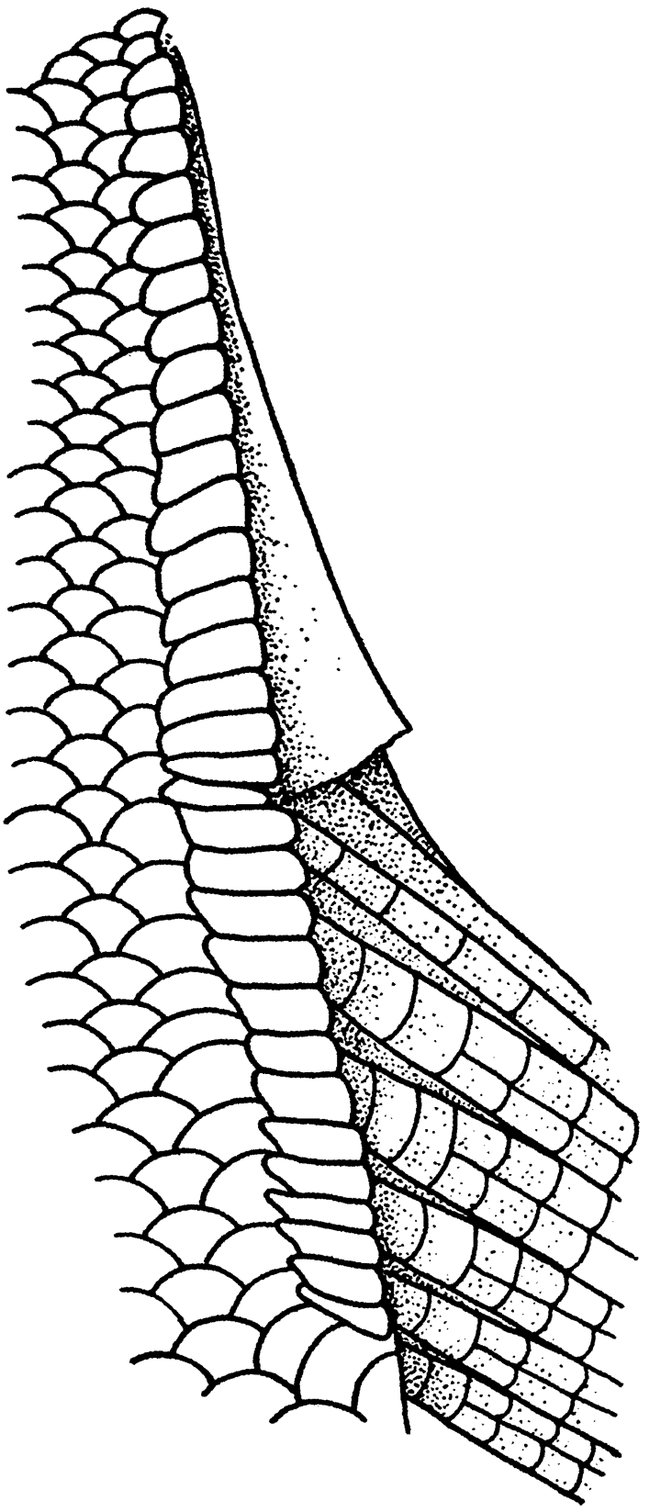


Fig. 96. Anal sheath of scales of *Schizothoraichthys labiatus*

fin 3.8-4.6 times, the distance between the bases of the pectoral and the pelvic fins 3.23-4.0 times, the distance between the bases of the pelvic and anal fins 3.0-3.53 times and the distance between the bases of the anal and the caudal fins 3.30-4.04 times in the standard length.

The colour of the body in spirit preserved specimens is reddish brown with dorso-lateral sides of body darker. The under-side of the body is silvery. The fins are immaculate.

Distribution :

Kashmir Valley, Indus river, Ladakh (J. & K.) ; Afghanistan (fig. 89).

Remarks :

It feeds on algae and insect larvae. The alimentary canal is nearly 1.5 times the total length of the fish. The swim-bladder is bilobed ; the anterior chamber is small while the posterior is much elongated. The walls of the swim-bladder are thickened and fibrous. The alimentary canal is nearly 1.5 times of total length of body in young examples.

Hora (1934), while studying the fishes of Chitral, compared the specimens of *S. labiatus* (McClelland) with those of *S. ritchianus* McClelland and remarked that the latter is a synonym of the former because the trilobed condition of the lower lip of *S. labiatus* is of highly variable nature. *S. ritchianus* is characterised by having a short middle lobe of lower lip, a condition which occurrs frequently in large collections of *S. labiatus.* Mukerji (1936) had only one specimen (260 mm. long) of this species from Indus river, Ladakh.

