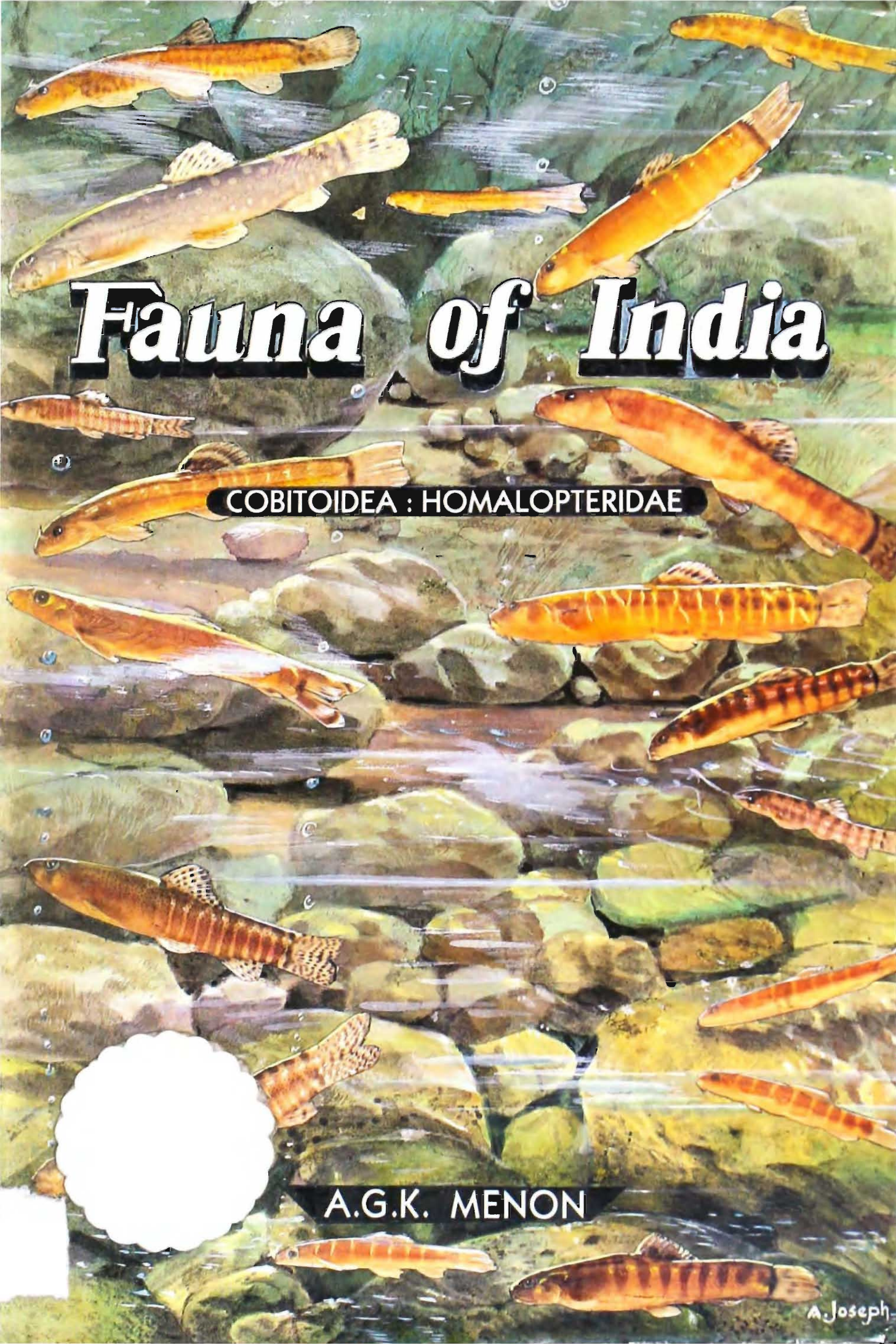
Fauna of India
COBITOIDEA : HOMALOPTERIDAE
A.G.K. MENON
A.Joseph

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AND

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BY

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EDITOR'S PREFACE

Dr. F Day's two volumes on Fishes of India, Burma and Ceylon in the *Fauna of British India* series, published in 1876–78, is the first comprehensive treatise on the systematics of fishes of the Indian region. However, the book was long out of date from the nomenclative point of view and the work of revising it was assigned in 1930 to late Dr. Sunder Lal Hora. Dr. Hora died in 1955 without leaving any manuscript though he had published several important revisional studies on different groups of fishes reorientating several genera and families of the Fishes of India. In August 1958, the work of revision of Fishes of India and the publication of the *Fauna of India* on Pisces in the new series in continuation of the well known *Fauna of British India* series was assigned to Dr. K.S. Misra, Asst. Superintendent in charge of the Fish Section of the Survey. He brought out three volumes: Volume 1, dealing with Elasmobranchii and Holocephali; Volume 2, comprising of five orders: Clupeiformes, Bathyclupeiformes, Galaxiformes, Scopeliformes and Ateleopiformes; and Volume 3, dealing with suborder Siluroidei of the order Cypriniformes. Dr. Misra expired in March 1969, when the last Volume was in the press.

The present Volume on Homalopteridae (Noemacheilinae and Homalopterinae) of the superfamily Cobitoidea by Dr. A.G.K. Menon, is the fourth under the new series on Pisces. These fishes are of considerable interest from a zoogeographical point of view to merit a separate Volume and I am sure it will become a very useful work of great importance to Ichthyologists in general and to Indian Ichthyology in particular.

Dr. Menon is a well known Ichthyologist who had his initial training under the eminent ichthyologist, the late Dr. Sunder Lal Hora. I wish to congratulate him for having accomplished the publication of this valuable book.

DR. B.S. LAMBA
Joint Director-in-charge,
Zoological Survey of India

Zoological Survey of India,
Calcutta, 30th May, 1987

AUTHOR'S PREFACE

An attempt has been made to recognise, describe and classify the mountain loaches of the family Homalopteridae (Noemacheilinae+Homalopterinae) of India and adjacent countries in this volume. Some of the Indian noemacheiline loaches form the most beautiful fishes of the world. However, hitherto it has been impossible to name even the commonest of these beautiful loaches because of the lack of a well illustrated reference work on them. In the present work seventy nine species of noemacheiline and eight of homalopterine loaches are described in detail, some of the noemacheiline loaches with coloured illustrations and most of them with black and white photographic illustrations including a few excellent line drawings. Nine distributional maps have also been included. A fully illustrated volume on Cobitidae (Botiinae + Cobitinae) in the same series of Monographs is nearing completion and it will soon be published. It is hoped that these two volumes on the superfamily Cobitoidea will prove to be of great use to ichthyologists in general and to aquarium hobbyists in particular and will form the basis for further research on a world-wide basis on this difficult group.

In the present work certain major changes on the phylogenetic classification of the suborder Cyprinoidei have been adopted. The noemacheiline loaches considered traditionally belonging to the family Cobitidae has been transferred along with Homalopterinae to the family Homalopteridae. The Homaloptridae and the Cobitidae, which comprises of the subfamilies Botiinae and Cobitinae, are together placed under the superfamily Cobitoidea. Hora's families Homalopteridae and Gastromyzonidae have been combined relegating them to the rank of a subfamily Homalopterinae under the family Homalopteridae.

Finally, I wish to record here my great appreciation and gratitude to M/s Amra Press, Madras, the printers of this volume, for their efficiency and excellence in printing which are second to none in India.

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April 1987

CONTENTS

INTRODUCTION

The fresh-water fishes of the superfamily Cobitoidea are distributed in Asia, Europe and certain parts of Africa. Most are small and many are more or less eel shaped. It includes more than 200 species and is the second largest group of the suborder Cyprinoidei.

The phylogeny of the cobitids has been studied by many workers (Regan, 1911; Rendahl, 1930; Berg, 1940). Regan was the first investigator who on the basis of comparative osteological studies treated these fishes as a group and established the family Cobitidae comprising two subfamilies: Cobitinae and Noemacheilinae. Later Berg (1940) divided Regan's subfamily Cobitinae into Cobitinae and Botiinae. Since then Berg's classification of the family Cobitidae has been widely accepted and several workers studied the osteological features of the fishes of this group (Alexander, 1964; Mester-Bacescu, 1970; Mester, 1972, 1973). These authors, however, did not attempt a study of the phylogeny of the family. The major phylogenetic studies to establish relationships between the subfamilies of the Cobitidae and the other Cyprinoid families are those of Hora (1932) and Ramaswamy (1952a; 1952b).

The Homalopterids are small loach-like fishes found in torrential streams of southern and eastern Asia and the Indo-Australian Archepelago excluding Sulawesi and New Guinea. Hora (1932) divided the family Homalopteridae into two subfamilies, Homalopterinae and Gastromyzoninae. He further concluded that the family is polyphyletic, the Homalopterinae having evolved from Cyprinidae and the Gastromyzoninae from Cobitidae. He was convinced that the superficial resemblance between Homalopterinae and Gastromyzoninae was due to the ecological similarity. Later, on the basis of hypothesis of polyphyletism Hora (1950) raised his subfamilies into two independent families. However, this division has not found acceptance amongst ichthyologists (Greenwood *et al*, 1966). Nelson (1984) and Wu *et al.* (1981), placed them in a single family.

In a recent study based on osteology of several species Sawada (1982) combined Hora's families Homalopteridae and Gastromyzonidae relegating them to the rank of subfamily Homalopterinae. He further considered noemacheiline loaches phylogenetically closer to Homalopteridae than to Cobitidae and accordingly

transferred Noemacheilinae to Homalopteridae. The Cobitidae considered traditionally as an independent family of Cyprinoidei has been placed along with Homalopteridae in the superfamily Cobitoidea. This system has been adopted here and is as follows:

Superfamily	Cobitoidea
Family	Cobitidae
Subfamily	Botiinae
Subfamily	Cobitinae
Family	Homalopteridae
Subfamily	Noemacheilinae
Subfamily	Homalopterinae

There has not been any comprehensive study of the species of Noemacheilinae occurring in Indian waters except the partial revision of the genus from Eastern Himalayas (Hora, 1935). Hamilton (1822), McClelland (1839), Günther (1868), and Day (1878) described several new species but most of them have not been collected again since their original descriptions. Consequently the taxonomy of these fishes has been in a great confusion. In the present work the results of a systematic study of the loaches of the subfamilies Noemacheilinae and Homalopterinae of India and the adjacent countries, Nepal, Pakistan, Bangladesh, Burma and Sri Lanka are embodied.

This study of the Cobitoidea of India and the adjacent countries was undertaken with a view to prepare a volume on Cobitoidea for the Fauna of India series. The present work deals with only the Homalopteridae and it is proposed to bring out another volume on Cobitidae in the same series in the near future. The species of the subfamily Noemacheilinae in the Indian region constitute two distinct genera, *Noemacheilus* van Hasselt and *Triplophysa* Rendahl with 69 and 10 species respectively.

Noemacheilines are known from Eurasia and the Blue Nile of Africa (Sawada, 1982). Banarescu and Nalbant, (1964, 1966, 1968, 1974, and 1976) have attempted the subdivision of this large genus into several genera or subgenera, the results however have not been very satisfactory. *Noemacheilus* s.str. should however be applied only to forms similar to the type species of this genus, *Noemacheilus fasciatus* van Hasselt, and should be restricted to species occurring in South China, Southeast Asia, South Asia, Pakistan, Baluchistan, Seistan, S. Anatolia and the Blue Nile of Africa. Species of "*Noemacheilus*" occurring in other parts of Eurasia must be assigned to other genera (*vide* infra. p.20). The noemacheiline fish occurring in Ladakh and the adjacent high

Asian region consists of species without any scales. While discussing the fish fauna of the southern and northern territories of the Himalayan region Hora (1937) stated:

"The Trans-Himalayan species (of *Noemacheilus*) usually grow to a fairly large size; the body is greatly elongated and almost whip-like posteriorly. The skin is totally devoid of scales. The colour on the sides forms a mottled pattern. The species of the Indian region are usually small in size and possess short, stumpy bodies. Small scales, sometimes hidden in the skin, are usually present, while the body is invariably marked by a series of transverse bands".

Rendahl (1933) ascribed these fishes to several subgenera: *Triplophysa* characterised by a large and free air bladder subdivided into three chambers, *Tauphysa* and *Deuterophysa* (new name for *Diplophysa* Kessler, 1874, pre-occupied; *Deuterophysa* itself being preoccupied it was later on replaced by *Didimophysa* Whitley, 1959) for two groups of species with well developed air bladder subdivided into two chambers. There are several other high Asian noemacheiline loaches with reduced and encapsulated air bladder like *stoliezkae, griffithi, gracilis, microps, tenuicauda,* etc., for which Rendahl did not suggest any new name. Banarescu and Nalbant (1976) included them under *Hedinichthys*. *Hedinichthys,* however, differs from all other High Asian forms and is a distinct genus (Zhu, 1981). There is, therefore no available generic name for the true High Asian noemacheiline fishes with reduced air bladder. *Diplophysa* is only a specialised form of the noemacheiline fish with a reduced and enclosed air bladder. Hora (1922) explained: that the members of the genus *Diplophysa* have in all probability come to live secondarily in the deep muddy waters of the lake basins of Central Asia in which situation they require a hydrostatic organ for vertical movements; he believed it to have originated from forms in which the air bladder is reduced and enclosed in a bony capsule and when the primary air bladder became enclosed in bone it probably could not again be modified for the performance of a hydrostatic function to suit the new environment. As the degree of development of air bladder is not considered to have any phyletic significance all the High Asian noemacheiline fishes except *yarkandensis* and its allied species (Zhu, 1981) have been assigned here to the genus *Triplophysa* Rendahl, 1933. Ten species of *Triplophysa* occurring in the Kashmir region are included here.

The 69 species of *Noemacheilus* include 9 species and 3 subspecies that are described here as new. They have been assigned to nine subgenera, *Viz.*, *Schistura* McClelland, *Acanthocobitis*

Peters, *Noemacheilus* van Hasselt, *Noemacheilichthys* Day, *Mesonoemacheilus* Banarescu and Nalbant, *Infundibulatus* subgen. nov., *Petruichthys* subgen. nov., *Aborichthys* Chaudhuri and *Indoreonectes* Rita and Banarescu. The subgenera *Petruichthys* and *Noemacheilichthys* both have only one species, *N brevis* and *N. ruppelli* respectively. In *Schistura*, 11 species complexes have been recognised.

The subfamily Homalopterinae is represented in India and Burma by four genera: *Homaloptera* (with four species), *Balitora* (two), *Bhavania* (one) and *Travancoria* (one).

Acknowledgements

I am greatly indebted to several persons who have contributed to this study in many ways especially by the loan of specimens, examination of specimens in their care, help either in procuring specimens from remote parts of India or assistance in the field, help in processing and printing colour films and for reading through portions of the manuscript and for their valuable suggestions, throughout the course of preparations of the work: E. Trewavas, Gordon Howes, Bernice Brewster, M. L. Bauchot, Pier Giorgio Bianco, M. R. Mirza, H. Wilkens, Petru M. Banarescu, Brian W. Coad, Carl Edelstam, Wang-you-huai, Wasco Watanabe, Yukio Sawada, H. Nijssen, Zhu Song-quan, S. C. Dey, Raj Tilak, K. K. Tandon, Erik Ahlander, Barbara Herzig and Mohan Singh Raina. To Drs Brian W Coad and Maurice Kottelat I am specially indebted for reading the entire manuscript and making valuable suggestions and corrections.

My colleagues in the department materially aided in the progress of this study by sending me the entire cobitid collections to the Southern Regional Station, Madras for my study, by attending to my innumerable queries for data on type specimens, for the preparations of illustrations and for the constant encouragement and interest shown in the progress of work, especially Dr. B. K. Tikader, the Director, P. K. Talwar, T K. Sen and T K. Chatterji of the Fish Division, Mrs. Sen, Librarian and Arun Ghose, Artist, Dr. R. S. Pillai, K. Rema Devi, K. V Lakshminarayana, T. Venkateswarlu, M. Srinivasan, D. Sengupta, S. K. Goswami and S. L. Vijayaraghavan of the Southern Regional Station helped me in several ways. To each I am greatly indebted. Although the cobitid collections of the Zoological Survey of India, Calcutta is by far the largest in the country, it was necessary to examine many additional specimens which have been made available by several individuals and institutions in India and abroad. A list of those individuals and institutions, together with the appropriate abbreviations used in the text are given below:

BMNH	British Museum (Natural History) London	Gordon Howes and Bernice Brewster
BNHS	Bombay Natural History Society	C. Daniel
DABFKU	Department of Aquatic Biology and Fisheries, University of Kerala, Trivandrum.	N. B. Nair and Padmanabhan
DZGU	Department of Zoology Gauhati University, Gauhati.	S. C. Dey
DZMU	Department of Zoology University of Manipur, Manipur	Tombi Sing
DZPU	Department of Zoology Punjab University, Chandigarh.	K. K. Tandon
DZTU	Department of Zoology Tribhuvan University Katmandu.	Jeevan Shrestha
ERS/ZSI	Eastern Regional Station Zoological Survey of India Shillong 3, Meghalaya.	C. Radhakrishnan
FBS/ZSI	Fresh Water Biological Station, Zoological Survey of India, Hyderabad.	M. Babu Rao
GPRS/ZSI	Gangetic Plains Regional Station, Zoological Survey of India, Patna.	S. M. Yazdani
HAZFS/ZSI	High Altitude Zoology Field Station, Zoological Survey of India, Solan.	Askat Singh
ISBB	Institutul de Stiinite Biologica Bucuresti	Petru M. Banarescu
MNHP	Museum National 'd'Histoire Naturelle, Paris	M. L. Bauchot

NMC	National Museum Colombo.	De Silva
NRS	Naturhistoriska Riksmuseet Stockholm.	Carl Edelstam and Erik Ahlander
NRS/ZSI	Northern Regional Station Zoological Survey of India Dehra Dun.	B. S. Lamba and Raj Tilak
NHV	Naturhistorisches Museum, Vienna, Austria.	K. Paul
SRS/ZSI	Southern Regional Station Zoological Survey of India Madras.	R. S. Pillai
WGRS/ZSI	Western Ghats Regional Station, Zoological Survey of India, Kozhikode.	G. U. Kurup
WRS/ZSI	Western Regional Station Zoological Survey of India Poona.	Ramakrishna
ZMA	Instituut voor Taxonomische Zoologie, University of Amsterdam.	H. Nijssen
ZMH	Zoologisches Institut Und Zoologische Museum, Universität, Hamburg.	H. Wilkens
ZSI	Zoological Survey of India Calcutta.	T K. Sen

Historical Review

The first species of noemacheilinae known from India are those described by Hamilton-Buchanan (1822). He described twelve loaches of which five species are referable to *Noemacheilus*, *Cobitis botia*, *C. savona*, *C. turio*, *C. bilturio* and *C. corica* two of these, *C. turio* and *C. bilturio*, are conspecific with *Noemacheilus botia*, the differences between them being due to sexual characters. *N. savona* and *N. corica* are valid species and are described in the present work based on fresh specimens collected along eastern Sub-Himalayas.

After Hamilton-Buchanan, McClelland in 1838 described two new species of *Noemacheilus* from the mountain streams of Simla under the generic denomination *Schistura, viz., S. montanus* and *S. rupecula.* In the subsequent year more species of *Noemacheilus* were described by McClelland: *S. scaturigina, S. subfusca, S. punctata, S. zonata, Cobitis pavonacea* and *C. ocellata. S. subfusca* and *S. zonata* are synonyms of *S. scaturigina* (Hora, 1935). *C. punctata* is the same as *N. corica* and *C. ocellata* the same as *N. botia* while *C. pavonacea* is a valid species.

N. scaturigina was figured by Hamilton-Buchanan in plate 53 of his manuscript drawings now preserved in the library of the Asiatic Society of Bengal. McClelland found the drawing labelled as "*Cobitis scaturigina*" and adopted this name for the species (Hora, 1935).

Heckel (1838) described two species, *Cobitis marmoratus* and *C. vittatus* from the Kashmir Valley. Günther combined Heckel's two species from Kashmir and adopted for them the specific name *marmoratus.* Day followed Günther and recognised only one form from the Kashmir lakes.

In 1849 Jerdon described 4 new cobitid fishes under the generic denomination *Cobitis* and characterised them by such meagre descriptions that it is not possible to distinguish them specifically. Günther (1868) regarded these species as doubtful members of the genus *Noemacheilus.* Day changed his opinion regarding these forms from time to time. I have followed Günther and have ignored Jerdon's forms altogether.

Sykes (1841) described *C. moreh* and *C. ruppelli* from the Western Ghats. These were regarded by Günther (1868: 347) as doubtful members of *Noemacheilus* but Day (1872) assigned them to the genus *Noemacheilus.*

In 1868, Günther added two species to the fauna of India: *N. beavani* from the Kosi River and *N. ladacensis* from Gnani Khorsum, Tibet.

In 1866 Steindachner described *C. stoliczkae, C. tenuicauda,* and *C. microps,* all from the headwaters of the Indus River.

Day (1872) described two new species, one from Poona with a pair of well developed nasal barbels (*N. evezardi*) and the other from Jabalpur (*N. aureus*). The latter appears to be a synonym of *N. moreh* (Sykes).

Day, in a series of papers (1865–1873) on the fish fauna of the Nilgiris and the adjoining hill ranges, described eight new species in the genus. Of these, *N. chryseus* is identical with *N. denisoni*. In his later and more comprehensive work Day (1878) recorded 8 species of *Noemacheilus* from Western Ghats, but his *N. beavani* is the same as *N. chryseus* which in its turn is a junior synonym of *N. denisoni*.

Day (1872) revised the genus in his monograph on Indian Cyprinidae: unfortunately in his *Fishes of India* (1878) he has not included any reference to it. In his monograph he described a specimen from Bezwada, now Vijayawada as *N. chlorosoma* (p. 188). I very much doubt the identification and it seems quite probable from the description that in this instance Day was dealing with a new form. It is rather difficult to include it in the list of valid species without examining the specimens. Moreover, it has not been possible for me to assign a definite position to Day's *N. rubripinnis* (p. 197) from Malabar. In all probability it represents a colour variant of *N. guentheri* Day. Thus, there are altogether six valid species of *Noemacheilus*, assigned to Day described from the Western Ghats. Most of these possess beautiful and distinctive colour patterns and in this respect they represent the prettiest loaches known from India.

Day (1878) included 33 species referred to *Noemacheilus* but did not include any reference to Günther's *Nemachilus montanus* in the synonymy of any of the species but added a foot note which runs thus:

"*Nemachilus montanus* Günther, although closely resembling the typical form, is not this species, but *N. multifasciatus*. His description is from two specimens in the British Museum which are thus noted in the Catalogue: Simla *a. b.* probably typical specimens from the collection of the East India Company. This supposition I consider incorrect; the specimens were from the collection of the East India Company but without any locality attached. McClelland (*Calcutta Journal Natural History*, 1842, 2, p. 573), enumerates the species he sent to Europe up to that time, and the only loaches were: *Cobitis boutanensis* and *C. marmoratus*, and in the chronological list of the contributions to the Museum at the India House (see preface to the catalogue of Mammalia, 1851) it will be seen that he sent only one collection. However, many fish from other parts were received at various periods but as this species appears to be absent from Simla, I prefer confining McClelland's two names of Simla species to the two forms of loaches now found there, and which agree moderately well with his description".

In spite of the above remarks of Day, I find that Günther's

description of *N. montanus* closely agrees with the typical specimens from Simla and also agree well with Day's description of *N. montanus*. Even if it be taken as a fact that Günther's specimens of *N. montanus* were not the type specimens, it is quite conceivable that in the collections forwarded to the Museum at the India House by the Asiatic Society of Bengal there were specimens of *N. montanus* from Simla that Günther considered to be type specimens.

Day's *Noemacheilus multifasciatus* described from "Darjeeling and Assam", has not since been collected again from these places. The Burmese and Siamese specimens reported under this name are not conspecific with the species from India and Hora (1935) proposed for these the name *N. vinciguerrae*. Day's figured specimen from Darjeeling is available in the collections of the Zoological Survey of India, but it is unfortunately in a bad state. From the figure of the species given by Day (1878: pl. 153; fig. 7) I am strongly inclined to consider *N. multifasciatus* as a species very close to *N. rupecola* from Simla and the Kumaon Himalayas and it replaces that form in the Eastern Himalayas. It differs from the Western Himalayan form in the possession of a well-marked nasal barbel, by the comparatively shorter fin and a stouter body. From the number of specimens that are preserved in the Zoological Survey of India collections, the species appears to be very common south of Darjeeling and in Sikkim. Günther (1868: 351) described *N. rupecola* based on 5 specimens from Sikkim and they are identical with the hundreds of specimens obtained from places below Darjeeling. There is a distinct nasal appendage in all these specimens. In the *rupecola* of the Western Himalayas the nasal barbel is present but is not so well developed. Further, the eastern Himalayan form has 7 branched dorsal rays, while the western Himalayan form has 8 branched rays in the dorsal. Hora considered the eastern Himalayan form as a subspecies of *N. rupecola*, and named it as *N. rupecola inglisi* (Hora, 1935: 58).

The vertical bars of the Darjeeling specimens vary considerably and in some young examples they are altogether absent. In some the bars in front of the dorsal fin tend to get subdivided into a number of narrow bars conforming well with Day's description of coloration of *N. multifasciatus:*

"Vertical bands as wide as the ground colour, pass from the back to the lower surface of the abdomen, those between the head and the dorsal fin are numerous, while there are about 5 posterior to it. In some examples these anterior bands coalesce. A dark band at the base of the caudal and dark marks on the head radiating from the eye"

The dorsal and caudal fins are provided with many rows of

spots in *N. multifasciatus* and judging from the colour pattern of the species, I have concluded that the Eastern Himalayan form is Day's *N. multifasciatus*. A detailed description of *N. multifasciatus* from Darjeeling in the eastern sub-Himalayas is provided here.

Besides the work of men like Hamilton-Buchanan, McClelland, Günther and Day, Chaudhuri, Annandale and Hora contributed much to our knowledge of noemacheiline fishes of India. During 1910 and 1913, Chaudhuri added to the fauna of India four species of noemacheiline fishes, by describing *N. macmahoni* from the Helmand River, Seistan, *N mackenziei* from Northern India, *N. manipurensis* from Manipur Valley and a new genus and species, *Aborichthys kempi*, from Abor Hills. Annandale described *N. anguilla* from Western Ghats (1919) and *N brunneanus* 1918 from Inle Lake, S. Shan State, Burma.

The most important studies on *Noemacheilus* during this century are those of Hora. Several new species, *monilis*, *sikmaiensis*, *kangjupkhulensis*, *prashadi*, *devdevi*, *inglisi*, *punjabensis*, *acuticephalus*, *raoe*, *shanensis*, *paucifasciatus*, *rivulicola*, *vinciguerrae*, *peguensis*, *choprai*, and *kashmirensis* were described and much information on the noemacheiline fishes of the Himalayan region of India and Central Asia were given.

In his paper on Central Asian Cobitidae (Hora, 1922) and in his Report on Cobitidae collected during the Yale North India Expedition Hora (1936) dealt in detail with the diverse structural and adaptive modifications of the noemacheiline fishes of the high altitude lakes and streams of Central Asia. Regarding the swim-bladder of Central Asian *Noemacheilus* Hora (1937: 300) observed.

"In 1930, I referred to the modifications of air bladder in species of *Noemacheilus* from several localities and indicated the close relation between its structure and the type of habitat in which the species lived. On account of the gradations between the *Noemacheilus* type of bladder and the *Diplophysa* type of bladder, it was indicated that the differences in the structure of the bladder could not be used for taxonomic purposes. Rendahl has, however, used this character in proposing several subgenera for the species of *Noemacheilus* obtained by Dr. Sven Hedin in Central Asia and has given detailed morphological account of the modificationo observed by him."

Besides the work of men already mentioned above, two Rumanian workers, P. M. Banarescu and T Nalbant, and M. R. Mirza from Pakistan contributed to our knowledge of the Inds-

Pakistan noemacheiline ichthyofauna (Banarescu and Nalbant, 1968; Mirza, Nalbant and Banarescu, 1981) and many other small papers by Mirza.

For our knowledge of the fishes of the Homalopterinae we owe a great deal to Hora. In 1932, Hora gave an account of the "classification, bionomics and evolution of the Homalopterid fishes"

In 1941, Hora described a new genus *Travancoria* from the hill ranges of northern Travancore. The genus *Bhavania* was merged by Hora with *Homaloptera* in 1932 but he later (1941) revived it.

In 1944 Hora and Law gave an account of the respiratory adaptations of South Indian homalopterine fishes. Law (1950) studied the scale structure in a number of homalopterine genera and discussed their phylogeny.

The recent work of Ramaswamy (1948, 1953) on the chondocranium of the homalopterine fishes has helped in confirming previous taxonomic findings as well as certain phylogenetic considerations.

Methods

Measurements

Since the fish grows throughout life, the absolute size of any structure, for example the head, will mean nothing unless compared with that of the head of another specimen of the same size. However, the various parts of fish grow at approximately the same rate, so that if the head is said to go 3 times into standard length, this statement, will hold well for the individuals in a moderately broad size range after the earliest stages. Therefore this method is used in the measurement of characters. The most important use of the relative lengths is that if the depth of the body is contained 3 times in the length for one species and 5 times in the length for another, one is justified in concluding that the first fish has a deeper body than the second.

The *total length* of a fish is the straight line distance from the tip of the snout to the tip of the tail. However, the basic length measurement used in descriptions and keys is the *standard length* (SL). The standard length is the straight line distance from the tip of the snout to the end of hypural plate.

The *depth of body* is the greatest depth (see figure 1) the body attains. The *head length* is the greatest straight line distance from the snout tip to the posteriormost point on the gill cover. *Snout length* is the straight line distance from the tip of the snout to the anteriormost point of the exposed part of the eyes. The *inter-orbital width* is the straight line distance between the orbits. The *eye diameter* is the horizontal distance across the exposed portion of the eyeball. *The length of the* fin base is measured from the front of the base of the first ray to the rear of the base of the last. The *depth of the caudal peduncle* is its least depth and *the length of the caudal peduncle* is the distance from the rear base of the last anal ray to the base of the middle caudal ray. *The height of head* is a straight line distance between a point on the occiput and the isthmus at right angles to the longitudinal axis of the head. The *width of head* is the distance through the head taken at the extreme posterior limit of head between the opercula on either side.

The distance between snout and dorsal fin is measured in a straight line and is the distance between the tip of snout and origin of dorsal fin. The distance between *pelvic and anal fin* is a straight line measurement between the insertion of the last ray of the pelvic and base of origin of anal fin. Similarly, the *pectoral to pelvic* is the distance between the posterior base of the pectoral to the origin of the pelvic fin. The distance from *vent to anal* fin is a straight line between posterior end of anal opening and the insertion of the first ray of anal fin. The *length of pectoral fin* is taken as the length of the longest ray. Similarly the *length of anal*, the *length of pelvic*, *height of dorsal* are the measurements of the longest ray.

Values are expressed in percentage of standard length or of other values (head length, etc.).

Counts

Differences in counts are extremely useful in distinguishing related species. Unlike measurements, the countable characters do not change with age. As the scales are very small and usually embedded in the skin in the Noemacheilinae the scale count is not taken. A more important character studied is the fin count especially the branched dorsal fin rays. The fin ray count has been taken by holding the fin against the light and dissection microscope with the light directed through the fin from below. The major difficulty in counting the branched dorsal fin rays occurs at the posterior end of dorsal fin. Here after the last branched ray, an unbranched ray is sometimes seen to arise as the last branched ray. For enumeration purpose this last ray is omitted.

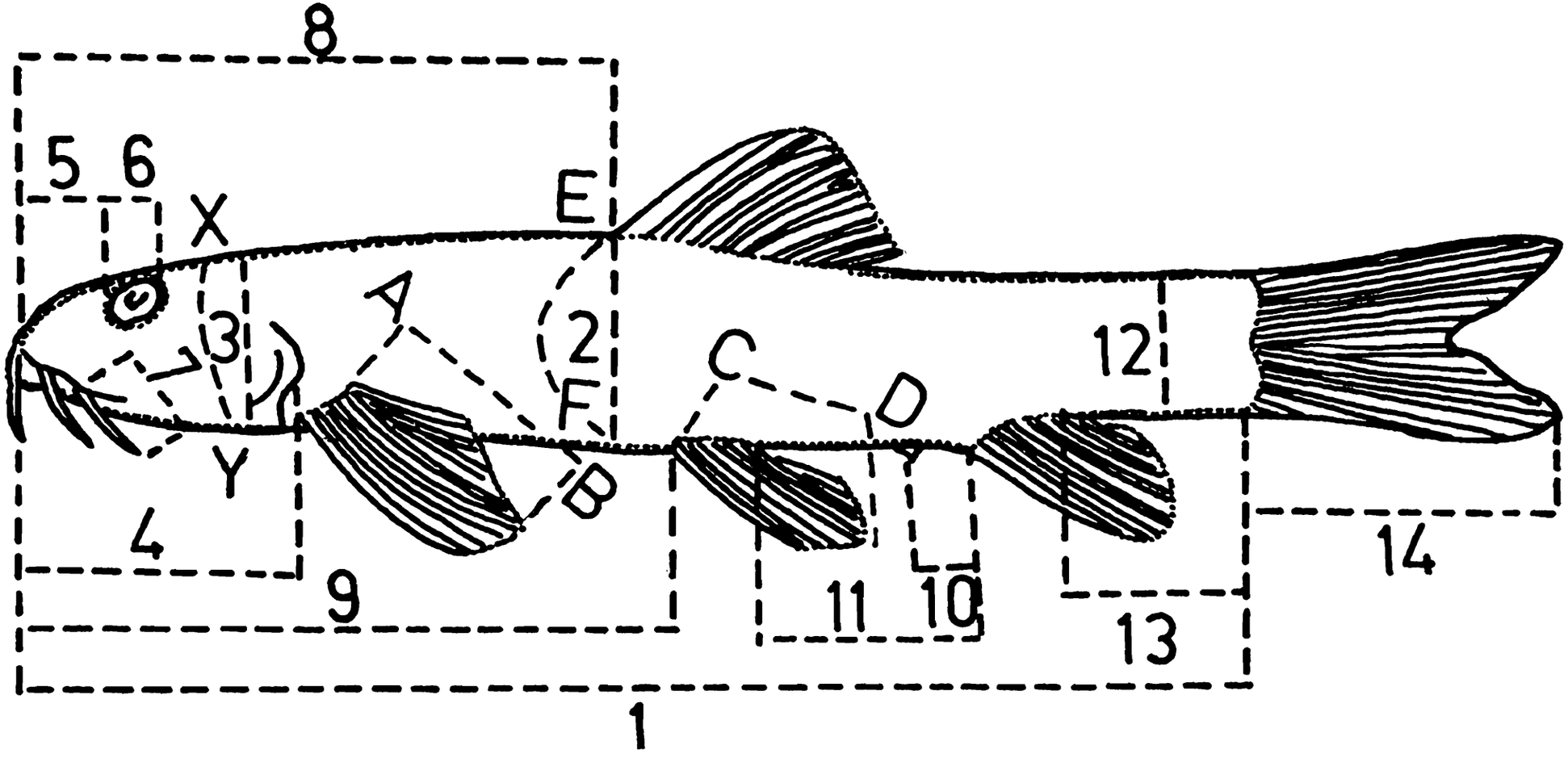


FIG. 1. A hypothetical *Noemacheilus*, showing important points of morphology. 1. Standard length; 2. Depth of body; 3. height of head; 4. length of head; 5. length of snout; 6. diameter of eye; 7. length of maxillary barbel; 8. Predorsal distance; 9. Pre-pelvic distance; 10. distance from vent to anal fin; 11. distance between pelvic and anal fin; 12. least height of caudal peduncle; 13. length of caudal peduncle. 14. length of caudal fin; A-B, length of pectoral fin; C-D, length of pelvic fin; E-F. width of body; X-Y, width of head.

Diagnosis of Subspecies

Some 300 specimens of different populations of *N. denisoni*, *N. triangularis* and *N. evezardi* were studied biometrically. Taxonomic characters are found to intergrade between closely related populations when a sufficiently large number of individuals are studied in detail. The degree of intergradation varies considerably and the determination whether two populations constitute two distinct species or only geographical populations or sub species has been based on the degree of intergradation or in other words the degree of divergence (Ginsburg, 1938, Simpson and Roe, 1942; Hubbs and Perlmutter, 1942; Hubbs, 1952; Mayr, Linsley and Usinger, 1953; Hubbs and Hubbs, 1953). To test the significance accurately Hubbs and Perlmutter (1942) used the graphical method. In this method, for each variable character the range, mean, one standard deviation on each side of the mean and two standard errors on each side of the mean are delineated on a graph. This method of plotting the biometrical parameters has been followed in this work. However, I have refrained from giving latinised names to geographical populations connected by intergradations (see graphs). The status of populations has been decided on the basis of their morphological differences plus the nature of the geographical barrier separating them.

For want of sufficient material the statistical analysis of most of the forms recognised here as full species has not been carried out. I have, however, grouped some of the closely related forms into complexes and an assemblage of related complexes into groups. Some of the complexes within the genus may be shown in the future to include superspecies ("a monophyletic group of geographically representative (allopatric) species which are morphologically too distinct to be included in one species" Mayr, 1942: 169).

The subgenus category is used as an expedient to denote a division within the genus marking a considerable systematic cleavage, above the species group level.

Evaluation of Systematic Characters

Noemacheilinae

The genus *Noemacheilus* consists of a group of species which are remarkably similar in general morphology. Because they lack the usual spines, scutes and various other processes and peculiari-

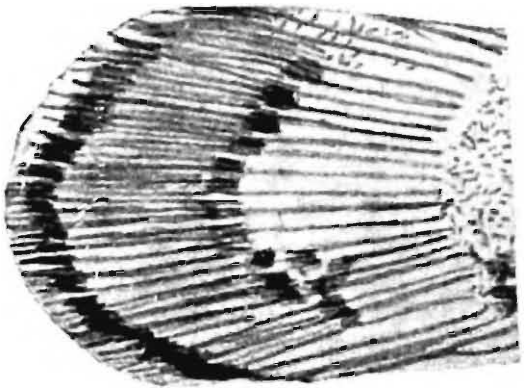
ties of structures, the species of *Noemacheilus* are often the most difficult to distinguish.

Environmental conditions tend to produce similar characters and it is probable that the great resemblance between the various species of *Noemacheilus* is due to a similarity in their environment. The usual environment of rapid running water of these loaches is full of stress and the animals that inhabit such habitat have to adjust themselves constantly to any fluctuation in the microclimate or ecological niche. In these circumstances the organisms are modelled and remodelled till ultimately the elucidation of their true systematic position become a matter of great difficulty. This is what has happened in *Noemacheilus*. Their body has become more and more cylindrical with the fins becoming smaller and compact to facilitate their living amongst pebbles and shingles in swift running waters. Detailed morphometric study of some of the species of which large series of specimens are available have enabled the taxonomic assessment of all characters used in segregating species by earlier workers. Caution should be taken in using the coloration, especially the number and nature of bars. This is a highly variable character. Likewise, caution should be exercised in using characters like the position of anal opening with regard to the ventrals, the position of the commencement of dorsal with regard to its distance from the tip of snout and the base of the caudal, as these characters are found to vary with growth. The nasal barbel is also very variable and no specific value can be attached to it except in such species as *N. evezardi* where it is unusually well developed. Differences in the structure of the swim-bladder are not of value for species differentiation as it depends upon the type of habitat in which the species lives (Hora, 1936). The nature of scales, *i.e.* the size and extent of scale cover over the body is also found to be highly variable among species depending upon the physicochemical nature of the water in which the species is found. In distinguishing species I have relied mostly on the character of the lateral line, the number of branched rays in the dorsal fin, the nature of the caudal fin (see fig. 2) and body colouration.

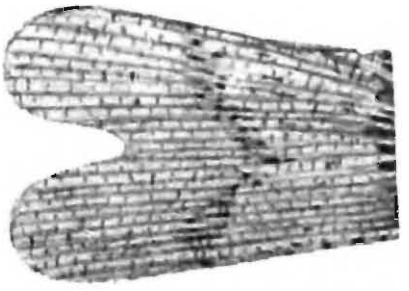
The position of the anal opening and the presence or absence of secondary sexual characters in the males are also found to be useful in the specific identification in the Noemacheilinae.

Homalopterinae

Hora (1930) has shown that the sucker is not an effective organ in fish of torrential waters. Kyle (1926) assumed that in



A



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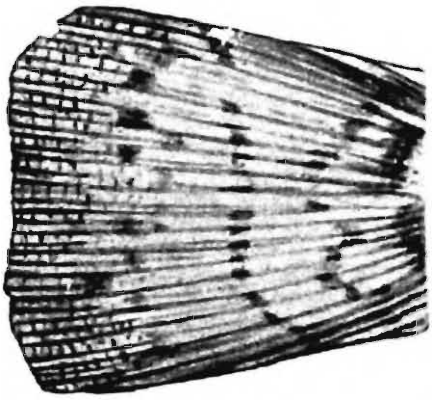

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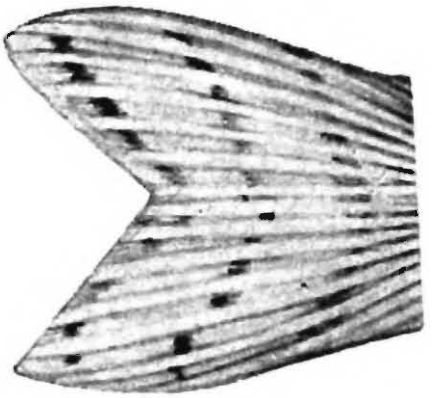

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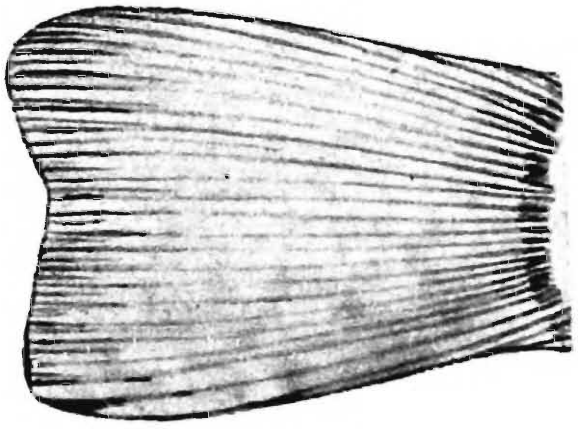

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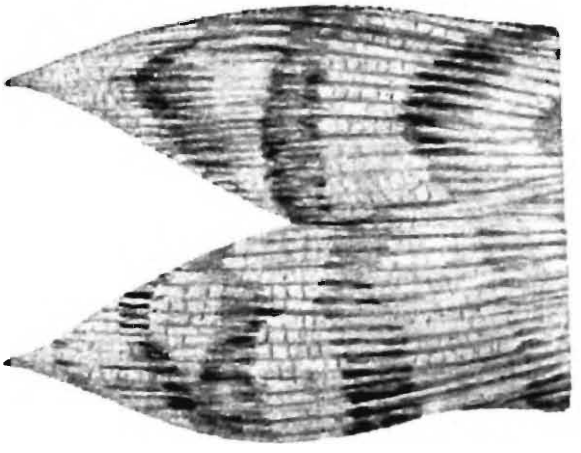


F

the highly specialised hill stream fishes the lips are laid flat on the substratum and served as the border of a sucker formation by a vacuum created by the mouth. Hora (1923) has shown that in the highly specialised torrential fishes the process of respiration continues even when the fishes are closely applied to the substratum and that it is impossible to conceive that a sucker can be created by the lips. Moreover, most of these fishes feed on algae which they scrape off the rocks by their specially modified jaws and in ingesting this matter advantage is taken of the current entering through the mouth. It has been noticed that some noemacheilines living in fast currents are flattened and the paired fins in them are more or less horizontally placed. The increase of the adhesive surface by a close application of the outer parts of the paired fins to the substratum is well marked in the Homalopterinae, some of the primitive members of which are similar in form and behaviour to the flattened species of *Noemacheilus*. Superficially the line of demarcation between noemacheilinae and Homalopteridae is very faint. They have been separated from each other on the character of the paired fins which are more horizontally placed in the Homalopterinae and in which some of the outer rays of the pectoral fins are simple. A gradual broadening of the fins and an increase in the number of rays have been induced by life in stronger and stronger currents. In these fishes, the outer rays of the paired fins become more and more specialised and in some forms the fins form a complete disc on the ventral surafce. In Homalopterinae at least 2, in some genera 3, 4 or 5 of the anterior ventral rays are simple and in the various highly specialised genera 4 to 13 of the anterior pectoral rays, are simple. Thus the number of simple rays in the paired fins in the Homalopterinae has been found to be a very dependable character in the separation of taxonomic categories.

The extent of the gill-opening and characters associated with the mouth, such as the nature and degree of development of rostral groove are some of the adaptive characters of the members of the Homalopterinae and these have also been found to be dependable taxonomic characters. There is little food except algal slime and encrusting organisms in the bare hill streams and it becomes essential for fishes living there to modify their jaws and the associated parts of mouth to scrape off and ingest the food most efficiently and economically. For this purpose the characters associated with the mouth such as the rostral groove and rostral folds are modi-

FIG. 2. Structure of caudal fin of the Noemacheilinae A. Caudal rounded (*N. kempi*); B. truncate (*N. manipurensis*); C. slightly emarginate (*N. carletoni*); D. deeply emarginate (*N. savona*); E. slightly forked (*N. semiarmatus*); F. deeply forked (*N. pulchellus*).

fied in the Homalopterinae (Hora, 1932). These characters have proved valuable taxonomic characters for the separation of the various genera of Homalopterinae (Hora, 1941). The highly oxygenated nature of the torrential streams has further induced in these fishes certain specialisation in their respiratory organs. The gill openings became restricted and the gills themselves are reduced in some forms (Hora, 1932: 325). The gill openings are restricted to above the base of the pectoral fins in *Bhavania* whereas in *Travancoria* they extend in front of the pectoral fins in the ventral surface for a short distance. In less specialised species of *Homaloptera* the gill openings have a greater extent on the ventral surface. Thus the extent of the gill openings has proved to be an important taxonomic character.

The lepidosis and the position of the dorsal fin *vis-a-vis* the pelvic have been found to be useful too.

Arrangement of Descriptions

The description of each species is arranged according to a uniform plan so that comparisons may be made easily. As far as possible, the paragraphs are arranged in uniform order in all descriptions. Wherever the description is based upon the examination of more than one specimen, the initial values are the ranges in percentage, the percentage mean of all specimens measured being given in parentheses.

The diagnosis includes the branched dorsal fin rays, the extent of the lateral line, the nature of the caudal fin (forked, truncate, emarginate etc.), the colour, and those characters which seem to be of great value in distinguishing the species from its nearest relatives. For rapid specimen identification, it is enough if one consults the keys and the diagnostic characters.

The synonymy under each species is not intended to provide a complete catalogue of all published references to that species. All those papers which give changes in name are included.

Zoogeography and Evolution

Distribution in time

Laube (1901) described a fossil cobitoid, *Noemacheilus tener* from the Bohemian Oligocene. However, it has not been established

with certainty that the species belongs to *Noemacheilus* (Nalbant, 1968). Laube recorded four other cobitid species from the upper Miocene of Ohningen, near Lake Konstans, West Germany. However it is hard to decide whether they belong to *Noemacheilus* or *Cobitis* (Nalbant, 1968). The next record of a *Cobitis*, *C. senogalliensis* Erasmo is from the Neogene of Senogallia, Italy (Nalbant, 1968). Next is that of Lebedev (1959) who described numerous specimens of a *Cobitis*, closely related to *C. taenia* from middle Miocene beds of Saison Nor Lake, near the source of the Irtysh River, W. Siberia. Gaudant (1976) reported a single incomplete fossil *Cobitis* related to the recent *Cobitis taenia* fom lignitic shales of the Pliocene of Puy-de-Dôme, France.

These fossil records lead one to the following conclusions:

1. The Cobitidae (*Cobitis*) and the Homalopteridae (*Noemacheilus*) have differentiated from their cyprinoid ancestors at almost the same time, probably by the end of Eocene or early Oligocene.

2. Their dispersal to Europe took place through Siberia during the Mid-Miocene-Pliocene period when favourable climatological conditions prevailed in Northern Europe and Siberia.

The above conclusions can, however, be assessed only after a careful consideration of the present day distribution of the superfamily.

Present day Distribution

Distribution of the Cobitidae: The family Cobitidae, comprising two subfamilies Botiinae and Cobitinae, is found today in Eurasia and the adjacent islands and in northern Morocco.