MATERIAL EXAMINED

Regd. No.	Locality	Collector	Date of collection	No of examples	Remarks
F. 11762/1	Chitral river Afghanistan	B. N. Chopra	?	1	
F. 11756/1	Chitral river Afghanistan	,,	?	26	
F. 11757/1	Lutkoh river, Sheghor, Chitral	,,	?	46	
F. 5323/1	Nepal (*S. ritchianus*)	ASB	?	1	
—	Irrigation Canal, Sheh (Ladakh)	Dr. R. Tilak	7.9.1977	4	
—	,,	,,	8.9.1977	2	
—	Tulamulla nala, near Tulamulla temple, Srinagar	,,	21.9.1977	7	
—	Dal lake, Dal gate, Srinagar	,,	5.11.1977	1	
—	Indus river, Sheh, Ladakh	,,	10.9.1977	2	
—	,,	,,	12.9.1977	1	
F. 5324/1	Nepal	ASB	—	1	

Key to the Identification of Indian Schizothoracinae

1. Body completely covered with scales ... (2)
   Body partially covered with scales ... (4)
2. Mouth inferior; lower jaw with a hard, horny and sharp edge; a hard and papillated labial plate at the chin present ... *Schizothorax* Heckel ... (7)
   Mouth mostly anterior; lower jaw without a horny plate; no labial plate at the chin present ... (3)

3.	Barbels 4 ; last undivided ray of the dorsal fin osseous and serrated ; pharyngeal teeth in 3 rows	... *Schizothoraichthys* Misra ... (8)
	Barbels 2 ; last undivided ray of dorsal fin soft and jointed ; pharyngeal teeth in 2 rows	... *Ptychobarbus* Steindachner ... ... *Ptychobarbus conirostris* Steindachner
4.	1/3rd lower part of body without scales, while the upper 2/3 part with scales ; 2 barbels present ; last undivided ray of dorsal fin soft and jointed	... *Diptychus* Steindachner ... ... *Diptychus maculatus* Steindachner
	Major part of body without scales except scapular or caudal patches ; barbels 4 or none ; last undivided ray of the dorsal fin osseous and serrated	... (5)
5.	Scales present on scapular region, body behind anus and base of dorsal fin ; scales large and fewer in number ; pharyngeal teeth in 3 rows	... *Lepidopygopsis* Raj ... ... *Lepidopygopsis typus* Raj
	Scales present only on scapular region and a few along lateral line ; scales small ; pharyngeal teeth in 2 rows	... (6)
6.	A horny layer covers anterior region of lower jaw and forms a sharp edge visible from below ; mouth ventral	... *Schizopygopsis Steindachner* ... *Schizopygopsis stoliczkae* Steindachner
	A horny layer covers the lower jaw on the inner side and is not visible from outside ; mouth terminal	... *Gymnocypris* Günther ... ... *Gymnocypris biswasi* Talwar.
7.	Head comparatively longer, being 4.05-5.05 times in standard length	... *Schizothorax richardsonii* Heckel
	Head shorter, being 5.14-5.57 times in the standatd length	... *Schizothora kumaonensis* Menon.
8.	Jaws not protrusible ; premaxillaries fixed ; the groove behind the lower lip interrupted, making two lobes of the lip	... *S.* (*Schizothoraichthys*) ... (9)
	Jaws protractile ; premaxillaries forming a movable rim and help in projecting the mouth forward, when opened ; the groove behind the lower lip uninterrupted and forms an intermediate lobe of the lower lip in addition to the two lateral ones	... *S.* (*Racoma*) McClelland ... (16)
9.	Cleft of mouth deep and the mouth opening wide	... *S.* (*Schizothoraichthys*) *esocinus* (Heckel)
	Cleft of mouth of normal type	... ... (10)

10. The scales along the anal sheath much longer than the body scales and the width of anal scale equal to or slightly less than eye diameter ... *S. (Schizothoraichthys) huegelii* (Heckel)

    Scales on anal sheath equal to half or less than half of the eye diameter ... ... (11)

11. The scales on the anal sheath not bigger than those on the body ... *S. (Schizothoraichthys) micropogon* (Heckel)

    The scales on the anal sheath bigger than the scales on the body ... ... (12)

12. Lips fleshy and blunt ; head longer, contained less than 4 times in standard length ... *S. (Schizothoraichthys) planifrons* (Heckel)

    Lips marginally sharp and thin ; head shorter, being more than 4 times in the standard length ... ... (13)

13. Mouth horse-shoe shaped ; body much darker in colour ... *S. (Schizothoraichthys) niger* (Heckel)

    Mouth crescentic ; body slightly dark on the back ... ... (14)

14. Anal reaching the base of the caudal ; caudal peduncle is short, being more than 6.00 times in standard length ... *S. (Schizothoraichthys) longipinnis* (Heckel)

    Anal normal, not reaching the base of the caudal ; caudal peduncle somewhat longer, being less than 6.00 times in standard length ... ... (15)

15. A horizontal line drawn from tip of snout towards the middle of caudal base passes clearly off the lower border of the eye ; eye small, being 5.55 times in head ... *S. (Schizothoraichthys) nasus* (Heckel)

    A horizontal line drawn from tip of the snout towards the middle of caudal base passes through half of the eye ; eye is large, being contained 4.2-4.22 times in head ... *S. (Schizothoraichthys) curvifrons* (Heckel)

16. The central lobe of the lower lip insignificantly small ; the body is deep, being 3.82-4.92 times in standard length ... *S. (Racoma) progastus* (McClelland)

    The central lobe of the lower lip well developed ; body not very deep, being 4.05-5.11 times in standard length ... *S. (Racoma) labiatus* (*McClellana*)

ADAPTATION OF SCHIZOTHORACINAE TO TORRENTIAL STREAMS

The Schizothoracinae are well adapted to the torrential streams of high altitudes. They are mostly distributed in the higher ranges of the Himalaya and Central Asia in the palaearctic region and have rarely infilterted into the submontane region.

In adaptation, only such organs are modified in relation to the environment (fast flowing water, stony bed and low temperature) that come most in touch with the surroundings. The structures which tend to exhibit special modification in Schizothoracinae are the following.

1. The Shape of Body :

The body in Schizothoracinae is stream-lined and cylindrical as needed in the habitat of fast current of the water. They have salmonid faciae. The stream-lined body puts least resistance to the fast current of water and these fishes are able to move against the current of the hill-streams with ease and perform all life functions normally. The paired and the median fins are also shaped in such a way that is conducive only for the propulsion or balancing of the body.

The snout is mostly pointed to steer its way against the current of water and thereafter the gradual slope of the body along both profiles is suitable for easy propulsion of the body forwards. The barbels are accordingly reduced in length or completely absent.

2. The Reduction of Scales :

The reduction in size and number of scales of the body is a step forward towards adaptation to hill-streams. For feeding, fishes require to press themselves against the substratum and, therefore, the lepidosis of the ventral side of the body is reduced or vanished. These fishes, of course, do not adhere to the stones contrary to what is generally believed by the earlier authors such as Hora (1937d). The reduction or absence of scales first takes place on the ventral side which comes in contact with the substratum and gradually the obliteration of scales ascends towards the dorsal side of the body. The body is completely covered with scales in *Schizothorax*, *Schizothoraichthys* and *Ptychobarbus* although the scales on the mid-ventral line are reduced. The next stage on the reduction of scales is exhibited by *Diptychus* in which the lower 1/3rd part of the body is without scales. Still another advanced stage in reduction of

scales is met with in *Lepidopygopsis* and finally the most advanced stages are seen in *Schizopygopsis* and *Gymnocypris*.

As stated earlier, the scales are an encumberance to these fishes because uncovered and smooth skin is a necessity for an additional cutaneous respiration. Hence, the scales have either reduced in size or vanished. The character of reduction of scales in Schizothoracinae is shared with Salmonidae and both these groups of fishes, inhabiting torrential streams in the high altitudes, have acquired this character, probably because of the increased necessity for respiration through skin but such a view does not appear very valid because fishes with a full compliment of scales do exist in the same environmental set up and respire normally. It appears that the reduction or loss of scales, as an adaptation to the high altitude environment, has been acquired through long process of evolution. In the same environment, some fishes have acquired this character while others have not, can be explained on the ground that these fishes which have acquired this character of the reduction or loss of scales have probably descended from such ancestors which lived in this environment for a much longer period than that of those which have not yet acquired that character. In other words, the total period of time for which these fishes (with scales reduced or absent) and their ancestors have faced this environment is much more than that of the fishes (with a full compliment of scales) and their ancestors together.

3. THE JAWS AND LIPS :

The modification of the lower lip to form a papillated hard labial plate and sharp horny edge on the lower jaw in *Schizothorax* and the sharp horny edge of the lower jaw in such genera as *Diptychus* and *Schizopygopsis* are adaptations to special type of herbivorous mode of feeding of these fishes. They need to scrap algal encrustation from the stones and rocks in fast running streams and, therefore, the development of these characters is needed for the purpose. In majority of these fishes, the premaxillaries and maxillaries are not movably articulated and the jaws are not able to protrude forward unlike many cyprinoid fishes. This modification is also acquired in relation to the special type of feeding habit of these fishes.