Distribution of the Botiinae: The subfamily comprises two genera, *Leptobotia* Bleeker and *Botia* Gray (Sawada, 1982: 184). *Leptobotia* is confined to the Amur drainage from Blagoveschensk to Liman, Ussuri, Sungari and Liao drainages in North-East Asia, Central Japan and Fukien in S.E. China. The genus *Botia* is found from South China to Sumatra and Borneo to the Indus drainage.

Distribution of the Cobitinae: The Cobitinae has the greatest number of genera and species of all the subfamilies of the superfamily and comprises of the 13 genera: (1) *Misgurnus* Lacépède, (2) *Cobitis* Linnaeus, (3) *Sabanejewia* Vladykov, (4) *Niwaella* Nalbant,

(5) *Somileptes* Swainson (6) *Enobarbichthys* Whitley, (7) *Acanthopsis* van Hasselt, (8) *Acanthopsoides* Fowler, (9) *Lepidocephalus* Bleeker (*Lepidocephalichthys* Bleeker) (10) *Paralepidocephalus* Tchang, (11) *Acanthophthalmus* van Hasselt (=*Cobitopsis* Myers), (12) *Neoeucirrhichthys* Banarescu, & Nalbant and (13) *Eucirrhichthys* Perugia. The distribution of the subfamily covers more or less the same area as that of the family Cobitidae.

Distribution of the Homalopteridae: The family, consisting of two subfamilies, is distributed in Eurasia and its adjacent islands and Lake Tuna, Ethiopia.

Distribution of Noemacheilinae: The subfamily is composed of 9 genera:(1) *Noemacheilus* van Hasselt, (2) *Turcinoemacheilus* Banarescu & Nalbant, (3) *Paracobitis* Bleeker, (4) *Oreias* Sauvage, (5) *Orthrias* Jordan & Fowler, (6) *Triplophysa* Rendahl, (7) *Hedinichthys* Rendahl, (8) *Oreonectes* (= *Lefua*) Günther and (9) *Vaillantella* Fowler.

Noemacheilus van Hasselt is restricted to South China, S.E. Asia, South Asia, Baluchistan (*N. lindbergi*, *N. kessleri*), Western Iran (*N. bampurensis*), South Anatolia (*N. argyrogramma*) and Lake Tsana (*N. abyssinicus*) in N. E. Africa.

Turcinoemacheilus is restricted to Turkey; *Paracobitis* to West Asia; *Vaillantella* to Malay Peninsula, Sumatra and Borneo; *Oreonectes* to the Amur drainage in USSR., Japan, Korea, and Shanghai in China, while *Orthrias* is widely distributed in the Palaeartic and also West Asia. *Triplophysa*, *Hedinichthys* and *Oreias* are distributed on the Qinghai-Xizang (Tibetan) Plateau and the adjacent territories (Zhu, 1981); *Oreias* in the eastern and western parts of the Plateau and Amu-Darya system in the U.S.S.R. and the Jinsha system of Sichuan Province of China; *Triplophysa* in Northern China, Tibetan Plateau, North Kashmir, Pakistan (Baluchistan), Afghanistan (Helmand System) and the U.S.S.R. (Syr- and Amu Darya), and *Hedinichthys* in Xinjiang and Gansu, China.

Distribution of Homalopterinae: The subfamily is restricted to South and South-East Asia.

Centre of origin and Dispersal

It is a well-known fact that the centre of origin and dispersal of the cyprinoid fishes is in South-East Asia, most probably in South China (Hora, 1949). The cobitoid fishes were most probably differentiated from cyprinid ancestor (Greenwood *et al.* 1966) in

the South-West Chinese region during the early Miocene period and had spread to Europe and thence to Northern Africa during the Oligocene-Miocene through a Siberian route when the climatological conditions there were favourable (Banarescu, 1973). Their dispersal westwards to Central Asiatic Highlands seems to have been along an eastern Tibtan route during the late Miocene or early Pliocene period (*vide*, Hora, 1937) and to India and thence to West Asia along the southern face of the Himalayas during the late Pliocene or early Pleistocene. The migration southwestwards to the Indian Peninsula and southwards to the Malay Archipelago had most probably taken place only during the Pluvial periods of the Pleistocene.

Geological history of the Himalayan and the South-West Chinese Mountain systems.

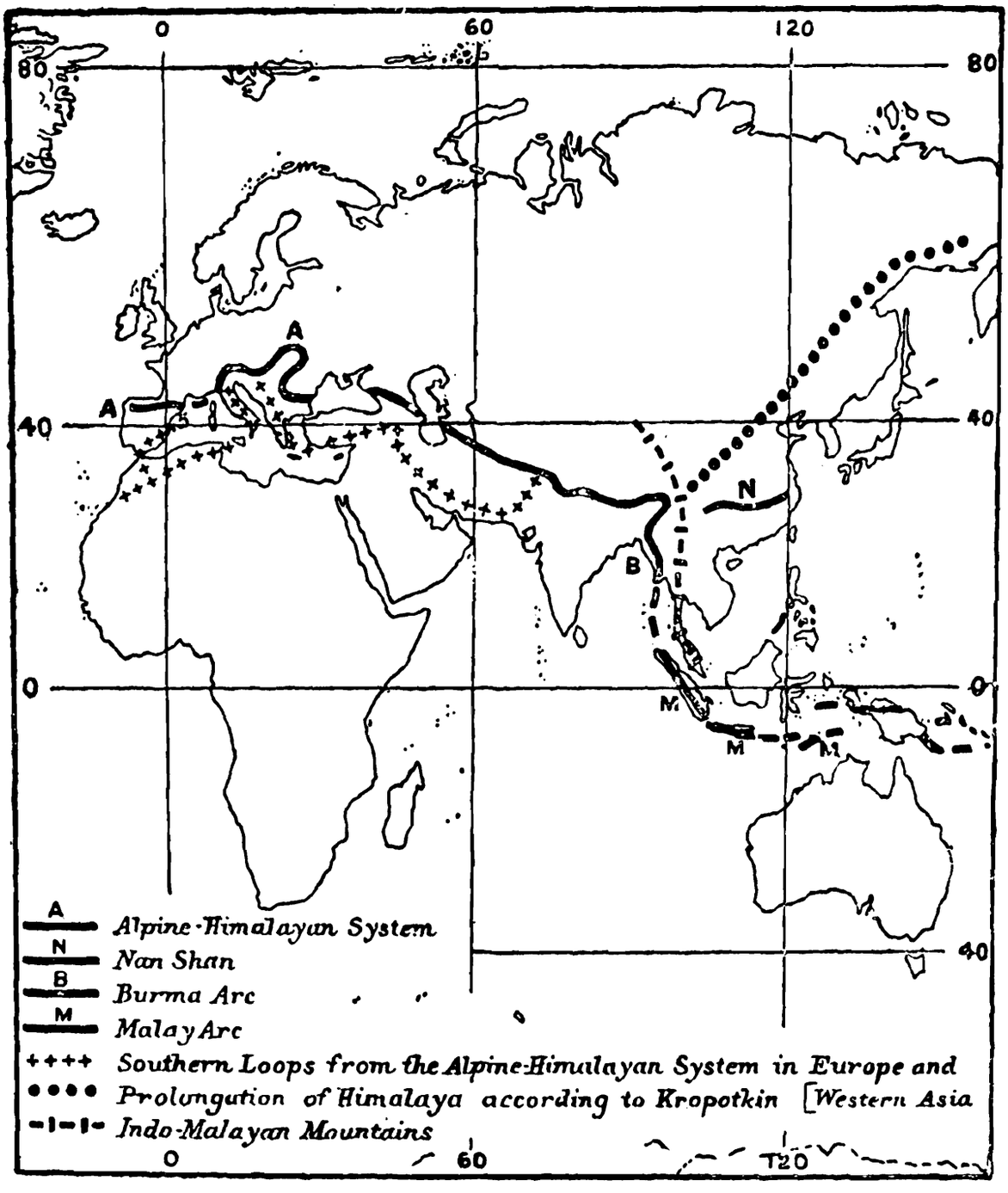
In considering the time of origin and evolution of any group of animals of which the fossil evidences are meagre, two main facts are taken into consideration—firstly, the present-day ecological requirements of the animal and secondly, the geological history of the countries it inhabits. In the case of cobitoid fishes the evolution of adaptive characters for torrential life seems to be closely related to the evolution of mountain systems in South-East Asia. In order to understand therefore the causes of evolution and dispersal, it is necessary to consider the geological facts regarding the evolutionary history of the mountain systems of South-East Asia.

The Himalayas

There is no evidence to show that the Himalayas as a great mountain range are older than the latter part of the Eocene period (Burrad and Hayden, 1933). Before that the Himalayan area formed the northern coast of Gondwana land and a number of rivers drained northward into the Tethys Sea of that time. The orogenic movement which was strongly pronounced during the Oligocene, probably began in late Cretaceous times and continued throughout the Eocene and Middle Tertiary periods. There is considerable evidence to show that it was still active during the Pliocene and later periods. The ossiferous beds of Ngari Khorsum and of the Karewas of Kashmir, however, indicate that during the Pleistocene period the Himalayas had already acquired the general features of their present day form. The nature of the Siwalik deposits shows that the main drainage lines of the south face of the Himalayas date as far back as the Pliocene epoch and that the rivers which brought down sands and boulders from the mountains to build up the Siwaliks of the Duns and Hundes were the direct ancestors of the modern Sutlej and Ganges.

The mountain systems of China and the Malay Archipelago.

The eastward extension of the Alpine-Himalayan systems has long been a subject of great controversy. According to one view it passed north-eastward across China to Bering Straits, according to another it was bent round against the mass of Chinese Tibet and passed through western Burma to Sumatra and thence along the southern islands to the eastern Archipelago. The interpretation of the mountain structure of Chinese Tibet is however, complicated by being due to movements at two different periods.



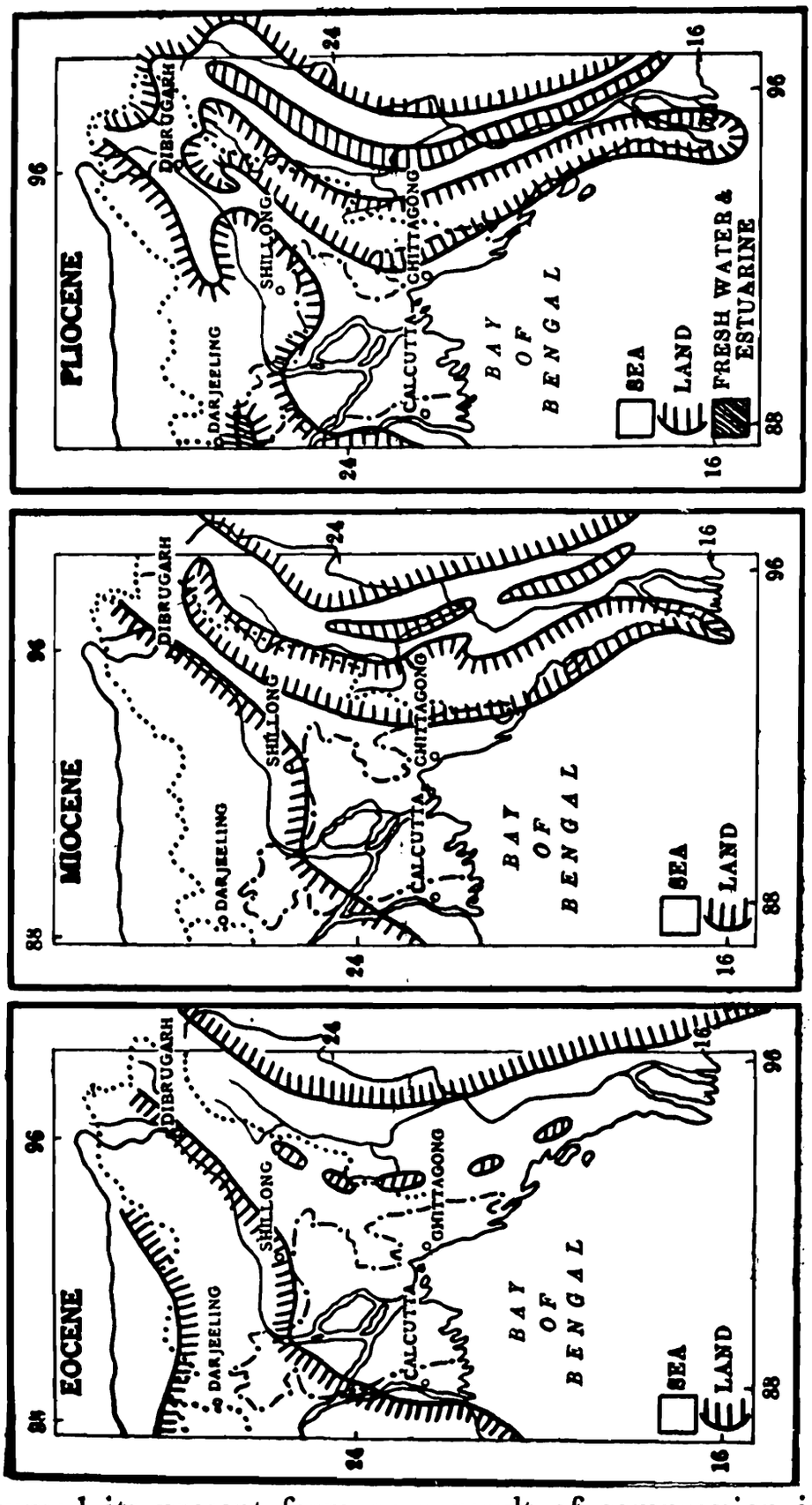
MAP 1. Alpine-Himalayan and associated mountain Systems of Asia and Europe.

The Himalayan movements as has been pointed out are not older than the latter part of the Eocene period while the other group is much older, this movement being culminated in South-East Asia in the middle Permian. The older system is represented in Europe by the Hercyian mountains, and in Asia by the Altaids, the members of which cross Chinese Tibet on lines approximately north and south, and continue southwards as the Indo-Malayan mountains. This older system is supposed to have stemmed the eastward extension of the direct Himalayan uplift. In this region of the Chinese Tibet where the Himalayan and the Altaid mountains meet, crustal movements have produced complex topographical features. As a result of the resistance offered by the Altaid mountains, the Himalayan movements became resolved into two factors one resulting in a chain of intense folding across Southern China known as Nan Shan and the other in the uplift of the Burmese-Malayan arc.

Miocene-Pliocene geology and distribution of Cobitoid fishes

The spread of cobitoid fishes westwards to Central Asiatic Highlands was facilitated along Chinese Tibet during the late Miocene or early Pliocene period. The drainage of Central and south-eastern Asia before the major Pliocene upheaval of the Himalayas was probably mainly through broad east to west trending valleys due to the gentle buckling of the earth's crust. The Himalayan movements confirmed this system, but during the subsequent settling down of the country the eastward outlet of the Tibetan rivers was reduced and Tibet became a land of lakes (Gregory, 1925).

Geologists have shown that a transgression of the Bay of Bengal during the Mid-Eocene cut off the land route between India and Burma and it lasted the whole of the Miocene. During this period no fresh-water fish seems to have migrated into India from South China (Hora and Menon, 1953). It is known (Menon, 1951) that during the Pliocene wet tropical conditions prevailed along the southern face of the Himalayas extending to China in the east and beyond Baluchistan towards the west facilitating the spread of marsh-loving fishes from south-west China to as far as Africa. The clear water hill-stream fishes like *Noemacheilus* had most probably dispersed along the southern face of Himalayas during the early Pleistocene period. During the end of Pliocene or early Pleistocene, the major final upheaval of the Himalayas had occurred which raised the Siwalik sediments into dry land and the Siwalik fore-deep (Krishnan, 1953) gradually disappeared leaving a shallowed depression, the Pleistocene fore-deep which, with the formation of the Assam Plateau by then began draining northern India from Assam to the Arabian Sea (Hora, 1953). The Pleistocene river was probably not pouring into the sea exactly at the place where the Indus today joins the Arabian Sea, for the floor of the north western part of the Indian Ocean as we know it today

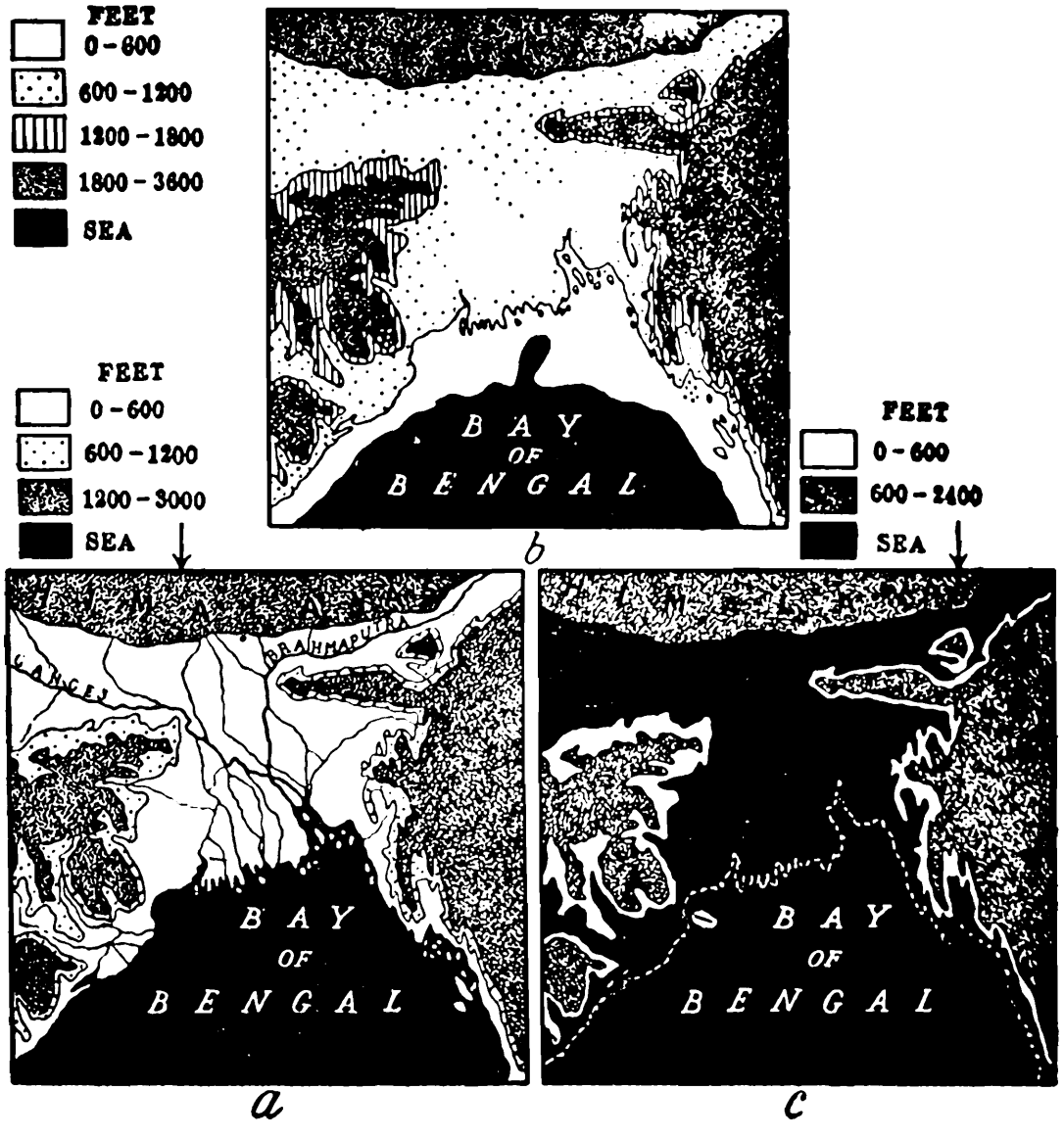


MAP 2. Northward transgression of the Bay of Bengal during the Eocene, Miocene, and Pliocene periods which cut off land connections between India and the Far East. After Krishnan, (*Bull. Nat. Inst. Sci. India*, **1**, pp. 26–28, 1952).

assumed its present form as a result of compression in Tertiary times, probably contemporaneously with upheaval of the Alpine Himalayan Mountain system and the Arcs of the Malay Archipelago and the formations of the rift valley. Consequently, in Pliocene or Post-Pliocene times the area of land that once filled the triangle now bounded by the northern part of the East African coast and its continuation, the south-east coast of Arabia, the

Baluchistan coast and the west-coast of India, became separated off by a series of faults and was submerged to its present depth (Wiseman and Sewell, 1937).

From the present-day distribution of *Noemacheilus* (*N. abyssinicus*) it would appear that the land mass between East African coast and the west-coast of India had submerged only quite recently, probably simultaneously with the birth of the Ganges and the Indus. Till then the present-day Persian Gulf must have probably been a river valley in cotinuation with Euphrates-Tigris basin and the Pleistocene fore-deep of the Himalayas may have had connections with it during the Pluvial periods of the Glacial epochs. Thus from the Yunnan Plateau in the east up to the headwaters of Euphrates-Tigris rivers there must have been a continuous route along which the *Noemacheilus* s.str. seems to have been distributed as far as South Anatolia (Kosswig, 1955).



MAP 3. Physiography of the Garo — Rajmahal Gap (After Hora, 1951).
a. Present-day conditions, b. During height of a Glacial period, c. Condition during an inter-glacial period.

The Garo Rajmahal Gap was under the sea during the whole of the Pliocene period and therefore practically no migration of cobitoid fishes from the north to the Indian Peninsula was possible. During the Pleistocene, however, the Garo-Rajmahal Gap became a dry land facilitating the migration of hill stream fishes. During the Glacial periods of this epoch, a eustatic drop in the sea level of 600 feet had actually bridged the Garo-Rajmahal Gap topographically and climatically enabling the cobitid fishes like *Lepidocephalus* and homalopterids like *Noemacheilus*, *Balitora* and *Homaloptera* to cross over from the north to the Peninsula. There was also greater run-off water in the streams and rivers especially in the big rivers like the Narbada—Tapti along the Satpur—Vindhyas during the Ice-ages of the Pleistocene enabling the quick spread of these fishes to the Peninsula and *Noemacheilus* and *Lepidocephalus* even to Sri Lanka, the final separation of Sri Lanka from the Peninsula being about 10,000 years ago (Jacob, 1949).

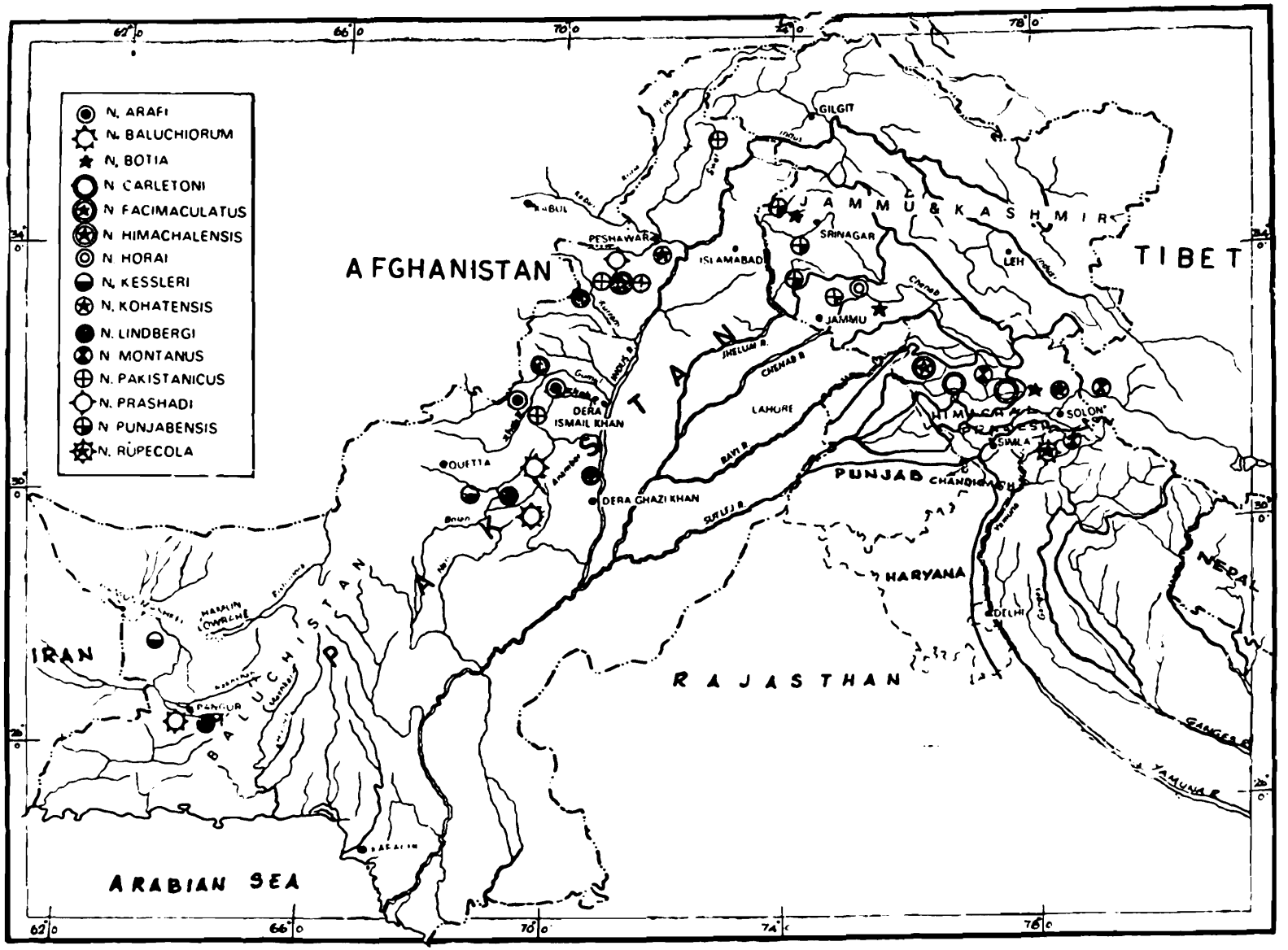
The spread of the Homalopterinae and the Noemacheilinae from South-China to the Malay Archipelago occurred during the Pluvial periods of the Pleistocene (Silas, 1952).

Possible sequence of evolution and spread of the Homalopteridae

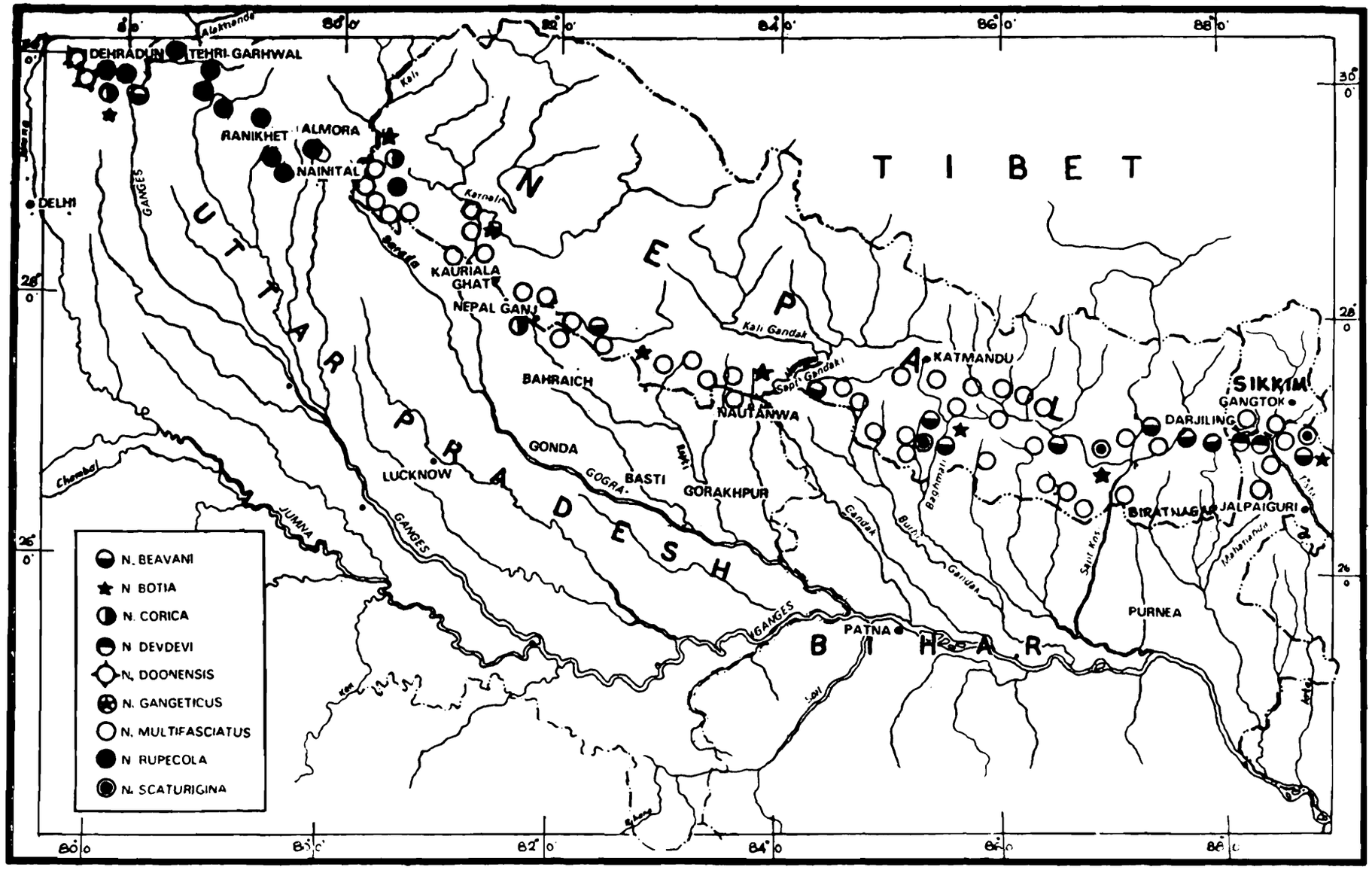
The Noemacheilinae

The Triplophysa—Wave: The first wave of evolution of the Noemacheilinae is the trans-Himalayan spreading of the earliest stock from Yunnan which probably had occurred during the late Miocene or early Pliocene period. The drainage before the major upheaval of the Himalayas was mainly through broad east-west trending valleys which had facilitated the spread of the earliest stock of the Noemacheilinae to Tibet. At the end of the Tertiary period, especially in the Pleistocene, the Tibetan Plateau had risen greatly bringing about vast changes in the environmental conditions there. The climate of the Plateau became dry and cold, the solar radiation rapidly increased and the rivers became torrential. This change in the environmental conditions had undoubtedly induced rapid evolution in the High Asian scaled loaches. The scaleless fishes of the genus *Oreias*, distributed today in the eastern and western parts of the Plateau, seem to have evolved first on the Plateau. *Triplophysa* and *Hedinichthys* are the results of further differentiation from *Oreias* (Zhu, 1981).

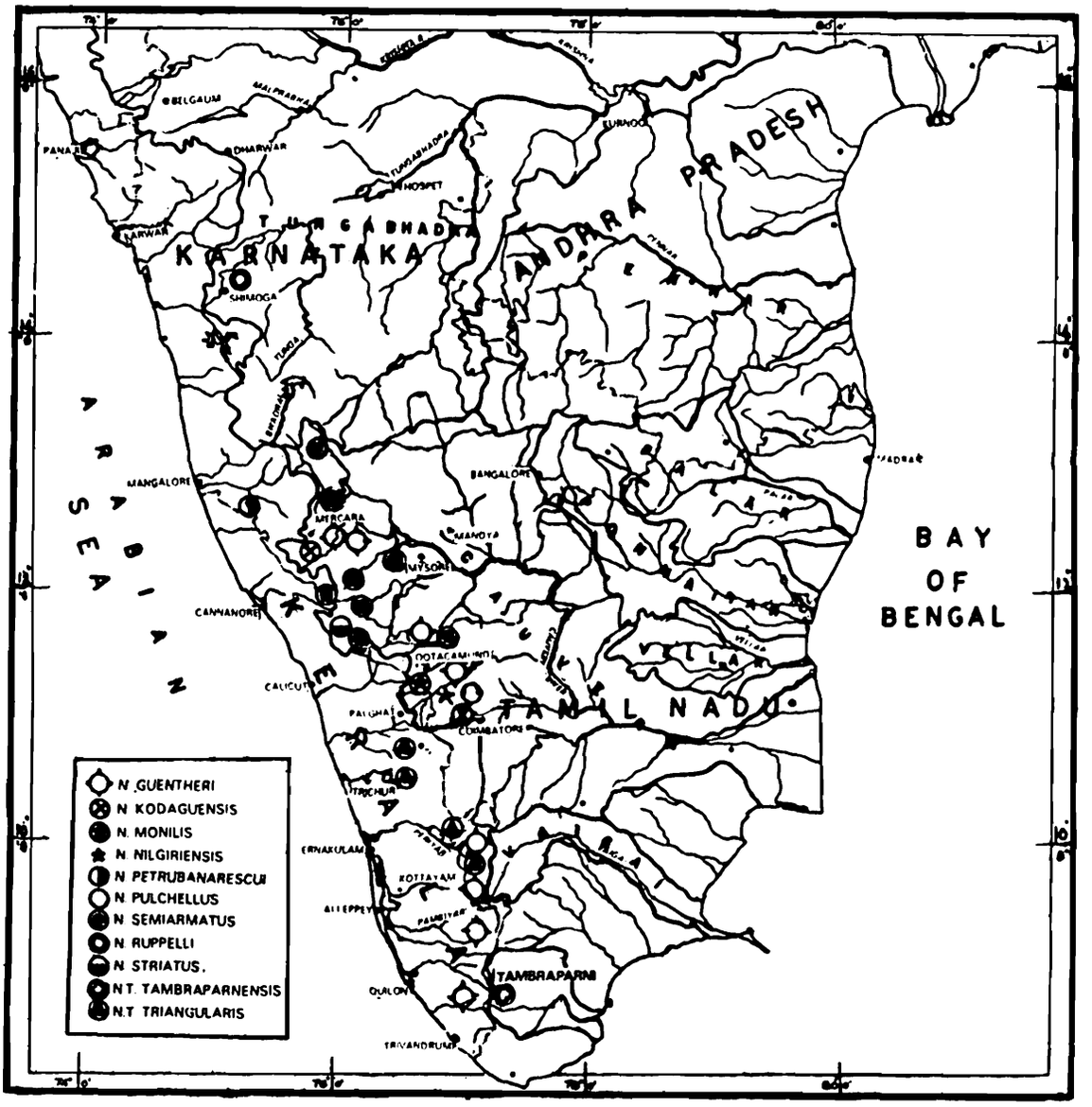
The Rupecola—Wave: The second wave of evolution of the Noemacheilinae from Yunnan seems to have taken place during the late Pliocene along the southern face of the Himalayas to as far west as Baluchistan, Western Iran, and through the Arabian Coast to South Anatolia and the Blue-Nile in Africa. The species of *Noemacheilus* found today in Africa, the *rupecola* and *beavani* groups of species found in Afghanistan, Pakistan and the Himalyas are the result of this wave.



MAP 4. Distribution of *arafi; baluchiorum; carletoni; fascimaculatus; himachalensis; horai; kessleri; kohatensis; lindbergi; montanus; pakistanicus; prashari; punjabensis; rupecola;* and *botia* (also found in the Ganges and the Brahmaputra systems).



MAP 5. Distribution of *beavani; corica; devdevi; doonensis; gangeticus; multifasciatus; rupecola;* (also found in Beas & Sutlej); *scaturigina* (also found in Brahmaputra system) and *botia* (also found in Brahmaputra and Indus systems).



MAP 6. Distribution of *guentheri; kodaguensis; monilis; nilgiriensis; petrubanarescui; pulchellus; semiarmatus; ruppelli; striatus; triangularis* and *tambraparniensis.*

The Denisoni—Wave: As a consequence of the *rupecola*—wave, but probably after some time lag we get the *denisoni* group of species in the Indian Peninsula and Sri Lanka. The Garo-Rajmahal Gap was under the sea during the Pliocene (Hora, 1951) and hence the *rupecola*-wave does not seem to have spread to the Peninsula till the end of that epoch. We have none of the primitive or less specialised species* of *Noemacheilus* in the Peninsula. On the other hand, a secondary burst of speciation seems to have

* Forms with a truncate or slightly emarginate caudal fin like *lindbergi* and *pakistanicus* are considered primitive and are distributed in the extreme farthest end of the range of distribution of the genus.

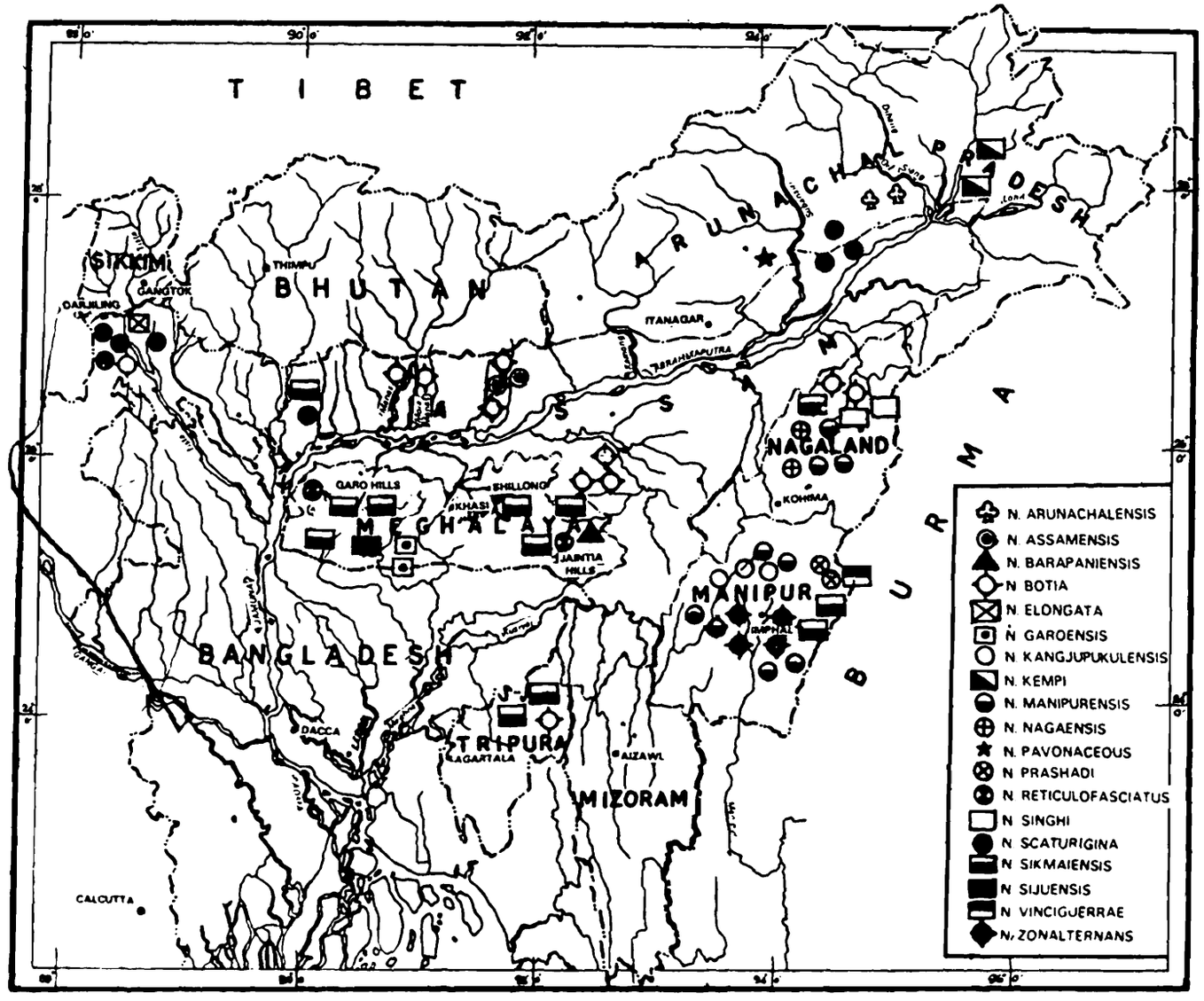
occurred in the Peninsula and a number of specialised species like *N. nilgiriensis*, *N. kodaguensis*, *N. semiarmatus* and *N. striatus* have evolved there from the early *denisoni* stock that spread there during the first pluvial period of the Pleistocene. Only during the pluvial period of the Pleistocene when the eustatic movements of the Bay of Bengal made the Garo-Rajmahal Gap a dry land did *Neomacheilus* migrate southwards to the Peninsula and thence to Sri Lanka (Hora, 1951: 438). Sri Lanka seems to have retained its connection with Peninsular India during the whole of the Pleistocene and the final isolation of the island as a separate geographical entity did not take place until after the Upper Pleistocene (Jacob, 1949).

Kangjupkhulensis — sikmaiensis — wave: The spread southwards to Burma and the Great Sunda Islands seems to have been accomplished only during the second or third pluvial period of the glacial epoch, probably after the uplift of the Yunnan Plateau (Hora, 1953). Recent investigations of the structural history of the East Indies have revealed that:

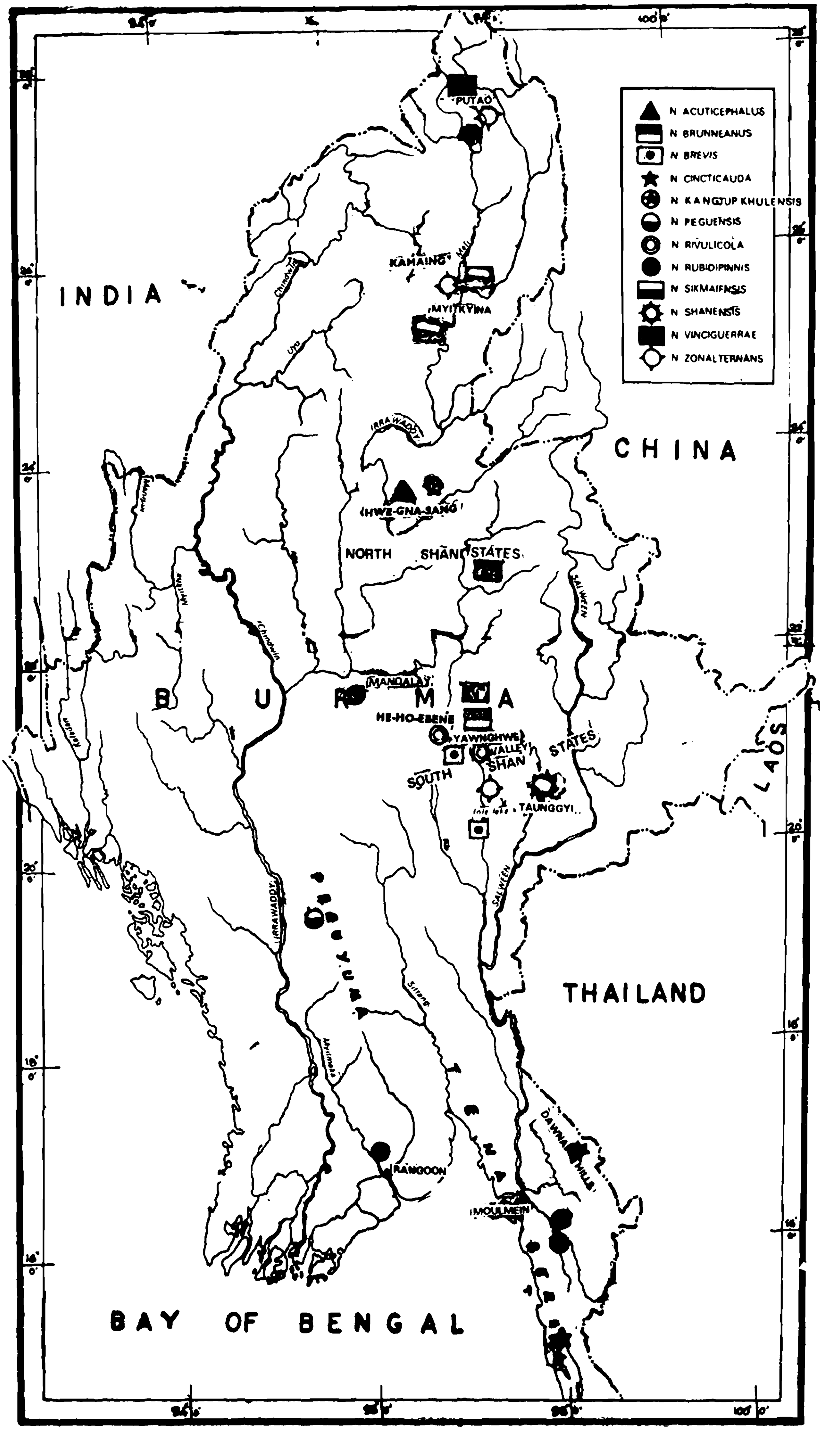
> "Between the basins of the north and east Sunda Rivers there existed a devide from Sumatra, across Banka, Baliton and the Karimata islands to Borneo. This devide must by its height, have offered great possibilities of migration to a number of animals and plants for which conditions of life were less favourable or insufficient in the extensive flat and low lying areas of north and east Sunda Rivers. Moreover, the land bridge between Sumatra and Borneo must have remained in existence to the very last during the rising of the sea level, whereas the lower areas must have submerged much sooner and the river systems dismembered" (Umgrove, 1949).

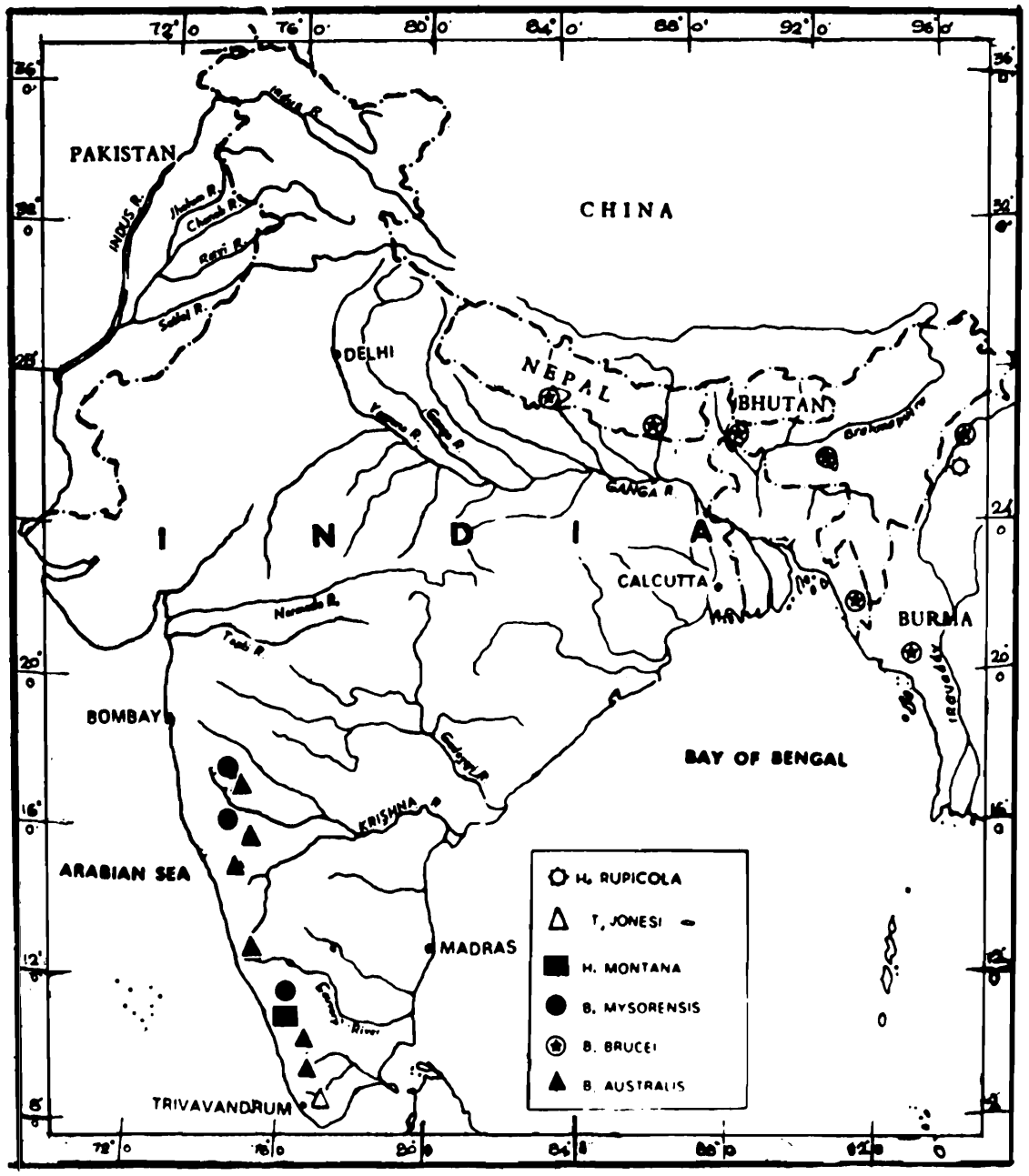
The Homalopteridae must have made use of the Sumatra land route for its spread to Borneo. The evolution of species of the *kangjupkhulensis–sikmaiensis* groups of species in Manipur—Burma area and the various species of *Noemacheilus* of the Malay Archipelago are the results of this wave.

Noemacheilus—Mesonoemacheilus—Wave: This wave seems to have followed immediately after the *kangjupkhulensis–sikmaiensis* wave. It had spread both southwards to Meghalaya and southwestwards to Peninsular India, probably during the last pluvial periods of the Pleistocene. This spread must have been earlier than 10,000 years ago for with the end of Holocene glaciation, i.e. about 10,000 years ago, the Garo-Rajmahal Gap must have become a barrier against their spread southwards (Menon, 1974). The rapid evolution of species like *N. ruppelli*, *N. monilis*, *N. anguilla*, *N. guentheri*, *N. petrubanarescui* and *N. triangularis* in the Western



MAP 7. Distribution of *arunachalensis; assamensis; barapaniensis; elongata; garoensis; kangjupkhulensis; kempi; manipurensis; nagaensis* (also found in Upper Burma); *pavonaceous; prashadi; reticulofasciatus; singhi; scatur, gina* (also found in Ganges systems) *sikmaiensis;* (also found in Upper Burma), *sijuensis; vinciguerrae* (also found in Upper Burma) *zonalternans* (also found in Irrawaddy and Salween systems of Burma) and *botia* (also found in the Ganges system).


N ACUTICEPHALUS
N BRUNNEANUS
N BREVIS
N CINCTICAUDA
N KANGJUP KHULENSIS
N PEGUENSIS
N RIVULICOLA
N RUBIDIPINNIS
N SIKMAIENSIS
N SHANENSIS
N VINCIGUERRAE
N ZONALTERNANS
INDIA
CHINA
BURMA
THAILAND
LAOS
BAY OF BENGAL
PUTAO
KAMAING
MYITKYINA
IRRAWADDY
HWE-GNA-SANG
NORTH SHAN STATES
MANDALAY
HE-HO-EBENE
YAWNGHWE VALLEY
SOUTH SHAN STATES
TAUNGGYI
Inle lake
SALWEEN
PEGU YOMA
RANGOON
MOULMEIN
DAWNA HILLS
TENASSERIM
Chindwin
Sittang



MAP 9. Distribution of *H. rupicola; Bhavania australis; Balitora brucei; B. mysorensis; H. montana* and *Travancoria jonesi.*

MAP 8. Distribution of *acuticephalus; brunneanus; brevis; cincticauda; naganensis;* (also found in Nagaland); *peguensis; rivulicola; rubidipinnis; sikmaiensis;* (also found in Brahmaputra system and Manipur); *shanensis; vinciguerrae* (also found in Manipur); and *zonalternans* (also found in Manipur).

Ghats can probably be attributed to the recent orogenic movements and the consequent rejuvenation of the base level streams of the Western Ghats (Silas, 1952: 441).

The Acanthocobitis—Wave: Acanthocobitis-wave seems to have

followed the *Kangjupkhulensis–Sikmaiensis* wave spreading southwards to Tenasserim on the one hand and westwards to the Himalayas and South-westwards along the Satpura — trend of mountains the Western Ghats of the Peninsular India. This wave south-westwards seems to have taken place during the Holocene Glacial epoch.

Aborichthys, *Petruichthys* and *Infundibulatus* are confined to north eastern India and Burma and have evolved there during recent times.

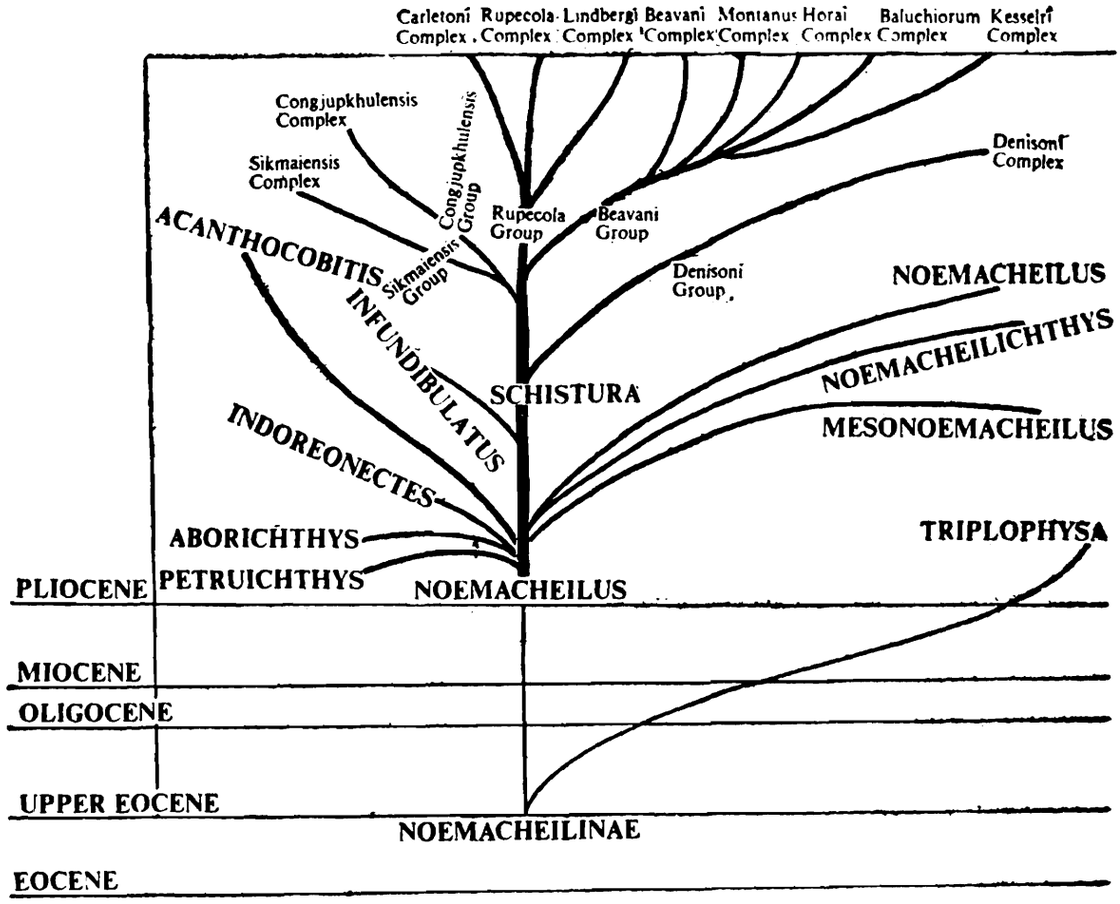


FIG. 3. Dendrogram showing the hypothetical evolutionary relationship of the species complexes of subgenera of the Noemacheilinae.

The Homalopterinae

As a group, Homalopterinae are extensively distributed in the hills of South-East Asia but in India proper they are found in the hills of Meghalaya, the Eastern Himalayas as far as the Kosi drainage in Nepal, and the hills of Peninsular India. Their spread from Meghalaya and the Eastern Himalayas had taken place during the pluvial periods of the Pleistocene along the Satpura trend of mountains (Menon, 1973). Both *Bhavania* and

Travancoria are *Balitora*-like in their general facies, nature of paired fins and the characters associated with the mouth, such as rostral groove, rostral fold, etc. There would thus appear to be a close association of the S. Indian forms and it is quite likely that these three genera evolved along independent lines from a common *Homaloptera*—like ancestral form.

The isolation of Peninsular forms from the main stock of the family for a long period seems to have induced in some forms like *Bhavania australis* characters which are not found in any other members of the Homalopterniae but are paralleled amongst the *Gastromyzon* of Borneo (Hora, 1941; Silas, 1954).

II SYSTEMATIC ACCOUNT

Order *CYPRINIFORMES*

Suborder *Cyprinoidei*

Key to families of suborder **Cyprinoidei**

1(a)	Head and body compressed, not flattened below.	
2(a)	A Single suborbital or preorbital spine; mouth inferior; barbels 6 or 8; pharyngeal teeth in a single row; air bladder enclosed in bone, its posterior part small or vestigial.	Cobitidae
2(b)	No suborbital or preorbital spine; mouth terminal or inferior; barbels none, 2 or 4; pharyngeal teeth in 1, 2 or 3 rows; air bladder divided into antero-posterior part not enclosed in bone.....	Cyprinidae
1(b)	Head and body depressed, flattened below.	Homalopteridae

Family *HOMALOPTERIDAE*

Key to subfamilies of family **Homalopteridae**

A.	Ventral and pectoral fins inserted horizontally; 2 rays of pectoral fins simple; air bladder in two connected lateral parts..	Homalopterinae
B.	Ventral and pectoral fins not inserted horizontally; only outermost ray of pectoral fin simple; air bladder reduced to two connected lateral parts and a small posterior part...	Noemacheilinae

I. Subfamily NOEMACHEILINAE

Key to genera of subfamily **Noemacheilinae**

A. Body elongate, completely naked, belly rounded (Central Asia).... *Triplophysa*

B. Body not elongate, at least partly covered with scales although minute, belly straight and horizontal (S. China; India; Pakistan; Afghanistan; W. Iran & N. E. Africa).... *Noemacheilus*

Genus 1. **Noemacheilus** van Hasselt, 1823

Noemacheilus van Hasselt, 1823. *Alg. Konst. Letterbode*, **2**(35): 133 (Type, *Noemacheilus fasciatus* van Hasselt).

Key to subgenera of genus **Noemacheilus**

1(a) Lips produced into a funnel-like structure (Burma & N. E. India) *Infundibulatus* subgen. nov.,

1(b) Lips normal, not produced into a funnel like structure

2(a) Form somewhat oblong, compressed, anterior nostril on a long flap-like tube; eyes large, visible from ventral surface (Burma, Assam)..... *Petruichthys*, subgen. nov.,

2(b) Form loach-like, anterior nostril normal or slightly tubular, eyes small, not visible from ventral surface.

3(a) Origin of dorsal behind origin of ventral (Burma & N. E. India) *Aborichthys*,

3(b) Origin of dorsal above origin of ventrals or slightly before.

4(a) Pair of well developed nasal barbels (Peninsular India)..... *Indoreonectes*,

4(b) No well developed nasal barbel.

5(a) Caudal fin truncate or slightly emarginate; a black ocellus at upper margin of base of caudal (India & Burma). .*Acanthocobitis*,

5(b) Caudal truncate, emarginate or forked; no black ocellus at upper angle of base of caudal.

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[1]Roberts in CLOFFA uses *Nemacheilus* Bleeker, and claims that *Noemacheilus* van Hasselt is a nomen nudum which he therefore rejects. In the present work I have used *Noemacheilus* van Hasselt on the grounds of recent wide usage of this name.

6(a) Snout elongated (Western Ghats).. *Noemacheilichthys,*

6(b) Snout not elongated.

7(a) Body marked with a series of vertical bands (S. China, Burma, India, Pakistan, Afghanistan, W. Iran and N. E. Africa).. *Schistura,*

7(b) Body not marked with a series of vertical bands.

8(a) Body with a lateral band; a blackish rounded spot at middle of base of caudal fin; anal opening placed at a distance about 30 to 43 percent in that between pelvic and anal fins (Western Ghats)..... *Noemacheilus,*

8(b) Body marked with irregular net of dark brownish and whitish yellow bars and stripes; a medium small dark bar at base of caudal fin; anal opening placed at a distance about 50 percent in that between pelvic and anal fins (Western Ghats) .... *Mesonoemacheilus,*

Subgenus: 1. *Schistura* McClelland, 1839

Type species: *Cobitis* (*Schistura*) *rupecula* Mc Clelland

Diagnosis: Small-sized noemacheiline fishes with rather low more or less cylindrical body; compressed or depressed head; short snout, short barbels; with or without scales; complete or almost complete or incomplete lateral line; short dorsal with usually 7 or 8 branched rays, but in some 9 or 10 branched rays; truncate, slightly emarginate, deeply emarginate or forked caudal fin; slightly or moderately furrowed or smooth lips; well defined transverse bands or stripes on body always present.

Schistura is the largest subgenus of *Noemacheilus* and most variable as well. Most of the S. Chinese, Thai, Burmese, Indian, Pakistani and a few of West Asian species belong to this subgenus. It is absent in the Malay Archipelago and Central Asia.

Key to species of the subgenus **Schistura**

1(a) Less than 9 branched rays in dorsal fin.

2(a) Dorsal with 8 branched rays.

3(a) Caudal truncate; 14-16 vertical black bands broader than interspaces; dorsal and caudal with rows of spots.(E. Himalayas). *N. multifasciatus,*

3(b) Caudal fin not truncate.

4(a) Caudal fin emarginate.

5(a) Caudal fin slightly emarginate.

6(a) Commencement of dorsal much nearer to base of caudal than tip of snout; 11–22 vertical brown bands, broader than pale inter spaces; dorsal with base black and with two rows of spots across it.(W.Ghats) *N. nilgiriensis*,

6(b) Commencement of dorsal equidistant between the base of caudal and tip of snout.

7(a) Lateral line incomplete.

8(a) Lateral line terminating above pectoral fins; 10-12 broad bands extending only to the middle of side of body; dorsal with base black and with a streak of black/dots across it (W. Ghats).. .. *N. kodaguensis* sp. nov.,

8(b) Lateral line terminating before or middle of dorsal fin.

9(a) Body marked with 6 saddle shaped bands extending only to middle side of body; lateral line ending above ventral fin (E. Himalayas). .... *N. devdevi*,

9(b) Body marked with 7–11 broad black bands extending from back to ventral surface; lateral line ending in front of dorsal (Nagaland).. *N. nagaensis*,

7(b) Lateral line complete; body with 16–18 narrow bands not extending to ventral surface (Punjab Himalayas)... *N. carletoni*,

5(b) Caudal fin deeply emarginate with rounded lobes; body with variable number of bands, usually 10-14, as wide as interspaces, caudal and dorsal with rows of spots; lateral line ending in front of dorsal (Peninsular India). *N. denisoni*,

4(b) Caudal forked.

10(a) Body spotted, a ray of pectoral greatly enlarged (All along sub Himalayas) *N. corica*,

10(b) Body banded.

11(a) Lateral line complete.

12(a) Body with numerous black dots irregularly distributed over body (W. Ghats, Cauvery & Bharathapuzha). *N. semiarmatus*,

12(b) Black dots absent.

13(a) Bands before dorsal broken up into a number of narrow bands.

14(a) 3 V-shaped bands on caudal and 2 bands on dorsal (Manipur & Burma) *N. vinciguerrae*,

14(b) Dorsal and caudal with a single row of spots (Alaknanda, upper Ganges system).. *N. gangeticus*,

13(b) Band before dorsal not broken up into narrow bands.

15(a) Bands before dorsal coalesced; dorsal surface and sides before dorsal dull brown; 4 broad black bands behind dorsal (Punjab Himalayas). *N. horai*,

15(b) Bands before dorsal not coalesced.

16(a) 6–9 broad black bands, broader than interspaces; caudal with 2, and dorsal with 1 band (Darjeeling, Nepal, Kumaon).. *N. beavani*,

16(b) 11–12 bands as wide as interspaces; dorsal and caudal unspotted (R. tributaries of U. Indus).. *N. arafi*,

11(b) Lateral line incomplete.

17(a) Lateral line extending only upto middle of body.

18(a) Lateral line terminating before dorsal fin origin (body marked with 10–11 regular bands extending from back to ventral surface). (N. E. India).. *N. arunachalensis* sp. nov.,

18(b) Lateral line terminating below dorsal fin.

19(a) 9–14 black bands, broader than interspace, extending from back to ventral surface (Meghalaya). *N. barapaniensis*,

19(b) 11–12 black bands broader than interspace, extending from back to below lateral line, not reaching ventral surface (R. tributary of U. Indus). *N. kohatensis*,

17(b) Lateral line extending beyond middle of body, terminating above middle of anal fin.

20(a) Body banded with regular bands.

21(a) Body marked with a series of bands (14–16) broader behind the dorsal, anteriorly broken up into number of bars (S. Shan States).... *N. rivulicola*,

21(b) Body marked with 12–13 black rings around body separated by equal number of slightly narrower white ones (Manipur, Meghalaya, U. Burma)..... *N. sikmaiensis*,

20(b) Body banded with 13 short bands across lateral line; above lateral line marked by a reticulum of dark bands and blotches. (Manipur)..... *N. prashadi*,

2(b) Dorsal with 7 branched rays.

22(a) Caudal truncate or lunate

23(a) Commencement of dorsal nearer base of caudal than tip of snout (colour varies; 8 grey bands in young; a few narrow vertical bands in middle of body in adults). (Middle & Lower Burma).... *N. cincticauda,*

23(b) Commencement of dorsal almost equidistant between the two.

24(a) Lateral line complete.

25(a) Body with varying number of bands; bands anterior to dorsal broken-up into a number of narrow bars, (Punjab & Himalayas). *N. montanus,*

25(*b*) Body with 14–16 vertical black bands; bands anterior to dorsal not broken up into a number of narrow bars. (Kumaon & Punjab Himalayas)..... *N. rupecola,*

24(b) Lateral line incomplete.

26(a) Lateral line terminating before dorsal origin.

27(a) Body striped.

28(a) Body marked with 23–26 black vertical stripes restricted to the sides of the body. (Dehra Dun).. *N. doonensis,*

28(b) Body marked with 25–26 black vertical stripes extending from back to ventral surface (Manipur & Nagaland).... *N. manipurensis,*

27(b) Body banded.

29(a) Body marked with 7–11 regular bands; membrane between dorsal and pectoral rays without any muscular pads. (Manipur)..... *N. kangjupkhulensis,*

29(b) Body marked with 7–11 irregular bands; membrane between dorsal and pectoral rays with muscular pads (Nagaland). *N. singhi* sp. nov.,

26(b) Lateral line extends beyond origin of dorsal fin.

30(a) Lateral line terminating below dorsal fin.; 9–10 vertical bands extending only to lateral line (Afghanistan & Baluchistan).. *N. lindbergi,*

30(b) Lateral line terminating above anal base.

31(a) 9–10 vertical broad black bands extending only to lateral line. (R. tributaries of U. Indus).. *N. pakistanicus,*

31(b) 9–10 vertical broad black bands extending to the side of body but not to ventral surface. (Punjab Himalayas & Kashmir). *N. punjabensis,*

22(b) Caudal not truncate or lunate.

32(a) Caudal deeply emarginate with rounded lobes. (Sri Lanka).. *N. notostigma,*

32(b) Caudal forked.

33(a) Lateral line complete.

34(a) 11 bands across lateral line interspaced with narrow short bands from above; caudal and dorsal spotted.(E. Himalayas)..... *N. scaturigina,*

34(b) 8–10 bands, narrower than interspaces, tapering below; caudal and dorsal unspotted. (Himachal Pradesh).. *N. himachalensis,*

33(b) Lateral line incomplete.

35(a) Commencement of dorsal nearer to base of caudal than tip of snout. (N. Shan States) *N. acuticephalus,*

35(b) Commencement of dorsal equidistant between the two

36(a) Body elongated depth about 16 to 20 percent of SL, compressed, head pointed. (Baluchistan).. *N. baluchiorum,*

36(b) Body deep depth about 12 to 18 percent of LS; head not pointed.

37(a) Body with regular cross bars.

38(a) Lateral line short, not reaching middle of body. (N. Baluchistan, Afghanistan & E. Iran)..... *N. kessleri*

38(b) Lateral line long. (North-west Frontier Province).. *N. prashari*

37(b) Body with irregular cross bars restricted to middle of the sides; back with dorsal spots not corresponding to lateral cross bars. (R. tributary of U. Indus).... *N. fascimaculatus,*

1 (b) 9–10 branched rays in dorsal fin.

39(a) Dorsal with 9 branched rays.

40(a) Caudal emarginate. (E. Himalayas). *N. savona,*

40(b) Caudal forked. (S. Shan States).. *N. shanensis,*

39(b) Dorsal with 10 branched rays.

41(a) Caudal emarginate (W. Ghats).... *N. striatus,*

41(b) Caudal forked (Burma)..... *N. brunneanus,*

1. *The rupecola group*

A number of related species complexes of the subgenus *Schistura* may be assembled together to what may be called the *rupecola* group. They are typified by truncate or slightly emarginate caudal fin and the typical *Schistura* colour pattern of dark vertical bands or stripes on body and 7 or 8 branched rays in the dorsal fin.

1. *The lindbergi complex*

This complex includes the most primitive or generalised species of the *rupecola* group characterised by 7 branched rays in the dorsal fin and a truncate or slightly emarginate caudal fin. Their distribution is towards the periphery of the range of the genus *Noemacheilus* (S. China; Malay Archipelago; Thailand; Burma; India (southern face of Himalayas southwards), Pakistan; Afghanistan; Iran; S. Anatolia; North East Africa)

Included in this complex are *N. lindbergi*, *N. pakistanicus* and *N. punjabensis*.

1. **Noemacheilus lindbergi** Banarescu & Mirza

1965. *Noemacheilus lindbergi* Banarescu & Mirza, *Senck. biol,*. **46** (4): 265 (Type locality: Afganistan, rivulet near Siaw, between Fareh and Dilaram (Farah rud drainage) and Pakistan: Baluchistan: Loralai River (Nari drainage) Loralai and Rakhsan River (Mashkel drainage) at Panjgur.

1981. *Schistura lindbergi*, Mirza, Nalbant & Banarescu (in part), *Bijdr. Dierk;* **51** (1): 111. (Loralai river, Rakhsan River basin and basin of lake Hanun-i-Mashkel; Unar river excluded).

Diagnosis: A small species of *Schistura* with truncate or slightly emarginate caudal fin; without scales on body; 7 branched dorsal fin rays; incomplete lateral line, ending in front or below dorsal fin; body marked with 10–12 irregular broad transverse bands on the sides.

Description: Based on 2 specimens, 41.5 and 43.0 mm SL from Loralai, Baluchistan.

D. 3/7; P. 1/9; V 2/6; A. 2/5; C. 16.

A small *Schistura* with both dorsal and ventral profiles more or less horizontal. Depth of body 14.46–20.93 head rather small, slightly broader than high at occiput, depressed; its length 21.69–22.67 per cent of standard length. Snout blunt, shorter than postorbital distance; its length 9.64–10.47 percent of standard

length, 44.44–46.15 per cent of head. Eye small, situated dorso-laterally in the anterior half of head, not visible from ventral surface; its diameter 13.89–15.38 per cent of head length, 31.25–33.33 per cent of snout, 38.46–46.15 per cent of inter-orbital width. Nostrils close to one another, nearer to eye than to tip of snout, anterior tubular. Mouth semi-circular, lips fleshy, deeply furrowed, upper with a median incision, lower broadly interrupted in the middle. Barbels well developed, inner rostral and maxillary barbels almost equal; maxillary extending perpendicular from anterior margin of eye.

Scales: None. Lateral line incomplete, ending in front of or below dorsal fin.

Fins: Dorsal small, less than length of head, edge of dorsal almost straight; origin of dorsal fin nearer base of caudal than tip of snout. Origin of pelvic opposite to that of dorsal. Pectoral shorter than head, extends two-thirds distance to pelvic. Pelvic shorter than head, not reaching anal opening. Anal fin not reaching base of caudal. Caudal fin as long or slightly shorter than head, slightly emarginate posteriorly.

Pre-dorsal distance 53.01–56.40 percent of standard length; pre-pelvic distance 52.33–55.42 percent; pre-anal 76.51–76.74 percent; distance from pectoral to pelvic origin 31.40–32.53 percent. Vent a short distance from anal fin; distance from vent to anal fin 11.90–14.29 percent of that between anterior origins of pelvic and anal fins. Pectoral 14.46–16.28, pelvic 13.25–13.95 percent of standard length; height of dorsal 14.46–16.86 percent; of anal 10.84–12.79 percent; base of dorsal 9.64–12.21 percent; anal 7.23–10.47 percent; caudal 18.07–18.60 percent.

Caudal peduncle short and stout; its length 13.86–14.53 percent of standard length; its least height 80.0–86.96 percent of its length.

Sexual dimorphism: None.

Colour: Body yellowish with 10–12 irregular transverse brown bands wider than interspaces between them, descending from back to lower surface of body. A dark bar at base of caudal fin; a blackish spot at anterior base of dorsal fin. Dorsal fin with a row of narrow stripes, caudal with two or three rows.

Size: Largest specimen examined 43.0 mm SL. Maximum recorded 58.0 mm SL.

Affinities: This species is very close to *N. pakistanicus*, but can be separated because of its short lateral line (lateral line is complete in *N. pakistanicus*).

Range: Afghanistan & Baluchistan: Inner river drainages from Farah Rund to Mashkel and Nari drainages.

Material examined: Pakistan: 2 specimens, ISBB 1362, Loralai.

2. **Noemacheilus pakistanicus** Mirza & Banarescu

(Fig. 1, Pl. 1)

1963. *Nemacheilus rupicola inglisi* (nec Hora), Ahmad & Mirza, *Pakistan J. Sci.*, **15:** 75 (Madyam River, Swat River basin, Pakistan).

1969. *Noemacheilus pakistanicus* Mirza & Banarescu, in Mirza, Banarescu & Nalbant, *Pakistan J. Zool.*, **1:** 87, figs. 1-3 (Type locality: Hindubagh, now Muslimbagh, Zhob River basin).

1970. *Noemacheilus rupecola alepidotus* Mirza & Banarescu in Mirza, Banarescu & Nalbant, *Pakistan J. Zool.*, **1:** 55, fig. 10 (Madyam River, Marghzar, Mingoara, Shiner, all in Swat River basin. Jhelum River basin, excluded).

1972. *Noemacheilus rhadineus* (nec Regan) Mirza, *Biologia*, Lahore, **18:** 173 (Fort Sandeman, now Zhob city, Zhob River basin)

1974. *Noemacheilus* (*Schistura*) *pakistanicus*, Mirza, *Biologia*, Lahore, **20:** (Zhob River drainage).

1975. *Noemacheilus cristatus* (nec Berg) Mirza, *Bijdr. Dierk.*, **45** (2): 160, 170–171.

1980. *Noemacheilus lindbergi* Mirza (in part), *Proc. 1st. Pakistan Congr. Zool.*, p. 22. (Baluchistan and Afganistan; Punjab included).

1980. *Noemacheilus pakistanicus*, Mirza, *Proc. 1st Pakistan Congr. Zool.*, p. 23 (Baluchistan).

1980. *Noemacheilus alepidotus alepidotus*, Mirza, *Proc. 1st Pakistan Congr. Zool.*, p. 23 (NWFP).

1981. *Schistura alepidota*, Mirza, Nalbant & Banarescu, *Bidjr. Dierk.*, **51** (1): 106, fig. 2 (Hongu on the Kohat Toi River, Abbottabad on the Dor River).

1981. *Schistura pakistanica*, Mirza, Nalbant & Banarescu, *Bijdr. Dierk.*, **51** (1): 107 (Zhob river).

1981. *Schistura lindbergi*, Mirza, Nalbant & Banarescu, (in part) *Bijdr. Dierk.*, **51** (1): fig. 14 (Unnar river near Ugi, Upper Indus).

1981. *Schistura microlabra* Mirza & Nalbant, *Bijdr. Dierk*, **51** (1): 126, fig. 56–60 (Ali Masjid, Khyber Pass, Kabul River basin and Unar River, a small tributary of U. Indus).

1981. *Noemacheilus* (*Schistura*) *pakistanicus*, Coad, *Nat. Mus. nat. Hist.*, Ottawa, Pub. Zool. 14: 15, 25 (Zhob-Gowmal drainages).

Diagnosis: A large-sized *Schistura* with truncate or very slightly emarginate caudal fin; 7 branched rays in dorsal fin; totally scaleless body; long lateral line almost complete, reaching up to or slightly beyond the end of anal fin; 9–10 broad bands on body extending down to lateral line; no sexual dimorphism.

Description: Based on 4 specimens, 40.0–82.0 mm SL from Swat Valley, Pakistan.

D. 3/7; P. 10; V 2/6; A. 2/5; C. 18.

A big-sized *Schistura* species, with robust body, anteriorly thick, compressed poteriorly. The dorsal profile slightly arched, ventral straight and horizontal. Depth of body 15.85–20.93 (M= 17.01); head slightly broader than high at occiput, depressed; its length 22.67–26.51 (M=25.29) per cent of standard length. Snout of moderate length, somewhat narrower anteriorly, shorter than postorbital distance; its length 9.38–11.61 (M=10.63) of standard length, 37.50–46.15 (M=42.07) per cent of head. Eye small, situated almost in the middle of head, not visible from ventral surface; its diameter 10.47–17.50 (M=13.54) per cent of head length, 25.0–46.67 (M=32.50) per cent of length of snout, 40.91–61.54 (M=51.0) per cent of inter-orbital width. Nostrils close to each other, situated closer to eye than to tip of snout, anterior nostril tubular. Mouth semicircular; lips moderately fleshy and somewhat furrowed, but not fringed, upper with a narrow median incision, lower broadly interrupted. Dentiform process moderately developed. Barbels well developed; outer rostral longest, extending to margin of eye; maxillary extending to perpendicular from posterior border of eye.

Scales: None. Lateral line almost complete, its posterior end nearer to caudal base than vertical from posterior margin of anal fin.

Fins: The dorsal fin small, less than length of head; edge of the dorsal straight or somewhat convex, origin of dorsal fin equidistant between tip of snout and caudal base; origin of pelvic

slightly behind that of dorsal. Pectoral shorter than the head, extends about half way of distance to pelvic. Pelvic shorter than pectoral separated from anal opening by a short distance. Anal fin not reaching base of caudal or almost touches the caudal base. Caudal fin slightly shorter than head, truncate or slightly emarginate posteriorly.

Pre-dorsal distance 52.44–58.14 (M=54.76) per cent of standard length; pre-pelvic distance 46.51–58.13 (M=54.44) per cent; pre-anal 76.74–80.49 (M=79.07) per cent; distance from pectoral to pelvic origin 30.23–34.15 (M=32.18) per cent. Vent a short distance from anal fin; distance from vent to anal fin 14.29–19.47 (M=15.89) per cent in that between anterior origins of pelvic and anal fins. Pectoral 16.25–18.90 (M=17.72) ,pelvic 13.95–16.95 (M=15.84) per cent of standard length; height of dorsal 16.25–18.67 (M=17.32) per cent; of anal 12.79–15.66 (M=14.54) per cent; base of dorsal 11.61–14.63 (M=13.03) per cent; of anal 7.62–10.47 (M=8.84) per cent; caudal 18.60–25.0 (M=22.57) per cent.

Caudal peduncle short and stout, its length 11.88–15.18 (M=13.43) per cent of standard length; its least height 80.0–100.0 (M=91.05) per cent of its length.

Sexual dimorphism: None.

Colour: Body yellowish, usually with 9–10 darker broad bands from back to sides upto lateral line, in some the last two or three bands extend below lateral line. A black blotch at base of anterior dorsal rays; an intensive vertical stripe at caudal base; 2–3 rows of small dots on caudal and dorsal fins, other fins plain or hyalin.

Size: Largest specimen examined 82.0 mm SL.

Affinities: *N. pakistanicus* is closely related to *N. lindbergi* Banarescu and Mirza of the inner river systems of Baluchistan. Both have similar caudal fins (truncate or somewhat slightly emarginated posteriorly) seven branched rays in the dorsal fin and similar colour pattern. It can be separated from *N. lindbergi* by the long alteral line (lateral line short in *N. lindbergi*). *N. pakistanicus* along with *N. lindbergi* and *N. punjabensis* form the *lindbergi* species complex. *Noemacheilus lindbergi* appears to have been differentiated in Baluchistan from the same stock that gave rise to *N. pakistanicus* and *N. punjabensis* in the right and left tributaries respectively of the Indus.

Range: Pakistan: From Swat to Zhob basin through the Kohat Toy and the Kurram, the right tributaries of the Indus.

Material examined: Pakistan: 1 specimen, ISBB 2232 (Paratype of *N. pakistanicus*) Hindubag (now Muslimbag), Zhob River basin. 1 specimen, ISBB 3888 (Paratype of *S. alepidota*), Shiner, Swat River basin. 1 specimen, ISBB 1233 (Paratype of *S. alepidota*), Madayam River, Swat State. 2 specimens, ZMA 114,718, Madayam, Swat Valley. 1 specimen, ZMA 116,448 (Paratype of *S. microlabra*), Unar River, a small tributary of U. Indus, near Ugi, Coll. M. R. Mirza, 19-12-1974.

3. **Noemacheilus punjabensis** Hora
(Fig. 2, Pl. 1 & Fig. 4, Pl. 16)

1923. *Nemachilus punjabensis* Hora, *Rec. Indian Mus.*, **75**: 384, fig. 2 & 3 (type locality: Salt range, Punjab).

1972. *Noemacheilus alepidotus nalbanti* Banarescu and Mirza, *Biologia*, Lahore, **18** (2): 121, figs. 1–2. (Type locality: Rawlakot, Azad Kashmir, Jhelum River basin).

1974. *Noemacheilus punjabensis*, Menon, *Ind. Fisheries Soc. India*, special publication, **1**: 56.

1980. *Noemacheilus punjabensis*, Mirza, *Proc. 1st Pakistan Congr. Zool.*, p. 22 (Punjab).

1980. *Noemacheilus alepidotus nalbanti*, Mirza, *Proc. 1st Pakistan Congr. Zool.*, p. 24 (Punjab & Azad Kashmir).

1981. *Schistura nalbanti*, Mirza, Nalbant & Banarescu, *Bijdr. Dierk* **51** (1): 107, fig. 5 (Jhelum River basin).

Diagnosis: A large—sized *Schistura* with slightly emarginate caudal fin; 7 branched rays in dorsal fin; totally scaleless body; incomplete lateral line extending upto middle or end of anal tip; 9 to 12 vertical broad bands on body; no sexual dimorphism.

Description: Based on 10 specimens, 36.0–64.0 mm SL from Tawi River, Jammu (6); Jhelum River, Azad Kashmir; Pakistan (4).

D. 3/7; P. 10; V 2/6; A. 2/5; C. 18.

A large sized *Schistura* species with dorsal profile slightly arched, ventral straight and horizontal. Depth of body 12.5–18.02 (M= 15.29); head slightly broader than high at occiput; its length 21.25–27.21 (M=24.53) per cent of standard length. Snout of

moderate length, somewhat narrowed anteriorly, shorter than postorbital distance; its length 8.23–10.81 (M=9.51) of standard length, 33.33–47.06 (M=38.64) per cent of head. Eye small, situated almost in the middle of head, not visible from the ventral surface; its diameter 11.76–23.53 (M=20.82) per cent of standard length, 30.77–60.0 (M=44.41) per cent of length of snout; 40.0–80.0 (M=56.03) per cent of inter-orbital width. Nostrils close to each other, situated closer to eye than tip of snout, anterior nostril tubular. Mouth semicircular; lips fleshy, somewhat furrowed, upper entire, lower broadly interrupted. Dentiform process moderately developed. Barbels well developed; outer rostral longest, extending to margin of eye; maxillary extending to perpendicular from posterior border of eye.

Scales: None. Lateral line incomplete, extending up to middle or end of anal tip.

Fins: Dorsal small, less than length of head; edge of dorsal straight; origin of dorsal fin equidistant between tip of snout and caudal base; origin of pelvic slightly behind that of dorsal. Pectoral shorter than head, extends about half distance to pelvic. Pelvic shorter than pectoral, separated from anal opening by a short distance. Anal fin not reaching base of caudal. Caudal fin shorter than head, slightly emarginate posteriorly.

Pre-dorsal distance 50.0–58.33 (M=53.63) per cent of standard length; pre-pelvic distance 51.47–58.57 (M=54.85) per cent; pre-anal 73.53–80.56 (M=78.19) per cent; distance between pectoral to pelvic origin 26.69–33.75 (M=32.20) per cent. Vent a short distance from anal fin; distance from vent to anal fin 12.50–19.23 (M=15.58) per cent in that between anterior origins of pelvic and anal fins. Pectoral 15.63–23.53 (M=19.53), pelvic 14.38–19.12 (M=16.18) per cent of standard length; height of dorsal 15.28–22.06 (M=18.48) per cent; of anal 12.86–16.98 (M=15.12) per cent; base of dorsal 10.0–15.94 (M=12.05) per cent; of anal 6.25–10.87 (M=8.71) per cent; caudal 17.5–27.5 (M=22.97) per cent.

Caudal peduncle short and stout; its length 10.30–15.0 (M=12.98) per cent of standard length; its least height 75.0–95.0 (M=84.10) per cent of its length.

Sexual dimorphism: None.

Colour: Body greyish with 9 to 12 dark broad vertical bands extending from back to ventral surface. A black blotch at base of anterior dorsal rays; an intensive black vertical stripe at caudal base; two to three rows of spots on caudal and dorsal fins.

Size: Largest specimen examined 64.0 mm SL.

Affinities: The species is closely related to *N. pakistanicus* from which it can be separated from the emarginate caudal fin (caudal fin truncate in *N. pakistanicus*); the incomplete lateral line (lateral line is almost complete in *N. pakistanicus*) and the vertical bands on body extending to ventral surface (bands extend only down lateral line in *N. pakistanicus*).

Range: Pakistan: Azad Kashmir. India: Punjab, Jammu and Kashmir.

Material examined: India: Punjab: 6 specimens, ZSI F10348/1 (Syntypes of *punjabensis*) streams below Watta Hills, Salt Range, Coll. S.L. Hora, 16-7-1922.

Jammu and Kashmir: 21 specimens, NRS/ZSI, uncatalogued, Surankot stream, Poonch, Coll. R. Tilak. 6 specimens SRS/ZSI uncatalogued, Poonch, Coll. R. Tilak. 4 specimens, NRS/ZSI, uncatalogued, Tawi River at Manawar, Rajouri, Coll. R. Tilak. 2 specimens, ZMA 114, 722 (Paratype of *N. alepidotus nalbanti*) Rawalakot, Coll. M. R. Mirza, 1969. 2 specimens, ISBB 2586 (Paratype of *S. nalbanti*) Rawalakot, Jhelum River basin.

2. *The rupecola Complex*

This is a small complex of medium-sized species whose distribution is confined to the sub Himalayan range, from the Tista basin to the Sutlej in the Punjab Himalayas.

Included in this complex are *N. multifasciatus* and *N. rupecola.*

4. **Noemacheilus rupecola** (McClelland)

(Fig. 6, Pl. 13)

1838. *Schistura rupecula* McClelland, *J. Asiat. Soc. Beng.*, **7**: 948, pl. 55 fig. 3. (Type locality: Simla).

1839. *Schistura rupecula* McClelland,*As. Res.* (*Ind. Cyprinidae*), p. 309, pl. 57, fig. 3.

1878. *Nemachilus rupecola.* Day, *Fish. India*, p. 616, pl. 153, fig. 9.

1889. *Nemachilus rupicola*, Fowler, *Proc. Acad. Nat. Sci. Philad.*, **76**: 70-71 (Kulu Valley and Gorges near Beas River).

1889. *Nemachilus rupecola*, Day, *Faun. Brit. India. Fish.*, **1**: 229.

1924. *Nemachilus beavani*, Fowler (nec Günther), *Proc. Acad. Nat. Sci. Phild.*, **76**: 71 (headwaters of the Sutlej and Beas Rivers).

1949. *Nemachilus rupecola*, Menon, *J. Bombay nat. Hist. Soc.*, **48** (3): 540, 542 (Bhowali nallah, Ramgar nallah, Naini Tal, Gola and Kosi Rivers, Kumaon).

1974. *Nemachilus rupecola*, Sehgal, *J. Bombay nat. Hist. Soc.*, **70** (3): 466 (Sirmour).

1977. *Noemacheilus rupecola rupecola*, Menon, *Inl. Fisheries Soc.*, Special publications, **1**: 56.

1977. *Noemacheilus rupecola*, Tilak and Hussain, *Zool. Jb. Syst. Bd.*, **104**: 285 (Kulu, Simla, Solan, Sirmour, Beas and Sutlej Rivers).

Diagnosis: A medium-sized *Schistura* with truncate or slightly-emarginate caudal fin; with 8 branched dorsal fin rays; scaled body; complete lateral line; 14–16 dark vertical bands encircling body.

Description: Based on 29 specimens, 27.0–66.5 mm SL from Kumaon (16) and Almorha (13).

D. 2/8; P. 12; V 8; A. 1/5; C. 16.

A medium-sized elongated fish with dorsal profile slightly arched, ventral straight and horizontal throughout. Depth of body 11.11–18.75 (M=14.86); head short, broader than high at occiput; its length 20.98–25.93 (M=23.12) per cent of standard length. Snout somewhat blunt, equal to postorbital distance; its length 7.41–11.76 (M=9.60) of standard length and 33.33–50.0 (M=41.63) per cent of head. Eye small, dorso-lateral in position, situated in the middle of head, not visible from ventral surface; its diameter 13.33–33.33 (M=20.19) per cent of head length, 30.77–80.0 (M=48.01) per cent of length of snout, 38.46–80.0 (M=54.14) per cent of interorbital width. Nostrils close to each other, situated nearer to superior margin of eye and separated by a flap but without any well developed nasal barbel; anterior nostril not tubular. Mouth semicircular; lips moderately fleshy, poorly furrowed, upper not interrupted, lower interrupted in middle. Dentiform process moderately developed. Barbels well developed, all longer than diameter of eye; inner rostral shorter, outer rostral longest, extending to middle of eye; maxillary extending to perpendicular from beyond posterior border of eye.

Scales: Small, indistinct, embedded in skin, absent on ventral side. Lateral line complete.

Fins: Dorsal fin small, less than length of head; edge of dorsal slightly convex; origin of dorsal fin equidistant between tip of snout and caudal base; origin of pelvic almost opposite to that of dorsal. Pectoral longer than head, extends almost two-thirds the distance to pelvic; Pelvic shorter than pectoral, separated from the

anal opening by a considerable distance. Anal fin not reaching base of caudal. Caudal fin longer than head, truncate or slightly emarginate posteriorly.

Pre-dorsal distance 47.48–55.56 (M=50.94) per cent of standard length; pre-pelvic distance 47.78–55.56 (M=51.25) per cent; pre-anal 74.07–98.89 (M=78.71) per cent; distance from pectoral to pelvic origin 25.93–33.93 (M=30.18) per cent. Vent a short distance from anal fin; distance from vent to anal fin 6.25–21.05 (M=15.48) per cent in that between anterior origins of pelvic and anal fins. Pectoral 11.36–23.0 (M=19.6), pelvic 13.58–22.73 (M=18.69) per cent of standard length; height of dorsal 14.81–20.78 (M=16.94) per cent; of anal 11.11–18.28 (M=14.07) per cent; base of dorsal 10.61–16.67 (M=13.32) per cent; of anal 5.56–11.11 (M=8.23) per cent; caudal 16.36–27.45 (M=23.25) per cent.

Caudal peduncle short and stout; its length 11.11–15.87 (M=14.0) per cent of standard length; its leaste height 63.64–100.0 (M=80.71) per cent of its length.

Sexual dimorphism: None.

Colour: 14–17 vertical bands encircling body in young specimens; in adult specimens 9–12 vertical bands, broader than interspace, descend from below base of dorsal fin to caudal, those in the posterior part encircling body, the bands before dorsal coalescing to form a uniform ground colour. A black spot at base of anterior dorsal rays; dark streaks on the outer rays of dorsal and caudal fins.

Affinities: This form is readily separated from its nearest relative *N. multifasciatus* Day by the absence of a distinct nasal barbel and 8 branched rays in the dorsal fin (7 in *N. multifasciatus*).

Range: Western Himalayas: Kumaon through Garhwal Himalayas to Yamuna, Sutlej, and Beas drainages of the Himachal Pradesh.

Material examined: India: Uttar Pradesh: Kumaon Himalayas: 28 specimens, NRS/ZSI uncatalogued, Bhatta Falls, Song River, Mussorie, Coll. A. Hussain, 2-xi-1966. 16 specimens, NRS/ZSI, uncatalogued. 28 specimens, ZSI F 11981/1, Mussorie, Coll. A. G. K. Menon, 21-v-1948. 13 specimens. ZSI F 152/2, Kosi River, Almorha. 51 specimens, ZSI F 144/2. 1 specimen, ZSI F 6742/1, Bhim Tal. Coll. S. Kemp, 2–10-v-1911. 2 specimens, ZSI F 150/2-151/2, Kumaon Hill Survey, May–June 1948. 5 specimens, ZSI F 155/2, Naukuchyata stream, 21-v-1948. 3 speci-

mens, ZSI 185/2, Kumaon Hills. 3 specimens, ZSI F 149/2, Niglat, 4 miles west of Bhowali, 23-v-1948. 1 specimen, ZSI F 147/2, Bhowali, 1948.

Himachal Pradesh: Punjab Himalayas: 48 specimens, NRS/ ZSI/F 83, Bilaspur, Coll. M. Chandra, 12-v-1972. 10 specimens, HAZFS/ZSI No. 449, Khud Kaushalya near Chakki More, Solan (Yamuna drianage), Coll. R. Tilak, 19-iii-1977. 1 specimen, HAZFS/ZSI, uncatalogued, Tarakulpind on Kalka-Chandigarh Road. 1 specimen, DZPU uncatalogued, Sujanpur District, Coll. K. K. Tandon. 6 specimens, ZSI F 11171/1, Beas River, Kangra.

5. **Noemacheilus multifasciatus** Day

(Figs. 3 & 4, Pl. 1)

1869. *Nemachilus rupecola*, Günther, (nec McClelland) *Cat. Fish Brit. Mus.*, **7:** p. 351.

1878. *Nemachilus multifasciatus* Day (in part), *Fish. India*, p. 617, pl. 153, fig. 7, (Type locality: Darjeeling and Assam).

1889. *Nemachilus multifasciatus*, Day (in part), *Faun. Brit. Ind. Fish.* **1:** 231 (Darjeeling and Assam)

1889. *Nemachilus rupecola*, Day (in part), *Fish India*, p. 613.

1889. *Nemachilus rupecola*, Day (in part), *Fauna. Brit. Ind. Fish.*, **1:** 229.

1935. *Nemachilus rupecola* var. *inglisi* Hora, *Rec. Indian Mus.*, **37:** p. 58, (Type locality: Eastern Himalayas; rivers below Darjeeling and Sikkim).

1937. *Nemachilus rupecola* var. *inglisi*, Shaw and Shebbeare, *J. Asiat. Soc. Beng.*, **3:** 74, fig. 71. (Northern Bengal)

1974. *Noemacheilus multifasciatus*,Menon, *Inl. Fisheries Soc.*, Special publication, **1:** 56. (Darjeeling and Assam).

1974. *Noemacheilus rupecola inglisi*, Menon, *Inl. Fisheries Soc.*, Special publication, **1:** 57 (Darjeeling, Sikkim and Assam).

Diagnosis: A medium-sized *Schistura* with robust body; truncate caudal fin; 7 branched rays in dorsal fin; scaled body; complete lateral line; distinct nasal barbel; 14–16 dark vertical bands encircling body.

Description: Based on 32 specimens, 43.0–98.0 mm SL from Kurseong, Darjeeling, Himalayas.

D. 2/7; P. 12; V 8; A. 1/5; C. 16.

A medium-sized robust, elongated fish with dorsal profile slightly arched, the ventral profile straight and somewhat flattened

in front of anus. Depth of body 10.0–15.49 (M=13.14); head short, broader than high at occiput; its length 17.39–23.49 (M=20.65) per cent of standard length. Snout somewhat rounded, equal to postorbital distance; its length 7.14–11.19 (M=9.47) of standard length, 33.33–58.33 (M=46.03) per cent of head. Eye small, dorso-lateral in position, situated almost in the middle of head; not visible from the ventral surface; its diameter 10.53–22.73 (M=17.23) per cent of head length, 22.22–57.14 (M=33.18) per cent of length of snout, 29.17–75.0 (M=47.27) per cent of inter-orbital width. Nostrils situated nearer to superior margin of eye, separated by a flap bearing a well developed barbel; anterior nostril not tubular. Mouth semicircular; lips moderately fleshy, poorly furrowed, upper not interrupted, lower interrupted in the middle. Dentiform process well developed. Barbels well developed; inner rostral shorter than outer, outer rostral longest extending to anterior margin of eye; maxillary extending to vertical posterior border of eye.

Scales: Small, indistinct, embedded in skin; absent on ventral side. Lateral line complete.