4. THE PAIRED FINS :

The paired pectoral and pelvic fins are comparatively large with their bases and outer rays thick and muscular. They are able to afford a greater amount of impact on the movement of the body in a fast current of water. These fins have moved somewhat outwards to the lateral sides to allow the ventral surface of the body to be directly applied to the rocks, if needed, for reducing the impact of the fast flowing water.

5. BARBELS :

The barbels are very short or completely absent among Schizothoracinae. Large barbels, obviously, should offer resistance to the fast flowing water and are, therefore, not convenient in a hill-stream environment. None of the fishes inhabiting torrential streams have long barbels. Short barbels or their absence is an adaptation to the fast current of water in hill-streams.

6. THE CAUDAL PEDUNCLE AND THE FIN :

The caudal peduncle is long and the caudal fin is deeply forked in Schizothoracinae ; these characteristics help the fish to dart about between the rocks with ease. It is obvious that the function of a long caudal peduncle with a fan-shaped caudul fin is to help the fish for a strong forward propulsion in these rapid flowing waters. Moreover, a strong caudal fin is needed to steer the strong muscular movements of the body of the fish against virulent current of water.

ZOOGEOGRAPHICAL CONSIDERATIONS

Schizothoracinae are a palaearctic group of fishes which have originally dispersed from the heart of the palaearctic region in U.S.S.R., China, Tibet etc. to various directions, of which the dispersal towards northern parts of India is an important route of migration of these fishes. Such migration should have taken place before the uplift of Himalaya, say before the Pleistocene era, when the hilly channels in the low hills were well connected with the drainage of the palaearctic region. The present distribution of Schizothoracinae in Himalaya is the result of a change in the drainage system of these areas due to uplift of Himalaya during Paleistocene.

Himalaya is a lofty mountain range on the southern margin of Tibet plateau. It is curved in a wide arc and runs 2160 kms. along the chord of the arc and 2400 kms. along the arc itself (Pascoe, 1964). It is embraced by the Indus river on the western end and the Brahmputra on the eastern. The mountain ranges of Himalaya continue westwards with the mountains of Chitral, Dir, Swat and Hazara districts of Pakistan. Karakoram range of mountains runs parallel and north of Himalaya. The pamirs forms the pivotal point at the western end of the Himalaya and Karakoram. Pamir-Kashmir theory of the distribution of Kashmir fishes has been put forward by Das (1965, 1966) and Das and Subla (1964, 1970). Hora (1937 d) enunciated Satpura Hypothesis of the distribution of the Malayan fauna and flora to peninsular India and stated that the

Malayan clements of fish could not disperse along Himalaya and were deflected along Satpura range of mountains due to some orogenic changes taking place in Himalaya at that time. Further evidences were provided to strengthen this hypothesis by Hora (1944, 1949, 1953), Menon (1951, 1954, 1978), Silas (1952) etc. Tilak and Husain (1978) have suggested a revision of the Hora's Satpura Hypothesis for the route of migration of fishes towards the west. Hora's Satpura Hypothesis explains the presence of Malayan elements in the peninsular India during Pliocene Siwalik period (Menon, 1973) but the torrential stream fauna of Himalaya developed much later, probabiy during Pleistocene era when the Himalaya rose higher. Thus, the distribution of specialised Schizothoracid fishes in Himalaya cannot be explained on the basis of Hora's Satpura Hypothesis. On the contrary, it appears that the route of migration of these elements took place from the north towards south and then along Himalaya towards the east ; this is just the opposite of the route of migration of Malayan elements into India.

Fishes are purely aquatic animals and due to their special ecological requirements, they restrict themselves to the drainage system which might be altered due to orogenic changes or river capture etc. As indicated by the present day distribution of Schizothoracids, it appears that both these modes of change have played part in distribution of fishes. The Pamir-Kashmir Theory of Das and Subla (1970) does not indicate the manner in which the fauna was distributed. The word 'Kashmir' has also been rather loosely used here without any regard to the geographical limits of the area.

Presuming that the home of palaearctic Schizothoracinae is in China, U.S.S.R. and Tibet, where a large number of genera such as *Schizothorax* Heckel, *Diptychus* Steindachner *Paratylognathus* Sauvage, *Herzensteinia* Chu, *Ptychobarbus* Steindachner, *Schizopygopsis* Steindachner, *Chaunchia* Herzenstein, *Platypharodon* Herzenstein, *Gymnocypris* Günther, *Gymodiptychus* Herzenstein, *Apiostoma* Nikolskii, *Apiorhynchus* Nikolskii, *Schizocypris* Regan, *Tetrastichodon* Tchang et al., *Aspiorhynchus* Kessler etc., are distributed, it appears that certain of these elements infiltrated into the region forming the present Ladakh where they established themselves into lakes and streams but subsquently, due to orogenic changes in Himalaya and the process of river cepture, a kind of discontinuous distribution of these fishes came into existence as seen at present.

Schizothorax, *Schizopygopsis*, *Diptychus*, *Ptychobarbus*, *Gymnocypris* and *Schizothoraichthys* are the Himalayan genera in India and all are present in Ladakh. The other areas along Himalaya do not have all these elements and this indicates that all of them could not infiltrate into areas beyond Ladakh before the orogenic changes or river capture took place to change the drainage pattern in the area.

Schizopygopsis, *Ptychobarbus* and *Diptychus* probably tried to travel towards the area now called Kashmir Valley, but were held up because of the uplift of the Himalaya between Ladakh and Kashmir Valley and therefore, they got perched into high altitude lakes existing on those high peaks, bordering the Kashmir Valley.

Chandra-Bhaga (Chenab river) river, now originating from high peaks north of the Lahaul Valley (H.P.) and flowing westwards to Jammu and Kashmir state, must have been connected with some water-way of Ladakh area and subsequently, due to uplift of that region, it got cut-off from Ladakh. This is amply justified by the presence of *Diptychus maculatus* in Chandra-Bhaga river. When Ladakh and Lahaul Valley areas were contiguous, without a barrier of high peaks around Baralacha and there was a river connection between them, *D. maculatus* might have entered into this part of the water-way and later got cut-off from Ladakh and became restricted to Chandra-Bhaga alone.

Sutlej and the Indus are the only two rivers of western Himalaya having their origin from Tibet and as such, there is infiltration of palaearctic elements into these rivers. *Schizopygopsis stoliczkae*, which is found in Ladakh, is also found in Sutlej in Kinnour district of Himachal Pradesh. Since this species is adapted to high altitude environment of torrential flow of water and low temperature, it is not found in the Sutlej river below Shongtong. Therefore, the possibility of dispersal of this fish or of *D. maculatus* in Chandra-Bhaga to other rivers or their tributaries, is completely ruled out. The reason being, that they will never descend to lower altitude in the same river so that they could enter into tributaries of these rivers. In this respect, *Schizothorax* and *Schizothoraichthys* are more dynamic and are found in the rivers over a very wide range of altitude and are, therefore, able to descend to the portions of the rivers as low as 600 mts. This dynamism of these genera has enabled them to disperse themselves into other water-ways along Himalaya as shown below.

The distribution of Schizothoracids from Tibet and Ladakh to the adjoining areas such as Kashmir Valley, Lahaul Valley and Kinnour district of Himachal Pradesh took place before the final uplift of Himalaya and the discontinuous distribution of some genera such as *Schizopygopsis*, *Diptychus* etc. occurred because of change in drainage pattern and river capture. The distribution of *Schizothorax* and *Schizothoraichthys* to other river systems along southern face of Himalaya also took place simultaneously but these genera could not invade the higher altitudes, say above 2000 mts. in these rivers although the same genera and species are found at altitudes higher than 3000 mts. in Sutlej river in Kinnour distsict or rivers of Ladakh.

The distribution of *Schizothorax* and *Schizothoraichthys* into the rivers on the southern face of Himalaya such as the Ravi, the

Beas the Yamuna, the Tons, the Bhagirathi, the Alakananda, the Sharda, the Kosi etc. is not similar in the manner and time in which other Schizothoracids entered Ladakh or other high altitude areas adjoining this region. In the rivers of Ladakh and adjoining areas, the Schizothoracids were already in existence and during the orogenic changes, same batches of them simply got cut-off with one another while others established connections with new drainage systems. Any migration of Schizothoracids, that took place, was probably towards the down-stream upto that limit of the river which those fishes could tolerate. While on the other hand, *Schizothorax* and *Schizothoraichthys* travelled through lower altitudes, invaded the rivers of Southern face of Himalaya and tried to ascend those waters upto limits which were congenial for them. In general, these fishes could not ascend to establish themselves higher than an altitude of 2000 mts. although the flow of water, the temperature and the nature of the bed of the rivers on the Southern face of Himalaya are somewhat similar to those of the higher altitude areas of Ladakh (J. & K.) and Kinnour (H.P.). The absence of *Schizothorax* and *Schizothoraichthys* and even other fishes in general at higher altitude in the rivers on the Southern face of Himalaya is thus understood.