Fins: Dorsal fin small, less than length of head, edge of dorsal straight, anterior margin somewhat rounded; origin of dorsal fin a little nearer to caudal base than to tip of snout; origin of pelvic opposite or slightly before that of dorsal. Pectoral shorter than head, extends about two-thirds the distance to pelvic. Pelvic shorter than pectoral, separated from anal opening by a considerable distance. Anal fin not reaching base of caudal. Caudal fin as long as or slightly shorter than head, truncate or slightly emarginate posteriorly.

Pre-dorsal distance 47.96–54.88 (M=51.63) per cent of standard length; pre-pelvic distance 44.35–54.88 (M=50.40) per cent; pre-anal 67.44–82.47 (M=76.89) per cent; distance from pectoral to pelvic origin 27.55–49.0 (M=32.02) per cent. Vent a short distance from anal fin; distance from vent to anal fin 8.0–20.0 (M=13.47) per cent in that between anterior origin of pelvic and anal fins. Pectoral 11.97–22.73 (M=18.74), pelvic 9.86–20.0 (M=13.47) per cent of standard length; height of dorsal 9.76–18.0 (M=13.16) per cent; base of dorsal 9.46–14.55 (M=11.50) per cent; anal 5.97–9.52 (M=8.02) per cent; caudal 9.52–22.18 (M=17.22) per cent.

Caudal peduncle short and stout; its length 16.45–20.0 (M=15.32) per cent of standard length; its least height 50.0–85.71 (M=71.16) per cent of its length.

Sexual dimorphism: None.

Colour: Body marked with 14–16 vertical bands, broader than the interspaces. A black spot at base of anterior dorsal rays; short dark streaks on the outer rays of dorsal and caudal fins. The arrangement and the number of bands varies considerably, in some specimens the bands are split up especially in front of dorsal fin into a number of narrower bands.

Affinities: It is most easily separated from its nearest relative *Noemacheilus rupecola* (McClelland) by the possession of a distinct nasal barbel, relatively shorter fins, in its stouter build and 7 branched dorsal fin rays (8 in *N. rupecola*).

Range: Eastern Himalayas: From Tista through the base of Nepal Himalayas as far as the Ghaghra and Kali drainages.

Material examined: India: W Bengal: Eastern Himalayas: 1 specimen, ZSI F 11755/1, (holotype of *N. inglisi* Hora) Darjeeling & Sikkim, Coll. S. L. Hora. 14 specimens, ZSI F 3045/1 to F 3054/1, Kurseong, Coll. N. Anandale. 6 specimens, ZSI F 77/1 to F 82/1, Kurseong. 24 specimens, ZSI F 11696/1, stream near the Tista Bridge, Kalimpong, Coll. S. L. Hora. 18 specimens, ZSI F 11712/1, Manjhitar, Coll. B. L. Chaudhuri, June 1913. 4 specimens, ZSI F 11712/1, Sikkim. 18 specimens, ZSI F 11716/1, Reamhead, Kurseong, Coll. S. L. Hora. 4 specimens, ZSI F 11711/1, Darjeeling, Coll. Kemp, 6-vii-1918. 3 specimens, ZSI F 11700/1, Gurila Factory Nallah, Mungpo. 7 specimen, ZSI F 11691/1, a small stream flowing over to Kalimpong, near Tista Bridge, Tissa, Coll. S. L. Hora, 14-vi-1934. 8 specimens, F 11716/1, 25-iv-1981. 5 specimens, ZSI F 11698/1, Pashok, Alt. 4500 ft. 3 specimens, ZSI F 11692/1, Kurseong, Alt. 6000 ft., Coll. E.A.D. Abreu. 1 specimen, ZSI F 11713/1, Mungpo, 19-ii-1921. 2 specimens, ZSI F 11718/1, Kurseong. 7 specimens, ZSI F 11694/1, Dhohijhar, Kurseong, Coll. B. N. Chaudhuri, 11-iii-1924. 5 specimens, F 1588/1 to 1592/1, Kurseong, 5000 ft., Coll. S. L. Hora, 15-iv-1934. 4 specimens, ZSI F 3150-2/1 and F 3154/1, Kurseong, Coll. N. Annandale. 1 specimen, ZSI F 11695/1, Teesta. 1 specimen, ZSI F 11709/1, a small stream, a mile from Tista Bridge on way to Grielli Khola Railway Station, Tista Valley, Coll. S. L. Hora, 1-xii-1934. 17 specimens, ZSI F 11710/1, Darjeeling, Kurseong. 19 specimens, ZSI F 13439/1, Tista River drainage. 1 specimen, ZSI F 3043/1, Kurseong, Coll. N. Annandale. 34 specimens, ZSI uncatalogued, Darjeeling. 44 specimens, ZSI F 3100–35/1 and ZSI F 3139/43/1, Darjeeling. 4 specimens, ZSI F 3147/1 to 3149/1 & 3155/1, Kurseong, Coll. N. Annandale. 1 specimen, ZSI F 2566, Darjeeling, purchased from F. Day. 13 specimens ZSI F 2666/1 to 2678/1, Darjeeling, Coll. I. Anderson. 2 specimens, ZSI F 4349/1 & 4350/1, Kurseong, Coll. N. Annandale. 7 specimens, ZSI F 11715/1, Reamhead, Coll. S. L. Hora. 29 specimens, ZSI F 11706/1, Kalimpong, 28-v-1930.

9 specimens, F 11701/1, Kali Jhora, Kurseong, Coll. M. Sharif, 12 vii 1927. 6 specimens, ZSI F 3056/1 to 3061/1, Kurseong, Coll. N. Annandale. 49 specimens, ZSI F 11702/1, Goethal, Coll. F. H. Gravely. 22 specimens, ZSI F 11703/1, Goethal, Alt. 5500 ft., Kurseong, Coll. M. Sharif, 10 iii 1926.

Uttar Pradesh: 56 specimens ZSI F 1478/2, Dhara nullah, 5 miles north of Jarwa Rly. Station, into Nepal territory, Jarwa, Gonda Dt., Coll. A. G. K. Menon, 14-ii-1949. 3 specimens, ZSI F 4253/1 to 5255/1, Ghumbi River, Coll. F. H. Gravely.

Sikkim: 8 specimens, ZSI F 11706/1, Gangtok, 23-i-1922. 19 specimens, ZSI F 8214/1-8235/1 Manjhitar, Rangit River drainage, Coll. B. L. Chaudhuri, June 1913. 26 specimens, ZSI, Rafong stream, Magan, 67 km north Gangtok, 1470 M., 8-ix-1977.

Nepal: 4 specimens, F 12285/1, Nagarkot, Coll. F. M. Bailey.

3. *The carletoni Complex*

This complex of small-sized species is found in the Eastern Himalayas (*N. devdevi*), Western Himalayas (*N. doonensis*) and Punjab Himalayas (*N. carletoni*). They are characterised by 7 or 8 branched rays in the dorsal fin and slightly emarginate caudal fin.

6. **Noemacheilus carletoni** Fowler

(Fig. 4, Pl. 1)

1924. *Noemacheilus carletoni* Fowler, *Proc. Acad. nat. Sci. Philad.*, **76**: 68, fig. 2. (Type locality: Kulu valley).

1974. *Noemacheilus carletoni*, Menon, *Inl. Fisheries Soc. India*, special publication, **1**: 54.

1977. *Noemacheilus carletoni*, Tilak & Husain, *Zool. Jb. syst. Sd.*, **104**: 284 (Kulu Valley).

Diagnosis: A small-sized *Schistura* species of the *rupecola* group with 8 branched dorsal fin rays; a slightly emarginate caudal fin; almost complete lateral line; body marked with 17–18 brownish bands, broader than interspaces, on sides of body, not extending either to back or ventral side of body; no sexual dimorphism.

Description: Based on 7 specimens, 20.0–31.5 mm SL from the Ghaggar River at Bharati Village, near Sabathu, Solan District, Himachal Pradesh.

D. 2/8; P. 1/9; V 1/6; A. 2/5; C. 18.

A small-sized species, body elongate, compressed, dorsal profile slightly convex, ventral horizontal and flat. Depth of body 15.0–17.39 (M=16.08); head moderately long, narrower anteriorly; its length 7.55–11.67 (M=9.57) per cent of standard length. Snout shorter than post-orbital length; its length 7.55–11.67 (M=9.57) of standard length, 28.57–43.75 (M=36.27) per cent of head. Eye small, situated in the middle of head, not visible from ventral surface; its diameter 23.08–33.33 (M=28.75) per cent of head length, 66.67–100.0 (M=80.44) per cent of length of snout, 75.0–100.0 (M=86.90) per cent of inter-orbital width. Nostrils close to each other, situated closer to eye than to tip of snout. Mouth semicircular; lips fleshy, moderately furrowed, upper uninterrupted, lower interrupted in the middle. Dentiform process moderately developed. Barbels well developed; inner rostral shorter than outer, outer rostral twice length of inner, extending to hind edge of eye; maxillary longest extending to perpendicular from beyond border of eye.

Scales: Minute, distinct, most evident posteriorly. Lateral line almost complete.

Fins: Dorsal moderately high; edge of dorsal straight; its origin nearer caudal base than tip of snout; origin of pelvic oppcsite to that of dorsal. Pectoral shorter than head reaches half of distance to pelvic. Pelvic shorter than pectoral separated from anal opening by a short distance. Anal fin not reaching base of caudal. Caudal longer than head, very slightly emarginate posteriorly.

Pre-dorsal distance 49.06–56.67 (M=51.75) per cent of standard length; pre-pelvic distance 47.83–56.67 (M=52.67) per cent; pre-anal 73.02–81.67 (M=78.41) per cent; distance from pectoral to pelvic origin 25.00–36.67 (M=30.27) per cent. Vent a short distance from anal fin; distance from vent to anal fin 13.33–23.53 (M=17.50) per cent in that between anterior origins of pelvic and anal fins. Pectoral 17.50–25.00 (M=20.93), pelvic 17.39–20.00 (M=18.73) per cent of standard length; height of dorsal 15.00–20.00 (M=18.24) per cent; of anal 15.87–20.00 (M=17.85) per cent; base of dorsal 10.00–16.67 (M=13.06) per cent; of anal 7.50–12.70 (M=9.50) per cent, caudal 19.57–30.16 (M=26.25) per cent.

Caudal peduncle short and stout; its length 12.70–15.87 (M=14.60) per cent of standard length; its least height 66.67–88.89 (M=78.34) per cent of its length.

Colour: Pale brownish, whitish below. About 17–18 transverse brownish bands broader than interspaces on middle of sides neither extending to back or ventral side of body. Dorsal with

3 pale brownish bands across; a deep brown bar at caudal base; a black blotch at dorsal origin.

Size: Largest specimen examined 31.5 mm SL.

Affinities: *N. carletoni* is closely related to *N. doonensis;* it can be easily separated by the number of branched rays in dorsal (8 in *N. carletoni;* 7 in *N. doonensis*).

Range: India: Himachal Pradesh (Beas River Basin).

Material examined: India: Himachal Pradesh: Solan Dist. 37 specimens, NRS/ZSI/507, Bharati Village, near Sabathu, Coll. R. Tilak & Party, 25-xi-1976.

7. **Noemacheilus doonensis** Tilak & Hussain

(Fig. 5, Pl. 1)

1977. *Noemacheilus doonensis* Tilak and Hussain, *Sci. & Cult.*, **43** (3) : (Type locality: Dehra Dun, Uttar Pradesh).

Diagnosis: A small-sized *Schistura* of the *rupecola* group with 7 branched dorsal fin rays; a slightly emarginate caudal fin; incomplete lateral line ending between the tip of pectoral and origin of ventral fin; pre-dorsal part of body stippled with fine black dots; in the post dorsal region 12 broken bands on the back, extending to sides and 22–23 vertical dark stripes on sides.

Description: Based on 8 specimens, 23.50–32.0 mm SL from Nunhodi Jaintan Ghala, Dehra Dun (Yamuna drainage).

D. 3/7; P. 1/8; V 1/6–7; A. 3/5; C. 16.

A small-sized *Schistura* of uniform body depth; its depth 13.33–17.02 (M=14.81); head slightly broader than high at occiput; its length 21.31–25.93 (M=23.35) per cent of standard length. Snout obtuse, rounded, somewhat shorter than postorbital distance; its length 8.20–10.42 (M=9.46) of standard length, 35.71–45.45 (M=40.58) per cent of head. Eye small, situated almost in the middle of head, not visible from ventral surface; its diameter 13.79–22.73 (M=17.50) per cent of head length, 33.33–50.0 (M= 42.08) per cent of length of snout, 40.0–71.43 (M=58.42) per cent of interorbital width. Nostrils close to each other, situated closer to eye than to tip of snout, nasal flap prolonged. Mouth semicircular; lips fleshy, poorly furrowed, upper uninterrupted; lower interrupted in the middle. Dentiform process moderately developed. Barbels short, inner rostral shorter than outer; maxillary longer than outer rostral, extending to perpendicular from posterior border of eye.

Scales: Minute, inconspicuous except a row of 12 scales along lateral line. Lateral line incomplete ending midway between tip of pectoral and origin of ventral fins.

Fins: Dorsal fin small, less than head length; its origin equidistant between tip of snout and caudal base; origin of pelvic opposite to that of dorsal, or very slightly before. Pectoral shorter than head, extends about half distance to pelvic; Pelvic shorter than pectoral, separated from anus by a considerable distance. Anal fin not reaching base of caudal. Caudal fin shorter than head, slightly emarginate posteriorly.

Pre-dorsal distance 48.83–56.25 (M=53.07) per cent of standard length; pre-pelvic distance 50.00–55.21 (M=52.34) per cent; pre-anal 75.00–80.21 (M=62.59) per cent; distance from pectoral to pelvic origin 27.87–33.33 (M=31.15) per cent. Vent a short distance from anal fin; distance from vent to anal fin 4.17–17.24 (M=12.60) per cent in that between anterior origins of pelvic and anal fins. Pectoral 18.03–22.92 (M=19.97), pelvic 14.75–18.87 (M=17.41) per cent of standard length; height of dorsal 14.75–19.44 (M=17.94) per cent; of anal 12.26–16.67 (M=13.90) per cent; base of dorsal 11.48–16.04 (M=13.94) per cent; of anal 6.56–12.50 (M=9.74) per cent; caudal 18.03–22.22 (M=19.89) per cent.

Caudal peduncle short and stout; its length 12.50–16.67 (M=15.10) per cent of standard length; its least height 52.63–92.31 (M=70.88) per cent of its length.

Sexual dimorphism: None.

Colour: Ground colour pale. Pre-dorsal part of body and head and its sides stippled with fine dots; 12 bands extending from back to lateral side of body on the post-dorsal part; 22–23 lateral vertical stripes, not continuous with bands on the back in the posterior regions of body. A dark spot at the anterior base of origin of dorsal; a dark band at base of caudal. A dark band across the middle of dorsal fin rays; other fins stippled with dark spots.

Size: Largest specimen examined 32.0 mm SL.

Affinities: *N. doonensis* is closely related to *N. carletoni*. The two can be easily separated by the number of branched dorsal fin rays (7 in *N. doonensis*; 8 in *N. carletoni*).

Range: *India:* Dehra Dun.

Material examined: *India:* Uttar Pradesh: 4 specimens, NRS/

ZSI, uncatalogued, Nunnadi, Jaintan Ghala, Dehra Dun, Coll. A. Hussain, 2-xi-1965. 4 specimens, NRS/ZSI, uncatalogued, Baldi stream, Sahasradhara ,Dehra Dun, Coll. A. Singh, 19-vii-1966.

8. **Noemacheilus devdevi,** Hora

(Fig. 7, Pl. 1)

1935. *Nemachilus devdevi* Hora, *Rec. Indian mus.*, **37,** p. 54 pl. 3, fig. 506 (Type locality: Eastern Himalayas; small streams below Darjeeling and in Sikkim).

1974. *Noemacheilus devdevi*, Menon, *Inl. Fisheries Soc. India*, special publication, **1**: 55.

Diagnosis: A slender small-sized *Schistura* species with 8 branched dorsal fin rays; incomplete lateral line; lunate caudal fin; body marked with 4–6 saddle shaped bands extending from back to the sides.

Description: Based on 10 specimens, 18.0–27.50 mm SL from Sevoke stream, Teesta Valley.

D. 3/8; P. 19; V 1/6; A. 2/5; C. 16.

A slender, small-sized species, the dorsal profile slightly arched, ventral almost straight and horizontal. Ventral surface in front of anal opening flattened; paired fins horizontally placed. Depth of body 13.89–18.60 (M=16.21); head narrow, broadly pointed, depressed; its length 23.64–26.92 (M=25.25) per cent of standard length. Snout of moderate length, equal to postorbital distance; its length 8.33–11.63 (M=9.79) of standard length; 33.33–47.6 (M=38.91) per cent of head. Eye small, situated in the middle of head, not visible from ventral surface; its diameter 25.0–33.3 (M=28.62) per cent of head length; 60.0–100.0 (M=74.45) per cent of length of snout, 75.0–100.0 (M=88.99) per cent of interorbital width. Nostrils close to each other, situated closer to eye than to tip of snout, anterior tubular. Mouth semicircular; lips moderately fleshy, poorly furrowed, upper uninterrupted, lower interrupted in middle. Dentiform process moderately developed. Barbels well developed; inner rostral shorter, outer rostral and maxillary subequal, outer rostral extending to margin of eye or falling a little shorter; maxillary extending to posterior border of eye.

Scales: Small, indistinct, more towards posterior part of body, absent on ventral surface. Lateral line incomplete, terminating above pelvic fin.

Fins: Dorsal small, less than length of head; edge of dorsal

almost straight; origin of dorsal fin nearer to base of caudal than to tip of snout; origin of pelvic almost opposite to that of dorsal or slightly behind. Pectoral somewhat shorter than length of head, extends for more than half distance to base of pelvic. Pelvic shorter than pectoral, reaches anal opening. Anal fin not reaching base of caudal. Caudal lunate.

Pre-dorsal distance 51.16–55.77 (M=53.06) per cent of standard length; pre-pelvic distance 51.16–53.85 (M=52.25) per cent; pre-anal 74.42–80.56 (M=76.43) per cent; distance from pectoral to pelvic origin 27.91–30.91 (M=29.55) per cent. Vent a short distance from anal fin; distance from vent to anal fin 15.38–22.73 (M=18.51) per cent in that between anterior origins of pelvic and anal fins. Pectoral 20.00–27.91 (M=24.32), pelvic 16.67–22.22 (M=19.94) per cent of standard length; height of dorsal 17.27–20.93 (M=18.95) per cent; of anal 16.36–23.61 (M=17.91) per cent; base of dorsal 16.35–23.61 (M=18.24) per cent; of anal 9.09–11.90 (M=10.38) per cent; caudal 19.05–26.92 (M=22.63) per cent.

Caudal peduncle short and stout, its length 13.89–20.93 (M=17.19) per cent of standard length; its least height 10.91–13.95 (M=12.66) per cent of its length.

Sexual dimorphism: None.

Colour: Body olivaceous, paler below with 4 to 6 broad saddle shaped bands extending from back to sides; dorsal fin marked with two series of black spots across its rays; a black spot at base of caudal.

Affinities: This species is quite distinct from the other members of the complex, *N. carletoni* and *N. doonensis*; it can be separated by its characteristic colouration. *Noemacheilus devdevi*, *N. carletoni* and *N. doonensis* form a complex of small-sized *Schistura* and may have evolved in small streams in the sub-Himalayas from a common ancestor close to the *rupecola* stock.

Range: Eastern Himalayas.

Material examined: India: Eastern Himalayas: Darjeeling: 22 specimens, ZSI F 11750/1, Rilli Stream, below Kalingpong, Coll. S. L. Hora, 22-v-1980. 26 specimens, ZSI F 11743/1, Sevoke Stream, March 1932. 61 specimens, ZSI F 11738/1, Sevoke Stream, below Railway Bridge, Coll. S. L. Hora, 7-vi-1930. 21 specimens, ZSI F 11736/1, Sevoke Stream, Teesta Valley, Coll. S. L. Hora, June 1930. 64 specimens, ZSI F 11744/1, Kalijhora Coll. S. L. Hora, 8-vi-1930. 10 specimens, ZSI F 11753/1, 14-v-1931 2 speci-

mens, ZSI F 11737/1, Teesta. 1 specimen, ZSI F 11747/1, Teesta Valley. 1 specimen, ZSI F 11735/1, River, below Darjeeling, Coll. Shaw & Shebbeare. 1 specimen, ZSI F 11746/1, Reang River, Coll. S. L. Hora, 10-i-1921. 10 specimens, ZSI F 11749/1, Mahananda River, Siliguri, Coll. D. C. Mukerjee, 20-iii-1932. 30 specimens, ZSI F 11745/1, Kalijhora Stream, Tista Valley, May 1937. 27 specimens, ZSI F 11748/1, Kalijhora Stream, Tista Valley, Coll. S. L. Hora, 12-iv-1933.

Sikkim: 1 specimen, ZSI F 11739/1, below Gangtok, 2000 ft., 25-i-1922.

2. *The beavani group*

A number of related species complexes of the subgenus *Schistura* may be assembled together in what may be called the *beavani* group. This group is considered more specialised than the *rupecola* group and is typified by a forked or somewhat deeply emarginate caudal fin.

Included under this group are the *kessleri*, *baluchiorum*, *horai*, *montanus*, *beavani*, *denisoni*, *kangjupkhulensis* and *sikmaiensis* complexes.

4. *The kessleri complex*

This complex includes the most generalised species of the *beavani* group. Their distribution is towards the periphery of distribution of the genus *Noemacheilus* and extends as far as East Iran (*N. kessleri*). Included in this complex are *kessleri* and *prashari* both characterised by absence of scales, 7 branched dorsal rays and short lateral line.

9. **Noemacheilus kessleri** Günther

(Fig. 1, Pl. 2)

1889. *Nemachilus kessleri* Günther, *Trans. Lin. Soc. London, (Zool)* **5:** 109 (Nushki, Pishin Lora River basin, Afghanistan).

1933 *Nemachilus kessleri*, Hora, *Rec. Indian Mus.*, **35:** 187, fig. 2, pl. v, fig. 3 (Nushki., Quetta and Pishin districts, Baluchistan).

1949. *Nemachilus kessleri*, Berg, *Ruby presnykhvod USSR i Sopredelnykh strau.* **2:** 877, fig. 623, (northern Baluchistan, eastern Iran and Kushka River).

1966. *Noemacheilus kessleri*, Banarescu and Nalbant, *Vidensk. Medd. dansk naturh. Foren.*, **129:** 171, fig. 11 and pl. 21, figs. 3, 4 (Ghazii

River, Helmand basin. Jannichel, Kabul basin, Quetta, Pishin Lora basin).

1980. *Noemacheilus kessleri*, Mirza, *Proc. 1st Pakistan Congr. Zool.*, p. 22 (Baluchistan, Iran and Afghanistan;Punjab excluded).

1981. *Schistura kessleri kessleri*, Mirza, Nalbant and Banarescu, *Bijd. Dierk.* ,**51** (1): 109, fig. 5 (Quetta, Pishin Lora basin; Panjgur on the Rakshan River, Hamun-Mashkel lake basin, Kalat in Central Brahui mountain range, Bodo River basin, inner drainage).

1981. *Noemacheilus* (*Schistura*) *kessleri*, Coad, *Nat. Mus. Nan. Hist.*, Ottawa, Pub. Zool., **14:** 14, 25 (Kabul, Pishin Lora and Helmand Seistan drianges).

Diagnosis: A small sized *Schistura* with 7 branched dorsal fin rays; body totally devoid of scales; forked caudal; short lateral line; without sexual dimorphism.

Description: Based on 2 specimens, 36.5 to 37.0 mm SL from Quetta.

D. 2/7; P. 10; V 1/7; A. 1/5; C. 18.

A slender moderately elongate species with body of uniform depth, dorsal profile slightly arched in front of dorsal, ventral straight and horizontal. Depth of body 14.19–15.07; head somewhat compressed, slightly broader than high at occiput; its length 22.60–24.32 per cent of standard length. Snout of moderate length, bluntly pointed, equal or slightly shorter than postorbital distance; its length 8.11–8.22 of standard length, 33.33–36.36 per cent of head. Eye small, situated almost in the middle of head, not visible from ventral surface; its diameter 13.89–15.15 per cent of head length; 41.67–45.45 per cent of inter-orbital width. Nostrils close to each other, situated closer to eye than to tip of snout, anterior nostril tubular. Mouth semicircular; lips moderately fleshy, poorly furrowed, upper not interrupted, lower interrupted in middle. Dentiform process well developed. Barbels well developed; inner rostral shorter, not extending to margin of eye; maxillary equal to outer rostral, extending to perpendicular from middle of eye.

Scales: None. Lateral line short, reaching above tip of pectoral fin.

Fins: Dorsal fin small, less than length of head; edge of dorsal straight; origin of dorsal equidistant between tip of snout and caudal base; origin of pelvic almost opposite to that of dorsal. Pectoral slightly shorter than head, extends about half way to pelvic base. Pelvic shorter than pectoral, not reaching anal opening Anal fin not reaching base of caudal. Caudal fin as long as or

slightly shorter than head, forked, lobes bluntly pointed, of equal length.

Pre-dorsal distance 51.35–54.79 per cent of standard length; pre-pelvic distance 52.70–53.42 per cent; pre-anal 75.68–76.11 per cent; distance from pectoral to pelvic origin 31.51–32.43 per cent. Vent a short distance from anal fin; distance from vent to anal fin 5.88–11.76 per cent in that between anterior origins of pelvic and anal fin. Pectoral 17.12–20.27 (M=18.70), pelvic 16.44–17.47 per cent of standard length; height of dorsal 12.33–14.86 per cent; of anal 13.51–16.44 per cent; base of dorsal 12.33–14.86 per cent; of anal 8.22–9.46 per cent; caudal 23.29–24.32 per cent.

Caudal peduncle short and stout; its length 12.33–14.86 per cent of standard length; its least height 77.27–94.44 per cent of its length.

Sexual dimorphism: None.

Colour: Body markings rather indistinct in preserved specimens; concentrated on back into 11 or 12 brownish vertical bands extending to a distance somewhat below the middle of the sides; a narrow blackish cross band at base of caudal; a deep black spot on the base of three anterior dorsal rays. Dorsal and caudal fins with two more or less indistinct oblique series of black spots.

Size: Largest specimen examined 37.0 mm SL.

Affinities: The morphology and the colour indicate this to be a member of the beavani species group. In that group it is closest to *N. prashari* Hora in colour pattern, in the incomplete lateral line and absence of sexual dimorphism. *N. kessleri* differs from *N. prashari* in the total absence of body scales; minute, indistinct scales present in *N. prashari*. Both evolved in isolation, *N. kesseleri* in northern Baluchistan and *N. prashari* in the North Eastern Frontier Province from a common ancestor.

Range: Pakistan: Northern Baluchistan: Quetta and Pishin districts (Pishin Lora basin); Panjgur on Rakshan (Hamun-i-Mashkel basin); Kalat in central Brahui mountain range (Bodo River basin), and Bolan Nasi Rivers.

Afghanistan: Nushki (Pishin Lora basin); Gazani River (Helmand basin).

Iran: Eastern Iran: Turkmenistan, probably a distinct subspecies, *N. kessleri turcomanus* (Nikolski, 1947).

Material examined: Pakistan: 2 specimens, ISBB 1359, Quetta.

10. **Noemacheilus prashari** Hora

(Fig. 2 & 3, Pl. 2)

1933. *Noemacheilus prashari*, Hora, *Rec. Indian Mus.*, **35:** 189 (Type locality: Pakistan: NWFP; a stream 300 yards north of Kohat city).

1963. *Noemacheilus punjabensis naseeri*, Ahmad and Mirza, *Pakistan J. Sci.*, **15:** 78, fig. 3 (Madyan stream at Madyan, Swat State).

1980. *Noemacheilus prashari*, Mirza, *Proc. 1st Pakistan Congr. Zool.*, p. 22 (NWFP, and Punjab).

1980. *Noemacheilus naseeri*, Mirza, *Proc. 1st Pakistan Congr. Zool.*, p. 24 (NWFP).

1981. *Schistura prashari*, Mirza, Nalbant and Banarescu, *Bijdr. Dierk.*, **51** (1): 121, fig. 40 (Swat River and Ali Masjid on Kabul River; the Haro River, a left tributary of the Indus excluded).

1981. *Schistura kessleri lepidocaulis* Mirza and Nalbant, in Mirza, Nalbant and Banarescu, *Bijdr. Dierk.*, **51** (1): 110, figs. 9–13 (Type locality: Parachinar, Basin of Kurram River; Sun Sakesar a left tributary of Indus opposite to Kurram).

Diagnosis: A small cylindrical *Schistura* species with forked tail; 7 branched dorsal fin rays; lateral line incomplete; body marked with 15–17 dark olive cross bars, descending from dorsal surface to the sides, not extending to ventral surface; caudal fin with two dark wavy bands at distal half.

Description: Based after Hora (1933).

D. 2/7; P. 9; V 7; A 2/5; C. 18.

A small cylindrical fish with both dorsal and ventral profiles slightly arched; ventral surface of head and body in front of ventral fins somewhat flattened. Depth of body 14.70–18.5 per cent; head small, broadly pointed anteriorly; its length 20.83–22.72 per cent of standard length. Height of head equal to width of head; its greatest width equal to length of head behind nostrils. Snout almost as long as postorbital distance. Eye small, dorso-lateral in the middle of head, not visible from ventral surface. Mouth small crescentic; lips fleshy anterior indistinctly fimbricated, posterior rugose, interrupted in the middle. Barbels well developed, maxillary slightly longer than the rostrals.

Scale: Minute, embedded in the skin. Lateral line incomplete, ending above base of ventral fin.

Fins: Commencement of dorsal fin almost opposite to that of ventral; it is nearer to base of caudal than to tip of snout. Pectorals shorter than head, separated from ventral by considerable

distance. Ventral fins similar to pectorals, not extending to anal opening. Caudal fin forked, upper lobe slightly longer. Least height of caudal peduncle 62.5–71.42 per cent of its own length.

Sexual dimorphism: None.

Colour: General colour greyish with cheeks and the opercular region yellowish. Body marked with 15–17 dark olive cross bands descending from dorsal surface to the sides, not extending to ventral surface. A darker interrupted band at base of caudal; a prominent dark spot at base of three anterior dorsal rays; an oblique band at middle of dorsal fin; two dark wavy bands across caudal fin in its distal half. Pectoral, ventral and anal fins pale yellow.

Size: Largest specimen known 49.5 mm TL.

Affinities: This species is closely related to *N. kessleri* known from Baluchistan (see above paragraph on affinities under *N kessleri*).

Range: Pakistan: N.W.F. Province: tributaries on the right bank of the Indus.

5. *The baluchiorum Complex*

Included in this complex are *baluchiorum*, *arafi*, *kohatensis* and *fascimaculatus* characterised by forked caudal, scaled body, and 7 or 8 branched dorsal rays. Its distribution is centred in Baluchistan and the right tributaries of the middle Indus. *N. baluchiorum* is probably a derivative of the stock which spread southwards during the glacial periods of the Pleistocene (see paragraph on affinities under *N. baluchiorum*).

11. **Noemacheilus baluchiorum** Zugmayer

(Fig. 4, Pl. 2)

1912. *Nemachilus baluchiorum* Zugmayer, *Ann. Mag. nat. Hist.*, (8): **10:** 599. (Type locality: Panjgur, Baluchistan).

1913. *Nemachilus baluchiorum*, Zugmayer, *Abh. K. Bayer. Akad. Wiss.*, **76:** 31 (Panjgur).

1933. *Nemachilus baluchiorum*, Hora, *Rec. Indian Mus.*, **35:** 185, pl. 5, figs. 6, 7 (Panjgur).

1969. *Noemacheilus harnaiensis* Mirza & Nalbant, in Mirza, Banarescu and Nalbant, *Pakistan J. zool.*, 1:89, pl. 2, figs. 4–6 (Harnai, Kaman Beji basin).

1970. *Noemacheilus baluchiorum*, Mirza, Banarescu & Nalbant, *Biologia*, Lahore, **16:** 48, figs. 1–3 (Panjgur).

1970. *Noemacheilus horai machensis* Mirza & Nalbant, in Mirza Banarescu & Nalbant, *Biologia*, Lahore, **16:** 54, figs. 7–9 (Mach River, tributary to the Bolan River, also Harnai, Kaman Beji basin).

1980. *Noemacheilus baluchiorum*, Mirza, *Proc. 1st Pakistan Congr. Zool.*, p. 22 (Baluchistan).

1980. *Noemacheilus anambarensis* Mirza, *Proc. 1st Pakistan Congr. Zool.*, p. 23 (Baluchistan).

1980. *Noemacheilus machensis*, Mirza, *Proc. 1st Pakistan Congr. Zool.*, p. 23 (Baluchistan).

1980. *Noemacheilus harnaiensis*, Mirza, *Proc. 1st Pakistan Congr. Zool.*, p. 23 (Baluchistan).

1981. *Schistura baluchiorum*, Mirza, Nalbant and Banarescu, *Bijdr. Dierk.*, **51** (1): 118 (Panjgur, lake Hamun-i-Mashkel basin, inner drainage of Baluchistan).

1981. *Schistura machensis*, Mirza, Nalbant & Banarescu, *Bijdr. Dierk.*, **51** (1): 116 (Bolan Nari basin).

1981. *Schistura anambarensis*, Mirza, Nalbant & Banarescu, *Bijdr. Dierk.*, **51** (1): 118 (Sasoe River at Khuzdar, Kolachi River basin).

1981. *Schistura harnaiensis*, Mirza, Nalbant & Banarescu, *Bijdr. Dierk.*, **51** (1): 119, (Harnai, Kaman Beji basin).

1981. *Noemacheilus* (*Schistura*) *baluchiorum*, Coad, *Nat. Mus., Nan. Hist.*, Ottawa, *Pub. Zool.*, **14:** 13, 25, (Helmand-Sistan drainage).

1981. *Noemacheilus* (*Schistura*) *prashari*, (nec Hora), Coad, *Nat. Mus. Nat. Hist.*, Ottawa, *Pub. Zool.*, **14:** 15, 25, (Helmand-Sistan age).

Diagnosis: A small-sized *Schistura* with slender body of almost uniform depth; pointed snout; 7 branched dorsal fin., incomplete lateral line; forked caudal; scaled body; suborbital pad present in males.

Description: Based on 3 specimens, 34.5–45.0 mm SL from Panjgur on Rakhshan River, Baluchistan.

D. 2/7; P. 10; V 1/7; A. 2/5; C. 18.

A slender, moderately elongated species, with dorsal profile slightly convex, ventral straight and horizontal. Depth of body 16.67–20.83 (M=18.30) ;head slightly compressed, as high as broad or slightly broader than high at occiput; its length 23.19–25.0 (M=24.03) per cent of standard length; snout long and pointed; its length 9.42–10.0 (M=9.71) of standard length; 38.89–41.86 (M=40.46) per cent of head; eye small, situated in the middle of head, not visible from ventral surface; its diameter

12.50–18.60 (M=15.92) per cent of head length, 30.77–40.44 (M=39.36) per cent of length of snout; 50.0–80.0 (M=61.52) per cent of inter-orbital width. Nostrils close to each other, situated closer to eye than to tip of snout; anterior nostril broad and slightly tubular. Mouth semicircular; lips moderately fleshy, deeply furrowed, upper three lobed fitting into grooves of base of barbels, lower faintly interrupted in middle, not separated, broadened laterally and papillated. Dentiform process moderately developed. Barbels well developed; inner rostral shorter, outer rostral longer than maxillary extending to margin of eye; maxillary extending almost to posterior border of eye.

Scales: Small, imbricate all over body, absent ventrally. Lateral line incomplete, its extent variable, marked up to middle of dorsal fin (in one it extends to above ventral and thence interrupted ending above anal).

Fins: Dorsal fin small, slightly less than length of head; edge of dorsal slightly concave; origin of dorsal fin somewhat nearer caudal base than tip of snout; origin of pelvic slightly behind that of dorsal. Pectoral shorter than head, extends about two thirds of distance. Pelvic shorter than pectoral separated from anal opening by a very small distance. Anal fin not reaching base of caudal. Caudal fin forked, upper lobe longer than lower.

Pre-dorsal distance 53.33–56.23 (M= 54.40) per cent of standard length; pre-pelvic distance 52.22–59.72 (M=56.15) per cent; pre-anal 75.56–83.33 (M= 79.29) per cent; distance from pectoral to pelvic origin 27.22–34.03 (M=31.53) per cent. Vent a short distance from anal fin; distance from vent to anal fin 6.67–15.56 (M= 11.71) per cent in that between anterior origins of pelvic and anal fins. Pectoral 18.84–20.83 (M= 20.08), pelvic 15.94–18.06 (M=17.26) per cent of standard length., height of dorsal 17.39–22.78 (M=20.33) percent, of anal 14.44–16.67 (M=15.44) per cent; base of dorsal 13.89–15.28 (M=14.55) per cent; of anal 8.33–9.42 (M=8.93) per cent; caudal 18.89–27.78 (M=22.32) per cent.

Caudal peduncle short and stout; its length 9.42–13.33 (M= 11.98) per cent of standard length; its least height 83.33–100.0 (M=91.67) per cent of its length.

Sexual dimorphism: Males with suborbital flap; second pectoral ray somewhat thickened and broadened.

Colour: Body colour pattern highly variable, usually with 9–14 brownish vertical bands reaching from back to ventral side; some of them interrupted or incomplete. An intense black vertical

stripe at base of caudal, sometimes interrupted, a black spot at base of first dorsal rays; two rows of somewhat indistinct spots on dorsal and three or four on caudal; other fins unspotted.

Affinities: *N. baluchiorum*, a species of *Schistura* that appears to be related to *N. fascimaculatus* Mirza and Nalbant from the Kohat Toy River. In the shortened lateral line and the colour pattern, especially, the inter-rupted nature of the vertical bands on body, the two species resemble each other very much. These characters, however, are subject to considerable variation from population to population in the case of *N. baluchiorum*. The slender body and pointed snout are exceptional to *N. baluchiorum* though the general morphology of the fish points to a relationship with *arafi* and *fasciatus* *N. baluchiorum* seems to have had an early divergence from the stock which gave rise to *arafi fasciatus* and *kohatensis*.

Just as *N. prashari* and *N. kessleri* have differentiated, *kessleri* in the south and *prashari* in the north, *N. baluchiorum* seems to have differentiated in the south the same way during early glacial period of the Pleistocene from the same ancestral stock that gave rise to the *arafi*-complex of species in the north.

Range: Pakistan: Baluchistan; Panjgur, Rakshan (Hamin-i-Mashkel basin), the Harnai River (Kaman Beji basin) the Anambar River (Nari-Bolan basin) and the Sesol River (Kolachi River basin), all in the inner drainage of Baluchistan.

Material examined: Pakistan: Baluchistan: 1 specimen, ISBB 1361, Panjgur, Rhakshan River. 1 specimen, ZMA 114. 720, Mach River 29°52 'N, 67°20'E), Coll. M. R. Mirza, 1964. 1 specimen, ISBB 2231, Harnai, Kaman Benji River Basin. 1 specimen ISBB 1363, Sasol River, Khuzdarr. 1 specimen ISBB 3452, (paratype of *S. machensis*) Harnai, Kaman Benji River basin. 1 specimen, ISBB 1942 (paratype of *S. anambarensis*), Anambar River, Lorali. 1 specimen ZMA 114. 460 (paratype of *N. harnaiensis*) Harnai, Kaman-Benji River drainage, Coll. M. R. Mirza.

12. **Noemacheilus arafi** Mirza and Banarescu

(Fig. 5, Pl. 2)

1981. *Schistura arafi* Mirza and Banarescu, *Bijdr. Dierk.*, **51** (1): 113, figs. 16–20, (Type locality: Zhob city in Zhob River basin).

1981. *Schistura curtistigma* Mirza and Nalbant (in part,) *Bijdr. Dierk.*, **51** (1): 115, (Type locality: Bannu on Kurram River, a right tributary of the upper Indus, NWFP, Pakistan).

1981. *Schistura macrolepis* Mirza and Banarescu (in part), in Mirza, Nalbant & Banarescu, *Bijdr. Dierk.*, **51** (1): 116, (Racki Munch, a small right tributary of Indus, upwards from the confluence of the Sutlej River).

1981. *Schistura afasciata* Mirza and Banarescu, *Bijdr. Dierk.*, **51** (1): 119, figs. 35–39, (Type locality: Havelian on the Dor River, left tributary of the Indus in northern Pakistan).

Diagnosis: A *Schistura* species with 8 branched rays; long lateral line reaching at least three quarters of caudal peduncle; forked caudal; 8–11 cross bars reaching almost ventral side; well marked sexual dimorphism.

Description: Based on 3 specimens, 29.5 to 67.0 mm SL from Bannu Kurram River, N.W.F.P. (1); Zhob city on Zhob River (1) and a small tributary of Indus at Racki Munch, Dera Ghazi Khan district (1).

D. 3/8; P. 1/9; V 1/6; A. 2/5; C. 18.

A small *Schistura* with dorsal profile slightly arched, ventral horizontal. Depth of body 14.49–16.95 (M=15.95); head slightly broader than high at occiput; its length 22.39–25.42 (M=23.67) per cent of standard length. Snout pointed, somewhat equal to postorbital distance; its length 9.70–11.86 (M=10.57) of standard, length, 43.33–46.67 (M=44.58) per cent of head. Eye small situated in the middle of head, not visible from the ventral surface; its diameter 16.67–25.0 (M=20.56) per cent of head length; 38.46–57.14 (M=46.15) per cent of length of snout, 75.0–88.89 (M=82.41) per cent of inter-orbital width. Nostrils close to each other, situated closer to eye than tip of snout. Mouth semicircular; lips fleshy, moderately furrowed, upper uninterrupted, lower interrupted in the middle. Dentiform process moderately developed. Barbels well developed; inner rostral shorter, outer rostral equal to maxillary extending to margin of eye; maxillary extending to perpendicular from middle of eye or almost to posterior margin of eye.

Scales: Small, non-imbricate, absent on back in front of dorsal fin. Lateral line complete reaching to base of caudal fin.

Fins: Dorsal fin small, less than length of head; edge of dorsal straight or slightly concave; origin of dorsal fin equidistant between the tip of snout and caudal base or sightly closer to the tip of snout than caudal base; origin of pelvic slightly behind that of dorsal. Pectoral slightly shorter than head, extends about half

way or almost two-thirds of distance to pelvic. Pelvic shorter than pectoral, reaching the anal opening. Anal fin not reaching the base of caudal. Caudal fin as long as or slightly shorter than head, forked, lobes of equal length.

Pre-dorsal distance 49.25–52.54 (M=51.32) per cent of standard length; pre-pelvic distance 55.93–56.72 (M=56.39) per cent; pre-anal 76.87–81.16 (M=79.23) per cent; distance from pectoral to pelvic origin 31.88–38.06 (M=34.61) per cent. Vent a short distance from anal fin; distance from vent to anal fin 13.79–27.59 (M=22.62) per cent in that between anterior origins of pelvic and anal fins. Pectoral 20.29–22.39 (M=21.29), pelvic 18.12–21.27 (M=19.91) per cent of standard length; height of dorsal 15.94–20.34 (M=18.31) per cent; of anal 13.04–16.95 (M=15.22) per cent; base of dorsal 15.22–17.80 (M=16.73) per cent; of anal 8.21–9.32 (M=8.74) per cent; caudal 21.74–23.88 (M=22.55) per cent.

Caudal peduncle short and stout, its length 14.93–15.94 (M=15.37) percent of standard length. Its least height 65.00–77.78 (M=71.84) per cent of its length.

Sexual dimorphism: Males with suborbital flap.

Colour: Body with 8–11 brownish cross-bars wider than interspaces, extending from back to almost the ventral surface. A black spot at the anterior base of the origin of dorsal fin; a dark stripe on caudal base; two rows of spots on dorsal, one or two on anal, three to five on caudal fin.

Size: Largest specimen examined 67.0 mm SL.

Affinities: N. arafi can be distinguished from the other related species by its complete lateral line (short or incomplete *N. kohatensis* and *N. fascimaculatus*).

Range: Pakistan: tributaries of the upper and middle Indus.

Material examined: Pakistan: one specimen, ZMA 116.442 (paratype of *N. arafi*) Zhob River, N.E.W.P. 1 specimen, ZMA 116443 (paratype of *S. curtistigma*) Kurram River at Bannu, right tributary to upper Indus River, Coll. M. R. Mirza. 1 specimen, ZMA 116.444 (paratype of *S. macrolepis*) Kham District, Dera Ghazi, Rachi Munh, small right tributary to Indus River, upwards from confluence with Sutlej River, Coll. M. R. Mirza.

13. **Noemacheilus kohatensis** (Mirza & Banarescu)

(Fig. 6, Pl. 2)

1981. *Schistura kohatensis* Mirza and Banarescu, in Mirza, Nalbant and Banarescu, *Bijdr. Dierk.*, **51** (1): 123, figs. 46–50 (Type locality: Hangu, Kohat District, on the Kohat Toi River, a right tributary of the Indus).

Diagnosis: A small-sized *Schistura* species with 8 branched dorsal fin rays, incomplete lateral line ending below dorsal fin; forked caudal; 10 to 12 regular cross-bars extending below lateral line; well marked sexual dimorphism.

Description: Based on 2 specimens, 21.5 and 27.0 mm SL from Kohat Toi River at Hangu, Pakistan.

D. 3/8; P. 1/9; V 1/7; A. 3/5; C. 18.

A small species of *Schistura* of uniform depth, dorsal profile slightly raising from tip of snout to nape, straight beyond; ventral horizontal and straight throughout. Depth of body 14.81–17.44; head wider than high at occiput; its length 25.93–27.91 per cent of standard length. Snout fairly long, blunt, somewhat equal or slightly shorter than postorbital distance; its length 11.11–11.63 of standard length, 41.67–42.86 per cent of head. Eye moderately big, dorso-lateral, situated in the middle of head, not visible from ventral surface; its diameter 25.0 per cent of head length, 58.33–60.0 per cent of length of snout; 87.50–100.0 per cent of interorbital width. Nostrils close to each other, situated closer to eye than to tip of snout. Mouth semicircular; lips moderately fleshy, furrowed, upper uninterrupted, lower interrupted in the middle. Dentiform process moderately developed. Barbels well developed, inner rostral shorter, outer rotral longer than maxillary not extending to margin of eye; maxillary extending to perpendicular from a little beyond middle of eye.

Scales: Minute, imbricate posteriorly, anteriorly present along lateral line but absent on back in front of dorsal fin and on belly in front of ventral fin. Lateral line incomplete, ending below anterior or middle part of base of dorsal fin.

Fins: Dorsal fin small, less than length of head; edge of dorsal straight; origin of dorsal fin equidistant between tip of snout and caudal base; origin of pelvic slightly behind that of dorsal. Pectoral shorter than head, extends about two-thirds of distance to pelvic. Pelvic shorter than pectoral, reaching anal opening. Anal fin almost reaching base of caudal. Caudal fin as long as or slightly shorter than head, forked, lobes pointed, of equal length.

Pre-dorsal distance 53.70–55.81 per cent of standard length; pre-pelvic distance 57.41–58.14 per cent; pre-anal 81.40–81.48 per cent; distance from pectoral to pelvic origin 34.26–34.88 per cent. Vent a short distance from anal fin; distance from vent to anal fin 19.23–20.00 per cent in that between anterior origins of pelvic and anal fins. Pectoral 23.15–23.26, pelvic 18.52–18.60 per cent of standard length; height of dorsal 18.60–20.37 per cent; of anal 15.74–16.28 per cent; base of dorsal 13.89–15.11 per cent; of anal 8.33–11.62 per cent; caudal 25.58–25.92 per cent.

Caudal peduncle short and stout, its length 12.96–13.95 per cent of standard length; its least height 71.42–83.33 per cent of its length.

Sexual dimorphism: Males with suborbital flap; 2nd pectoral fin ray thickened.

Colour: Body light whitish grey with 10 to 12 regular cross-bars wider than the light interspaces extending from back to below lateral line, not reaching ventral surface. An intensive dark bar at base of caudal fin. A blackish blotch at the anterior origin of dorsal fin; two rows of indistinct spots on dorsal fin; irregular spots forming four or five bars on the caudal fin.

Size: Largest specimen examined 27.0 mm SL.

Affinities: This species is closely related to *N. fascimaculatus*, both endemic to Kohat Toy River. It differs from *N. fascimaculatus* in the number of branched dorsal fin rays (7 in *N. fascimaculatus;* 8 in *N. kohatensis*).

Range: Pakistan: Kohat Toy River, a right tributary of the upper Indus.

Material examined: Pakistan: 2 specimens, ZMA 116.446 (paratypes), Hangu, Kohat District.

14. **Noemacheilus fascimaculatus** (Mirza & Nalbant)

(Fig. 7, Pl. 2)

1981. *Schistura fascimaculata* Mirza and Nalbant, *Bijdr. Dierk.*, **51** (1): 121 (Type locality: Hangu, Kohat District on the Kohat Toi River).