From the actual distribution of Schizothoracids in the different river systems at present, one can see that slightly less than 50% of the palaearctic elements of Schizothoracids of U.S.S.R., China and Tibet have entered Ladakh. Of the Schizothoracid genera in Ladakh, hardly 50% of them have been able to disperse to adjoining areas. The Kashmir Valley has only two genera but with large number of species while the rivers on the Southern face of Himalaya also got these two genera but with only three species, of which (*S. kumaonensis*) is restricted to Kumaon hills and has probably got evolved due to their long separation and changed living conditions.

This gradual reduction in Schizothoracid genera and species from U.S.S.R., China and Tibet on the one hand and Ladakh and some adjoining areas and rivers on the Southern face of Himalaya on the other, is a clear indication of the route of migration of Schizothoracid fishes from the palaearctic region to Indian region.

The higher reaches of Brahamputra, which has eastward flow, has *Diptychus, Schizopygopsis, Gymnocypris* etc. while the lower reaches, where it deflects towards the west and passes through Arunachal Pradesh and Assam, only *Schizothorax* and *Schizothoraichthys* are found. Thus, the manner of distribution of Schizothoracids in Himalaya is almost of a similar pattern in all waterways. The presence of *Schizothorax* and *Schizothoraichthys* in the rivers on the Southern face of Himalaya is the result of a secondary introduction which took place after the present pattern of the drainage was attained and that the introduction took place from lower towards higher altitude.

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ADDENDUM

After writing out an account of the Fauna of India on the fishes of the subfamily Schizothoracinae and also its submission for publication, a few species of schizothoracids were described from Nepal and Pakistan and while assessing the systematic position of those taxa, this author felt it important to add notes on them and to list out the species of this group of fishes distributed in countries adjacent to India such as Pakistan, Nepal, Burma, Bangladesh and Srilanka because from zoogeographical angle, these areas are contiguous to that of India. With this view in end, the following remarks are added to this volume.

There are no schizothoracids in Burma, Bangladesh and Srilanka. The schizothoracid fishes distributed in Pakistan and Nepal have, therefore, been taken into account here.

Schizothoracinae of Pakistan

Majority of the schizothoracid fishes now recorded from Pakistan by various workers in that country were described originally from the river Jhelum in Kashmir Valley and the Indus river in Ladakh. Both these rivers flow down through Pakistan in montane and submontane regions and, therefore, some of the fishes described from Kashmir Valley and Ladakh have also been reported from the himalayan region falling under the political jurisdiction of Pakistan. The schizothoracid fishes of Pakistan have been dealt with by Ahmad (1963), Ahmad and Mirza (1963), Mirza (1966, 1973, 1975, 1976, 1980), Mirza and Awan (1978, 1979 a, b), Mirza and Hameed (1975) etc. and the following schizothoracid fishes have been so far recorded from the region falling under Pakistan.

1. *Schizothorax plagiostomus* Heckel
2. *Schizothorax skarduensis* Mirza and Awan
3. *Schizothoraichthys* (*Racoma*) *labiatus* McClelland
4. *Schizothoraichthys* (*Schizothoraichthys*) *esocinus* (Heckel)

5. *Schizothoraichthys* (*Schizothoraichthys*) *nasus* (Heckel)
6. *Schizothoraichthys* (*Schizothoraichthys*) *longipinnis* (Heckel)
7. *Schizothoraichthys* (*Schizothoraichthys*) *Intermedius* (McClelland)
8. *Schizocypris brucei* Regan
9. *Diptychus maculatus* Steindachner
10. *Diptychus pakistanicus* Mirza & Awan
11. *Ptychobarbus conirostris* Steindachner
12. *Schizopygopsis stoliczkae* Steindachner

Among these representatives of Schizothoracinae, *Schizothorax plagiostomus* is a synonym of *Schizothorax richardsonii* (Gray). In the above mentioned species, there are two new taxa described by Mirza and Awan (1978 and 1979b). *Schizothorax skarduensis* Mirza and Awan differs from *Schizothorax richardsonii* in possessing barbels longer than the diameter of eye. The hard papillated plate on the ventral side of the head of this species, as shown in the figures of the species given by Mirza and Awan (1979a) indicates that it is a form intermediate between *Schizothorax* and *Schizothoraichthys*. This transitional stage is one of the intermediate stages of the hard papillated plate depicted and described earlier in this work. This proposition is possible because schizothoracids are highly pron to hybridization and invariably, one or more than one examples possessing hybrid like characters have been noticed in our collections from Indian waters. However, it is not possible to render any definite opinion about the systematic status of this species unless the type material is examined and compared with such examples of our collection which have been designated here as hybrids without a definite species status.

Diptychus pakistanicus Mirza and Awan has been differentiated from *Diptychus maculatus* Steindachner by Mirza and Awan (1979 b) in having lesser height of body (6.57 -6.69 times in standard length against 5.00-5.26 times in *D. maculatus*), the longer dorsal ray and colour markings on the head. These characteristics have been compared with the description of *D. maculatus* here after the study of the material collected from various drainage systems in higher altitudes of Himalaya and I have come to the conclusion that

the variations, as described in *D. pakistanicus*, are available in the material studied from India and they fall well within the range of variation of *D. maculatus*. There is no uniform set of characters of one population which differ from those of another. The depth of the body in *D. maculatus* has been observed to be 5.52-6.73 times in standard length against 6.57-6.69 times in *D. pakistanicus* which falls within the range of variation of the material of *D. maculatus* studied here. Similarly, the longest ray of the dorsal fin in our material is equal to or slightly shorter than the depth of the body below the dorsal fin and hence, *D. pakistanicus* having a dorsal fin as high as the depth of body below it does not stand as a taxon different from *D. maculatus*. There is a great variation in the colour markings on the head and body of *D. maculatus* ; this differs from one kind of habitat to another. The specimens from *Chandrabhaga* river in Lahaul and spiti Valley of Himachal Pradesh and the open channel of Indus river in Ladakh possess somewhat ligher colouration while those from slow moving rivers and streams with plenty of algal encrustations on stones and rocks, the head and body are marked with intense colouration ; the ground colour of the body is also deeper than that of the specimens from fast flowing and clear streams. Since, these slow moving streams mingle with the main Indus river, there is a continuous mixing of the colour forms. Apart from the colour of the head and the body, they do not differ from each other in any other morphometric characteristics. *D. maculatus* is a highly variable species which inhabits both slow and fast moving streams at high altitude and also lakes at high altitude (Raina and Bali, 1983). In view of the great adaptability of this species to different habitats, a greater variation in the different characteristics of this species is expected to be met with but when the total material from all different kinds of habitats is examined collectively, it is found to belong to a single species with wide range of variation in morphometric and descriptive characters. In view of the brief reasoning put forward above, it is clear that *D. pakistanicus* is only a synonym of *D. maculatus* and not a different taxon.

The other schizothoracid taxa of the genera *Schizothoraichthys*, *Diptychus*, *Ptychobarbus*, *Schizopygopsis*, *Schizocypris* etc., reported from Pakistan by Mirza and other workers (op. cit.), are likely to

exist there because the Indus river drainage continues from Kashmir and Ladakh into the regions falling under Pakistan and because of this continuity of water ways, some of the elements of Schizothoracinae of Ladakh and Kashmir have travelled westwards and distributed in the Himalayan ranges in Pakistan having suitable ecological niches.

Schizothoracinae of Nepal

Guenther (1861) studied and named the skins and diagrams of fishes collected and prepared by Mr. H. Hodgson from Nepal and reported the following species.

Oreinus maculatus McClelland (= *Schizothorax richardsonii* (Gray)), *Oreinus hodgsonii* Guenther (= *Schizothoraichthys* (*Racoma*) *progastus* (McClelland)) and two unnamed species of the genus *Oreinus*. As shown here, *Oreinus maculatus* and *Oreinus hodgsonii* are synonyms of *Schizothorax richardsonii* and *Schizothoraichthys* (*Racoma*) *progastus* respectively whereas one of the unnamed species of *Oreinus* is probably *Crossocheilus diplochilus* (Heckel) while the other one is still of a doubtful nature. Day (1877) recorded *Schizothorax richardsonii* and *Diptychus maculatus* from Nepal. Regan (1907) recorded *Schizothorax richardsonii* and described a new species, *Diptychus annandalei* Regan from Nepal. *D. annandalei* was of a doubtful systematic nature and, therefore, Mukerji (1937) doubtfully put it under *Schizothorax richardsonii*. In the present work, it is confirmed that *D. annandalei* is in fact a very young specimen of *Schizothorax richardsonii*. Hora (1937 e), Dewitt (1960) and Dutta (1964) recorded *S. richardsonii* from Nepal. Recently, Terashima (1984) described three new species of the genus *Schizothorax*; they are *S. raraensis*, *S. macrophthalmus* and *S. nepalensis*. The characters of the three new taxa from Nepal are compared with one another in the table given below.