Diagnosis: A small size *Schistura* species with 7 branched dorsal fin rays; short lateral line reaching only above tip of pectoral; forked caudal; 11–15 short brownish cross-bars across the middle of the sides; well marked sexual dimorphism.

Description: Based on 2 specimens 21.5 and 24.5 mm SL. from Kohat Toi River, at Hangu, Pakistan.

D. 3/7; P. 1/9; V 1/6; A. 2/5; C. 18.

A small-sized loach with dorsal profile convex from tip of snout to nape, horizontal beyond; ventral profile straight and horizontal. Depth of body 11.63–13.27; head slightly broader than high at occiput; its length 24.49–25.58 per cent of standard length. Snout of moderate length, blunt, narrower anteriorly, shorter than postorbital distance; its length 9.18–10.47 per cent of standard length; 37.50–40.91 per cent of head. Eye small, situated in the middle of head, not visible from the ventral surface; its diameter 22.73–25.00 per cent of head length; 55.56–66.67 percent of length of snout; 75.0–83.33 percent of inter-orbital width. Nostrils somewhat distant from one another, situated closer to eye than to tip of snout. Mouth semicircular; lips fleshy, furrowed, anterior one uninterrupted, lower interrupted in the middle. Dentiform process moderately developed. Barbels well developed; inner rostral shorter, outer equal to maxillary, not extending to margin of eye; maxillary extending to perpendicular from beyond middle of eye.

Scales: Minute, isolated, present only on the caudal peduncle. Lateral line short, reaching only above tip of pectorals.

Fins: Dorsal fin small, less than length of head; edge of dorsal straight; origin of dorsal fin equidistant between tip of snout and caudal base or somewhat nearer to caudal base than to tip of snout; origin of pelvic slightly behind that of dorsal. Pectoral shorter than head, extends about half distance to pelvic. Pelvic shorter than pectoral, extends beyond anal opening. Anal fin not reaching base of caudal. Caudal fin as long as or slightly shorter than head, forked, lobes pointed and of equal length.

Pre-dorsal distance 55.81–57.14 per cent of standard length; pre-pelvic distance 58.14–58.16 per cent; pre-anal 72.09–81.63 per cent; distance from pectoral to pelvic origin 32.56–33.67 per cent. Vent a short distance from anal fin; distance from vent to anal fin 15.38–18.18 per cent in that between anterior origins of pelvic and anal fins. Pectoral 20.93–23.47, pelvic 16.28–18.37 per cent of standard length; height of dorsal 17.35–20.93 per cent; of anal 16.33–17.44 per cent; base of dorsal 12.24–16.28 per cent; of anal 11.22–13.95 per cent; caudal 20.93 per cent.

Caudal peduncle short and stout, its length 13.27– 13.95 per cent of standard length; its least height 75.00–92.31 per cent of its length.

Sexual dimorphism: Male with suborbital flap; 2nd and 3rd pectoral fin rays thickened.

Colour: Ground colour greying with 11–15 brownish cross-bars in the middle of sides; a few spots not corresponding to lateral cross-bars on the back; blackish dots all over the sides, not extending to the ventral side. A dark spot at the base of the anterior dorsal fin rays; an oblique stripe on the longest ray of the caudal fin; one or two rows of spots on the caudal fin.

Size: The largest specimen examined 24.5 mm SL.

Affinities: This species is most closely related to *N. kohatensis*, both endemic in Kohat Toy River.

Range: Pakistan: Kohat Toy River, a right tributary of the upper Indus.

Material examined: Pakistan: Kohat District: 1 specimen, ZMA 116.445 (paratype of *N. fascimaculatus*), Kohat Toi River at Hangu, Coll. M. R. Mirza, Dec. 1974.

6. *The horai complex*

Included in this assemblage are *horai* and *himachalensis* whose centre of distribution extends from the Beas basin to Chenab in the Punjab Himalayas.

15. **Noemacheilus horai** Menon

(Fig. 1, Pl. 3 & Fig. 3 & Pl. 16)

1951. *Nemachilus horai* Menon, *Rec. Indian Mus.*, **49** (2): 227, pl. 7, figs. 1 & 2 (Type locality: Kangra valley, Punjab, now in Himachal Pradesh).

1974. *Noemacheilus horai*, Menon, *Inl. Fisheries Soc. India*, special publication, **1:** 55 (Kangra valley, Punjab).

1977. *Noemacheilus horai*, Tilak and Hussain, *Zool. Jb Syst. Bd.*, **104:** 285 (Kangra valley).

1981. *Schistura curtistigma* Mirza and Banarescu (in part) in Mirza, Nalbant & Banarescu, *Bijdr. Dierk.*, **51** (1): 114 (Ravi River, Lahore).

1981. *Schistura shadiwalensis* Mirza & Nalbant in Mirza, Nalbant & Banarescu, *Bijdr. Dierk.*, **51** (1): 125, figs. 51–55 (Type locality: Shadiwal on the Chenab River, a tributary of the Sutlej River).

1981. *Schistura macrolepis* Mirza and Banarescu (in part), in Mirza, Nalbant & Banarescu, *Bijdr. Dierk.*, **51** (1): 116 (Shadiwal,

upper reach of the Chenab River, a tributary of the Sutlej River).

Diagnosis: A medium-sized *Schistura* with 8 branched dorsal fin rays; deeply forked caudal; complete lateral line; 4–5 broad vertical bands, restricted to posterior part of body; suborbital flap in males.

Description: Based on 4 specimens, 42.5 mm to 48.5 mm SL. from Tawi River (Chenab basin), Jammu.

D. 3/8; P. 1/10; V 7; A. 1/5; C. 19.

Body stoutly built with dorsal profile somewhat arched, ventral almost straight and horizontal. Depth of body 14.95–17.06 (M=16.21); head conical, almost as broad as high at occiput; its length 22.68–25.88 (M=24.51) per cent of standard length. Snout bluntly pointed, equal to postorbital distance; its length 8.76–10.23 (M=9.55), per cent of standard length, 36.36–40.91 (M=38.98) per cent of head. Eye small, dorso-lateral in position, situated at middle of head, not visible from ventral surface; its diameter 15.91–18.18 (M=17.51) per cent of head length, 41.18–50.0 (M= 45.02) per cent of length of snout; 58.33–72.73 (M=67.62) per cent of inter-orbital width. Nostrils close to each other, situated closer to eye than tip of snout, anterior tubular. Mouth semicircular; lips moderately fleshy, poorly furrowed, upper faintly interrupted with a median insertion, lower interrupted in the middle. Dentiform process moderately developed. Barbels well developed; inner rostral shorter, outer rostral equal to maxillary not extending to margin of eye; maxillary extending to perpendicular from middle of eye.

Scales: Small, imbricate all over, absent on ventral side. Lateral line complete.

Fins: Dorsal fin small, less than length of head, edge of dorsal straight, origin of dorsal fin equidistant between tip of snout and caudal base; origin of pelvic slightly behind that of dorsal. Pectoral slightly shorter than head, extends two-thirds of distance to pelvic. Pelvic shorter than pectoral, separated from anal opening by a short distance. Anal fin not reaching base of caudal. Caudal fin longer than head, deeply forked, lobes bluntly pointed and of equal length.

Pre-dorsal distance 47.42–51.76 (M=50.22) per cent of standard length; pre-pelvic distance 51.55–55.68 (M=54.20) per cent; pre-anal 76.29–81.18 (M=79.10) per cent; distance from pectoral to pelvic origin 27.32–31.52 (M=28.87) per cent. Vent a short distance from anal fin; distance from vent to anal

fin 18.75–23.40 (M=20.19) per cent in that between anterior origins of pelvic and anal fins. Pectoral 21.59—22.83 (M=22.11), pelvic 19.07–20.11 (M=19.63) per cent of standard length; height of dorsal 18.56–20.49 (M=19.78) per cent; of anal 15.46–16.47 (M=16.04) per cent; base of dorsal 15.29–19.02 (M=16.94) per cent; of anal 7.65–8.70 (M=8.28) per cent; caudal 23.71–28.26 (M=26.58) per cent.

Caudal peduncle short and stout; its length 12.13–14.89 (M=13.40) per cent of standard length; its least height 80.0–90.90 (M=83.70) per cent of its length.

Sexual dimorphism: Males with suborbital flap.

Colour: Four to five black bands broader than the whitish interspaces, behind dorsal fin. Body below middle of dorsal to head of uniform brown colour, lighter below lateral line.

Size: Largest specimen examined 48.5 mm SL.

Affinities: *N. horai* and *N. himachalensis* are tentatively recognised as forming a species complex. According to material presently available this species is quite distinct from *N. himachalensis* and can be easily recognised by its distinctive colouration, and 8 branched rays in the dorsal fin (7 in *N. himachalensis*).

Range: Punjab Himalayas: Beas and Chenab drainages.

Material examined: India: Himachal Pradesh: Kangra District: 1 specimen, ZSI F 637/2 (holotype of *N. horai*), Bener Khand, South of Kangra, Coll. S. L. Hora. 8 specimens ZSI F 638/2, (paratypes of *N. horai*), taken along with holotype. 1 specimen, ZMA 116.447 (paratype of *N. shadiwalensis*) Chenab River, at Shadiwal, right tributary of Sutlej River, Coll. M. R. Mirza, 7.i.1971.

Jammu and Kashmir: 4 specimens, SRS/ZSI, uncatalogued, Tawi River, Jammu, donar H. Raina.

16. **Noemacheilus himachalensis** sp. nov.

(Fig. 2, Pl. 16)

Diagnosis: A somewhat slender and elongated *Schistura* species with 7 branched dorsal rays; incomplete lateral line; pelvic separated from anal opening; deeply forked caudal; 8 to 11 dark transverse bands, narrower than interspaces and tapering below lateral line; no sexual dimorphism.

Description: Based on 3 specimens, 29.0—40.0 mm SL from Nadaun, Kangra Dt., Himachal Pradesh.

D. 3/7; P. 10; V 7; A. 1/5; C. 18.

Body elongated, dorsal profile rising very little from tip of snout to base of dorsal fin. Ventral surface flattened and almost horizontal. Depth of body 12.50–13.79 (M=13.20); head slightly broader than high at occiput; its length 21.25–25.86 (M=23.48) per cent of standard length. Snout of moderate length, bluntly pointed, almost equal to postorbital distance; its length 8.26–10.0 (M=9.26) per cent of standard length, 33.33–47.05 (M=39.88) per cent of head. Eyes small, situated in the middle of head, not visible from the ventral surface; its diameter 20.0–23.52 (M=21.64) per cent of head length; 50.00–60.00 (M=54.84) per cent of length of snout; 75.0–100.0 (M=85.0) per cent of inter-orbital width. Nostrils distinct from one another, situated closer to eye than to tip of snout. Mouth semicircular; lips moderately fleshy, poorly furrowed, upper uninterrupted, lower interrupted in the middle. Process dentiformes moderately developed. Barbels short and inner rostral shorter, outer rostral equal to maxillary, not extending to margin of eye; maxillary equal to outer rostral, extending to perpendicular from middle of eye.

Scales: Rudimentary, sparcely distributed, little evident except on hind part of trunk especially caudal peduncle. Lateral line incomplete ending before dorsal fin.

Fins: Dorsal fin small, less than length of head; edge of dorsal fin slightly concave; origin of dorsal fin almost equidistant between tip of snout and caudal base; insertion of pelvic slightly behind that of dorsal. Pectoral shorter than head, extends about half way to pelvic; pelvic shorter than pectoral, separated from the anal opening by some distance; anal fin not reaching base of caudal; caudal as long as or slightly shorter than head, deeply forked, lobes pointed and of equal length.

Pre-dorsal distance 50.0–55.17 (M=52.83) per cent of standard length; pre-pelvic distance 53.75–56.89 (M=54.93) per cent; pre-anal 76.25–79.31 (M=77.96) per cent; distance from pectoral to pelvic insertion 32.75–33.75 (M=33.27) per cent. Vent a short distance from anal fin; distance from vent to anal fin 15.75–19.23 (M=17.5) per cent in that between anterior origins of pelvic and anal fins. Pectoral 17.50–21.55 (M=19.12), pelvic 14.37–17.24 (M=15.53) per cent of standard length; height of dorsal 16.25–20.68 (M=18.42) per cent; anal 13.75–15.5 (M=14.47) per cent; base of dorsal 10.00–12.50 (M=11.23) per cent; of anal 6.25–10.34 (M=8.03) per cent; caudal 17.50-23.33 (M=20.50) per cent.

Caudal peduncle short and stout, its length 12.06–15.0 (M= 13.46) per cent of standard length; its least height 75.0–85.71 (M=78.57) per cent of its length.

Sexual dimorphism: None.

Colour: 8 to 11 transverse bands on body, narrower than interspaces and tapering below lateral line. A dark patch at base of caudal; fins unspotted.

Size: Largest specimen examined 40 mm SL.

Affinities: This species is tentatively grouped with *N. horai* into a species complex (see affinities under *N. horai*).

Holotype: 40 mm SL. Nadaun (Beas drainage) Kangra district, Himachal Pradesh, Coll. Sharma, SRS/ZSI F 566.

Paratype: 2, 29.0 and 30.0 mm SL., data as above, SRS/ZSI F 567

7 *The montanus Complex*

N. montanus and its relative *N. gangeticus* have their centre of distribution in the upper Ganges and the rivers of the Punjab Himalayas. They are characterised by lunate or forked caudal, 7 or 8 branched rays in the dorsal, complete lateral line and body marked by 10–12 broad black bands, the bands anterior to dorsal usually broken up into several narrow bands in adult specimens.

17. **Noemacheilus montanus** (McClelland)
(Fig. 6 & 7, Pl. 11)

1838. *Schistura montanus* McClelland, *J. Asiat. Soc. Beng;* **7,** 947, pl. 55, fig. 1 (Type locality: Mountain streams of Simla).

1839. *Schistura montanus* McClelland, *Asiat. Res.*, **19:** 304, 440, pl. 57, fig. 1.

1868. *Nemachilus montanus*, Günther, *Cat. Fish. Brit. Mus.*, **7:** 350 (Simla).

1878. *Nemachilus montanus*, Day, *Fish. India.*, p. 616, pl. 153, fig. 6 (Himalayas).

1889. *Nemachilus montanus*, Day, *Faun. Brit. Ind. Fish.* **1:** 230, (Himalays).

1924. *Nemachilus montanus*, Fowler, *Proc. Acad. nat. Sci. Philad.*, **76:** 72 (Mandi and River Sutlej near Ludhiana).

1951. *Nemachilus kangrae* Menon, *Rec. Indian Mus.*, **49** (2): 229, pl. 70, figs. 4 & 5, (Type locality: Kangra valley Punjab).

1974. *Nemachilus montanus*, Sehgal, *J. Bombay nat. Hist. Soc.* **70** (3): 466 (Mandi, Bilaspur, Chamba).

1974. *Nemachilus kangrae*, Sehgal, *J. Bombay nat. Hist. Soc.* **70** (3): 466 (Mandi, Bilaspur).

1974. *Noemacheilus kangrae*, Menon, *Inl. Fisheries Soc.India*, special publication, **1**: 55 (Kangra valley, Punjab).

1974. *Noemacheilus montanus*, Menon, *Inl. Fisheries Soc. India*, special publication, **1**: 56 (Simla and Kangra hills, Western Himalaas).

1977. *Nemachilus kangrae*, Tilak and Hussain, *Zool. Jb. Syst. Bd.*, **109**: 285 (Kangra valley, Mandi, Bilaspur).

1977. *Noemacheilus montanus*, Tilak & Hussain, *Zool. Jb. Syst. Bd.*, **104**: 285 (Simla, Kangra hills, Chamba, Mandi).

Diagnosis: A *Schistura* with 7 branched dorsal fin rays; pelvic not reaching anal opening; caudal emarginate or lunate; lateral line complete, body with 9–12 vertical bands, bands anterior to dorsal fin break up into numerous narrow bands.

Description: Based on 15 specimens, 26.0–59.0 mm SL from Sirali stream, Koti, Himachal Pradesh.

D. 3/7; P. 1/6; V 7; A. 1/5; C. 18.

Body much elongated, of uniform depth, dorsal profile rising very little from tip of snout to base of dorsal fin, ventral almost horizontal. Depth of body 11.36–16.67 (M=12.95); head slightly broader than high at occiput, depressed; its length 22.37–30.0 (M=24.87) per cent of standard length. Snout of moderate length, rounded, somewhat shorter than postorbital distance; its length 7.50–10.53 (M=9.26) per cent of standard length, 30.0–47.06 (M=37.31) per cent of head. Eye small, situated in the middle of head, not visible from ventral surface; its diameter 18.18–29.41 (M=24.0) per cent of head length, 50.0–83.33 (M=65.0) per cent of length of snout, 66.67–100 (M=89.16)per cent of inter-orbital width. Nostrils close to each other, situated closer to eye than to tip of snout. Mouth semicircular; lips moderately fleshy, deeply furrowed, upper uninterrupted, lower interrupted in the middle. Dentiform process well developed. Barbels well developed; inner rostral shorter almost as long as diameter of eye, outer rostral and maxillary longer than eye.

Scales: Minute, nonimbricate, more conspicuous posteriorly. Lateral line complete.

Fins: Dorsal fin higher than depth of body, less than length of head; its origin somewhat nearer to caudal base than to tip of snout; pelvic origin almost opposite to that of dorsal. Pectoral shorter than head, extends about half way to pelvic; pelvic shorter than pectoral separated from anal opening by a short distance; anal fin not reaching base of caudal; caudal fin shorter than head emarginate posteriorly.

Pre-dorsal distance 48.57–55.56 (M=52.37) per cent of standard length; pre-pelvic distance 50.00–56.47 (M=53.99) per cent; pre-anal 72.53–82.86 (M=77.73) per cent; distance from pectoral to pelvic origin 27.50–34.62 (M=31.06) per cent. Vent a short distance from anal fin; distance from vent to anal fin 4.55–18.18 (M=12.52) per cent in that between anterior origins of pelvic and anal fins. Pectoral 15.38–22.86 (M=19.66), pelvic 14.63–20.00 (M=17.19) per cent of standard length; height of dorsal 12.96–20.00 (M=16.38) per cent; of anal 12.96–16.67 (M=15.04) per cent; base of dorsal 11.43–15.38 (M=12.82) per cent; of anal 6.82–11.43 (M=8.70) per cent; caudal 17.31–29.41 (M=21.83) percent.

Caudal peduncle short and stout; its length 11.86–16.25 (M= 14.01) per cent of standard length; its least height 50.0–80.0 (M= 69.07) percent of its length.

Sexual dimorphism: Males with suborbital flap.

Colour: 10–12 black vertical bands broader than interspaces, encircling body; bands anterior to dorsal fin break up into numerous narrow bands in bigger specimens. Caudal with a black band at its base and a bar across each lobe. Dorsal with a black base and a black blotch at base of its first few rays; a dark bar across its centre.

Size: Largest specimen examined 59 mm SL.

Affinities: This is very close to *N. gangeticus* but is readily separated by the lesser number of branched rays in the dorsal fin (7 in *N. montanus;* 8 in *N. gangeticus*).

Range: Punjab Himalayas.

Remarks: In his *Fishes of India* Day did not include any reference to Günther's *Noemacheilus montanus* in the synonymy of this species, but added a long note at the end of the description to justify his conclusion. He stated thus:

"*Noemacheilus montanus* Günther, although closely resembling the typical specimens is not this species, but *Noemacheilus multifasciatus*. His description is from two specimens in the British Museum which are thus noted in the catalogue: Simla, *a, b*. Probably the typical specimens from the collection of the East India Company. This supposition, I consider incorrect: the specimens were from the collection of the East India Company but without any locality attached. McClelland (*Calcutta Journal Natural History* 1842,ii p. 573) enumerated the species he sent to Europe at that time, and the only loaches were:

1. *Cobitis boutanensis* and *C. marmorata:* and in the chronological list of the contributions to the Museum at the India House (see preface to the Catalogue of Mammalia, 1851) it will be seen that he only sent one collection. However, many fish from other parts were received at various periods, but as this species appears to be absent from Simla, I prefer confining McClelland's two names of Simla species to the two forms of loaches now found there, and, which agree moderately with his descriptions." By this statement evidenly Day had concluded that *N. montanus* of Gunther is in reality Day's *N. multifasciatus*.

However, a comparison of the descriptions of Gunther's *montanus* with that of Day's *N. multifasciatus* it becomes very clear that the species are not identical, for in the former "The pre-orbital terminates in a slight and obtuse projection situated below the eye, sometimes movable, sometimes hidden below the skin while the latter possess "No enlargement of the pre-orbital" The colouration of the two species is absolutely different. In Gunther's *montanus* the caudal and the dorsal fins are stated to possess a single row of spots while in *N. multifasciatus* the dorsal is provided with four bands of spots and an equal number are present on the caudal".

It is quite possible that Day had confused Gunther's *montanus* for the same authors *N. rupecola*, for Gunther's *N. rupecola* is not McClelland's *N. rupecola* but *N. multifasciatus* of Day.

Gunther's description of *N. montanus* does agree with typical specimens of this species from Simla. They also agree with Day's description of *N. montanus*. It is quite conceivable that in the collections forwarded to the Museum at the India House by the Asiatic Society of Bengal there were specimens of *N. montanus* from Simla which Gunther considered as typical specimens.

Range: India: Punjab Himalayas: Himachal Pradesh.

Material examined: India: Himachal Pradesh: 4 specimens, HAZFS/ZSI F 503, Kunikhud, near Kunihar, Solan, Coll. Dr. R.

Tilak & Party, 24.ii.1975. 1 specimen HAZFS/ZSI F 10280/1, a tributary of Giri stream on way to Ganga Khud, Simla. 10 specimens, HAZFS/ZSI, uncatalogued, Union of Tons and Yamuna Rivers at Haripur. 3 specimens, NRS/ZSI, uncatalogued. 14 specimens, MRS/ZSI FC No. 260, Sirli stream near Koti, Coll. R. Tilak, 25.v.1978. 4 specimens, NRS/ZSI F 13478, Sadhupul, Solan, Coll. H. S. Mehta, 13.iv.78. 2 specimens, ZSI F 1028, Simla. 1 specimen, NRS/ZSI, uncatalogued, New Chakki More, Solan, Coll. High Altitude Station, Solan. 64 specimens ZSI, uncatalogued, Kangra Valley.

18. **Noemacheilus gangeticus** sp. nov.

(Fig. 6, Pl. 12)

Diagnosis: A *Schistura* generally with 8 branched dorsal fin rays, rarely 7; pelvic separated from anal opening by a short distance; caudal forked; lateral line complete; body marked with 12 vertical bands, broader than interspaces; bands anterior to dorsal fin break up and form numerous narrow bands in some.

Description: Based on 21 specimens, 45.0–82.0 mm SL from Srinagar, Garhwal.

D. 2/(7)8; P. 11; V 1/7; A. 1/5; C. 18.

A slender, elongated species with dorsal profile almost slightly arched in front of dorsal; ventral profile almost straight and horizontal throughout. Depth of body 9.46–17.78 (M=13.34) head slightly broader than high at occiput; its length 19.70–25.0; (M=21.91) per cent of standardlength. Snout of moderate length, pointed shorter than postorbital distance; its length 6.33–11.11 (M=8.36) per cent of standard length, 33.33–45.45 (M=38.50) per cent of head. Eye small, situated somewhat in the anterior half of head; not visible from ventral surface; its diameter 11.76–23.08 (M=15.51) percent of head length, 33.33–60.0 (M=40.33) per cent of length of snout, 50.0-100.0 (M=67.06) per cent of interorbital width. Nostrils somewhat distinct from one another, closer to eye than to tip of snout; mouth semicircular; lips moderately fleshy, furrowed, upper uninterrupted, lower interrupted in middle. Dentiform process well developed. Barbels well developed; inner rostral shorter, outer rostral longer than maxillary, almost extending to margin of eye; maxillary extending to perpendicular from posterior border of eye.

Scales: Minute, distinct in posterior part of body, absent anteriorly in front of dorsal fin and on ventral side. Lateral line complete.

Fins: The dorsal fin small, less than length of head; edge of dorsal slightly concave; origin of dorsal fin almost equidistant between tip of snout and caudal base; pelvic origin slightly behind that of dorsal. Pectoral equal to head, extends about half way to pelvic; pelvics almost the same length as pectoral, separated from anal opening by a considerable distance. Caudal fin as long as or slightly shorter than head, forked, lobes pointed, upper shorter than lower.

Pre-dorsal distance 43.04–53.73 (M=51.13) per cent of standard length; pre-pelvic distance 36.59–59.70 (M=53.85) per cent; pre-anal 74.39–85.29 (M=80.11) per cent; distance from pectoral to pelvic origin 29.73–49.24 (M=33.59) per cent. Vent a short distance from anal fin; distance from vent to anal fin 9.52–19.23 (M=13.32) per cent in that between anterior origins of pelvic and anal fins. Pectoral 14.86–22.22 (M=17.76), pelvic 13.24–20.27 (M=16.34) per cent of standard length; height of dorsal 14.86–19.12 (M=16.94) per cent; anal 13.51–16.67 (M=15.49) per cent; base of dorsal 10.61–15.56 (M=12.20) per cent; of anal 5.41–8.89 (M=6.81) per cent; caudal 18.18–25.0 (M=20.69) per cent.

Caudal peduncle short and stout; its length 9.72–18.18 (M=11.98) per cent of standard length; its least height 50.0–87.50 (M=72.23) per cent of its length.

Sexual dimorphism: Males with suborbital flap.

Colour: Body marked with 12 vertical bands, broader than interspaces, usually bands anterior to dorsal fin break up and form numerous narrow bands; a black band at base of caudal; dorsal with a dark base and a black patch at its base anteriorly; dorsal and caudal fins with a single row of spots.

Affinities: Close to *N. montanus* (see above paragraph on affinities of *N. montanus*).

Holotype: 82.0 mm SL Alaknanda River (Ganges system), at Srinagar, Garhwal, U.P., SRS/ZSI F. 582.

Paratype: 40, 63.0–79 mm SL data as above. SRS/ZSI F.583.

Material examined: India: Western Himalayas: Dehra Dun: 5 specimens, NRS/ZSI, uncatalogued, Field collection No. 12, Dhamoka Nala, Haripur, Coll. A. Hussain, 11.vii.66. 10 specimens, NRS/ZSI, Baldi River, Sahasradara, 1967 28 specimens, NRS/ZSI, uncatalogued, Field collection No. 10, Maldevta, Coll. A. Hussain, 10.xi.1965. 1 specimen, NRS/ZSI, FF 301, Songi River,

Maldevta, Coll. T D. Soota, 10.xii. 1965. 3 specimens, ZSI, uncatalogued, stream near Sahastradhara, Coll. G. U Kurup, 5.xii.1961.

Gahrwal: 30 specimens, Birla Govt. Degree College Collections, uncatalogued, Srinagar, Coll. Prof. H.R. Singh, 1.x. 1982. 2 specimens, Birla Govt. Degree College F 5876/ F 5877/-, a small rivulet, 2000', Garhwal, Donor Prof. H.R. Singh. 1 specimen, Birla Govt. Degree College F 5878/-, Alaknanda River, Srinagar, Donor Prof. H.R. Singh. 1 specimen, Birla Govt. Degree College F 5879/-, Srinagar, Donor Prof. H.R. Singh.

8. *The beavani Complex*

The *bevani* complex has its centre of distribution in the Eastern sub-Himalayan ranges. The principal characters distinguishing the complex are their small size, the forked or deeply emarginate caudal fin, complete lateral line, 8 or 9 (*savona*) branched rays in the dorsal fin.

19. **Noemacheilus beavani** Günther

(Fig. 4 & 5, Pl. 13)

1869. *Nemachilus beavani* Günther, *Cat. Fish Brit. Mus.*, **7,** p. 350 (Type loca-lity: Kossye River).

1935. *Nemachilus beavani*, Hora, *Rec. Indian Mus.*, **37,** p. 63 (Eastern Himalayas).

1937. *Nemachilus beavani*, Shaw and Shebbeare, *J. Asiat. Soc., Bengal,* **3** (3): 70, fig. 66 (Northern Bengal).

1937. *Nemachilus beavani*, Menon, *J. Bombay. nat. Hist., Soc.*, **48** (3): 538, 542 (Kosi and Gola Rivers, Kumaon Himalayas).

1947. *Noemacheilus beavani*, Menon, *Inl. Fisheries Soc. India*, special publication, **1:** 53 (Assam, Eastern Himalayas and U.P.).

Diagnosis: A small *Schistura* species with 8 branched dorsal rays; complete lateral line; forked caudal; vertical bands broad and few in number.

Description: Based on 30 specimens, 21.5—31.5 mm SL from Sarada river, Tarakpur, Nainital, U.P

V 8; C. 19.

D. 3/8; A. 5/2; P. 10;

The dorsal profile gradually rises from the snout to the origin of dorsal fin, and beyond the dorsal it descends slowly to the base of caudal; the ventral profile is slightly arched in the abdominal

region. Depth of body 13.04–19.64 (M=16.31), width 12.14–17.3 (M=14.45) per cent of standard length; head slightly broader than high at occiput; its length 22.41–28.57 (M=25.10) per cent of standard length. Snout of moderate length, narrower anteriorly somewhat shorter than postorbital distance; its length 6.89–12.28 (M=8.99) per cent of standard length. Eye small, situated in the middle of head; its diameter 3.22–9.30 (M=5.84) per cent of standard length, 50.0–78.94 (M=62.70) per cent of length of snout, 50.0–100.0 (M=86.81) per cent of length of inter-orbital width. Nostrils close to each other, situated closer to eye than tip of snout. Mouth semicircular, lips fleshy, furrowed, upper uninterrupted, lower interrupted in middle. Dentiform process moderately developed. Barbels well developed; all longer than eye, maxillary longest.

Scale: Small inconspicuous, more prominent posteriorly, absent on ventral surface. Lateral line complete.

Fins: Dorsal fin short, less than head length, edge of dorsal straight; origin of dorsal fin midway between tip of snout and caudal base; pelvic origin slightly behind that of dorsal. Pectoral shorter than head extending more than half distance to pelvic; pelvic slightly shorter than pectoral, extending to anal opening; anal fin not reaching base of caudal; caudal slightly shorter than head, forked lobes pointed and of equal length.

Pre-dorsal distance 48.07–57.69 (M=53.37) per cent of standard length; pre-pelvic 50.0–61.53 (M=55.01) per cent; pre-anal 69.2–82.75 (M=76.17) per cent; distance from pectoral to pelvic origin 27.0–39.28 (M=33.8) per cent of standard length. Vent a short distance from anal fin; distance from vent to anal fin 12.5–33.0 (M=22.45) per cent in that between anterior origins of pelvic and anal fins. Pectoral 14.28–25.58 (M=18.70), pelvic 11.5–20.5 (M=16.11)per cent of standard length; height of dorsal 11.62–22.22 (M=17.94) per cent, anal 12.0–19.23 (M=15.86) per cent; base of dorsal 6.97–17.54 (M=14.52) per cent, of anal 5.35–12.28 (M=9.33) per cent; length of caudal 17.85–26.92 (M=22.16) per cent of standard length.

Caudal peduncle short and stout, its length 10.71–21.73 (M=14.67) per cent of standard length, its least height 7.40–15.38 (M=12.26) per cent of its length.

Colour: About 9 vertical bands, broader than interspaces; a dark band at base of caudal fin, broad and conspicuous. A row of dark spots on dorsal, 2< shaped bands on caudal.

Size: Largest specimen examined 42 mm SL.

Affinities: Though a member of the *beavani*-complex, *N. beavani* seems to be closer to *montanus*, adult *beavani* resembling the young *montanus*. *N. montanus* is a much larger species with bands anterior to the dorsal fin, breaking up into numerous narrow bands in adult. *N. beavani* can be immediately separated from *N. montanus* by the pelvic extending to the anal opening (in *montanus* it ends considerably in advance of the anal opening). From the rest of the members of *bevani*-complex, *beavani* is distinguished by its characteristic colouration. The members of the *beavani* complex apparently evolved in the Eastern Himalayas from the common ancestor which probably gave rise to *N. montanus* in the Punjab Himalayas.

Range: Himalayas; North Bengal to Kumaon and Garhwal through Nepal.

Material examined: India: Uttar Pradesh: 43 specimens, F 1481/2, Sarda R., Tanakpur, Coll. A.G.K. Menon, 5.ii.1949. 1 specimen, NRS/ZSI, uncatalogued, Song R., Maldevta, 10.xii. 1965. 10 specimens, ZSI F 11983/1, Dehra Dun.

Nepal: 4 specimens, ZSI F 1682/2, the Bagmati R., 5 miles down Pashpathinath temple, Katmandu.

20. **Noemacheilus scaturigina** (McClelland)

(Figs. 2 & 3, Pl. 3; Figs. 8 & 9, Pl. 13)

1839. *Cobitis* (*Schistura*) *scaturigina* McClelland, *Asiat. Res.*, **19:** 308, 443, pl. 53, fig. 6 (from a figure from Hamilton-Buchanas collection).

1839. *Cobitis* (*Schistura*) *subfusca* McClelland, *Asiat. Res.*, **19:** 308, 443, pl. 53, fig. 5 (upper Assam).

1839. *Schistura zonata* McClelland, *Asiat. Res.*, **19:** 308, 441, pl. 53, fig. 1 (Type locality: upper Assam).

1868. *Nemachilus subfuscus*, Günther, *Cat. Fisch. Brit. Mus.*, **7:** 351 (Assam).

1868. *Nemachilus scaturigina*, Günther, *Cat. Fish. Brit. Mus.*, **7:** 347 (Bengal).

1869. *Nemachilus mugah* Day, *Proc. Zool. Soc. Lond.*, p. 382 (Type locality: Cossye River at Midnapore).

1878. *Cobitis scaturgina*, Day, *Fish India*, p. 614.

1878. *Nemachilus zonatus*, Day (in part), *Fish India.*, p. 618, pl. 156, fig. 2.

1889. *Nemachilus zonatus*, Day (in part), *Faun. Brit. Ind. Fish.*, **1:** 233 (Jamuna and Ganges and other affluents, Bearbhoon, Assam and Orissa).

1935. *Nemachilus scaturigina*, Hora, *Rec. Indian Mus.*, **37**, pl. 3, p. 64, fig. 7–8, (Eastern Himalayas and Assam).

1935. *Nemachilus shebbearei* Hora, *Rec. Indian Mus.*, **37,** p. 52 (Type locality: Norhtern Bengal).

1968. *Noemacheilus sikmaiensis* (nec Hora), Banarescu & Nalbant, *Mitt. Hamburg Zool. Mus. Inst.* **65:** 334 (Janali River at Raimona, Bhutan).

1974. *Noemacheilus scaturigina*, Menon, *Inl. Fisheries Soc. India*, special publication, **1:** 58.

Diagnosis: A small elongated *Schistura* with 8 branched rays in the dorsal; forked caudal; complete lateral line; 9–12 dark vertical bands descending on the sides but not extending to ventral surface; suborbital flap in males.

Description: Based on 11 specimens, 21.0–49.0 mm SL from Kalizhora stream, Tista drainage, Darjeeling Himalayas.

D. 3/8; P. 10; V 8; A. 1/5; C. 19.

A small elongated species with both dorsal and ventral profiles almost straight and horizontal. The ventral surface somewhat flattened in front of ventral fins. Depth of body 13.16–20.34 (M= 17.54); head slightly broader than high at occiput, long, narrow and pointed anteriorly; its length 20.41–28.57 (M=24.70) per cent of standard length. Snout somewhat equal to postorbital distance; its length 7.14–10.53 (M=9.38) in standard length, and 33.33–44.44 (M=38.04) per cent of head. Eye small, situated in the middle of head, dorso-lateral in position, not visible from ventral surface; its diameter 15.63–23.08 (M=19.31) per cent of head length; 40.0–64.29 (M=51.02) per cent of length of snout; 41.67–75.0 (M=59.90) per cent of inter-orbital width. Nostrils close to each other, situated closer to eye than to tip of snout, anterior nostril slightly tubular. Mouth semicircular, lips moderately fleshy, poorly furrowed, upper uninterrupted, lower interrupted in the middle. Dentiform process moderately developed. Barbels well developed; inner rostral shorter, outer rostral and maxillary subequal; outer rostral extending to margin of eye; maxillary extending to perpendicular from posterior border of eye.

Scales: Small, imbricate, more prominent in the tail region, absent on the ventral surface. Lateral line complete.

Fins: Dorsal fin small, edge of dorsal straight; its origin equidistant between tip of snout and caudal base; origin of pelvic slightly behind that of dorsal. Pectoral longer than head, separated from the pelvic by a considerable distance. Pelvic shorter than pectoral, separated from the anal opening by a very short distance. Anal fin not reaching base of caudal. Caudal fin longer than head, forked, lobes pointed.

Pre-dorsal distance 43.88–52.38 (M=49.54) per cent of standard length; pre-pelvic distance 46.94–58.33 (M=52.83) per cent; pre-anal 69.39–80.0 (M=75.93) per cent; distance from pectoral to pelvic origin 26.32–32.14 (M=29.77) per cent. Vent a short distance from anal fin; distance from vent to anal fin 14.29–35.0 (M=21.13) per cent in that between anterior origins of pelvic and anal fins. Pectoral 21.55–25.0 (M=23.06), pelvic 14.29–20.83 (M=17.73) per cent of standard length; height of dorsal 17.35–24.58 (M=20.45) per cent; of anal 13.16–21.89 (M=15.98) per-cent; base of dorsal 15.52–19.64 (M=17.31) per cent; of anal 7.14–11.46 (M=9.23) per cent; caudal 13.27–28.81 (M=22.54) per cent.

Caudal peduncle short and stout; its length 13.27–18.75 (M=15.34) per cent of standard length; its least height 63.64–88.89 (M=77.73) per cent of its length.

Sexual dimorphism: Males with suborbital flap; 1st branched ray of pectoral thickened, upper surface tuberculated.

Colour: Body greyish above, olivaceous below with 9 to 12 dark vertical bands, broader dorsally, narrowing down on sides not extending to ventral surface. A narrow black bar on base of the caudal fin with one or two series of dots forming a V-shaped pattern on the fin itself. A black spot at base of anterior dorsal rays.

Affinities: A typical species of the group of small *Schistura* of eastern Himalayas close to *N. corica*, having a forked caudal, 8 branched rays in the dorsal fin and complete lateral line.

Range: Eastern sub-Himalayas.

Material examined: India: Darjeeling: ZSI F 11719/1. (holotype of *N. shebbeari* Hora), North Bengal, Coll. G. E. Shaw & E. O. Shebbeare. 7 specimens, ZSI F 11727/1, Sevoke stream, Teesta Valley, Coll. S.L. Hora, June, 1930. 1 specimen, ZSI F 11728/1, Sevoke stream, Coll. S.L. Hora, 1.vi. 1930. 10 specimens, ZSI F 11731/1, River below Darjeeling, Coll. Shaw & Shebbeare. 1 specimen, ZSI F 11729/1, Kalijhora stream, Tista Valley, Coll. S.L. Hora, 25, 28.v. 1934. 17 specimens, ZSI F 11730/1, Darjeeling, Coll. Shaw & Shebbeare.

Assam: 2 specimens, DZGU, uncatalogued, Beki River, Assam, Coll. S.C. Dey. 5 specimens, DZGU, uncatalogued, Upper Assam, Coll. S.C. Dey.

Nepal: 30 specimens, ZSI F 1600/2, Dhara Nellah. 29 specimens, ZSI F 1682/2, Bagmati River below Katmandu.

NEFA: 1 specimen, ZSI, uncatalogued, 4 miles S.W of Siggaon, Coll. S. Biswas, 29. viii. 1961

21. **Noemacheilus corica** (Ham. Buch.)

(Fig. 3, Pl. 12)

1822. *Cobitis corica* Hamilton-Buchanan., *Fish. Ganges*, p. 359, 395 (Type locality:Kosi River).

1839. *Schistura punctata* McClelland, *Asiat. Res.* (*Ind. Cyprinidae*) **19**, pp. 308, 442, pl. 54, fig. 4 (from Ham. Buchanan's Ms Drawing).

1839. *Acoura cinerea* Swainson, *Nat. Hist. Fish.*, **2**: 310.

1868. *Nemachilus corica*, Günther, *Cat. Fish. Brit. Mus.*, **7**: 361 (North-eastern Bengal, Assam).

1878. *Nemachilus corica*, Day, *Fish India*, p. 616, pl. 156, fig. 1 (N. Bengal, Punjab and Assam).

1889. *Nemachilus corica*, Day, *Faun. Brit. Ind. Fish.*, **1**: 229, (N.E. Bengal, Punjab and Assam).

1924. *Nemachilus corica*, Fowler, *Proc. Acad. nat. Sci. Philad.*, **76**: 70 (Beas, Sutlej basin and Mandi).

1937. *Nemachilus corica*, Shaw and Shebbeare, *J. Asiat. Soc. Begl*, **3** (3): 72, fig. 68 (Northern Bengal).

1971. *Nemachilus corica*, Tilak, *Rec. Zool. Surv. Ind.*, **65** (1–4): 186, 199–201, 208, figs. 2a, b, c, d (redescription).

1973. *Nemachilus corica*, Bhatnagar, *J. Inland Fish. Soc. Ind;* **5**: 135 (hill-streams as well as the Bhakra reservoir).

1974. *Nemachilus corica*, Seghal, *J. Bombay nat. Hist. Soc.*, **70** (3): 466 (Chamba, Mandi, Bilaspur).

1974. *Nemachilus corica*, Menon, *Inl. Fisheries Soc. India*, special publication, **1**: 54 (all along the Himalayas).

1977. *Noemacheilus corica*, Tilak and Hussain, *Zool. Jb. Syst. Bd.*, **104**: 284 (Bhakra, Chamba).

Diagnosis: A small *Schistura* with 8 branched fin rays; forked caudal; body marked with one or two longitudinal series of spots.

Description: Based on 8 specimens, 29.0–42.0 mm SL from confluence of the Yamuna River with the Tons at Haripur, Dehra Dun (2) and Girwa River at Baraich District, U.P. (6).

D. 3/8; P. 11; V 1/7; A. 2/5; C. 17

A small elongate *Schistura* of uniform depth with dorsal profile slightly arched, ventral almost straight and horizontal. Depth of body 14.74–22.02 (M=18.0); head slightly broader than high at occiput; its length 21.25–24.29 (M=23.02) per cent of standard

length. Snout of moderate length, rounded, shorter than postorbital length; its length 6.43–8.62 (M=7.89) in standard length, 28.13–36.36(M=34.28) per cent of head. Eye small, situated almost in the middle of head, not visible from the ventral surface; its diameter 15.0–24.24 (M=20.84) per cent of head length; 42.86–77.78 (M=61.32) per cent of length of snout; 50.0–80.0 (M=72.39) per cent of interorbital width. Nostrils close to each other, closer to eye than to tip of snout, anterior tubular. Mouth semicircular; lips fleshy, poorly furrowed, upper not interrupted, lower interrupted in the middle. Dentiform process well developed. Barbels well developed; inner rostral shorter, outer rostral longest; both outer rostral and maxillary extending to perpendicular from posterior border of eye.

Scales: Small, imbricate all over, more prominent posteriorly. Lateral line complete.

Fins: Dorsal fin small, slightly shorter than length of head, edge of dorsal slightly concave, origin of dorsal fin nearer tip of snout than caudal base; origin of pelvic slightly before that of dorsal in female, slightly behind in males. Pectoral longer than head, extends about two-thirds of distance to pelvic; second branched ray elongated. Pelvic shorter than pectoral separated from anal opening by a short distance. Anal fin not reaching base of caudal. Caudal fin as long as or slightly shorter than head, forked, lobes pointed and equal.

Pre-dorsal distance 47.50–52.56 (M=50.15) per cent of standard length; pre-pelvic distance 48.72–54.17 (M=51.01) per cent; pre-anal 73.08–79.31 (M=76.60) per cent; distance from pectoral to pelvic insertion 26.68–31.94 (M=28.92) per cent. Vent a short distance from anal fin; distance from vent to anal fin 17.65–30.77 (M=24.90) per cent in that between anterior origins of pelvic and anal fins. Pectoral 22.62–31.03 (M=25.96), pelvic 16.67–18.57 (M=17.56) per cent of standard length; height of dorsal 20.00–24.29 (M=21.54) per cent; of anal 14.10–17.95 (M=16.34) per cent; base of dorsal 16.67–20.14 (M=18.09) per cent; of anal 8.33–13.79 (M=10.03) per cent; caudal 17.95–28.57 (M=24.42) per cent.

Caudal peduncle long and stout; its length 13.89–18.13 (M=16.18) per cent of standard length; its least height 48.28–70.00 (M=58.28) per cent of its length.

Sexual dimorphism: Males with suborbital flap; pectoral fin rays thickened; tubercles on cheek and nape; first branched ray of pectoral very broad and well developed. Insertion of pelvic slightly before that of dorsal in females, behind in males.

Colour: Yellowish with a row of eleven round to oval spots along lateral line on each side and a similar row along the back, and descending to between them; usually a silvery band along middle side.

Size: The largest specimen examined 42 mm SL.

Affinities: A number of *beavani* complex and stands close to *N. scaturigina;* it can be distinguished by the distinctive colouration and by the much elongated second branched ray of the pectoral fin.

Range: All along the sub-Himalayan range, from Darjeeling through Nepal and Kumaon to Himachal Pradesh and Punjab (Sutlej basin).

Material examined: India: Uttar Pradesh: 7 specimens, ZSI F 1490, Sarda River at Tanakpur, Coll. A. G. K. Menon, 5.ii. 1949. 2 specimens, NRS/ZSI, uncatalogued, Union of Tons & Yamuna Rivers at Haripur, Dehra Dun, Coll. R. Tilak, 22.iii. 1978. 11 specimens, ZSI F 1601/2, Girwa River, Baraich District, Coll. A. G. K. Menon, 1949.

22. **Noemacheilus savona** (Ham. Buch.)

(Fig. 10, Pl. 13)

1822. *Cobitis savona* Hamilton-Buchanan, *Fish Ganges,* p. 357 (Type locality: Kosi River at Nathpur).

1839. *Schistura savona,* McClelland, *Asiat. Res.* (*Ind. Cyprinidae*) **19,** pp. 803, 442, pl. 53, figs. 3 (Reproduced from Hamilton-Buchanan's Ms Drawing).

1839. *Acoura obscura* Swainson, *Nat. Hist. Fish.,* **2:** 310

1868. *Nemachilus savona,* Günther, *Cat. Fish. Brit. Mus.,* **7,** p. 354 (Northern Bengal).

1878. *Nemachilus savona,* Day (in part), *Fish India,* p. 619.

1889. *Nemachilus savon,* Day (in part), *Faun. Brit. Ind. Fish.,* **1,** p. 234.

1935. *Nemachilus savona,* Hora, *Rec. Indian Mus.,* **37:** 56, pl. 3, figs. 3 & 4.

1974. *Noemacheilus savona,* Menon, *Inl. Fisheries Soc. India,* special publication, **1:** 57.

Diagnosis: A small, slender loach with 9 branched dorsal fin rays; caudal fin deeply emarginate with rounded lobes; 9 to 10 narrow, yellowish bands encircling the body.

Description: Based on 6 specimens, 20.5–24.0 mm SL from Girwa River, Katarnian Ghat, U.P.

D. 3/9; P. 9; V 7; A.2/5; C. 20.

A small, slender loach almost sub-cylinderical, with body somewhat pointed at both ends; dorsal profile slightly arched, ventral almost horizontal and straight throughout. Depth of body 14.63–17.39 (M=15.87); head narrow, pointed; its length 23.86–22.27 (M=25.78) per cent of standard length. Snout pointed, somewhat equal to postorbital distance; its length 9.09–9.78 (M=9.47) in standard length, 33.33–38.10 (M=36.86) per cent of head. Eye prominent, situated dorsolaterally in the middle of head, not visible from ventral surface; its diameter 16.67–28.57 (M=24.56) per cent of head length; 55.56–75.0 (M=68.98) per cent of length of snout, 66.67–100.0 (M=86.11) per cent of inter-orbital width. Nostrils close to each other, situated close to eye than to tip of snout, anterior tubular. Mouth semicircular; lips fleshy, furrowed, upper uninterrupted, lower interrupted in the middle. Barbels well developed; inner rostral slightly shorter than outer rostral; outer rostral equal to maxillary, extending to margin of eye; maxillary extending to perpendicular from posterior border of eye.

Scales: Small, imbricate all over body, prominent posteriorly. Lateral line complete.

Fins: Dorsal fin moderate, longest ray somewhat longer than depth of body below it; edge of dorsal straight; origin of dorsal fin nearer to tip of snout than to caudal base; origin of pelvic slightly behind that of dorsal. Pectoral shorter than head, extends two-thirds of distance to pelvic. Pelvic shorter than pectoral, separated from anal opening by a short distance. Anal fin not reaching base of caudal. Caudal fin as long as or slightly shorter than head, deeply emarginate with rounded lobes of equal length.