Since these species are adapted to lacustrine habitat, they have developed a smaller caudal peduncle and shorter dorsal fin because of the decreasing capacity of locomotion in a lake. The lake Rara has been formed from old Karnali river and the riverine forms have taken to lacustrine form of life. The food habits of the three

Showing a comparison of the characters of three new species of the genus *Schizothorax* described by Terashima (1984)

Characters	*S. raraensis* Lake Rara 245 mm	*S. macrophthal-mus* Lake Rara 122-156 mm	*S. nepalensis* Lake Rara 107 mm
1. Condition of lower lip	Horse-shoe shaped	Horse-shoe shaped	More or less straight with ends curved back
2. Tip of lower jaw	Fleshy	Fleshy	Covered with blunt horny sheath
3. Scales on breast	Present	Present	Presnt
4. Origin of dorsal	Slightly behind middle of body and in advance of pelvics.	Same	Slightly anterior to middle of body
5. Scales above lateral line	25-31	26-33	29-30
6. Scales below lateral line	19-25	18-25	20-21
7. Rostral bar-bel length	3.3% of standard length	2.0%	1.9%
8. Maxillary barbel length	3.6% of standard length	2.7%	2.4%
9. Outer Gill rakers	11-15	17-23	17-20
10. Inner gill rakers	13-20	27-29	21-28
11. Head length in standard length	27.5%	24.5%	24.5%
12. Height of dorsal in standard length	16.5%	17.4%	21.1%
13. Nostrils	nearer eye than snout	Same	Same
14. Anal fin	Reaches base of caudal in female but not reaching in male	Same	Same

Characters	*S. raraensis* Lake Rara 245 mm	*S. macrophthalmus* Lake Rara 122-156 mm	*S. nepalensis* Lake Rara 107 mm
15. Eye in standard length	5.2% in Standard length	5.8%	5.6%
16. Snout in standard length	11.00%	8.6%	9.4%
17. Food	Insectivorous	Planktivorous	Herbivorous
18. Relationships	*S. (R.) progastus* *S. kozlovi* (Chinese) Differences with *S. (R.) progastus* in (i) Dorsal and pelvic position (ii) Prepelvic length in standard length (iii) Height of dorsal fin in standard length (iv) Head length in standard length (v) Interorbital width	*S. (R.) progastus* Differs from this in (i) Dorsal and pelvic situated more anteriorly (ii) Prepelvic distance (iii) Predorsal distance (iv) Length of dorsal fin (v) Eye diameter in standard length (vi) Snout length in standard length	Resembles *S. macropogon* in Tibet and *S. skarduensis* in east Karokorum and Pakistan in lower jaw with blunt horny layer. *S. macropogon* has long barbels, rostral 15.2% and maxillary 16.3% of standard length *S. skarduensis* has horse-shoe shaped lower lip and long barbels.
	Differ from *S. kozlovi* in (i) Long rostral and maxillary barbels. *S. esocinus* of Shrestha (1978) is this species.	Differs from *S. raraensis* in (i) Short head and snout	

species of the lake Rara viz. *S. rarensis*, *S. macrophthalmus* and *S. nepalensis* are different. *S. rarensis* is described to be insectivorous, *S. macrophthalmus* is planktivorous and *S. nepalensis* is herbivorous. Their gill rakers are accordingly modified. *S. rarensis* and *S. nepalensis* are species of the littoral zone while *S. macrophthalmus* belongs to the pelagic zone. Terashima (1984) has tried to show that the species are isolated from one another in feeding habits and also breeding and hence, there is very little competition among them because they are endemic species of the lake Rara and found no where else in Nepal waters. The morphology of the lower lip and jaw in these species indicates that they are various hybrid forms. *S. rarensis* is clearly representing one of the stages of variation of *S. richardsonii*, as shown earlier in this work and clearly approaches *Schizothorax* type of lip. In *S. macrophthalmus* and *S. nepalensis*, the lower lip and jaw show different stages approaching *Schizothoraichthys* (*Racoma*) type. The exact systematic position of these species can be ascertained after a thorough study of the type material belonging to these species.

However, the known species of schizothoracid fishes from Nepal till date are the following.

1. *Schizothorax richardsonii* (Gray)
2. *Schizothorax rarensis* Terashima
3. *Schizothorax macrophthalmus* Terashima
4. *Schizothorax nepalensis* Terashima
5. *Schizothoraichthys* (*Racoma*) *progastus* McClelland
6. *Diptychus maculatus* Steindachner

Zugmayer (1909, 1910) described two species, *S. ladacensis* Zugmayer and *S. montanus* Zygmayer from Indus river near Leh but no reference to these species appeared to have been made by subsequent authors on Ladakh fishes. It is not possible to study the type material of these species in order to check up the exact systematic position of fishes described by Zygmayer (1909, 1910). Due to this reason, these two species have not been included in this work as Schizothoracinae of Ladakh. As and when material of these species is available for study, the systematic position of these species in relation to *S. richardsonii* will be decided in future.

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INDEX