Pre-dorsal distance 48.78–51.14 (M=49.61) per cent of standard length; pre-pelvic distance 53.49–54.88 (M=54.17) per cent; pre-anal 75.61–81.82 (M=78.55) per cent; distance from pectoral to pelvic origin 29.06–31.25 (M=30.27) per cent. Vent a short distance from anal fin; distance from vent to anal fin 13.33–17.86 (M=16.31) per cent in that between anterior origins of pelvic and anal fins. Pectoral 19.57–24.42 (M=21.81), pelvic 18.48–20.83 (M=19.53) per cent of standard length; height of dorsal 16.67–22.09 (M=19.60) per cent; of anal 15.22–17.07 (M=16.30) per cent; base of dorsal 17.39–21.95 (M=19.37) per cent; of anal 9.38–14.63 (M=11.59) per cent; caudal 20.93–25.00 (M=23.07) per cent.

Caudal peduncle short and stout; its length 13.10–16.67 (M=14.55) per cent of standard length; its least height 58.33–91.67 (M=74.21) per cent of its length.

Sexual dimorphism: None.

Colour: Body marked with 9–10 narrow, yellowish bands, 4 in front of dorsal fin, 2 or 3 below and 3 or 4 behind; a vertical black band at base of caudal fin; fins usually devoid of markings, in some the caudal provided with one or two V shaped bands and rays of dorsal and anal marked with black dots in middle.

Size: The largest specimen examined 24.0 mm SL.

Affinities: A distinct species without any close affinity to any other species but in general nature of stripes on body it is close to *Schistura* group though there are several dissimilarities in colour, body and head shape and number of branched dorsal fin rays. (9 branched dorsal fin rays; 7 to 8 in other species of *Schistura*).

Range: Eastern Himalayas; Tista drainage at Darjeeling through Nepal to Karnali and Kali Drainages in U.P.

Material examined: India: Uttar Pradesh: 19 specimens, ZSI F 1443/2, Girwa River, Katarnian Ghat, Baraich District, U.P., Coll. A.G.K. Menon, 1948. 3 specimens, NRS/ZSI, Reh River, Lachhiwala, Dehra Dun.

9. *The denisoni Complex*

The *denisoni* complex has its centre of distribution in the Peninsular India. Included in this complex are *N. denisoni* and its relatives, *N. notostigma*, *N. nilgiriensis*, *N. kodaguensis*, *N. semiarmatus* and *N. striatus*. Their most pronounced tendency is towards a reduction in the extent of the lateral line (*N. semiarmatus* and *N. striatus* have lateral line complete) and the general increase in the body pigmentation. They constitute some of the most beautiful species of *Noemacheilus*.

23. **Noemacheilus denisoni denisoni** Day

(Figs. 3 & 4, Pl. 10)

1867. *Nemachilus denisoni* Day, *Proc. Zool. Soc. Lond.*, p. 287 (Type locality:Bhawany River, base of Nilgiris).

1868. *Nemachilus denisonii*, Günther, *Cat. Fish. Brit. Mus.*, **7**: 352 (Nilgiris).

1872. *Nemachilus chlorosoma* Day, *J. Asiat. Soc. Beng.* **41** (2): 186 & 188 (Bezawada).

1872. *Nemachilus denisonii*, Day, *J. Asiat. Soc. Beng.* **41** (2): 194.

1873. *Nemachilus chryseus* Day, *J. Linn. Soc.* (*Zool.*) **11**: 529.

1878. *Nemachilus denisonii*, Day (in part), *Fish. India*, p. 617, pl. 153, fig. 5.

1878. *Nemachilus beavani*, Day (nec Günther), *Fish ;ndia*, p. 620, pl. 156, fig. 8 (Bhavany River).

1889. *Nemachilus densonii*, Day (in part), *Faun. Brit. Ind. Fish.*, p. 231.

1889. *Nemachilus beavani*, Day (nec Gunther), *Faun. Brit. Ind. Fish.*, **1**: 234.

1940. *Nemachilus denisonii*, Hora, *Rec. Indian Mus.*, **42**: 373 (Mahanadi river, Raipur, M.P.).

1968. *Noemacheilus denisonii*, Banarescu & Nalbant (in part), *Mitt. Hamburg. Zool. Mus., Inst.*, **65**: 333, pl. 1, fig. 5 (Mucki, Balaghat, Madhya Pradesh, upper Narbada drainage).

1968. *Noemacheilus rendahli* Banarescu & Nalbant, *Mitt. amburg Zool. Mus. Inst.*, **65**: 336, pl. 1 fig. 8, figs. 5, 6 (Type locality: Nandur, Madhmeswar).

1968. *Noemacheilus altipedunculatus* Banarescu & Nalbant, *Mitt. Hamburg Zool. Mus., Inst.*, **65**: 337, pl. 1, fig. 10, figs. 7, 8 (Type locality: Mandurli, N. Canara).

Diagnosis: A species of *Schistura* with 8 branched dorsal fin rays; pelvic touching anal opening; caudal deeply emarginate; lateral line incomplete; body marked with varying number of brown bands, more distinct behind dorsal fin; no sexual dimorphism:

Description: Based on 50 specimens from Bhavany River, Cauvery basin, at Mettupalayam, the type-locality of the species.

D. 3/8; P. 11; V 7; A. 2/5; C. 18.

Body uniform depth, dorsal profile slightly arched, ventral almost straight and horizontal. Depth of body 14.28–21.05 (M= 16.29); width 10.4–18.9 (M=14.5); head almost as broad as deep at occiput; its length 12.79–27.25 (M=23.70); width 10.42–18.97 (M=14.53) per cent of standard length. Snout of moderate length, somewhat blunt, rounded, shorter than posterior portion of head; its length 14.28–21.05 (M=16.29) per cent of standard length; 34.44–72.73 (M=42.47) per cent of head. Eye small, situated in the middle of head, not visible from ventral surface; its diameter 3.57–7.02 (M=4.9) per cent of standard length, 33.33–80.0 (M= 49.9) per cent of snout, 44.4–100.0 (M=66.39) per cent of interorbital width. Nostrils close to each other, distinct from one another, closer to eye than tip of snout, anterior tubular. Mouth semicircular; lips moderately fleshy, lower furrowed, upper uninterrupted, lower interrupted in the middle. Dentiform process

moderately developed. Barbels well developed; thread-like, all almost as long as diameter of eye.

Scales: Small, imbricate posteriorly, closely set, not imbricate in the middle, scattered anteriorly. Lateral line incomplete ending in front of dorsal fin or slightly longer.

Fins: Dorsal fin small, almost as high as length of head, edge straight, origin equidistant between tip of snout and caudal base or slightly nearer tip of snout; pelvic origin slightly behind that of dorsal. Pectoral shorter than head, separated from pelvic by a short distance. Pelvic shorter than pectoral, reaches anal opening. Anal fin reaches base of caudals. Caudal fin as long as head, deeply emarginate, lobes rounded.

Pre-dorsal distance 22.5–55.5 (M=44.0) per cent of standard length; pre-pelvic distance 48.0–55.5 (M=52.6) per cent; pre-anal 45.8–86.8 (M=73.41) percent; distance from pectoral to pelvic origin 20.8–28.0 (M=23.8) per cent of standard length. Vent a short distance from anal fin; distance from vent to anal fin 17.3–41.6 (M=23.6) per cent in that between anterior origins of pelvic and anal fins; pectoral 16.4–22.9 (M=19.5), pelvic 13.0–22.9 (M=16.6) percent of standard length; height of dorsal 15.7–29.5 (M=23.5) per cent; anal 14.4–19.6 (M=16.65) per cent; base of dorsal 11.3–25.4 (M=16.4) per cent; of anal 5.2–10.4 (M=8.1) per cent; caudal 17.7–29.6 (M=23.4) per cent.

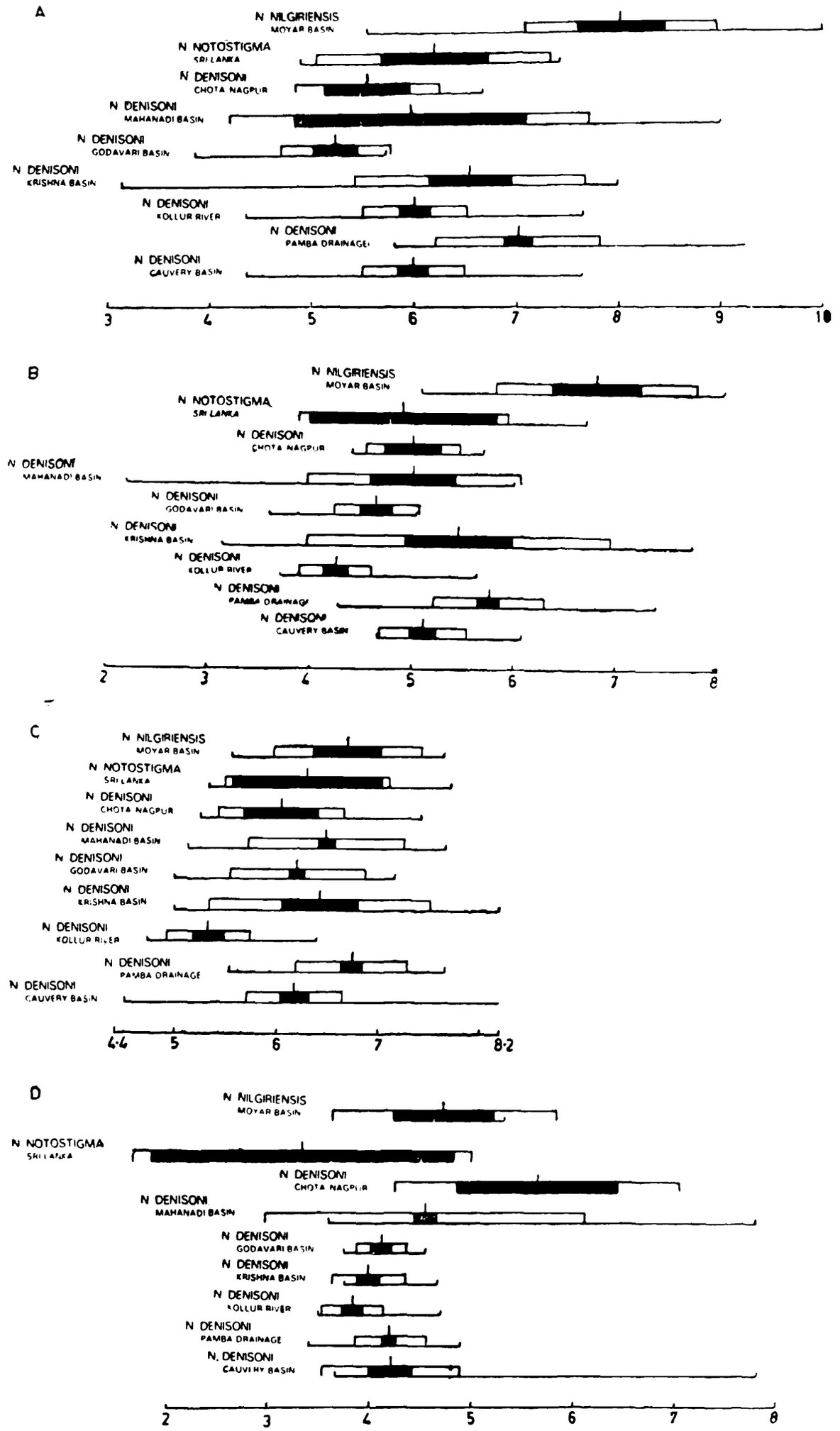
Caudal peduncle short and stout; its length 11.4–22.2 (M=14.26) per cent of standard length; its least height 11.1–16.8 (M=13.4) per cent of its length.

Sexual dimorphism: None.

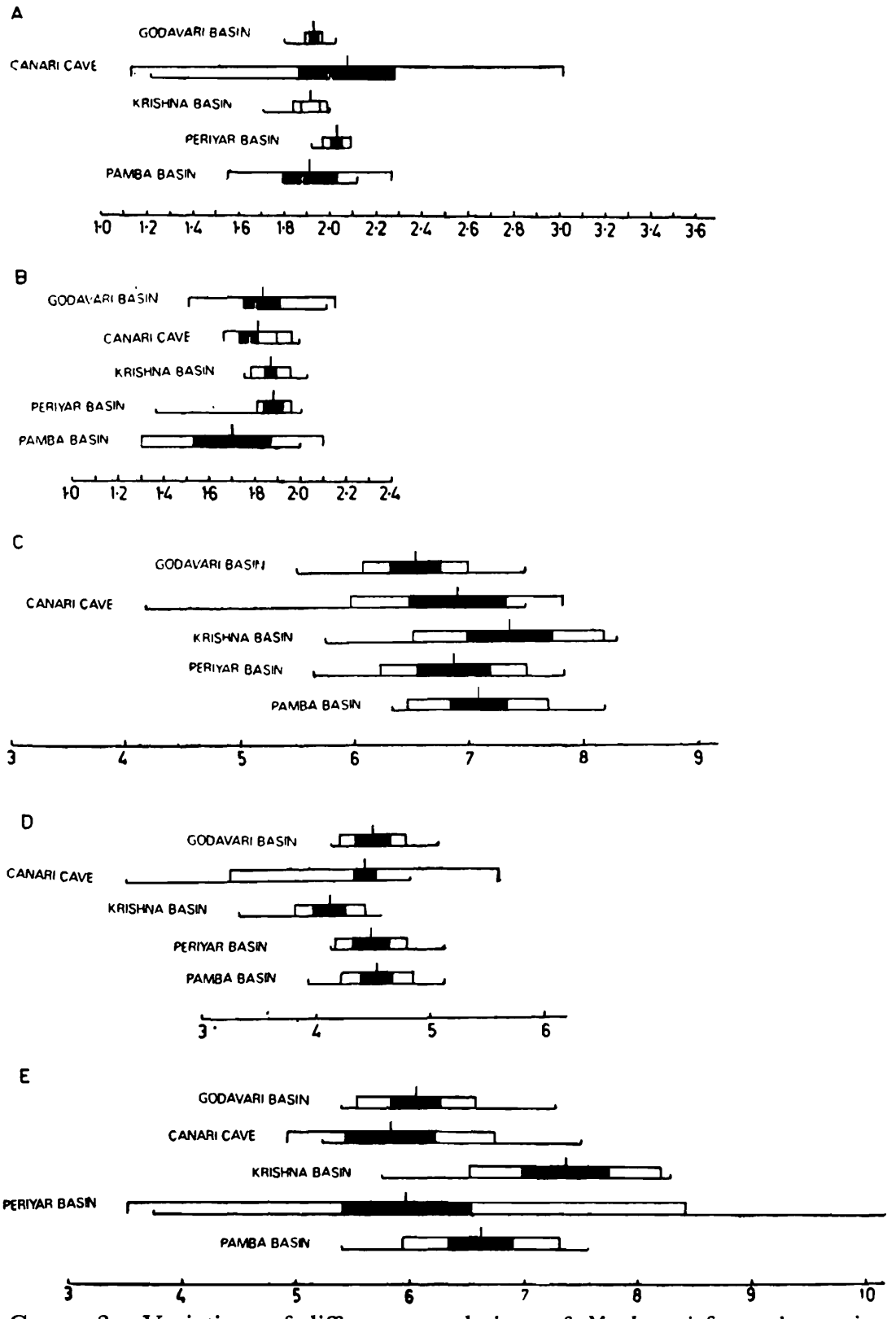
Colour: The number of brown bands extending from dorsal to ventral surface of body variable; in some cases the bands totally absent on side; bands broader than light interspaces, better marked behind dorsal fin. A blackish band at base of caudal fin; a blackish spot at base of dorsal origin; the dorsal and caudal banded with varying rows of well marked brownish spots, other fins unspotted.

Size: Maximum length examined 51.1 mm SL.

Affinities: Closely related to species of *denisoni* complex distinguished from its Chota Nagpur representative, *N. denisoni dayi* by its body markings (bands separated by wider interspaces in *N. denisoni denisoni;* narrower in *N. denisoni dayi*) and other related species by the position of anal opening, nature of caudal peduncle; length of head and paired fins.



GRAPH 1. Variations in different populations of *N. denisoni* from the river systems of the Peninsular India compared with *N. nilgiriensis* sp. nov.
A. Length of pelvic in SL., B. Length of pectoral in SL., C. Depth of body in SL., D Length of head in SL.,
Note that *N. nilgiriensis* has a shorter pectoral and pelvic fins than those of *N. denisoni*.



GRAPH 2. Variations of different populations of *N. densoni* from the various river systems of the Peninsular India compared with *N. nilgiriensis* sp. nov. A. Distance from Vent to anal fin in distance between pelvic to anal fins; B. Height of caudal peduncle in SL., C. Length of caudal peduncle in SL., Note that the Pamba form has a much narrower caudal peduncle and the Kollur form a more forwardly located vent.

Range: Peninsular India: widely distributed except the Chota Nagpur plateau including Bastar, M.P., and the Pamba and the Kollur drainages of Kerala and Karnataka states respectively on the S.W coast.

Material examined: India: Peninsular India: Andhra Pradesh: 6 specimens SRS/ZSI, uncatalogued, Bheema madugu, Jawadi Hills, Coll. K.R. Rao, 24.ii.83. 84 specimens, ZSI, uncatalogued, (Western Ghats Survey Stn. No. 46), pool near Alapalli, base of Seshachalam, Cuddapah District. Coll. H. S. Pruthi, 18--23. vii. 1929. 1 specimen, SRS/ZSI uncatalogued, Araku Village, Araku Valley, Coll. T Venkateswarlu, 8.iv. 1979. 15 specimens SRS/ZSI, uncatalogued, Gorapur, Araku Valley, Coll. T Venkateswarlu, 1979.

Madhya Pradesh: 2 specimens, ZSI F 2392/2, Pandava Hills, Vindhya Pradesh. 2 specimens, ZSI F 12350/1, Sagar. 24 specimens, ZSI F 13165/1, Dokal, Raipur Dist., Coll. H. S. Rao, 20.xii. 1939. 15 specimens, ZSI F 13319/1 3 specimens, ZSI F F 13318/1. 19 specimens, ZSI F 13166/1, Mahanadi River, about 3 miles from Sihawa, Rajpur Dist. Coll. H.S. Rao, 14.xii. 1939. 1 specimen, ZSI F 13163/1, Mahanadi River, at Sihawa, Raipur, Dist., Coll. H.S. Rao, 12.xii. 1939. 22 specimens, ZSI 13164/1, irrigation Channel at Rudri, Raipur Dist., Coll. H. S. Rao. 25.xii. 1939.

Maharashtra: Western Ghats: 2 specimens, WRS/ZSI F 788, Pirangut, Poona, Coll. K. R. Rao, 16.xi. 1971 6 specimens, WRS/ZSI F 791, Khed, Poona, Coll. K. R. Rao, 13.xii. 1971 5 specimens, WRS/ZSI F 795, Khed, Poona, 19.xi. 1960. 8 specimens, WRS/ZSI, uncatalogued, Sinhgad, 16 km. from Poona, Poona and Mysore Survey, Coll. Kripalani, 19.xii. 1960. 11 specimens, WRS/ZSI, $\frac{12627}{1}$, Deolali, Coll. A.G.L. Fraser. 1 specimen, WRS/ZSI V/1030, Bhorghat, Poona, Coll. B. S. Lamba, 8.ii.1966. 1 specimen, WRS/ZSI V/194, Lonawala, Poona, Coll. B. K. Tikader, 13.xi. 1963. 1 specimen, WRS/ZSI, V/1079, Moshi, Poona, Coll. B. S. Lamba, 24.i.1967 1 specimen, WRS/ZSI V/1069, Taligaon, Poona, Coll. B. S. Lamba, 31 iii. 1967 2 specimens, WRS/ZSI V/1632, Khed Poona, Coll. K. R. Rao, 25.iii1972. 2 specimens, WRS/ZSI, V/9721, Kowadi, Poona, Coll. B. S. Lamba, 6.iv.1967 2 specimens, WRS/ZSI V/1329, Moshi, Poona, Coll. B. S. Lamba, 28.iii.67 2 specimens, WRS/ZSI V/1180, Nalla near Vadgaon, Poona, Coll. B. S. Lamba, 7.ii.1966. 2 specimens, WRS/ZSI, V/1543, Kabbhar River, Kabbhor, Poona, Coll. G. M. Yazdani, 19.ii.1975. 5 specimens, WRS/ZSI, 9142, Moshi, Poona, Coll. K. R. Rao, 23.x.70. 4 specimens ZSI F 1690/2.

Poona. 1 specimen, WRS/ZSI V/1631, Kameshet, Poona, Coll. R. H. Kamble, 12.ii.1975. 1 specimen, WRS/ZSI, V/1497, Kirki Nullah, Coll. M. B. Rao. 1 specimen, WRS/ZSI, V/988, Koregaon, Poona, Coll. B. S. Lamba, 20.iv.1967 117 specimens, D.Z. Marathwada University collections, uncatalogued, streams at Aurangabad, Coll. Tandon.

Karnataka: 27 specimens, SRS/ZSI, uncatalogued, Bluff, Sivasamudram at Gathagala bridge, Coll.A.G.K. Menon, 9.iii.1982.

Rajasthan: 10 specimens, ZSI Rajasthan Survey Stn.No.9, uncatalogued, Dhuler-ki-Nadi, 3 miles from Parsad, Mewar, Coll. B. N. Chopra and M. L. Roonwal, 20.x.1941 2 specimens, ZSI, uncatalogued, Rajasthan Survey Stn. No. 1, Coll. B. N. Chopra and M. L. Roonwal. 7 specimens, ZSI Rajasthan Survey Stn. 8., Nalla, near Prasad, Mewar, Coll. Chopra and M. L. Roonwal. 1 specimen, ZSI, uncatalogued, Rajasthan Survey Stn. 11, Soorpur-ki-Nadi, 3 miles from Nungarpur town, Dungarpur, Coll. B. N. Chopra and M. L. Roonwal, 26.x.1941 9 specimens, ZSI Rajasthan Survey Stn. 12, uncatalogued, river at Pipradia village, about 9 miles north of Dungarpur town, Dungarpur State, Coll. B. N. Chopra and M. L. Roonwal. 11 specimens, ZSI Rajasthan Survey, uncatalogued, Parai-ki-Nadi, one mile south of Parsad, Coll. B. N. Chopra and M. L. Roonwal.

24. **Noemacheilus denisoni dayi** Hora
(Fig. 6, Pl. 16)

1935. *Nemachilus dayi* Hora, *Rec. Indian Mus*, **37**: 57 (Type locality: hills near Raniganj, Chota-Nagpur).

1938. *Nemachilus zonatus*, Hora (nec McClelland), *Rec. Indian Mus.*, **40**: 178, (Rajmahal hills).

1938. *Nemachilus dayi*, Hora, *Rec. Indian Mus.*, **40**: 240.

1939. *Nemachilus denisonii*, Day, *Rec. Indian Mus.*, **41**: 446, fig. 4 (Hazaribagh District, Chota-Nagpur).

Diagnosis: A *Schistura* with 8 branched dorsal fin rays; pelvic touching anal opening or close to it; caudal deeply emarginate; lateral line incomplete; body marked with 12–13 vertical bands separated by equal number of narrow pale interspaces; no sexual dimorphism.

Description: Based on 12 specimens, 44.0–73.5 mm SL from Parasnath hills, Chota Nagpur, Bihar State.

D. 3/8; P. 11; V 7; A. 2/5; C. 18.

A pretty loach with the dorsal profile slightly arched, ventral almost straight and horizontal throughout. Depth of body 13.48–19.05 (M=16.53), width, 2.74–15.80 (M=14.24) per cent of standard length; head almost as broad as high at occiput; its length 24.51–27.25 (M=25.57) per cent of standard length. Snout of moderate length, somewhat rounded, shorter than postorbital distance; its length 9.61–11.43 (M=10.53) per cent of standard length, 37.93–46.15 (M=41.16) per cent of head. Eye small, situated in the middle of head, not visible from ventral surface; its diameter 5.0–6.67 (M=5.80) per cent of standard length, 50.0–60.0 (M=55.07) per cent of length of snout, 54.54–87.50 (M=72.50) per cent of inter-orbital width. Nostrils close to each other, situated nearer to eye than tip of snout, anterior tubular. Mouth semicircular; lips fleshy, lower weakly furrowed, upper uninterrupted, lower interrupted. Dentiform process moderately developed. Barbels well developed; thread like, all almost as long as diameter of eye.

Scales: Small, imbricate posteriorly, close-set in the middle, scattered anteriorly, absent on the undersurface. Lateral line incomplete ending at the origin or middle of dorsal fin.

Fins: Dorsal fin small almost as high as length of head; edge of dorsal fin straight; origin of dorsal fin equidistant between tip of snout and caudal base or slightly nearer caudal base; pelvic origin opposite to that of dorsal; pectoral shorter than head, separated from pelvic by considerable distance; pelvic shorter than pectoral, reaching anal opening or just missing; caudal fin slightly shorter than head, lobes rounded, deeply emarginate.

Pre-dorsal distance 50.0–56.82 (M=52.08) per cent of standard length; pre-pelvic distance 51.02–55.55 (M=53.76) per cent; pre-anal 75.28–80.0 (M=77.09) per cent; distance from pectoral to pelvic origin 28.33–31.82 (M=30.04) per cent of standard length. Vent a short distance from anal fin; distance from vent to anal fin 16.0–31.95 (M=23.31) per cent in that between anterior origin of pelvic and anal fins. Pectoral 17.54–22.73 (M=20.0), pelvic 14.97–18.18 (M=18.92) per cent of standard length; height of dorsal 15.24–21.57 (M=18.92) per cent, anal 13.54–18.18 (M=15.47) per cent; base of dorsal 16.19–19.61 (M=17.95) percent, of anal 8.16–10.9 (M=9.40) per cent, caudal 16.33–23.86 (M=20.80) per cent.

Caudal peduncle short and stout, its length 13.16–18.18 (M=15.06) per cent of standard length; its least height 13.33–15.72 (M=14.33) per cent of its length.

Sexual dimorphism: None.

Colour: 12–13 broad vertical bands with an equal number of narrow pale interspaces on body, very characteristic of the species. A black band at base of caudal fin; a blackish spot at base of dorsal origin; the dorsal two rows and caudal four rows of well marked spots, other fins unspotted.

Size: Largest specimen examined 73.5 mm SL.

Affinities: Close to *N. d. denisoni* (see above paragraph on affinities under *N. d. denisoni*).

Range: Peninsular India: Chota Nagpur plateau and Bastar, Madhya Pradesh.

Material examined: India: Peninsular India: Chota Nagpur Plateau: ZSI F 3581–93, Parasnath Hills. 1 specimen, ZSI F9609/1, Stream between Chaibassa and Chakradharpur, Coll. N. Annadale & F H. Gravely. 11 specimens, ZSI F 2142/2, Rosana River, 1½ miles from Nimia ghat, Hazaribagh, Parasnath Hills Survey, 13.iv.1948.

25. **Noemacheilus denisoni mukambbikaensis** subsp. nov.
(Fig. 7, Pl. 10)

Diagnosis: A *Schistura* with 8 branched dorsal fin rays; ventral reaching anal opening or just missing it; caudal deeply emarginate; lateral line incomplete; body marked with bands, broader than interspace; invariably distinct behind dorsal fin; no sexual dimorphism.

Description: Based on 32 specimens, from 21.0–36.0 mm SL from Kashi stream, tributary of Kullur River, Mukambbika, Karnataka State.

D. 3/8; P. 11; V 7; A. 2/5; C. 18.

Body uniform depth, dorsal profile slightly arched, ventral almost straight and horizontal. Depth of body 15.6–21.4 (M=18.7), width 15.6–21.1 (M=18.7) per cent of standard length; head almost as broad as high at occiput; its length 21.2–30.2 (M=26.0) per cent of standard length. Snout of moderate length, somewhat rounded, shorter than the posterior portion of head; its length 9.0–13.9 (M=11.6) per cent of standard length, 38.8–50.0 (M=44.5) per cent of head. Eye small, situated in the middle of head, not visible from ventral surface; its diameter 6.9–11.6 (M=8.5) per cent of standard length, 62.5–83.3 (M=73.0) per cent of snout, 66.6–83.3 (M=82.8) per cent of inter-orbital width. Nostrils close

to each other, distinct from one another, closer to the eye than to tip of snout, anterior tubular. Mouth semicircular; lips fleshy, lower furrowed, upper uninterrupted, lower interrupted in the middle. Dentiform process moderately developed. Barbels well developed, thread like, all almost as long as diameter of eye.

Scales: Small imbricate posteriorly, close-set in middle, scattered anteriorly, absent on under surface. Lateral line incomplete, ending in front of dorsal fin, or slightly longer.

Fins: Dorsal fin small, almost as high as length of head, edge straight; origin of dorsal equidistant between tip of snout and caudal base or slightly nearer to caudal base; pelvic origin opposite that of dorsal; pectoral shorter than head, separated from pelvic by a short distance; pelvic shorter than pectoral, reaches anal opening or close to it; caudal fin as long as head, deeply emarginate, lobes rounded.

Pre-dorsal distance 50.0–57.1 (M=53.4) per cent of standard length; pre-pelvic distance 48.5–57.1 (M=51.8) per cent; pre-anal 72.7–88.0 (M=80.4) percent; distance from pectoral to pelvic origin 23.2–30.7 (M=27.3) per cent of standard length. Vent a short distance from anal fin; distance from vent to anal fin 30.7–50.0 (M=33.8) percent in that between anterior origins of pelvic and anal fins. Pectoral 19.3–26.9 (M=23.4), pelvic 17.2–23.9 (M=20.12) per cent of standard length; height of dorsal 20.0–26.5 (M=22.8) per cent; anal 7.57–12.5 (M=9.8) per cent; caudal 25.0–34.61 (M=28.7) per cent.

Caudal peduncle short and stout, its length 14.0–20.0 (M= 16.6) per cent of standard length; its least height 12.0–17.3 (M= 14.5) per cent of its own length.

Sexual dimorphism: None.

Colour: 5–6 brownish bands with narrow interspaces behind the origin of dorsal fin; anteriorly the bands are diffused, evident only in young ones. A black band at base of caudal fin, a blackish spot at base of dorsal origin; the dorsal and caudal with varying rows of well marked spots, other fins unspotted.

Size: Largest specimen examined 36 mm SL.

Affinities: Close to *N. d. denisoni* (see above paragraph on affinities under *N. d. denisoni*).

Holotype: 36.0 mm SL, Kashi stream, a tributary of Kollur River, Mukambbika, 145 km. north east of Mangalore, Karnataka, Coll. Dr. A. G. K. Menon, 23.iii.1982, SRS/ZSI F 568.

Paratype: 36, 21.0–36.0 mm SL data as above, SRS/ZSI F 569.

Other material examined: 76 specimens, SRS/ZSI, uncatalogued, Kashi stream, tributary of Kollur River, near Mukambbika Temple, Coll. A. G. K. Menon, 25.iii.82.

26. **Noemacheilus denisoni pambaensis** subsp. nov.

(Figs. 5 & 6, Pl. 10)

Diagnosis: A somewhat elongated sub-species of *Schistura* with 8 branched dorsal fin rays, pelvic separated from anal opening; caudal, deeply emarginate; lateral line incomplete; body marked with bands, broader than the interspace, more distinct behind dorsal fin; no sexual dimorphism.

Description: Based on 30 specimens 28.0–40.0 mm SL from Sabarigiri, S.E. of Pamba, Kerala State.

D. 3/8; P. 10; V 7; A. 3/5; C. 18.

Body of almost uniform depth; dorsal profile slightly arched, ventral straight and horizontal. Depth of body 13.0–18.0 (M= 14.79), width 11.53–16.0 (M=13.17) per cent of standard length; head slightly broader than high at occiput; its length 20.41–29.41 (M=23.8) per cent of standard length. Snout of moderate length, narrower anteriorly, somewhat shorter than posterior portion of head; its length 6.5–10.0 (M=8.5) per cent of standard length and 20.3–29.4 (M=23.9) per cent of head. Eye small, situated in the middle of head; its diameter 3.8–6.9 (M=5.0) per cent of standard length; 40.0–80.0 (M=59.5) per cent of length of snout, 50.0–100.0 (M=77.39)per cent of inter-orbital width. Nostrils close to each other, situated closer to eyes than to tip of snout, anterior nostrils tubular. Mouth semicircular, lips moderately fleshy, not furrowed, upper uninterrupted, lower interrupted in middle. Dentiform processes moderately developed. Barbels well developed, thread-like, inner rostral shorter, maxillary longer extending to perpendicular from posterior border of eye.

Scales: Small, imbricate posteriorly, close-set in middle, scattered anteriorly, absent on the under surface. Lateral line incomplete ending above tip of pectoral fin.

Fins: Dorsal fin small, less than length of head; edge of dorsal straight, slightly concave in young; origin of dorsal fin almost equidistant between tip of snout and caudal base; pelvic origin slightly behind that of dorsal. Pectoral slightly shorter than

head, extends more than half distance to pelvic, pelvic slightly shorter than pectoral, almost reaching anal opening; anal fin not reaching base of caudal, as long as head, deeply emarginate, lobes rounded.

Pre-dorsal distance 46.5–53.4 (M=51.4) per cent of standard length; pre-pelvic distance 48.7–57.4 (M=52.7) per cent; pre-anal 70.0–80.0 (M=76.5) per cent; distance from pectoral to pelvic origin 25.5–35.2 (M=29.8) per cent of standard length; Vent short distance from anal fin; distance from vent to anal fin 17.3–38.4 (M=26.12) per cent in that between anterior origins of pelvic and anal fins. Pectoral 14.7–23.3 (M=17.2), pelvic 11.5–17.1 (M=14.2) per cent of standard length; height of dorsal 18.9–24.0 (M=21.62) per cent; anal 13.1–17.3 (M=14.74) per cent; base of dorsal 12.9–16.6 (M=14.7) per cent, anal 5.8-15.0 (M=7.9) per cent, caudal 17.3–26.0 (M=21.5) per cent of standard length.

Caudal peduncle long; its length 12.0-17.3 (M=14.5) per cent of standard length; its least height 66.7-100.0 (M=80.8) per cent of its length.

Sexual dimorphism: None.

Colour: 10–14 brownish bands broader than the interspace. Head mottled with large blotches distinct in younger specimens. A black band at base of caudal fin; a black spot at base of dorsal origin; the dorsal and caudal with varying number of well marked spots, other fins unspotted.

Size: Largest specimen examined 40.0 mm SL.

Affinities: Close to *N. d. denisoni* (see above paragraph on affinities under *N. d. denisoni*).

Holotype: 40.0 mm SL, Sabarigiri, S.E. of Pamba, Kerala State Coll. R. S. Pillai, 28.iv.1981, SRS/ZSI F 563.

Paratype: 13, 28.0–40.0 mm SL, data as above, SRS/ZSI F 564.

27. **Noemacheilus notostigma** Bleeker

(Fig. 8, Pl. 4)

1864. *Nemacheilus notostigma* Bleeker, *Nat. Verh. Holl. Maatsch. Wetensch.* 2 *Verz.*, **20:** 5, p. 11, fig. 2.

1868. *Nemacheilus notistigma*, Günther, *Cat. Fish. Brit. Mus.*, **7:** 352.

1878. *Nemacheilus notostigma*, Day, *Fish. India*, p. 618.

1889. *Nemachilus notostigma*, Day, *Faun. Brit. Ind. Fish.*, **1**: 232 (Ceylon).

1952. *Noemacheilus notostigma*, Deraniyagala, *Col. Atlas Verteb Ceylon*, p. 49, pl. 12, fig. 3.

1955. *Noemacheilus notostigma*, Munro, *Mar. & Fresh water Fishes of Ceylon*, p. 48.

1962. *Noemacheilus notostigma*, Mendis & Fernando, *Bull. Fisheries Res. Stn.*, Ceylon, **17**: 107, (S. Gomera Ahirava, Kandhu Ahirava).

Diagnosis: A *Schistura* with 7 branched dorsal fin rays; pelvic reaching anal opening; caudal deeply emarginate with rounded lobes; lateral line incomplete; body marked with 13–14 broad vertical bands; no sexual dimorphism.

Description: Based on 5 specimens, 33.5 to 54.0 mm SL from Sri Lanka.

D. 3/7; P. 11; V 7; A. 2/5; C. 18.

Body of almost uniform depth, dorsal profile slightly arched and ventral more or less straight and horizontal throughout; undersurface of head and anterior part of body somewhat flattened. Depth of body 12.97–18.86 (M=15.87); width 22.22–27.47 M= 24.45) per cent of standard length; head almost as broad as high at occiput; its length 12.03–15.97 (M=13.89) per cent of standard length. Snout of moderate length, rounded, somewhat shorter than posterior portion of head; its length 9.26–11.98 (M=10.43) per cent of standard length, 36.36–50.0 (M=42.59) per cent of head. Eye small situated in the middle of head; its diameter 3.99–5.97(M=4.81) per cent of standard length, 33.3–57.14 (M=46.67) per cent of length of snout, 50.0–66.67 (M=59.17) per cent of inter-orbital width. Nostrils close to each other, placed nearer eye than tip of snout, anterior tubular. Mouth semicircular; lips fleshy, lower weakly furrowed, upper uninterrupted, lower interrupted. Dentiform process moderately developed. Barbels well developed, thread like, longer than diameter of eye.

Scales: Minute, scattered. Lateral line incomplete, terminating opposite to commencement of dorsal.

Fins: Dorsal fin higher than length of head, edge straight; origin or dorsal slightly nearer to base of caudal than to tip of snout; pelvic origin slightly behind that of dorsal; pectoral shorter than head, separated from pelvic by considerable distance; pelvic shorter than pectoral, just reaching anal; caudal fin longer than head, deeply emarginate with rounded lobes.

Pre-dorsal distance 50.0–53.76 (M=51.8) per cent of standard length; pre-pelvic distance 50.0–80.64 (M=58.82) percent; pre-

anal 72.22–30.60 (M=77.05) per cent; distance from pectoral to pelvic origin 28.70–35.0 (M=30.67) per cent of standard length. Vent a short distance from anal fin; distance from vent to anal fin 16.67–28.01 (M=23.20) per cent in that between anterior origins of pelvic and anal fins. Pectoral 14.92–20.88 (M=20.37), pelvic 13.44–20.88 (M=16.13) per cent of standard length; height of dorsal 15.97–25.92 (M=22.38) per cent; anal 14.97–20.00 (M=17.19) per cent; base of dorsal 11.94–16.67 (M=14.75) per cent; of anal 7.98–10.45 (M=9.81) per cent; caudal 20.89–23.88 (M=22.62) per cent.

Caudal peduncle short and stout; its length 11.93–16.26 (M=13.55) per cent of standard length; its least height 11.93–14.99 (M=13.39) per cent of its length.

Sexual dimorphism: None.

Colour: 13–14 brownish vertical bands with light interspaces almost of same width. A black band at base of caudal fin; a blackish spot at base of dorsal origin; dorsal with two rows of spots; caudal four rows, other fins unspotted.

Size: Largest specimen examined 54.0 mm SL.

Affinities: Close to *N denisoni denisoni*, but can be separated by the number of its branched dorsal fin rays (8 in *N. denisoni*).

Material examined: 5 specimens, NMC, uncatalogued, Sri Lanka.

28. **Noemacheilus nilgiriensis** sp. nov.

(Figs. 8 & 9, Pl. 10 & Figs. 1 & 2, Pl. 14)

Diagnosis: A species of *Schistura* with 8 branched dorsal fin rays; pelvic fin separated from anal opening by a considerable distance; caudal emarginate; lateral line incomplete; terminating above tip of pectoral fin; body marked with 11–12 brownish vertical bands, broader than whitish interspace; no sexual dimorphism.

Description: Based on 20 specimens, 30.5–51.0 mm SL inincluding the holotype and paratypes.

D. 3/8; P. 10; V 7; A. 2/6; C. 18.

Body uniform depth, dorsal profile slightly arched, ventral straight and horizontal. Depth of body 11.36–18.03 (M=14.98);

head slightly broader than high at occiput; its length 18.81–24.59 (M=20.31) per cent of standard length. Snout of moderate length, somewhat blunt, rounded, almost equal to posterior portion of head; its length 7.69–13.11 (M=9.29) of standard length; 37.71–53.33 (M=45.76) per cent of head. Eye small, situated in the middle of head, not visible from ventral surface; its diameter 2.94–4.92 (M=3.63) per cent of standard length, 33.3–60 0 (M= 39.34) per cent of length of snout, 37.5–75.0 (M=49.41) per cent of inter-orbital width. Nostrils close to each other, situated closer to eyes than to tip of snout, anterior tubular. Mouth semicircular; lips moderately fleshy, lower furrowed, upper uninterrupted, lower interrupted in middle. Dentiform process moderately developed. Barbels well developed, thread like; inner rostral shorter reaching corner of mouth at confluence of lips; second reaching anterior nostrils; maxillary extending to perpendicular from middle of eye.

Scales: Minute, isolated in posterior third of body, absent anteriorly in front of dorsal fin and on ventral side. Lateral line incomplete terminating opposite to middle of pectoral fin.

Fins: Dorsal fin small, less than length of head, edge arched, origin of dorsal equidistant between tip of snout and caudal base; pelvic origin opposite to that of dorsal; pectoral shorter than head, extends about half way to pelvic; pelvic equal to pectoral, separated from anal opening by a cosiderable distance. Anal fin not reaching base of caudal; caudal fin as long as or slightly shorter than head, emarginate with rounded lobes, upper lobe longer than lower.

Pre-dorsal distance 44.61–59.01 (M=48.43) per cent of standard length; pre-pelvic distance 46.39–55.76 (M=48.99)per cent; pre-anal 68.18–81.97 (M=72.49) per cent; distance from pectoral to pelvic origin 26.19–36.0 (M=29.51) percent. Vent a short distance from anal fin, distance between vent to anal fin 20.0–35.71 (M=25.03) percent in that between anterior origins of pelvic and anal fins. Pectoral 11.11–19.67 (M=15.01), pelvic 10.0–18.03 (M=12.63) per cent of standard length; height of dorsal 16.92–24.59 (M=19.58) per cent; anal 12.31–18.03 (M= 14.20) per cent; base of dorsal 12.16–18.03 (M=14.20) per cent; caudal 16.67 21.52 (M=19.24) per cent.

Caudal peduncle short and stout; its length 12.5–18.0 (M= 14.2) per cent of standard length; its least height 9.64–14.75 (M= 11.2) per cent of its length.

Sexual dimorphism: None.

Colour: Body with 11–12 light brown bands, broader than the pale interspace. In most cases the bands are split up to 17

bands by the appearance of pale streaks in their middle along the dorsal surface. The upper surface of head dusky and the under-surface dull white. Dorsal with a light margin bounded below by a jet black band and having a dark base; in younger specimens the bands on dorsal are not continuous and are represented by series of spots. A dark band at base of caudal; in young specimens there is a prominent spot in the middle of band.

Size: Largest specimen examined 51.0 mm SL.

Affinities: This species is related to species of *denisoni* complex but it is immediately distinguished by its slightly emarginate caudal fin(deeply emarginate in *denisoni*) by its shorter pectoral and ventral fins (*vide* graph 1 & 2) and the characteristic colouration especially that of dorsal fin. *N. nilgiriensis* and the specis of *denisoni* complex have evolved from the common ancestor that spread to the Peninsular during the glacial epochs of the pleistocene.

Holotype: 48.5 mm SL. small stream joining the out let stream from Pykara Dam, Nilgiri District, Tamil Nadu, India, Coll. A. G. K. Menon, 31.x.82. SRS/ZSI F 561

Paratypes: 19 specimes, 30.5–51.0 mm SL, data, SRS/ZSI F 562.

Other materials examined: 6 specimens, SRS/ZSI, uncatalogued, Maravakandi Dam, (Moyar basin), Misingudi, Nilgiri District, Tamil Nadu.

29. **Noemacheilus kodaguensis** sp. nov.

(Fig. 11, Pl. 16)

Diagnosis: A *Schistura* with 8 branched dorsal fin rays; caudal fin slightly emarginate; short lateral line ending above middle of pectoral fin; pelvic fin separated from anal opening by a short distance; body marked with 11–14 vertical black bands; broader above tapering below extending below lateral line but reaching ventral surface only in posterior half; dorsal with a light margin bounded below by an arched black band, another below it in young fish; and a dark base.

Description: Based on 6 specimens 23.0–36.0 mm SL from Kotu Hola, 8 km. N.W of Merkara, Karnataka.

D. 3/8; P. 10; V 1/6; A. 2/5; C. 18.

A small subcylindrical form. Depth of body 14.54–19.44 (M=17.34); head broad, depressed, its length 21.82–25.07 (M= 23.16) percent of standard length. Snout rounded, of moderate length, slightly shorter than posterior portion of head; its length 7.69–11.11 (M=9.57) of standard length, 30.77–50.0 (M=41.53) percent of head. Eye small, situated almost in the middle of head, not visible from ventral surface; its diameter 21.43–33.33 (M= 26.81) percent of head length; 50.0–80.0 (M=65.83) percent of length of snout; 60.0–100.0 (M=76.94) percent of inter-orbital width. Nostrils somewhat distinct from one another, situated a little closer to eye than tip to of snout, anterior tubular. Mouth semicircular; lips moderately fleshy, poorly furrowed; upper uninterrupted, lower interrupted in middle. Dentiform process moderately developed. Barbels well developed, thread like; inner rostral shorter than outer; outer rostral shorter than maxillary not extending to margin of eye; maxillary longest, extending to perpendicular from middle of eye.

Scales: Minute, scattered, more numerous posteriorly, absent on ventral side. Lateral line incomplete terminating above middle of pectoral fin.

Fins: Dorsal fin small, less than length of head; edge of dorsal slightly convex, rounded anterioirly; origin of dorsal fin almost equidistnat between tip of snout and caudal base; origin pelvic slightly behind that of dorsal or opposite to that of dorsal. Pectoral shorter than head, extends about half way to pelvic. Pelvic shorter than pectoral, separated from anal opening by a short distance or slightly falls short of anal opening. Anal fin not reaching base of caudal. Caudal fin as long as head, emarginate posteriorly with rounded lobes of equal length.

Pre-dorsal distance 47.22–51.85 (M=49.63) percent of standard length; pre-pelvic distance 47.27–51.85 (M=49.17) percent; pre-anal 69.56–75.92 (M=73.33) percent; distance from pectoral to pelvic origin 24.07–31.25 (M=28.01) percent. Vent a short distance from anal fin; distance from vent to anal fin 15.38–23.07 (M=20.59) percent in that between anterior origins of pelvic and anal fins. Pectoral 16.36–19.23 (M=17.82), pelvic 14.54–15.62 (M=15.14) percent of standard length; height of dorsal 10.87–18.75 (M=13.47) percent; of anal 8.69–11.11 (M=10.13) percent; base of dorsal 15.22–20.31 (M=18.79) percent; of anal 11.54–14.06 (M=13.04) percent; caudal 14.54–19.44 (M=17.34) percent.

Caudal peduncle short and stout; its length 15.38–17.39 (M=16.61) percent of standard length; its least height 72.73 83.33 (M=76.94) percent of its length.

Sexual dimorphism: None.

Colour: Body with 11–14 vertical bands, broader above lateral line tapering below, reaching ventral surface only in the posterior half; in some bars are broader in the middle tapering at ends. Dorsal with a light margin bounded below by a jet black arched band; another similar band below it in young specimens and having a dark base. A dark band at base of caudal; a black band across the middle of caudal fin with several black spots scattered on the distal portion, other fins unspotted.

Size: Largest specimen examined 36.0 mm SL.

Affinities: The closest relative of this species is *N. nilgiriensis*, the body markings especially the broad tapering crossbars descending from back to below lateral line or posteriorly to ventral surface distinguish it (bands are of uniform width, forming rings round the body, in most case numbering 17, and broader than the narrow interspaces between them in *N. nilgiriensis*).

Range: Western Ghats: Nilgiris and Coorg (Cauvery basin).

Holotype: 36 mm SL, Kotu Hola, 8 km N. W of Merkara, Karnataka, India, Coll. A. G. K. Menon, 14.iii.193; SRS/ZSI F 565.

Paratypes: 40, 23.0–36.0 mm SL, data as above, SRS F 565(A).

30. **Noemacheilus semiarmatus** Day

(Figs. 1–3, Pl. 11 & Fig. 3, Pl. 14)

1867. *Nemachilus semiarmatus* Day, *Proc. Zool. Soc. Lond.*, p. 286, (Type locality: "Bowany and Seegoor rivers along the base of the Neilgherry; also imported into tanks on those mountains")

1868. *Nemachilus semiarmatus*, Gunther, *Cat. Fish. Brit. Mus.*, **7:** 353 (Nilgherries).

1872. *Nemacheilus semiarmatus*, Day, *J. Asiat. Soc. Beng.*, **41** (2): 186.

1878. *Nemacheilus semiarmatus*, Day, *Fish India*, p. 616, pl. 156. fig. 11.

1889. *Nemachilus semiarmatus*, Day, *Fauh. Brit. Ind. Fish.* **1:** 229.

Diagnosis: A *Schistura* with 8 branched dorsal rays; slightly forked caudal; complete lateral line; 9 to 10 vertical bands with narrow interspaces evident only behind the origin of dorsal fin;

spotted dorsal, pelvic, anal and caudal fins; a large number of irregularly scattered conspicuous black dots on the head and body.

Description: Based on 23 specimens, 33.5–56.5 mm SL, from Vaithri, Wyanad, Kerala.

D. 2-3/8; P. 11; V 7; A. 2/5; C. 18.

In this pretty loach the dorsal profile gradually rises from tip of snout to dorsal origin and then slopes down to caudal base; ventral profile almost straight and horizontal throughout. Depth of body 12.6–26.08 (M=18.75), width 13.9–17.0 (M=15.16) percent of standard length. Head as broad as high at occiput; its length 20.54–26.86 (M=22.92) percent of standard length. Snout of moderate length, narrow anteriorly, somewhat shorter than posterior portion of head; its length 7.14–10.81 (M=9.34) percent of standard length. Eye small situated nearer tip of snout than posterior end of operculum; its diameter 4.12–7.46 (M=5.55) of standard length, 40.0–82.85 (M=60.78) percent of length of snout, 64.10–96.66 (M=78.57) percent of inter-orbital width. Nostrils situated closer to eye than tip of snout, anterior nostril tubular, Mouth semicircular; lips thick and fleshy, furrowed, upper uninterrupted, lower interrupted in middle. Barbels well developed, thread-like, all are almost as long as diameter of eye.

Scales: Small, imbricate all over sides and upper surface of body. Lateral line complete.

Fins: Dorsal fin of moderate size, less than length of head; edge of dorsal straight, slightly concave in young, origin of dorsal fin slightly nearer to the tip of snout than to caudal base. Pelvic origin slightly behind that of dorsal. Pectoral slightly shorter than head, extends more than half distance to pelvic. Pelvic slightly shorter than pectoral, extends to anal opening. Anal fin not reaching base of caudal. Caudal fin almost as long as head, slightly forked lobes pointed and of equal length.

Pre-dorsal distance 41.64–50.64 (M=47.18) percent of stndard length; pre-pelvic distance 47.61–59.45 (M=54.75) percent; pre-anal 53.57–82.14 (M=76.08) percent; distance from pectoral to pelvic origin 27.27–36.03 (M=29.57) percent of standard length. Vent considerable distance from anal fin; distance from vent to anal fin 20.0–26.0 (M=23.07) percent in that between anterior origin of pelvic and anal fins. Pectoral 12.5–20.0 (M=16.50), pelvic 12.79–16.66 (M=13.9) percent of standard length; height of dorsal 17.07–21.42 (M=19.48) percent; anal 14.41–25.30 (M=19.48) percent; base of dorsal 14.13–19.40 (M=16.57) percent; of anal 7.0–10.71 (M=8.67) percent; caudal 21.64–26.50 (M=24.16) percent of standard length.

Caudal peduncle short and stout; its length 12.63–21.95 (M=15.20) percent of standard length; its least height 12.63–16.0 (M=14.16) percent of its length.

Sexual dimorphism: None.

Colour: Irregularly scattered but conspicuous black dots on sides of head and body. In young specimens dots absent, but marked with 8 to 10 brownish bands without any markings on fins. Somewhat older specimens are marked with 12 to 13 bands as wide as the interspace, more distinct posteriorly, with rows of black dots on dorsal and caudal fins. With growth, the bands in the anterior region coalesce and those of posterior region become much wider than the interspaces. Three rows of dots on dorsal, several rows on caudal, a row on anal and a few on ventrals; a black band below eye and another in front of it running below nostrils.

Size: Largest specimen examined 56.5 mm SL.

Affinities: N. semiarmatus is a member of *denisoni* complex, but it is easily distinguished from *denisoni* by its characteristic colouration especially that of fins and the complete lateral line. (Lateral line incomplete in *denisoni*) From *striatus, semiarmatus* can be easily distinguished by the 8 branched rays in the dorsal fin (10 in *striatus*).

Range: Peninsular India: Cauvery basin in Wyanad, Nilgiris and Mysore and Silent Valley (Bharathapuzha basin).

Material examined: India: Peninsular India: Mysore: 172 specimens, SRS/ZSI uncatalogued, Cauvery river at Chelangala, N. W of Bagmandala, Coll. A. G. K. Menon, 15.iii.1983. 1 specimen, SRS/ZSI, uncatalogued, R. Kabini at Nanjancud, 20 km. from Mysore. 4 specimens, SRS/ZSI, uncatalogued, Bagamandala, Coll. A. G. K. Menon, 2 specimens, SRS/ZSI, uncatalogued, Coorg. Coll. A. G. K. Menon, 17.iii.1983.

Kerala: Wyanad: 1 specimen, SRS/ZSI, uncatalogued, Panamaram River, Coll. A. G. K. Menon, 15.viii.1982. 5 specimens, SRS/ZSI, uncatalogued, Vaithri River at Vaithri, Coll. A. G. K. Menon, 13.iii.83. 10 specimens, SRS/ZSI, uncatalogued, Vaithri River at Vaithri, Coll. A. G. K. Menon, 9.viii.1982. 2 specimens, SRS/ZSI, uncatalogued, Mavennalla River at Sultan Battery, Coll. A. G. K. Menon, 19.iii.1982.

Tamil Nadu: Nilgiris: 5 specimens, BMNH. 67.7.24. 25–27 and 68.10.27, 42–3, from Nilgherries, Coll. F Day. 16 specimens,

SRS/ZSI, uncatalogued, Avarellah River at Maravakandi Dam (Moyar drainage), Mesningudi, Coll. A. G. K. Menon. 4 specimens, ZSI F 1742/2. Stream in Rockwood Estate, Nellakotta, Coll. S. Rajan, March, 1954. 1 specimen, SRS/ZSI, uncatalogued, Pauliarpalam Puza, Coll. Chandra & Party, Oct. 1982.

31. **Noemacheilus striatus** Day

(Fig. 1, Pl. 5)

1867. *Nemachilus striatus* Day, *Proc. Zool. Soc. Lond.*, p. 347 (Type locality: "Wynaad").

1868. *Nemachilus striatus*, Günther, *Cat. Fish. Brit. Mus.*, **7**: 353. ("Wynaad").

1872. *Nemacheilus striatus*, Day, *J. Asiat. Soc. Beng.* **41** (2): 190.

1878. *Nemacheilus striatus*, Day, *Fish. India*, p. 617. pl. 153, fig. 8.

1889. *Nemachilus striatus*, Day, *Faun. Brit. Ind. Fish*, **2**: 230.

1937. *Nemachilus bhimachari* Hora, *Rec. Indian Mus.*, **39**: 13, fig. 5 (Type locality: Thunga River, Shimoga).

Diagnosis: A small sized *Schistura* characterised by 10 branched dorsal fin rays; deeply forked caudal fin; complete lateral line; 16 to 20 narrow dark rings on body.

Description: Based on 3 specimens, 40.0–50.0 mm SL from Tunga River, Shimoga, Mysore.

D. 2/10; P. 11; V 8; A. 2/5; C. 20.

A narrow, elongated species with both dorsal and ventral profiles almost straight and horizontal. Depth of body 12.24–20.0 (M=15.33). Head almost as broad as high at occiput; its length 22.50–23.0 (M=22.65) percent of standard length. Snout of moderate length, somewhat shorter than post orbital part of head; its length 8.67–11.0 (M=9.68) in standard length and 38.64–47.83 (M=42.71) percent of head. Eye small, situated in the middle of head not visible from ventral surface; its diameter 19.44–30.43 (M=23.44) percent of head length, 46.47–63.64 (M=54.42) percent of length of snout, 81.82–100.0 (M=93.94) percent of interorbital width. Nostrils nearer to the eye than to tip of snout; the anterior tubular; tube produced posteriorly into a short process. Mouth semicircular; lips moderately fleshy, poorly furrowed, upper uninterrupted, lower interrupted in the middle. The area immediately behind the lower lip is thickened and fairly grooved forming a sort of mental adhesive apparatus. Dentiform process moderately developed. Barbels long and narrow; the inner rostrals slightly longer than the diameter of orbit; the other two pairs much longer.

Scales: Small, prominent all over body except on under surface. Lateral line complete.

Fins: All the fins are relatively small. Dorsal fin small, slightly less than length of head; edge of dorsal fin straight; origin of dorsal fin slightly nearer tip of snout than caudal base; origin of pelvic slightly behind that of dorsal. Pectoral shorter than head, separated from the pelvic by a distance almost equal to its own length. The pelvic shorter than pectoral, separated from anal opening by a short distance. Anal fin reaching base of caudal. Caudal fin as long as or slightly shorter than head, deeply forked, lobes pointed and of equal length.

Pre-dorsal distance 46.94–51.0 (M=48.48) percent of standard length; pre-pelvic distance 47.96–53.0 (M=50.74) percent; pre-anal 71.43–80.0 (M=75.06) percent; distance from pectoral to pelvic origin 26.53–28.75 (M=27.43) percent. Vent a short distance from anal fin; distance from vent to anal fin 21.43–30.77 (M=25.73) percent in that between anterior origins of pelvic and anal fins. Pectoral 14.29–22.0 (M=17.72), pelvic 13.78–19.0 (M=15.93) percent of standard length; height of dorsal 13.78–19.0 (M=16.34) percent; of anal 9.18–15.0 (M=13.06) percent; base of dorsal 19.39–21.25 (M=20.21) percent; of anal 7.0–12.5 (M=8.88) percent, caudal 20.0–22.5 (M=20.97) percent.

Caudal peduncle short and stout, its length 12.0–16.33 (M=14.65) percent of standard length; its least height 56.0–56.25 (M=56.13) percent of its length.

Sexual dimorphism: None.

Colour: 16 to 20 vertical bands, wider than the ground colour, encircle body; a black band at base of caudal fin; dorsal fin with a black edge with a light external margin and a dark base; one or two rows of bands across dorsal; two rows of spots on caudal fin; dull black spots on the anal.

Affinities: This species distinguished by its colouration and a larger number of branched rays in the dorsal fin, is close to *N. semiarmatus.*

Range: Western-Ghats: Kerala: Wyanad; Karnataka: Shimoga.

Material examined: India: Western Ghats: 1 specimen, BMNH, 70.7.12.9, Wyanad, Coll. F Day. 3 specimens, ZSI, uncatalogued, Thunga River, Shimago.

3. *The kangjupkhulensis Group*

10. *The kangjupkhulensis Complex*

The centre of evolution of this group seems to be Manipur–Nagaland–Burma area. The outstanding characteristics of the members are: truncate or slightly emarginate caudal; incomplete lateral line ending before dorsal (*kangjupkhulensis*, *nagaensis*, *singhi*) or above ventral (*manipurensis* and *cincticauda*) and the absence of sexual dimorphism. The group is probably a product of the wave of migration from S. China that took place during the late glacial epoch of the Pleistocene.

32. **N. kangjupkhulensis** Hora

(Figs. 2 & 3, Pl. 5)

1921. *Nemachilus kangjupkhulensis* Hora, *Rec. Indian Mus.*, **22**: 202, pl. 10, figs. 4, 4 *a* (Type locality: Manipur valley).

1948. *Nemachilus kangjupkhulensis*, Rendahl, *Ark. for. Zoolog.*, Bd. 40 No. **7**: 32 (Putao, N. Burma).

1974. *Noemacheilus kangjupkhulensis*, Menon, (in part) *Inl. Fisheries Soc, India*, special publication, **1**: 55, (Manipur valley and Burma. Nagaland excluded).

Diagnosis: A medium sized *Schistura* with 7 branched dorsal fin rays; slightly emarginate caudal fin; incomplete lateral line ending before commencement of dorsal fin; 7–11 broad black bands; no sexual dimorphism.

Description: Based on 11 specimens, 21.5–40.0 mm SL from Manipur Valley.

D. 2/7; P. 9; V 1/6; A. 2/5; .C. 16.

A medium sized elongated fish with dorsal profile slightly arched, ventral horizontal and flat throughout; depth of body 13.24–18.18 (M=15.59); head bluntly pointed, slighly depressed; its length 21.62–38.46 (M=25.97) percent of standard length. Snout somewhat rounded, equal to or slightly shorter than post-orbital distance; its length 8.97–12.50 (M=10.58) in standard length, 23.33–50.0 (M=41.62) percent of head. Eye small, dorso-lateral in position, situated in middle of head, not visible from ventral surface; its diameter 13.33–33.33 (M=25.89) percent of head length, 50.0–80.0 (M=62.32) percent of length of snout, 66.67–100.0 (M=86.67) percent of inter-orbital width. Nostrils distinct from one another, situated closer to eye than to tip of snout, anterior not tubular. Mouth semicircular, lips fleshy, poorly furrowed, upper uninterrupted, lower interrupted in the middle.

Dentiform process moderately developed. Barbels well developed; inner rotral shorter, outer equal to maxillary, not extending to margin of eye; maxillary extending to perpendicular from middle of eye.

Scales: Minute, embedded, more numerous posteriorly. Lateral line incomplete ending before commencement of dorsal fin.

Fins: Dorsal small, less than length of head; edge of dorsal slightly concave; origin of dorsal fin slightly nearer caudal base than tip of snout; origin of pelvic opposite to that of dorsal. Pectoral shorter than head, or almost equal, extends about half way of distance to pelvic. Pelvic shorter than pectoral, separated from anal opening by considerable distance. Anal fin not reaching base of caudal. Caudal fin as long as or slightly shorter than head, truncate or slightly emarginate.

Pre-dorsal distance 50.0–58.14 (M=54.73) percent of standard length; pre-pelvic distance 52.24–56.25 (M=54.29) percent; pre-anal 75.76–81.08 (M=78.31) percent; distance from pectoral to pelvic origin 29.51–35.14 (M=32.09) percent. Vent a short distance from anal fin; distance from vent to anal fin 10.0–18.75 (M=15.47) percent in that between anterior origins of pelvic and anal fins. Pectoral 18.92–23.26 (M=21.55), pelvic 13.51–20.0 (M=17.43) percent of standard length; height of dorsal 16.25–21.31 (M=18.58) percent; of anal 10.0–18.60 (M=15.24) percent; base of dorsal 13.95–18.03 (M=16.15) percent; of anal 7.50–10.45 (M=9.23) percent; caudal 15.38–25.0 (M=21.15)

Caudal peduncle short and stout, its length 14.10–17.57 (M=15.71) percent of standard length; its least height 61.54–100.0 (M=81.66) percent of its length.

Sexual dimorphism: None.

Colour: 7–11 broad black bands separated by narrowed white ones, a black bar at base of caudal fin; a black spot at base of first three rays of dorsal fins; two black streaks radiating from eye to snout. In some the bands of the anterior rgion coalesce to form a uniform dusky colour.

Size: Largest specimen examined 40 mm SL.

Affinities: The closest relative of this species is *N. manipurensis* inhabiting the Manipur Valley and adjacent Naga Hills; separation is easily accomplished through such characters as: colour, nature of lateral line and nature of caudal fin (slightly emarginate in *N. kangjupkhulensis;* truncate in *N. manipurensis*).

Range: Manipur and Burma.

Material examined: India: Manipur: 1 specimen, ZSI F10060/1, (holotype of *N. kangjupkhulensis*), Yaribuk, Manipur, Coll. S.L. Hora. 10 specimens, ZSI F 10061/1, Manipur. 2 specimens, ZSI F 10067, Manipur, Coll. S. L. Hora. 3 specimens, DZGU, Lake Chaudubi, Assam, Coll. S. C. Dey.

33. **Noemacheilus nagaensis** sp. nov.

1935. *Nemachilus kangjupkhulensis*, Hora and Mukerji (nec Hora) *Rec. Indian Mus.*, **37:** 397 (Naga Hills).

1974. *Noemacheilus kangjupkhulensis*, Menon (in part), *Inl. Fisheries Soc. India*, special publication, **1:** 55 (Nagaland, Burma and Manipur excluded).

Diagnosis: A medium-sized *Schistura* species with 8 branched dorsal rays; slightly emarginate caudal fin; incomplete lateral line ending before dorsal origin; 7–12 broad black bands; no sexual dimorphism.

Description: Based on 13 specimens, 36.0–59.0 mm SL from Naga Hills, Nagaland.

D. 2/8; P. 9; V 1/6; A. 2/5; C. 16.

A medium sized elongate fish; its dorsal profile slightly arched, ventral horizontal and flat. Depth of body 12.90–19.61 (M=16.47); head bluntly pointed, depressed; its length 18.97–27.40 (M=22.53) percent of standard length. Snout somewhat rounded, a little shorter than postorbital distance; its length 6.90–10.96 (M=9.53) in standard length, 33.33–50.0 (M=42.53) percent of head. Eye small, situated in the middle of head, not visible from ventral surface; its diameter 13.64–30.0 (M=20.54) percent of head length, 37.50–83.33 (M=49.09) percent of length of snout, 50.0–100.0 (M=61.53) percent of inter-orbital width. Nostrils distinct from one another, situated closer to eye than to tip of snout, anterior not tubular. Mouth semicircular, lips moderately fleshy, weakly furrowed, upper uninterrupted, lower interrupted in middle. Dentiform process moderately developed. Barbels well developed; inner rostral shorter; outer rostral equal to maxillary extending to almost margin of eye; maxillary extending to perpendicular from middle of eye.

Scales: Minute, embedded, scattered, more numerous posteriorly. Lateral line incomplete ending before dorsal origin.

Fins: Dorsal small, less than length of head, provided with muscular pads between rays; edge of dorsal slightly concave; origin of dorsal fin slightly nearer caudal base than to tip of snout; origin of pelvic opposite to that of dorsal. Pectoral almost equal to head length extending half way of distance to pelvic. Pelvic shorter than pectoral, separated from anal opening by a considerable distance. Anal fin not reaching base of caudal. Caudal fin as long as or slightly shorter than head, emarginate.

Pre-dorsal distance 49.46–56.16 (M=52.78) percent of standard length; pre-pelvic distance 49.46–57.53 (M=52.28) percent; pre-anal 73.47–82.19 (M=78.01) percent; distance from pectoral to pelvic origin 31.73–41.30 (M=34.11) percent. Vent a short distance from anal fin; distance from vent to anal fin 8.46–21.05 (M=11.25) percent in that between anterior origins of pelvic and anal fins. Pectoral 17.02–21.92 (M=18.83), pelvic 15.38–19.56 (M=17.35) percent of standard length; height of dorsal 16.33–21.57 (M=19.63)percent; of anal 12.77–18.28 (M=15.97) percent; base of dorsal 13.51–19.44 (M=16.39) percent; of anal 7.63–10.96 (M=9.06) percent; caudal 18.28–23.91 (M=20.95) percent.

Caudal peduncle short and stout; its length 13.51–17.65 (M=15.66) percent of standard length; its least height 62.50–90.0 (M=74.33) percent of its length.

Sexual dimorphism: None.

Colour: 7 to 11 broad black bands separated by an equal number of narrower white ones; a black bar at caudal base; a black spot at base of first three rays of dorsal fins. In some the bands of the anterior region coalesce to form a uniform dusky surface.

Size: Largest specimen examined 59.0 mm SL.

Affinities: Most specimens of this species are immediately noticeable because of the conspicuous white pads between the branched rays of dorsal fin. The number of branched dorsal fin rays (8 in *N. nagaensis;* 7 in *N. kangjupkhulensis*) readily serve to separate the species from its closest relative, *N. kangjupkhulensis* inhabiting Burma and Manipur and the southern drainages of the Naga Hills, draining into the Chindwin system. It replaces *N. kangjupkhulensis* in Nagaland draining into the Brahmaputra system.

Range: India: Nagaland (Brahmaputra basin).

Holotype: 59.0 mm SL. Phodung River, tributary of Tizu River, Naga Hills, Nagaland, J. H. Hutton, March 1972, SRS/ ZSI F 574.

Paratypes: 13, 36.0–59.0 mm SL., data as above, SRS/ZSI F 575.

34. **Noemacheilus singhi** sp. nov.

(Fig. 1, Pl. 16)

Diagnosis: A small-sized species of *Schistura* with 7 branched rays in the dorsal fin; caudal truncate or very slightly emarginate; incomplete lateral line; ending below dorsal origin; dorsal commencing nearer to the caudal base than to tip of snout; scales small, imbricate all over body except head and back in front of dorsal fin and the ventral surface; 12–13 dark irregular vertical bands descending from back to below lateral line; the bands behind dorsal fins are broader than the interspaces; anteriorly they are narrow and tapering below lateral line.

Description: Based on 4 specimens 27.5 to 36 mm SL from Kiphire, Nagaland.

D. 3/7; P. 1/8; C. 7; A. 2/5; C. 18.

Dorsal profile slightly arched, ventral horizantal throughout. Depth of body 14.54–18.05 (M=17.02); head bluntly pointed, depressed, broader than high at occiput; its length 25.0–27.45 (M=25.56) percent of standard length. Open pores scattered over the body; a row of pores just below eyes are continued along the lateral line. Snout of moderate length, pointed, almost equal to postorbital distance; its length 10.9–12.5 (M=11.57) percent of standard length, 12.85–47.05 (M=45.25) percent of head. Eye small situated dorsolaterally in the middle of head; not visible from ventral surface, its diameter 29.41–35.71 (M=32.94) percent of head length; 62.5–83.33 (M=73.06) percent of the length of snout, 83.33–112.5 (M=102.08) percent of inter-orbital width. Nostrils close to each other, nearer to eye than to tip of snout, anterior in a flap. Mouth semicircular; lips moderately fleshy, not furrowed, upper uninterrupted, lower interrupted in the middle. Dentiform process well developed. Barbels well developed, thread-like, inner rostral slightly shorter than the outer rostral; outer rostrals extend to the narial opening; maxillary longest, extending to perpendicular from the middle of eye.

Scales: Small, imbricate, all over the body except head, surface in front of dorsal fin and ventral surface. Lateral line incomplete ending below the dorsal origin.

Fins: Dorsal fin small, not as high as length of head; edge of dorsal rounded; origin of dorsal fin nearer to caudal base than to tip of snout; origin of pelvic slightly behind that of dorsal. Membrane between the rays both on the dorsal and pectoral fins provided with thick muscular pads. Pectoral slightly shorter than head length, extends two-thirds the distance to pelvic. Pelvic shorter than pectoral, just short of vent. Vent situated a short distance in front of anal fin. Anal fin not reaching the caudal base. Caudal fin shorter than head length, truncate or slightly emarginate posteriorly.

Pre-dorsal distance 52.94–55.55 (M=54.15) percent of standard length; pre-pelvic distance 52.77–54.54 (M=53.45) percent; pre-anal 76.47–80.35 (M=78.65) percent; distance from pectoral to pelvic origin 31.94–32.72 (M=32.29) percent. Vent a short distance from anal fin; distance from vent to anal fin 14.28–25.0 (M=17.55) percent in that between anterior origins of pelvic and anal fins. Pectoral 19.44–23.21 (M=21.26), pelvic 66.66–73.33 (M=70.50) percent of standard length; length of dorsal 17.85–20.58 (M=18.25) percent; length of anal 66.66–86.66 (M=73.83) percent; base of dorsal 14.28–18.18 (M=15.96) percent; of anal 8.33–12.5 (M=10.50) percent; length of caudal 22.22–25.00 (M=23.59) percent.

Caudal peduncle short and stout; its length 13.23–19.64 (M=15.67) percent of standard length; its least height 72.72–90.90 (M=81.88) percent of its length.

Sexual dimorphism: None.

Colour: 12–13 dark irregular vertical bars descending from back to sides below lateral line; bands behind dorsal fin are broader; anteriorly they are narrower and taper below lateral line; not extending to vertical surface. A black bar at base of caudal fin; a black spot at first three rays of the dorsal fin. Undersurface of head and ventral side whitish.

Size: Largest specimen examined 36 mm SL.

Affinities: This species is close to *N. kangjupkhulensis* occurring in the southern watershed of the Naga Hills draining into the Manipur Valley and also to *N. nagaensis* from the northern watershed of the Naga Hills, draining into the Brahamaputra basin; it can be separated from *N. kangjupkhulensis* by the position of the dorsal origin commencing nearer to the caudal base than to the tip of snout (origin of dorsal equidistance between tip of snout and caudal base in *N. kangjupkhulensis*) from *N. nagaensis* by the number of branched dorsal fin rays (7 in *N. singhi;* 8 in *N. nagaensis*).

Holotype: 36.0 mm SL., SRS/ZSI F 580, Kiphire, Nagaland, Coll. K. P. Singh, 17.i.1981.

Paratype: 5 specimens, 27.5 to 34.0 mm SL., SRS/ZSI F 581, collected along with the holotype.

35. **Noemacheilus manipurensis** Chaudhuri

(Fig. 4, Pl. 12)

1912. *Nemachilus manipurensis* Chaudhuri, *Rec. Indian Mus.*, **7:** 443, pl. 40 figs. 4, 4 *a* 4 *b* and pl. 41, figs. 1, 1 *a* & 1 b (Type locality: Manipur).

1921. *Nemachilus manipurensis*, Hora, *Rec. Indian Mus.*, **22:** 199 (Auwlok and Maklang Rivers, Kangjupkul Hills).

1935. *Nemachilus manipurensis*, Hora and Mukerji, *Rec. Indian Mus.*, **37:** 398 (Naga Hills).

1974. *Noemacheilus manipurensis*, Menon, *Inl. Fisheries Soc. India*, special publication **1:** 55 (Manipur and Naga hills).

Diagnosis: A medium sized *Schistura* with truncated caudal fin; 7 branched rays in the dorsal fin; body marked with brownish vertical stripes encircling body; males with suborbital flap.

Description: Based on 8 specimens, 33.0–58.0 mm SL from Manipur Valley.

D. 1/7; P. 12; V 8; A. 2/5; C. 19.

Body uniform depth, dorsal profile slightly arched, ventral straight and horizontal. Depth of body 10.34–17.78 (M=14.74); head slightly broader than high at occiput, depressed; its length, 14.66–25.0 (M=22.60) percent of standard length. Snout of moderate length, somewhat shorter than postorbital distance; its length 5.17–10.0 (M=8.67) in standard length; 35.29–41.18 (M=38.27) percent of head. Eye small, situated somewhat in the middle of head; not visible from ventral surface; its diameter 17.65–25.0 (M=21.52) percent of head length, 42.86–83.33 (M= 56.75) percent of length of snout; 42.86–83.33 (M=59.53) percent of inter-orbital width. Nostrils somewhat distinct from one another, situated closer to eye than to tip of snout, anterior tubular. Mouth semicircular; lips moderately fleshy, weakly furrowed, upper uninterrupted, lower interrupted in middle. Dentiform processes moderately developed: Barbels well developed; outer rostral longest, extending to margin of eye; maxillary extending to beyond posterior border of eye.

Scales: Small, scattered all over except ventral surface. Lateral line incomplete, absent after pelvic fin.

Fins: Dorsal fin small, less than length of head; edge of dorsal almost straight; origin of dorsal fin somewhat nearer to caudal base than to tip of snout; origin of pelvic slightly before that of dorsal. Pectoral equal to head, extends about two-thirds of distance to pelvic. Pelvic almost equal to pectoral, separated from anal opening by a considerable distance. Anal fin not reaching base of caudal. Caudal fin as long as head, truncate.

Pre-dorsal distance 34.48–55.88 (M=51.47) percent of standard length; pre-pelvic distance 32.76–52.94 (M=47.71) percent; pre-anal 46.55–82.50 (M=74.70) percent; distance from pectoral to pelvic origin 19.83–31.25 (M=27.40) percent. Vent a short distance from anal fin; distance from vent to anal fin 8.33–20.00 (M=12.89) percent in that between anterior origins of pelvic and anal fins. Pectoral 12.93–22.34 (M=18.50), pelvic 11.21–19.15 (M=16.94) percent of standard length; height of dorsal 11.21–20.00 (M=16.59) percent; of anal 11.21–20.00 (M=15.23) percent; base of dorsal 10.34–12.82 (M=11.90) percent; of anal 6.70–11.11 (M=9.26) percent; caudal 13.79–22.27 (M=21.96) percent.

Caudal peduncle short and stout, its length 9.48–15.55 (M=13.98) percent of standard length; its least height 70.00–88.88 (M=79.28) percent of its length.

Sexual dimorphism: Males with suborbital flap.

Colour: 14–20 brown vertical stripes on body.

Size: Largest specimen examined 58.0 mm SL.

Affinities: Among the species of *kangjupkhulensis*-complex, *N. manipurensis* is more closely related to *N. kangjupkhulensis* than any other. Both have 7 branched rays in the dorsal fin and incomplete lateral line (lateral line ends before commencement of dorsal fin or end of pectoral in *N. kangjupkhulensis*).

Range: India: Manipur Valley and Nagaland.

Material examined: India: Manipur: 6 specimens, ZSI F 2171/2, Manipur Valley.

Nagaland: 7 specimens, ERS/ZSI, uncatalogued, stream, 15 km. from Tuensang, Coll. K. P. Singh, 21.ix.81. 2 specimens, ERS/ZSI, uncatalogued, Nagaland, Coll. K. P. Singh, 21.ix.81 2 specimens, ERS/ZSI, uncatalogued, Melory stream, Coll. K. P. Singh, 16.ix.81 14 specimens ZSI F 2193/2, Naga Hills, Assam.

36. **Noemacheilus cincticauda** (Blyth)

(Fig. 4, Pl. 5)

1860. *Cobitis cincticauda* Blyth, *J. Asiat. Soc. Beng.*, **29**: 172 (Type locality: Dawna Hills and Tenasserim, Lower Burma).

1869. *Nemacheilus cincticauda*, Day, *Proc. Zool. Soc. Lond.*, p. 552.

1890. *Nemachilus savona*, Vinciguerra (nec Ham-Buch), *Ann. Mus., Civ. Stor. Nat. Genova*, (2) **9**: 211.

1929. *Nemachilus cincticauda*, Hora, *Rec. Indian Mus.*, **31**: 326.

1929. *Nemachilus paucifaciatus* Hora, *Rec. Indian Mus.*, **31**: 330, pl. 15, figs. 1 and 2 (Type locality: Hwe-gna-sang River, Pazi Township, Hsipaw, North Shan States, Burma).

1948. *Nemacheilus cincticauda*, Rendahl, *Arkiv for zoologi* Bd. 40A, No. **2**: 36 (Dawna Hills, S. Burma).

1948. *Noemacheilus balteatus* Rendahl, *Arkiv. for. zoologi* Bd. 40A. No. **7**: 42, fig. 20, to 23. (Type locality: Melwedeung, Tenasserim).

Diagnosis: A small *Schistura* species with 7 branched rays in dorsal fin; slightly emarginate caudal fin; incomplete lateral line; body marked with 3–4 narrow vertical bars of deep brown in the middle of body in adult specimens; young with 8 broad grey bars extending from the back to the sides.

Description: Based on a single specimen 42.5 mm SL (holotype of *N. paucifasciatus* Hora) from Hwe-gna-sang River, Monglong subdivision, N. Shan States, Burma.

D. 3/7; P. 9; V 1/8; A. 1/5; C. 18.

A small strongly built species of narrow uniform depth; depth of body 16.47; head somewhat depressed, broader than high at occiput; its length 23.43 per cent of standard length. Snout somewhat rounded, slightly shorter than postorbital distance; its length 10.59 of standard length, 45.0 per cent of head. Eye small, dorso-lateral in position, situated in the middle of head, not visible from ventral surface; its diameter 20.0 per cent of head length, 44.44 per cent of length of snout, 66.67 per cent of inter-orbital width. Nostrils close to each other, situated closer to eye than to tip of snout, anterior tubular; membrane between the two nostrils produced into a small blunt projection. Mouth semicircular; lips moderately fleshy, deeply furrowed, upper uninterrupted, lower interrupted in the middle. Dentiform process moderately developed. Barbels well developed; inner rostral shorter than the outer rostral; the outer rostral extending below middle of the eye, maxillary longer than the outer rostral, extending to perpendicular from posterior border of eye.

Scales: Minute, non-imbricate, inconspicuous, more prominent in the posterior half. Lateral line incomplete ending at base of pelvic fin.

Fins: Dorsal small, less than length of head; edge of dorsal slightly convex; origin of dorsal fin somewhat nearer to caudal base than tip of snout; origin of pelvic opposite to that of dorsal. Pectoral shorter than head, extends about two-thirds of the distance to pelvic. Pelvic shorter than pectoral; separated from anal opening by a short distance in older specimens, almost reaching anal opening in young ones. Anal fin not reaching base of caudal. Caudal fin slightly shorter than head, emarginate posteriorly.

Pre-dorsal distance 54.12 per cent of standard length; pre-pelvic distance 54.12 per cent; pre-anal 77.65 per cent; distance from pectoral to pelvic origin 32.94 per cent. Vent a short distance from anal fin; distance from vent to anal fin 18.18 per cent in that between anterior origins of pelvic and anal fins. Pectoral 18.82, pelvic 15.29 per cent of standard length; height of dorsal 18.82 per cent; of anal 14.12 per cent; base of dorsal 11.76 per cent; of anal 11.24 per cent.

Caudal peduncle short and stout, its length 16.47 per cent of standard length; its least height 71.43 per cent of its length.

Sexual dimorphism: None.

Colouration: The colouration in the preserved specimen is somewhat brownish. According to Hora (1929) there are 8 broad, gray bands in young examples. With growth the bands fade away and the adult is characterised by 3 or 4 narrow vertical bars of deep reddish-brown colour in the middle of body.

Size: Largest specimen examined 42.5 mm SL.

Affinities: The species is close to the other members of the *kangjupkhulensis* group; it can be separated from them by its characteristic colouration.

Range: Lower and middle Burma.

Material examined: Burma: 1 specimen, F 6314/1, ZSI (Holotype of *N. paucifasciatus* Hora) Hwe-gna-sang River, Monglong subdivision, N. Shan States, Coll. Coggin Brown, 1910.

4. *The sikmaiensis Group*

11 *The sikmaiensis Complex*

The *sikmaiensis* group has its centre of distribution in Burma. The group is related to the *kangjupkhulensis* group and both may

have descended from a common stock. The principal characteristics that distinguish this group are the forked caudal and the typical *Schistura* type of dark vertical broad bands on the body in most of the members.

37. **Noemacheilus sikmaiensis** Hora

(Figs. 4 & 5, Pl. 3)

1921. *Nemachilus sikmaiensis* Hora, *Rec. Indian Mus.*, **22**: 201, pl. 9, fig. 4 pl. 10, fig. 1, 1a (Type locality: Sikmai stream, near Patel, Manipur).

1929. *Nemachilus sikmaiensis*, Hora, *Rec. Indian Mus.*, **31**: 324.

1974. *Noemacheilus sikmaiensis*, Menon, *Inl. Fisheries Soc. India*, special publication, **1**: 58 (Manipur and Myitkyina, Burma).

Diagnosis: A medium sized *Schistura* with 8 branched dorsal fin rays; deeply forked caudal fin; incomplete lateral line extending to middle of anal fin; 12–13 black rings around body; males with suborbital flap.

Description: Based on 8 specimens, 24.0–27.0 mm SL from Sankha, a large hill stream, midway between Kamiang and Mogaung, Myitkyina Dt., Burma.

D. 2/8; P. 11–12; V 8; A. 2/5; C. 19.

A medium-sized, elongated fish; its dorsal profile raising gradually from snout to dorsal fin and beyond sloping gradually to caudal base; ventral profile almost horizontal and straight. Depth of body 12.0–18.75 (M=15.51); head slightly depressed, as broad as high at occiput; its length 22.22–28.0 (M=26.30) per cent of standard length. Snout of moderate length, somewhat rounded, equal to postorbital distance its length 11.54–16.67 (M=14.04) of standard length and 42.86–61.54 (M=53.45) per cent of head. Eye small, situated in the middle of head, not visible from the ventral surface; its diameter, 28.57–41.67 (M= 32.54) per cent of head length, 55.0–83.33 (M=61.91) per cent of length of snout; 100.0 per cent of inter-orbital width. Nostrils close to each other, (situated closer to eye than tip of snout, a fold of skin, provided with a sharp barbel-like process separating the nostrils on each side. Mouth semicircular; lips thick, poorly furrowed, upper uninterrupted, lower notched in middle, devoid of any papillae. Barbels well developed; inner rostral shorter, outer rostral longest extending to posterior margin of nostrils.

Scales: Minute, scattered all over body except ventral surface; lateral line incomplete extending up to a middle of anal fin.

Fins: Dorsal fin small, less than length of head; edge of dorsal straight; origin of dorsal fin equidistant between tip of snout and caudal base; insertion of pelvic slightly behind that of dorsal. Pectoral rounded, shorter than head extending half of distance to pelvic. Pelvic shorter than pectoral, provided with scaly appendage at base, reaching anal opening. Anal fin not reaching base of caudal. Caudal fin as long as or slightly shorter than head, deeply forked, lobes pointed, lower lobe longer than upper.

Pre-dorsal distance 46.94–54.17 (M=51.52) per cent of standard length; pre-pelvic distance 48.98–56.25 (M=52.74) per cent; pre-anal 69.39–80.0 (M=75.94) per cent; distance from pectoral to pelvic insertion 27.08–30.61 (M=28.76) per cent. Vent a short distance from anal fin; distance from vent to anal fin 14.29–25.0 (M=19.84) per cent in that between anterior origins of pelvic and anal fins. Pectoral 20.41–26.92 (M=23.49), pelvic 18.37–20.83 (M=19.78) per cent of standard length; height of dorsal 18.52–25.0 (M=22.06) per cent; of anal 16.33–20.83 (M=19.28) per cent; base of dorsal 14.29–20.00 (M=17.46) per cent; of anal 11.76–16.00 (M=13.23) per cent; caudal 20.83–28.0 (M=24.33) per cent.

Caudal peduncle short and stout; its length 14.58–18.0 (M= 16.23) per cent of standard length; its least height 62.50–85.71 (M=71.21) per cent of its length.

Sexual dimorphism: Males with suborbital flap.

Colour: 12–13 black rings around body, separated by narrowed white ones; a black cross bar at caudal base, a black spot at base of first few dorsal rays. Dorsal fin with black bar in the middle; caudal fin dusky; rest unspotted. In some the rings in the anterior portion split into a number of narrow stripes, or coalesced rings become indistinguishable and colour uniformly black.

Size: The largest specimen examined 27.0 mm SL.

Affinities: The forked tail, incomplete lateral line and general body shape and markings indicate a close relationship with the other species of the *Sikmaiensis* complex.

Range: India: Manipur valley and Meghalaya; Burma: Myitkyina Dist.

Material examined: India: Meghalaya: 3 specimens, ZSI F 15345, Barapani, East Khasi Hills. 7 specimens, DZGU, uncatalogued, Coll. S. C. Dey. 6 specimens, Umium River, Khasi

Hills, DZGU uncatalogued, Coll. S. C. Dey. 4 specimens, Khowai River, Jaintia Hills, DZGU, uncatalogued, Coll. S. C. Dey. 9 specimens, Khri River, Jaintia Hills, DSGU, uncatalogued, Coll. S. C. Dey. 3 specimens, Manda River, Garo Hills, DZGU, uncatalogued, Coll. S. C. Dey. 2 specimens, Garo Hills, DZGU, uncatalogued, Coll. S. C. Dey.

Tripura: 6 specimens, ERS/ZSI, uncatalogued, Lakshmi Chara, Coll. S. K. Charlu, 19.viii.78.

Nagaland: 1 specimen, ERS/ZSI, uncatalogued, 15 km from Tuensang, Coll. K. P. Singh, 21.ix.83.

Assam: 2 specimens, Deki River, DZGU, uncatalogued, Coll. S. C. Dey.

Burma: Myitkyina: 3 specimens, ZSI F 11067/1, small rocky stream, Kamaing, U. Burma, Coll. B. N. Chopra, 23.30.xii.1926. 56 specimens, ZSI F 11066/1, Sankla, a small hill-stream, mudway between Kamaing and Mogaung, U. Burma, Coll. B. N. Chopar, 25.xii.1926.

38. **Noemacheilus prashadi** Hora

(Figs. 8 & 9, Pl. 3)

1921. *Nemachilus prashadi*, Hora, *Rec. Indian Mus.*, **22**: 203, pl. 10, figs. 2, 2a (Type locality: Thonagpal Tank, and Thoubal and Sikmai streams, Manipur).

Diagnosis: A medium-sized *Schistura* with deeply forked caudal fin; 8 branched dorsal fin rays; lateral line almost complete extending to anal fin. Body marked with 13 vertical broad black bands crossing the lateral line on sides, reticulated with dark bands and blotches above. Males with suborbital flap.

Description: Based 9 specimens, 32.0–46.25 mm SL from Manipur.

D. 3/8; P. 11; V 8; A. 2/5; C. 19.

Body uniform depth, dorsal profile slightly arched, ventral straight and horizontal. Depth of body 13.95–19.12 (M=39.0); head almost as broad as high at occiput; its length 19.57–27.94 (M=23.09) per cent of standard length. Snout of moderate length, somewhat shorter than postorbital distance ; its length 8.82–11.83 (M=9.93) of standard length, 38.10–55.56 (M=43.15) per cent of head. Eye small, situated somewhat in the anterior half of head, not visible from ventral surface; its diameter 16.67–36.84 (M=

26.22) per cent of head length, 36.36–87.50 (M=61.91) per cent of length of snout, 55.0–100.0 (M=75.19) per cent of interorbital width. Nostrils close to each other, situated closer to eye than tip of snout, anterior tubular. Mouth semicircular; lips moderately fleshy, weakly furrowed, upper uninterrupted, lower interupted in middle. Dentiform process moderately formed. Barbels well developed; inner rostral shorter; outer rostral equal to maxillary extending to margin of eye; maxillary reaching to perpendicular from posterior border of eye.

Scales: Small, imbricate all over, more prominent posteriorly; absent on ventral surface. Lateral line almost complete extending up to origin or middle of anal fin.

Fins: Dorsal small, less than head length; edge of dorsal slightly concave; origin of dorsal fin nearer tip of snout than caudal base; origin of pelvic slightly behind that of dorsal. Pectoral longer than head, extends about two-thirds of distance to pelvic; pelvic shorter than pectoral, reaching anal opening. Anal fin not reaching base of caudal. Caudal fin as long as or slightly longer than head, deeply forked, lobes pointed, upper slightly longer than lower.

Pre-dorsal distance 44.19–55.88 (M=48.79) per cent of standard length; pre-pelvic distance 48.89–58.82 (M=54.42) per cent; pre-anal 72.22–80.88 (M=77.61) per cent; distance from pectoral to pelvic origin 25.00–32.35 (M=28.17) per cent. Vent a short distance from anal fin; distance from vent to anal fin 15.00–33.33 (M=25.25) per cent in that between anterior origins of pelvic and anal fins. Pectoral 20.59–27.96 (M=24.09), pelvic 14.71–21.59 (M=18.41) per cent of standard length; height of dorsal 17.65–24.73 (M=20.08) per cent; of anal 12.22–20.45 (M=17.52) per cent; base of dorsal 17.65–23.66 (M=20.62) per cent; of anal 8.70–10.84 (M=9.54) per cent caudal 17.44–29.41 (M=22.83) per cent.

Caudal peduncle short and stout; its length 14.71–25.8 (M=21.08) per cent of standard length; its least height 38.10–100.00 (M=55.85) per cent of its length.

Sexual dimorphism: Males with suborbital flap.

Colour: 12 to 14 short black vertical bands across lateral line on sides, characteristic reticulum formed by numerous dark bands and blotches above, under surface pale olivaceous. A deep black bar at the base of caudal; two dotted bands across the fin; a black spot at base of first few rays of dorsal fin; two bands across it, other fins unspotted.

Size: The largest specimen examined 46.25 mm SL.

Affinities: The deeply forked caudal fin, incomplete lateral line and colour pattern indicate this to be a member of the *sikmaiensis* complex; it can be readily separated by its characteristic colouration.

Range: Manipur Valley.

Material examined: India: Manipur: 26 specimens (syntypes of *N. prashadi*) ZSI F 9988/1, Thonagpal tank, 5 miles from Yaribuk. 9 specimens, ZSI F 10095/1.

39. **Noemacheilus arunachalensis** sp. no.v

(Fig. 10 & Pl. 16)

Diagnosis: A small *Schistura* species, with 8 branched dorsal rays; forked tail; incomplete lateral line ending at base of pelvic; body marked with 10–12 broad black bands encircling body with narrow yellowish interspaces.

Description: Based on 3 specimens, 41.0–56.0 mm SL from Riwa River at Nampong, Tirap District, Arunachal Pradesh.

D. 2/8; P. 11; V 1/7; A. 2/5; C. 18.

Body of uniform depth, dorsal profile slightly arched, ventral horizontal and flat, head and body before dorsal fin depressed, tail somewhat compressed side to side. Depth of body 15.69–16.07 (M=15.87). Head almost as broad as high at occiput; its length 25.49–28.57 (M=27.37) per cent of standard length. Snout of moderate length, rather pointed, shorter than postorbital distance; its length 11.76–12.50 (M=12.15) of standard length; 43.48–46.15 (M=44.40) per cent of head. Eye large, situated in the middle of head, dorsolateral in position, not visible from ventral surface; its diameter 18.75–26.92 (M=23.92) per cent of head length; 42.86–60.0 (M=53.73) per cent of length of snout, 75.0–100.0 (M=91.07) per cent of inter-orbital width. Nostrils close to each other, situated closer to eye than to tip of snout; anterior nostril tubular. Mouth semicircular; lips fleshy, not furrowed, upper uninterrupted, lower interrupted in the middle Dentiforms procces moderately developed. Barbels well developed, thread like; inner rostral shortest, outer rostral shorter than maxillary extending to margin of eye; maxillary extending to perpendicular from posterior border of eye.

Scales: Small, non-imbricate, all over body, more prominent on posterior portion of body, absent on ventral side. Lateral line incomplete ending at base of pelvic.

Fins: Dorsal fin small, almost as high as length of head; edge of dorsal straight; origin of dorsal somewhat nearest to base of caudal than to tip of snout; origin of pelvic opposite to that of dorsal or slightly behind. Pectoral shorter than head, extends three-fourth distance to pelvic. Pelvic shorter than pectoral not extending to anal opening. Anal not reaching caudal base. Caudal fin slightly shorter than head, forked, lobes of equal length.

Pre-dorsal distance 50.98–53.66 (M=52.74) per cent of standard length; pre-pelvic distance 53.66–55.36 (M=54.64) per-cent; pre-anal 75.89–83.33 (M=80.72) per cent; distance from pectoral to pelvic origin 29.27–31.37 (M=30.63) per cent. Vent a short distance from anal fin; distance from vent to anal fin 16.67–28.57 (M=23.08) per cent in that between anterior origins of pelvic and anal fins. Pectoral 17.86–23.17 (M=20.21), pelvic 17.65–19.51 (M=18.34) per cent of standard length; height of dorsal 18.63–2073 (M=19.67) per cent; of anal 13.73–16.07 (M= 15.22) per cent; base of dorsal 17.07–17.86 (M=17.53) per cent; of anal 7.84–8.93 (M=8.44) per cent; caudal 21.43–28.05 (M= 24.33) percent.

Caudal peduncle short and stout; its length 14.29–15.69 (M=14.87) per cent of standard length; its least height 81.25–91.67 (M=86.81) per cent of its length.

Sexual dimorphism: None.

Colour: Body marked with 10 to 12 broad black rings separated by an equal number of narrower yellow ones. In front of the ventrals the rings are incomplete; the under surface of body is dull white, a black bar across the base of caudal; a black spot at base of first few dorsal rays; other fins unspotted.

Size: Largest specimen examined 56.0 mm SL.

Affinities: This species is close to *N. sikmaiensis;* it can be separated by its shorter lateral line extending only up to base of ventral (lateral line extends to middle of anal fin in *N. sikmaiensis*) and the ventrals not reaching the anal opening (ventrals reach the vent in *N. sikmaiensis*).

Holotype: 56.0 mm SL, Riwa River at Nampong, Tirap District, Arunachal Pradesh, SRS/ZSI F. 572.

Paratype: 2, 41.0 and 51.0 mm SL., data same as above. SRS/ZSI F. 573.

40. **Noemacheilus barapaniensis** nom. nov.

(Figs. 5, 6, 7, Pls. 4 & 12)

1981. *Noemacheilus barapaniensis*, nom. nov. pro. *Physoschistura elongata* Sen and Nalbant, *Tran. Mus., Hist. nat. Grigore Antipa*, **23**: 201 nec. *Aborichthys elongatus* Hora, *Rec. Indian Mus.*, **22**: 735, 1921.

Diagnosis: A species of *Schistura* with small slender body (depth 10.77–15.48 per cent of standard length), with 8 branched dorsal fin rays, incomplete lateral line, ending below dorsal fin and with 9–14 black cross-bars.

Description: Based on 3 specimens, 21.0–32.5 mm SL from Barapani, 200 km from Shillong, Meghalaya.

D. 3/8; P. 1/10; V 1/6; A. 2/5; C. 19.

Body slender, elongated; both dorsal and ventral profiles straight and horizontal. Depth of body 10.77–15.43 (M=12.77), head slightly broader than high at occiput; its length 22.41–23.81 (M=23.10) per cent of standard length. Snout of moderate length, blunt, somewhat shorter than postorbital distance; its length 8.62–9.52 (M=9.12) per cent of standard length, 38.46–40.0 (M=39.48) per cent of head. Eye small, situated somewhat in the anterior half of head, not visible from ventral surface; its diameter 23.08–30.0 (M=25.47) per cent of head length, 58.33–75.0 (M=64.44) per cent of length of snout, 75.00–100.0 (M=87.50) per cent of interorbital width. Nostrils close to each other, situated closer to eye than to tip of snout, anterior nostril not tubular. Mouth semicircular; lips moderately fleshy, weakly furrowed, upper uninterrupted, lower interrupted in the middle. Dentiform processes moderately developed. Barbels well developed; outer rostral longer than maxillary, not reaching the anterior margin of eye; maxillary extending to perpendicular from a little beyond middle of eye.

Scales: Small, more prominent on posterior half of body, absent anteriorly and on ventral surface. Lateral line incomplete ending below dorsal fin.

Fins: Dorsal small, less than length of head; edge of dorsal slightly convex; origin of dorsal fin slightly nearer tip of snout than to caudal base; origin of pelvic slightly behind that of dorsal. Pectoral shorter than head, extends half way distance to pelvic. Pelvic shorter than pectoral reaching the anal opening. Anal fin not reaching base of caudal. Caudal fin as long as or slightly shorter than head, forked, lobes pointed and of equal length.

Pre-dorsal distance 51.72–54.76 (M=52.93) per cent of standard length; pre-pelvic distance 50.0–54.76 (M=52.45) per cent; pre-anal 73.85–85.71 (M=79.05) per cent; distance from pectoral to pelvic origin 27.59–30.95 (M=28.74) per cent. Vent a short distance from anal fin; distance from vent to anal fin 30.77–37.50 (M=33.87) per cent in that between anterior origins of pelvic and anal fins. Pectoral 18.46–22.62 (M=20.59), pelvic 16.15–20.24 (M=17.59) per cent of standard length; height of dorsal 15.38–22.62 (M=18.41) per cent; of anal 12.31–16.67 (M=14.26) per cent; base of dorsal 10.00–14.29 (M=11.54) per cent; of anal 6.15–10.34 (M=8.67) percent; caudal 17.24–23.81 (M=20.35) per cent.

Caudal peduncle short and stout; its length 15.48–17.24 (M=16.29) per cent of standard length; its least height 57.14–69.23 (M=62.12) per cent of its length.

Sexual dimorphism: None.

Colour: Body light yellowish with 9–14 well marked almost vertical brown cross bars of variable shape; continuous across the back or interupted on the back; the bars are usually divided into an upper and a lower fragment. A dark bar on the caudal base and a spot at dorsal origin.

Size: Largest specimen examined 32.5 mm SL.

Affinities: This species is closely related to *N. brunneanus* but can be easily distinguished from it by the number of branched dorsal rays (8 in *N. barapaniensis;* 9 in *N. brunneanus*), and the body shape (depth 18.5–19.5 per cent of standard length in *N. brunneanus*, 10.77–15.48 per cent in *N. barapaniensis*).

Range: India: Meghalaya: Barapani, 20 km east of Shillong (Brahmaputra basin).

Material examined: 3 specimens (Paratypes of *Physoschistura elongata*), ERS/ZSI, Barapani, Shillong Meghalaya.

41. **Noemacheilus acuticephalus** Hora

(Figs. 6 & 7, Pl. 3)

1929. *Nemachilus acuticephalus* Hora, *Rec. Indian Mus.*, **31:** 328, pl. 14, figs. 5 & 6 (Type locality: Hwe-gna-sang River, Pazi Township, Hosipaw, North Shan States, Burma).

Diagnosis: A *Schistura* species with a rounded tapering head; 7 branched dorsal fin rays; forked caudal; incomplete lateral line ending in between pectoral and dorsal fins; small compact fins; dorsal fin situated nearer base of caudal than to tip of snout.

Description: After Hora (1929).

D. 3/7; P. 1/8; V 1/6; A. 2/5; C. 18.

A small slender loach with both the profiles arched; ventral surface rounded. Head almost cylindrical and pointed anteriorly. Depth of body 16.94–18.86, length of head 20.40–22.22 per cent of standard length, width of head equals height at occiput. Eye minute situated in the anterior half of head, not visible from the ventral surface. Mouth small, situated ventrally slightly behind tip of snout; lips continuous at the angles, the lower interrupted. Nostrils close to one another, nearer to eye than to tip of snout; a membrane between the nostrils covers the posterior nostril and distally produced into a short process in the middle. Barbels thread-like; the inner rostral extends to nostrils; the outer rostral to middle of eye; the maxillary a little beyond the eye.

Scales: Small, rudimentary embedded in skin. Lateral line incomplete, ending between pectoral and dorsal fins.

Fins: Dorsal fin small, less than length of head; origin of dorsal slightly in advance of ventral; its commencement nearer base of caudal than to tip of snout. Pectoral much shorter than the head, extends half way to base of ventral. Ventral shorter than pectoral, separated from anal opening by a considerable distance. Anal fin is very small, not reaching base of caudal. Caudal fin as long as head, forked, lobes pointed, and of equal length. Rays in all the fins are cramped together. A low adipose dorsal present along dorsal surface, behind the dorsal and ventrally behind the anal fin. Least height of caudal peduncle 76.9–83.3 per cent of its own length.

Colour: 11–13 vertical bands, wider than interspaces, on sides of body; a black spot at base of the anterior rays of dorsal fin; a distinct black blotch at the base of caudal fin.

Size: Largest specimen 40.0 mm TL.

Affinities: The rounded and tapering head,the small compact fins and the general facies of the species distinguish it from all other known species. Evidently it is highly specialised for a burrowing mode of life.

Range: Burma: Northern Shan State: Hwe. gna-Sang stream a tributary of waters of the Madeya River (Irrawadi basin).

42. **Noemacheilus vinciguerrae** Hora

(Fig. 3, pl. 4)

1890. *Nemachilus multifasciatus*, Vinciguerra (nec Day), *Ann. Mus. Civ. stor. Nat. Genova* (2) 9, p. 209 (Type locality: Burma: S. Shan States).

1935. *Nemachilus vinciguerrae* Hora, *Rec. Indian Mus.*, **37**, p. 62, pl. 3, fig. 12.

1940. *Nemacheilus putaoensis* Rendahl, *Ark. Zool.* 40A, No. **7**: 27 (Type locality: Putao, W. Burma).

Diagnosis: A *Schistura* species with 8 branched dorsal fin rays; forked caudal; lateral line complete; body marked with a number of vertical bands; anteriorly broken up into a number of narrow bands.

Description: Based on 6 specimens, 47.50–78.0 mm SL from Manipur, Chindwin drainage (4) Namya River at Kongan, Thana Shan Valley (1), Heekalam, Burma (1).

D. 3/8; P. 12; V 1/6; A. 2/5; C. 19.

A stout muscular fish with dorsal profile somewhat elevated, ventral straight and horizontal. Depth of body 14.0–22.44 (M=18.41) head slightly broader than high at occiput; its length 20.51–24.21 (M=22.61) per cent of standard length. Snout of moderate length, narrower anteriorly, somewhat shorter than postorbital distance; its length 8.33–10. 0 (M=9.25) of standard length, 34.78–45.45 (M=41.03) per cent of head. Eye small, situated somewhat in anterior half of head, not visible from ventral surface; its diameter 12.0–22.22 (M=15.96) per cent of head length, 29.17–50.0 (M=38.83) per cent of length of snout, 46.15–75.0 (M=58.05) per cent of inter-orbital width. Nostrils close to each other, situated closer to eye than to tip of snout, anterior tubular. Mouth semicircular; lips moderately fleshy, poorly furrowed, upper faintly notched, lower interrupted in the middle. Dentiform process well developed. Barbels well developed, threadlike; inner rostral shortest, outer rostral almost equal to maxillary not extending to margin of eye; maxillary extending to perpendicular from middle of eye.

Scales: Small, imbricate all over body, more prominent on posterior portion of body, absent on ventral surface. Lateral line complete.

Fins: Dorsal fin small, less than head length; edge of dorsal straight; origin of dorsal fin slightly nearer caudal base than tip of snout; origin of pelvic slightly behind that of dorsal. Pectoral shorter than head, extends half way distance to pelvic. Pelvic

shorter than pectoral, not reaching anal opening. Anal fin not reaching base of caudal. Caudal fin as long as or slightly shorter than head, forked, lobes pointed, of equal length.

Pre-dorsal distance 48.39–53.33 (M=50.23) per cent of standard length; pre-pelvic distance 52.00–57.14 (M=54.36) per cent; pre-anal 76.00–81.90 (M=78.43) per cent; distance from pectoral to pelvic origin 30.00–34.62 (M=32.68) per cent. Vent a short distance from anal fin; distance from vent to anal fin 14.29–22.41 (M=19.58) per cent in that between anterior origins of pelvic and anal fins. Pectoral 15.71–23.16 (M=20.32), pelvic 15.24–20.00 (M=17.39) per cent of standard length; height of dorsal 16.67–18.95 (M=17.45) per cent; of anal 10.48–83.33 (M=25.37) per cent; base of dorsal 16.00–17.74 (M=16.74) per cent; of anal 6.67–10.48 (M=8.90) per cent; caudal 18.20–23.39 (M=21.05) per cent.

Caudal peduncle short and stout; its length 11.90–16.13 (M=14.03) per cent of standard length; its least height 71.43–100.0 (M=88.33) per cent of its length.

Sexual dimorphism: Males with suborbital flap.

Colour: Body marked with about 17 vertical bands, broken up anteriorly into smaller bands; dorsal surface and sides of head covered with short black markings; a well marked short prominent vertical band in the middle of base of caudal. Dorsal fin with one or two series of spots; caudal fin with two V-shaped bands; pelvic and anal fins with one band each.

Size: Largest specimen examined 78.0 mm SL.

Affinities: The morphology and colour pattern indicate this to be a member of *sikmaiensis* group. In that group it is closest to *N. sikmaiensis* in its geographical distribution and general morphology. The two exhibit considerable similarity in colour pattern (the anterior bands split up into number of smaller bands in some specimens of *N. sikmaiensis*).

Range: India: Manipur (Chindwin drainage; Burma: North Burma (Irrawady basin), S. Shan States (Salween basin).

Material examined: India: 6 specimens, DZMU, uncatalogued.

Burma: Specimen, ZSI F 12459/1, Namya River, Kongan Thana, Shan Valley.

43. **Noemacheilus brunneanus** Annandale

(Fig. 4, Pl. 4)

1918. *Nemachilus brunneanus* Annandale, *Rec. Indian Mus.*, **14:** 44, pl. 2, fig. 2 (type locality: S. Shan States, Burma).

1929. *Noemacheilus raoe* Hora, *Rec. Indian Mus.*, **31:** 332, pl. 15, figs. 7 & 8 (Type locality: Mongyai, N. Shan States, Burma).

Diagnosis: A small slender species with 9 branched rays in the dorsal fin; forked caudal; incomplete lateral line terminating opposite to origin of dorsal fin; a varying number of dark horizontal bars on the side; separated by narrow interspaces.

Description: Based after Anmandale (1918) and Hora (1929)

D. 4/9; P. 1/10; V 1/7; A. 3/5–6; C. 18.

A small cylindrical fish; the depth of body 16.66–19.60 per cent; head, proportionately longer in young; its length 23.25–25.0 per cent of standard length. Eye large, its diameter 23.25–25.64 per cent of head; not visible from the ventral surface. Snout longer than diameter of eye; inter-orbital width slightly longer than diameter of eye. Nostrils close together, situated nearer to eye than to tip of snout, anterior somewhat tubular; the tube produced posteriorly into a flap-like projection. Mouth small crescentic; lips thick, lower papillated, interrupted in the middle. Barbels well developed; the inner barbels extend to nostrils, the outer to the eye; the maxillaries longer than the outer barbels, extend to slightly beyond the eye.

Scales: Small, distinct all over the body. Lateral line incomplete, terminating opposite to origin of dorsal fin.

Fins: Commencement of dorsal fin equidistant between the tip of snout and base of the caudal or slightly nearer to snout than base of caudal. Pectoral fins long, slender, falcate, longer than head. Pelvics much shorter than pectorals; reach the anal opening. Anal fin much shorter than dorsal, reaches the base of the caudal. Caudal fin longer than head, deeply forked. Least height of caudal peduncle 83.33–90.90 per cent of its length.

Sexual dimorphism: None.

Colour: Ground colour olivaceous; dorsal surface of head mottled and spotted with black. Body marked with about 20 horizontal bars on the sides separated by narrow interspaces. Two deeply coloured short black bars on each side of caudal peduncle;

a black blotch at base of dorsal fin in front, a row of short black lines across the middle. Caudal fin indistinctly marked in the proximal half with two or three V-shaped dark bands.

Size: Largest specimen known 45 mm TL.

Affinities: This species is closely related to *N. barapaniensis* but can be easily distinguished from it by the greater number of branched dorsal rays (8 in *N. barapaniensis*), deeper body and the distincive colouration.

Range: Burma: South Shan States: Yawnghwe valley; North Shan States: Mongvai.

44. **Noemacheilus shanensis** Hora

1929. *Nemachilus shanensis* Hora, *Rec. Indian Mus.*, **31:** 322, pl. 15, figs. 5 & 6 (Type locality: Thals-stream near Fort Stedman, South Shan State Burma).

Diagnosis: A stout, well built *Schistura* species, with 9 branched rays in the dorsal fin; complete lateral line; forked caudal; 8 to 9 short broad vertical bars across the lateral line; a few similar markings on the doral surface of the tail region.

Description: Based on Hora (1929).

D. 4/9; P. 1/8; V 1/6; A. 3/6; C.

A stout, well built fish with head depressed, undersurface flattened. Depth of body 16.69–19.58 (M=18.02); head short and globular; its length 19.80–22.25 (M=20.75) per cent of standard length. Snout blunt, equal to postorbital distance; its length 8.73–9.42 (M=9.14) per cent of standard length, 42.35–45.91 (M=44.12) per cent of head. Eye small, situated in the middle of head, not visible from ventral surface; its diameter 23.46–24.70 (M=24.42) per cent of head length; 51.11–58.33 (M=54.99) per cent of length of snout; 95.45–104.54 (M=99.99) per cent of inter-orbital width. Nostrils close to each other, situated closer to eye than tip of snout. Mouth semicircular; lips moderately fleshy, furrowed, upper uninterrupted, lower interrupted in the middle by a narrow channel. Dentiform process well developed. Barbels short and stumpy; inner rostral shorter than diameter of eye, other too longer.

Scales: Minute, indistinct covering the entire body. Lateral line complete.

Fins: Dorsal fin extensive, fan shaped in outline; height less than length of head; the length of its base almost equal to length of head; origin of dorsal fin equidistant between tip of snout and caudal base; origin of pelvic slightly behind that of dorsal. Pectoral considerably longer than head, extends two-thirds of distance to pelvic; the outer most ray simple, bears a broad thick pad of skin anteriorly. Pelvic shorter than pectoral and just misses the vent; outermost ray modified the same way as that of pectoral. Both paired fins horizontally placed; membranes between rays are provided with pads of skin used for adhesion. The anal fin is considerably removed from anal opening; its origin is nearer to the base of caudal than to origin of ventral fin; membranes between the rays are thickened in their proximal halves. Caudal fin longer than head and deeply forked, both lobes rounded, upper longer, better developed.

Pre-dorsal distance 50.00 per cent of standard length; Pre-pelvic distance 52.43 per cent; pre-anal 79.26 per cent; distance from pectoral to pelvic origin 32.92 per cent. Vent a short distance from anal fin; distance from vent to anal fin 19.56 per cent in that between anterior origins of pelvic and anal fins. Pectoral 23.78 per cent, pelvic 21.95 of standard length; height of dorsal 14.93 per cent; of anal 15.85 per cent; caudal 22.33–25.65 (M=23.89) per cent.

Caudal peduncle short and stout; its length 13.59–14.39 (M=13.86) per cent of standard length; its least height 76.36–83.33 (M=79.42) per cent of its length.

Sexual dimorphism: None.

Colour: 8 to 9 short broad bands along lateral line and a few similar markings on the dorsal surface in the tail region. Anteriorly the upper surface of body is speckled with black spots. The upper surface and the sides of head grey; a black streak along lateral line; ventral surface pale. Dorsal fin with two rows of black spots; a black blotch at the base of its origin; number of vertical black bands composed of longitudinal short bars on the caudal fin.

Size: Maximum 51.0 mm SL.

Affinities: This species is quite distinct from other members of the *sikmaiensis* group. It can be readily distinguished by the form of its fins and its characteristic colouration.

Range: Burma: Thale-u-Stream near Fort Stedman, Southern Shan States.

45. **Noemacheilus rivulicola** Hora

(Figs. 1 & 2, Pl. 4)

1929. *Noemachilus rivulicola* Hora, *Rec. Indian Mus.*, **31**: 324, (Yawnghwe valley and the He-Ho plain, S. Shan State, Burma).

Diagnosis: A small, slender *Schistura* with 8 branched rays in dorsal; a complete lateral line well marked upto middle of base of anal fin; forked caudal; body marked with brownish vertical bands as wide as or narrower than whitish interspace, reaching below lateral line in the posterior half; bands anterior to dorsal fin broken up into smaller ones.

Description: Based on Holotype 48.5 mm SL from In-gam near He-Ho plain, Southern Shan State.

D. 3/8; P. 1/10; V 1/6; A. 2/5–6; C. 18.

A small slender fish with head and anterior part depressed, ventral surface flattened, tail compressed side to side. Depth of body 17.52; head almost as broad as high at occiput; its length 22.68 per cent of standard length. Snout rounded, somewhat shorter than postorbital distance, its length 10.31 of standard length, 45.45 per cent of head. Eye small, situated in anterior half of head, not visible from ventral surface; its diameter 27.27 per cent of head length; 60.0 per cent of length of snout, 100 per cent of inter-orbital width. Nostrils close to each other, situated closer to eye than to tip of snout. Mouth semicircular; lips moderately fleshy, furrowed, upper uninterrupted, lower interrupted in middle. Dentiform process moderately developed. Barbels well developed; inner rostral shorter; outer rostral as long as maxillary extending to middle of eye; maxillary extends beyond the eye.

Fins: Dorsal fin small, less than length of head; greater than depth of body below it; edge of dorsal straight; origin of dorsal fin nearer tip of snout than caudal base; origin of pelvic slightly behind that of dorsal. Pectoral almost as long as head, extends about half way distance to pelvic. Pelvic shorter than pectoral, reaches anal opening. Anal fin not reaching caudal base. Caudal fin longer than head, forked, lobes bluntly pointed, of equal length.

Pre-dorsal distance 45.36 per cent of standard length; pre-pelvic distance 51.55 per cent; pre-anal 74.23 per cent; distance from pectoral to pelvic origin 28.87 per cent. Vent a short distance from anal fin; distance from vent to anal fin 25.00 per cent in that between anterior origins of pelvic and anal fins. Pectoral 20.62,

pelvic 15.46 per cent of standard length; height of dorsal 13.40 per cent; of anal 14.43 per cent; base of dorsal 21.65 per cent; aanal 12.37 per cent; caudal 25.77 per cent.

Caudal peduncle short and stout; its length 14.43 per cent of standard length; its least height 71.43 per cent of its length.

Sexual dimorphism: None in the specimen examined.

Colour: According to Hora (1929) the head and body pale olivaceous; dorsal surface of head mottled, and spotted with black. A variable number of vertical bars on the sides of body, fairly broad behind the dorsal, anteriorly broken up into a number of narrower bars. A dark spot at base of origin of dorsal fin; two rows of dotted longitudinal lines on its rays; caudal with two or three faint V-shaped markings; a black interrupted band at its base; other fins unspotted.

Size: Only specimen examined 48.5 mm SL.

Affinities: This species is closer to *N. brunneanus* than to any other member of the *sikmaiensis* complex. *N. brunneanus* is a sluggish water form and is replaced by *N. rivulicola* in the clear, rapid running streams of the Inle basin. *N. rivulicola* can be easily separated by its smaller eyes and small compact paired fins (eyes large and paired fins long in *N. brunneanus*).

Range: Burma: Southere Shan States: Yawnghwe valley and He-Ho plains.

Material examined: Burma: 1 specimen, ZSI F 11060/1 (holotype of *N. rivulicola*). He-Ho plain, S. Shan States.

Subgenus 2. *Acanthocobitis* Peters, 1861

Type species: *Acanthocobitis longipinnis* Peters

Diagnosis: Body stout built, spindle shaped comparatively deep, snout blunt. Scales conspicous and imbricate, absent on head and considerably reduced on chest. Lateral line complete or incomplete. Upper lip with a few rows of papillae, lower lip interrupted in the middle, with a broad papilose disc on each side. No nasal barbels. Dentiform process well developed. Dorsal long with 10–18 branched rays; caudal truncate or rounded. Vent at some distance in front of anal origin. Colour pattern variable, consisting of an irregular net of spots and stripes, often many vertical stripes, but never complete vertical bands as in *Schistura*. A roundd ark spot on upper part of caudal base.

Key to Species

1(a)	Lateral line complete.	
2(a)	More than 12 (14-15) branched rays in dorsal fin (North and middle Burma).....	*N. rubidipinnis*
2(b)	Less than 12 (9–11) branched rays in dorsal fin.	
3(a)	Body deep, more than 20 (25) percent of SL (Sri Lanka).	*N. Uropthalmus*
3(b)	Body slender, about 20 percent of SL (North India and Pakistan). ...	*N. botia*
3(c)	Lateral line incomplete.	
4(a)	More than 12 (15–18) branched rays in dorsal fin (Assam)....	*N. pavonaceous*
4(b)	Less than 12 (9–10) branched rays in dorsal fin.	
5(a)	Lateral line ending opposite to posterior end of dorsal fin (Peninsular India).	*N. moreh*
5(b)	Lateral line ending below or end of dorsal fin base (Burma and Manipur).....	*N. zonalternans*

46. **Noemacheilus botia** (Ham-Buch).

(Fig. 5, pl. 5; Fig. 1, pl. 13; Figs; 1, 2, 3 pl. 15)

1822. *Cobitis botia* Hamilton-Buchanan, *Fish-Ganges*, pp. 350, 394. (Type locality: Rivers of north eastern parts of Bengal)

1822. *Cobitis bilturio* Hamilton-Buchanam, *Fish. Ganges*, pp. 358, 395, (Type locality: Brahmaputra River)

1822. *Cobitis turio* Hamilton-Buchanan, *Fish. Ganges*, pp. 358, 395 (Type locality: Brahmaputra River).

1839. *Cobitis bimucronata* McClelland, *Asiat. Rec.*, pp. 304-435, pl. 51, fig. 5 (from Hamilton-Buchanan's Ms drawings).

1861. *Acanthocobitis longipinnis* Peters, *Mon. Ak. Wiss. Berl.*, p, 712 (Ganges).

1868. *Botia nebulosa* Blyth, *J. Asiat. Soc. Beng.*, **29**, p. 165 (Type locality: Darjeeling).

1868. *Nemacheilus botia*, Gunther, *Cat. Fish. Brit. Mus.*, **7**: 349.

1878. *Nemacheilus botia*, Day (in (part), *Fish India*, p. 614, pl. 156, fig. 5.

1889. *Nemacheilus botia*, Day (in part), *Faun. Brit. India. Fish.*, **1**: 227.

1919. *Nemachilus mackenziei* Chaudhuri, *Rec. Indian Mus.*, **5**: 183 (Type locality: Cheriyadhang and Joulasal in Nainital district UP; Jharia and Jamwari nadi near Siripur (Bengal) and Purnahia in Champaran).

1924. *Nemacheilus botia*, Fowler, *Proc. Acad. nat. Sci. Philad.*, **76**: 70 (Bilaspur, the Jamna, Sutlej and Ghagger Rivers, Umballah and Ludhiana).

1959. *Noemacheilus botia*, Misra, *Rec. Indian Mus.*, **57**: 171, (Northern India, Bangladesh, Pakistan).

1968. *Noemacheilus botia*, Banarescu & Nalbant (in part), *Mitt. Hamburg zool. Mus. Inst.*, Bd., **65**: 332 (Janali River at Raimona, Bhutan; Varei river at Nichangara, Uttar Pradesh, Asan River at Dharmewalla, Siwaliks; Ganges at Banares; Kaziranga, Mikir hills, Assam).

1974. *Noemacheilus botia*, Menon, *Inl. Fisheries Soc. India*, special publication, p. 58.

Diagnosis: An *Acanthocobitis* with 9–11 branched dorsal fin rays; complete lateral line; 12–16 blackish crossbars broken up and scattered irregularly on the sides in adult specimens. A round dark spot on upper part of caudal base.

Description: Based on 33 specimens, 40.0–69.0 mm SL from Nagaland.

D. 3/9-11; P. 1/11; V 1/7; A. 3/5; C. 18.

An *Acanthocobitis* species with dorsal profile rising from tip of snout to dorsal fin insertion and gradually sloping beyond the caudal fin. Ventral profile slightly convex. Depth of body 16.66 – 23.18 (M=19.89); head slightly broader than high at occiput, depressed; its lengtsh 21.05–27.50 (M=24.35) per cent of standard length. Snout rounded, somewhat longer than postorbital distance; its length 8.49–13.82 (M=10.98) of standard length, 34.44–58.06 (M=45.14) per cent of head. Eye moderate, situated in the middle of head, not visible from ventral surface; its diameter 18.18–38.46 (M=26.18) per cent of head length, 40.0–100.0 (M=59.27) per cent of length of snout, 75.0–150.0 (M=100.11) per cent of inter orbital width. Nostrils close to each other, situated closer to eye than tip of snout, anterior not tubular. Mouth semicircular; lips moderately fleshy, upper lip uninterrupted; with a few rows of papillaet, lower lip interrupted in the middle with a broad papillose disc on each side. Dentiform process moderately developed. Barbels well developed; inner rostral short, outer rostral equal to maxillary extending to beyond margin of eye; maxillary extending to perpendicular from posterior border of eye.

Scales: Conspicuous, imbricate, considerably reduced on chest. Lateral line complete or ending beyond anal base.

Fins: Dorsal long; edge of dorsal straight; height less than length of head; origin of dorsal nearer tip of snout than caudal base; origin of pelvic slightly behind that of dorsal. Pectoral shorter

than head, extends about two-thirds of distance to pelvic. Pelvic shorter than pectoral, separated from anal opening by a short distance. Anal fin not reaching base of caudal. Caudal fin slightly shorter than head, slightly emarginate posteriorly.

Pre-dorsal distance 41.55–47.78 (M=45.50) per cent of standard length; pre-pelvic 48.07–61.70 (M=51.70) per cent; pre-anal 72.72–86.66 (M=77.75) per cent; distance from pectoral to pelvic origin 20.47–32.50 (M=27.39)per cent. Vent a short distance from anal fin; distance from vent to anal fin 16.66–28.57 (M=22.25) per cent in that between anterior origins of pelvic and anal fins. Pectoral 14.92–23.33 (M=19.50), pelvic 12.98–18.36 (M=15.64) per cent of standard length; height of dorsal 25.00–35.83 (M=30.65) per cent; of anal 13.72–20.00 (M=17.39) per cent; base of dorsal 15.38–23.18 (M=20.10) per cent; of anal 5.97–9.80 (M=7.88) per cent; caudal 16.66–26.02 (M=22.51) per cent.

Caudal peduncle short and stout; its length 10.25–16.66 (M=13.37) per cent of standard length; its least height 80.00–125.00 (M=98.40) per cent of its length.

Sexual dimorphism: Males with suborbital flap.

Colour: Ground colour pale olivaceous to yellowish orange, with 12–16 blackish crossbands of various turns and twists, descending below the level of lateral line, interrupted in young and half-grown specimens, broken up into patches and scattered irregularly on sides in adults. A black ocellus on upper base of caudal. A narrow dark band from tip of snout to anterior margin of eye. Dorsal fin with 5–6 oblique zig-zag narrow bands; caudal with 5–7 posteriorly directed V-shaped dark bands.

Size: Largest specimen examined 69.0 mm SL.

Affinities: Amongst the members of the subgenus *Acanthocobitis* this species is close to *N. moreh* (Sykes). Both have almost similar branched dorsal fin ray counts (9–11 in *N. botia*) (9–10 in *N. moreh*) and general morphological features; it can be separated only by its extended lateral line (lateral line ending posterior end of dorsal fin *N. moreh*). In body shape, colour pattern especially the black ocellus spot on the upper base of the caudal and the number of branched dorsal fin ray counts and other morphological characters all the species within the subgenus except *N. pavonaceous* are closely related. *N. pavonaceous* with 15–18 branched dorsal fin rays is the most isolated species.

Range: India: Northern India (Brahamaputra, Ganges and Indus basins).

Material examined: India: Assam: 10 specimens, DZGU, uncatalogued, Lake Chaudubi. 14 specimens, DZGU, uncatalogued, hill-streams at Manas. 6 specimens, DZGU, uncatalogued, Pagladia River.

Tripura: 2 specimens, ERS/ZSI 2943, Santi bazar. 2 specimens, ERS/ZSI, uncatalogued, Gigiema Chwa Ambara, Coll. K. P. Singh, 12.viii.1978.

West Bengal: Darjeeling: 7 specimens, ZSI F 11782/1, Sevoke stream, Coll. S. L. Hora, 7.vi.1930. 4 specimens, F 2054/2, Pulta Water Works. 1 specimens, ZSI F 1972/2, Pulta Water Works. 1 specimen, ZSI F 11434/1, Laska River about 8 km from Siliguri, Coll. D. D. Mukerjee, 29.iii.1932. 5 specimens, ZSI F 13435/1, Kalimpong Duars & Siliguri Terai, Coll. S. L. Hora. 1 specimen, ZSI F 2017/1 (Syntype of *N. machenziei*) Cheriyadhang, Museum Collection 1908–09.

Nagaland: 2 specimens, ERS/ZSI, uncatalogued, Mokakchung, Coll. K. P. Singh, 28.ix.1981.

Uttar Pradesh: 3 specimens, ZSI F 1588/2, Sarda River, Tanakpur, Coll. A. G. K. Menon, 1949.3 specimens, ZSI 2716/2, Dehra Dun, Coll. S. Lal, 27.xi.1971. 9 specimens, NRS/ZSI, Song River, Dehra Dun. 2 specimens, F 1608/2, Dhanda River, 2 miles north of Nautanwa A. G. K. Menon 7.ii.49. 2 specimens, F 1518/2 Birthapur, Confluence of Kauriala with Girwa River, Bahraich District, 24.iii.1943. 20 specimens, NRS/ZSI, uncatalogued, Balci R. Dehra Dun. 1 specimen, SRS/ZSI, uncatalogued, Srinagar Garhwal.

Bihar: 2 specimens, ZSI F 3788/1, Siripur. 2 specimens, ZSI F 4170/1 & 4171 (syntypes of *N. machenzici*) Jhil, Purnea. 2 specimens, ZSI F 4172 & 4173/1, Jamwari River, Saran District.

Himachal Pradesh: 7 specimens NRS/ZSI F 385 Soon Khud, 8 km from Palampur. Coll. R. Tilak, 2 ii.1976. 2 specimens, HAZFS/ZSI, uncatalogued, Pinjore, near Kalka, 1964.

Punjab: 2 specimens, DZPU, uncatalogued, Machiwara near Ludhiana, 1965.

J & K: 5 specimens SRS/ZSI, uncatalogued, Jammu, Doner H. Raina, 23.xi.82. 44 specimens, ZSI F 11394/1, Terai & Duars. 1 specimen, NRS/ZSI, uncatalogued, Tawi River, Jammu. 1 specimen F 2281/2.

47. **Noemacheilus moreh** (Sykes)

1841. *Cobitis moreh* Sykes, *Trans. Zool. soc. Lond.*, **2:** 266, (Type locality: Western Ghats).

1870. *Nemacheilus sinuatus* Day, *Proc. zool. soc. Lond.*, p. 371 (Type locality: Wynaad).

1872. *Nemacheilus moreh*, Day, *J. Asiat. Soc. Beng.*, **41 (2):** 184.

1872. *Nemacheilus aureus*, Day, *J. Asiat. Soc. Beng.*, **41(2)**: 184.

1872. *Nemacheilus sinuatus*, Day, *J. Asiat. Soc. Beng.*, **41(2)**: 188.

1878. *Nemacheilus botia*, Day (in part), *Fish India*, p. 614, pl. 156, fig. 4.

1878. *Nemacheilus sinuatus*, Day, *Fish India*, p. 615, pl. 156, fig. 3.

1889. *Nemachilus botius*, Day (in part), *Faun. Brit. Ind. Fish.*, **1:** 227.

1889. *Nemachilus sinuatus*, Day, *Faun. Brit. Ind. Fish*, **2:** 228.

1919. *Nemachilus botia*, Annandale, *Rec. Indian Mus.*, **16:** 127.

1959. *Noemacheilus botia aureus*, Misra, *Rec. Indian Mus.*, **57:** 172, (Dccan, Deolali, Poona, Orissa).

1968. *Noemacheilus botia*, Banarescu & Nalbant (in part), *Mitt. Hamburg. Zool. Mus. Inst.*, Bd. **65:** 332 (Anshi, North Canara; Moola Motha river at Poona).

Diagnosis: An *Acanthocobitis* species with 9–10 branched dorsal fin rays; incomplete lateral line ending opposite to posterior end of dorsal fin.

Description: Based on 10 specimens, 24.0–44.0 mm SL from streams at Aurangabad, Maharashtra.

D. 3/9–10; P. 1/11, V 1/7; A. 3/5; C. 18.

A stout-built, spindle-shaped fish; its dorsal profile rises from tip of snout to the insertion of doral fin; beyond and the origin of dorsal, the outline slopes down slowly to the root of caudal fin. Ventral profile is uniformly and faintly convex. Depth of body 19.64–24.24 (M=21.68); head of moderate size, its length 24.36–31.25 (M=26.81) per cent of standard length. Snout prominent, blunt anteriorly, somewhat shorter than postorbital distance; its length 9.48–12.50 (M=10.27) of standard length, 33.33–48.0 (M=38.33) per cent of head. Eye large, situated in the middle of head, not visible from the ventral surface; its diameter 15.63–25.0 (M=21.20) per cent of head length; 44.44–63.44 (M=55.17) per cent of length of snout, 50.0–83.33 (M=71.18) per cent of inter-orbital width. Nostrils close to each other, situated closer to eye than tip of snout. Inter-orbital space flat, slightly concave. Mouth semicircular; lips flesy, upper lip with a few rows of small fleshy papillae, lower lip interrupted in the middle, with two

rounded, raised cushion-like clusters of small papillae situated on either side of the cleft of the lower lip. Dentiform process well developed. Barbels well developed; inner rostral shorter than the outer; outer rostral extending to margin of eye; maxillary reaching to below posterior edge of eye.

Scales: Conspicuous and imbricate, considerably reduced on chest. Lateral line incomplete ending opposite to the posterior end of dorsal fin.

Fins: Dorsal long; edge of dorsal straight; height less than head length; origin of dorsal near tip of snout than caudal base; origin of pelvic slightly behind that of dorsal. Pectoral shorter than head, extends about two-thirds of the distance to pelvic. Pelvic shorter than pectoral, separated from the anal opening by a short distance. Anal fin not reaching base of caudal. Caudal fin shorter than head, slightly emarginate posteriorly.

Pre-dorsal distance 45.45–54.17 (M=49.29) per cent of standard length; pre-pelvic distance 51.28–60.0 (M=56.39) per cent; pre-anal 79.31–85.42 (M=82.13) per cent; distance from pectoral to pelvic origin 27.50–32.95 (M=29.93) per cent. Vent a short distance from anal fin; distance from vent to anal fin 13.64–23.33 (M=17.97) per cent in that between anterior origins of pelvic and anal fins. Pectoral 20.00–24.24 (M=22.29), pelvic 15.63–19.70 (M=17.54) per cent of standard length; height of dorsal 18.00–22.92 (M=20.01) per cent ; of anal 12.00–15.91 (M=13.88) per cent; base of dorsal 18.75–21.95 (M=20.38) per cent; of anal 6.00–10.34 (M=8.20) per cent; caudal 25.00–30.30 (M=27.55) per cent.

Caudal peduncle short and stout; its length 10.71–12.88 (M=11.97) per cent of standard length; its least height the same as its length.

Sexual dimorphism: Suborbital flap in males.

Colour: General pattern similar to that described for *N. botia.*

Size: Largest specimen examined 44 mm SL.

Affinities: This species is closely related to *N. botia* (Ham.-Buch) of North India and Pakistan; it can be immediately separated from *N. botia* by its incomplete lateral line (lateral line is complete in *N. botia*).

Range: India: Peninsular India.

Material examined: India: Andhra Pradesh: 1 specimen, SRS/ZSI, uncatalogued, Gonapur, Araku Valley, Coll. T Venkateswarlu 10.iv.1979.

Maharashtra: 2 specimens, WRS/ZSI P 794, Khed, Coll. K. R. Rao, 19.xi.1971. 3 specimens, ZSI F 13009/1. 142 specimens, DZMU, uncatalogued, Stream at Aurangabad, Coll. Javad. 8 specimens, WRS/ZSI P 783, Khadi, Poona, Coll. B. M. Chopra, 27.iii.1969. 5 specimens, WRS/ZSI F 781, Khed Sivapur, Poona, Coll. R. M. Chopra, 4 ix.69.

Tamil Nadu: Nilgiris: 1 specimen, F 9937/1 1 specimen ZSI, uncatalogued, Streams in Rockwood Estate, Nellakkota, Coll. S. Rajan, March, 1959.

48. **Noemacheilus zonalternans** (Blyth)

1860. *Cobitis zonalternans* Blyth, *J. Asiat. Soc. Beng.*, **17:** 172 (Type locality: Tenasserim).

1921. *Nemachilus zonalternans*, Hora, *Rec. Indian Mus.*, **22:** 199, pl. 10, figs. 3, 3a (Manipur valley).

1929. *Nemachilus botia*, Hora, *Rec. Indian Mus.*, **32:** 318, (Myitkyina, Mukong Valley frontier, Indewgyi Lake).

1929. *Nemachilus zonalternans*, Hora, *Rec. Indian Mus.*, **31:** 319 (Burma).

1948. *Nemacheilus zonalternans*, Randahl, *Ark. f. zool.*, Bd. 40A, No. **7:** 21, fig. 10 (Tenasserim).

Diagnosis: An *Acanthocobitis* with 10 branched rays in the dorsal fin; incomplete lateral line, invariably ending below dorsal fin base.

Description: Based on 14 specimens 48.0 to 78.0 mm SL from Putao, Burma.

D. 3/10; P. 1/11; V 1/7; A. 3/5-6; C. 18.

An *Acanthocobitis* species with the dorsal profiile raised, ventral slightly convex. Depth of body 18.81–24.21 (M=20.34); head slightly broader than high at occiput, depressed; its length 22.85–25.52 (M=24.47) per cent of standard length. Snout of moderate length, rounded somewhat equal to postorbital distance; its length 8.73–11.32 (M=9.88) of standard length, 36.66–44.44 (M=40.37) per cent of head. Eye small, situated almost in the middle of head, not visible from the ventral surface; its diameter 14.70–22.22 (M=17.55) per cent of head length, 35.71–60.0 (M=43.66) per cent of length of snout, 45.45–71.42 (M=61.40) per cent of interorbital width. Nostrils close to each other, situated closer to eye than tip of snout, anterior tubular. Mouth semicircular; lips

moderately fleshy, upper lip not interrupted, with a few rows of papillae, lower interrupted in the middle with a broad papillose disc on each side. Dentiform process moderately developed. Barels well developed, inner rostral shorter, outer rostral longer than maxillary extending almost beyond posterior margin of eye; maxillary extending well beyond posterior border of eye.

Scales: Conspicuous, imbricate, reduced on chest. Lateral line incomplete, ending below dorsal fin base, either in the middle or end of dorsal fin base.

Fins: Dorsal long, edge of dorsal straight, height less than head length; origin of dorsal fin nearer tip of snout than caudal base; origin of pelvic well behind that of dorsal. Pectoral shorter than head, extends about half way or slightly more of distance to pelvic. Pelvic shorter than pectoral, separated from anal opening by a considerable distance. Anal fin not reaching base of caudal. Caudal fin as long as or slightly shorter than head, emarginate posteriorly.

Pre-dorsal distance 46.73–54.54 (M=50.11) per cent of standard length; pre-pelvic distance 52.72–58.18 (M=54.98) per cent; pre-anal 79.62–84.54 (M=81.74) per cent; distance from pectoral to pelvic origin 28.18–33.59 (M=31.25) per cent. Vent a short distance from anal fin; distance from vent to anal fin 11.32–20.00 (M=16.04) per cent in that between anterior origins of pelvic and anal fins; pectoral 15.94–20.90 (M=18.82), pelvic 13.76–17.18 (M=15.63) per cent of standard length; height of dorsal 15.71–18.75 (M=17.00) per cent; of anal 11.57–15.45 (M=13.33) per cent; base of dorsal 17.27–21.07 (M=18.93) per cent of anal 6.43–9.09 (M=7.81) per cent; caudal 20.00–25.45 (M=22.50) per cent.

Caudal peduncle short and stout; its length 10.00–15.45 (M=12.34) per cent of standard length; its least height 11.85–14.45 (M=13.50) per cent of its length.

Sexual dimorphism: Males with suborbital flap.

Colour: Variable. Usually 9–10 irregular blackish cross bands on the sides descending below the lateral line. A black ocellus on upper base of caudal. A narrow dark band from tip of snout to anterior margin of eye. Dorsal with 3 narrow bands; caudal with 2 posteriorly directed V-shaped bands.

Size: Largest specimen examined 78 mm SL.

Affinities: This species is quite close to *N. botia* (Ham-Buch). but can be separated because of its shorter lateral line (lateral line complete in *N. botia*).

Range: Burma and Manipur Valley.

Material examined: Burma: 37 specimens, NRS/1934 168. 3747, Kachin, Putao, Coll. Fan Li San, 1848.

49. **Noemacheilus urophthalmus** Günther

(Fig. 5, Pl. 5)

1868. *Nemacheilus urophthalmus* Günther, *Cat. Fish. Brit. Mus.*, **7:** 348 (Southern Ceylon).

1872. *Nemachilus urophthalmus*, Day, *J. Asiatic. Soc. Beng.*, **41** (1): 183.

1878. *Nemacheilus botia*, Day (in part), *Fish India*, p. 64.

1889. *Noemacheilus botius*, Day (in part), *Fauna Brit. India. Fish.*, **1:** 227.

1952. *Noemacheilus botia botia*, Deraniyagala, *Col. Atlas Vertb. Ceylon*, p. 48, pl. 12, fig. 2.

1952. *Noemacheilus aureus*, Derniyagala, *Col. Atlas. Vertb. Ceylon*, p. 49, pl. 12 fig. 2.

1955. *Noemacheilus botia*, Munro (in part), *Mar. Fresh-Water Fish. Ceylon*, p. 48, p. 13, fig. 133.

1968. *Noemacheilus botia*, Mandia & Fernando, *Bull. Fisheries Res. Stn.*, Ceylon **17:** 107, fig. 14.

Diagnosis: An *Acanthocobitis* species with 10 branched dorsal fin rays; lateral line complete ending at base of caudal fin or above anal base; 12–16 blackish crossbars; a dark band from tip of snout to anterior margin of eye; a black ocellus on upper base of caudal.

Description: Based on Günther (1868).

"D. 14; A. 7; V 8. The pre-orbital terminates behind in a slight and obtuse projection situated below the eye, sometimes movable, sometimes hidden below the skin. Scales very distinct, imbricate. Caudal fin subtruncate, with the angles rounded. Body compressed; its height is one-fourth of the total length (without caudal), the length of head a little less than one-fourth. Origin of dorsal fin scarcely nearer to the end of snout than to the root of the caudal. Snout of moderate length; eye occupying the middle of the length of head, of moderate size, one-fourth of the length of head. Body with from ten to thirteen dark brown cross bands, somewhat lighter in the middle, and separated from one another

by narrow yellow streaks (ground colour); head spotted with brown. A black white edged ocellus on the base of the upper caudal lobe. Dorsal and caudal fins with six transverse series of black dots"

Size: Two and a third inches long.

Affinities: This species is closely related to *N. botia*. It is quite likely that *N. botia*, *N. moreh*, *N. zonalternans* and *N. urophthalmus* were derived from a common ancestral stock and the specific differences now noticeable between them are probably due to the divergence in their habitats.

Range: Sri Lanka: Southern Sri Lank in small streams upto an elevation of 3000 metres.

Remarks: Day in his Monograph of Indian Cyprinidae regarded this species as distinct but later in the *Fishes of India* considered it synonymous with *N. botia* of Hamilton-Buchanan. I have not examined any specimen of this species but from the fact that Day has grouped together several forms under his *N. botia* I considered it safe to recognise *N. urophthalmus* as a separate species from a purely zoogeographical point of view until material becomes available of the species from Sri Lanka.

50. **Noemacheilus pavonaceous** (McClelland)

(Fig. 1, Pl. 6)

1839. *Cobitis pavonaceous* McClelland, *Asiat Res.*, **19,** pp. 305, 437, pl. 52 fig. 1 (Type locality: Assam).

1868. *Nemachilus pavonaceous*, Günther, *Cat. Brit. Mus.*, **2:** 348 (Assam).

1878. *Nemachilus pavonaceous*, Day, *Fish India*, p. 613, pl. 153, fig. 12.

1889. *Nemachilus pavonaceous*, Day, *Faun. Brit. Ind. Fish.*, **1:** 226.

Diagnosis: An *Acanthocobitis* species with 15–18 branched rays in the dorsal fin; a short lateral line ending about the tip of pectoral fin; body marked by 20 half crossbars of darkish grey colour.

Description: Based on 2 specimens, 76.0 and 81.0 mm SL.

D. 3/15–18; P. 1/11; V 1/9; A. 2/5; C. 20.

N. pavonaceous is an elongated species with body of uniform depth; depth of body 16.97–18.52 (M=17.75); head almost as broad as high at occiput; its length 20.99–21.05 (M=21.02)

per cent of standard length. Snout rounded, equal to posterior portion of head; its length 7.89–8.64 (M=8.27) of standard length, 37.50–41.18 (M=39.34) per cent of head. Eyes moderate, situated in the middle of head, not visible from ventral surface, its diameter 20.59–21.88 (M=21.24) per cent of head length, 50.0–58.33 (M=54.10) per cent of length of snout, 70.0–77.78 (M=73.89) per cent of inter-orbital width. Nostrils close to each other, situated closer to eye than tip of snout, anterior not tubular. Mouth semi-circular; lips moderately fleshy, upper lip uninterrupted, with a few rows of papillae, lower lip interrupted in the middle with a broad papillose disc each side. Dentiform process moderately developed. Barbels well developed; inner rostral shorter, outer rostral longer than maxillary, extending to posterior border of eye; also maxillary extending to perpendicular from posterior border of eye.

Scales: Conspicuous, imbricate over body; absent on head and chest. Lateral line incomplete ending almost tip of pectoral fin.

Fins: Dorsal fin long; edge of dorsal straight; origin of dorsal near tip of snout than caudal base; origin of pelvic slightly behind that of dorsal. Pectoral shorter than head, extends about half way to pelvic. Pelvic shorter than pectoral, separated from anal opening by a short distance. Vent situated nearer to posterior end of pelvic base than to origin of anal fin. Anal not reaching base of caudal. Caudal fin shorter than head, slightly emarginate posteriorly with rounded lobes.

Pre-dorsal distance 40.12–43.12 (M=41.77) per cent of standard length; pre-pelvic distance 50.00–51.85 (M=50.93) per cent; pre-anal 77.78–78.95 (M=78.37) per cent; distance from pectoral to pelvic orign 30.25–30.92 (M=30.59) per cent. Vent a short distance from anal fin; distance from vent to anal fin 14.58–20.93 (M=17.76) per cent in that between anterior origins of pelvic and anal fins. Pectoral 15.43–15.79 (M=15.61), pelvic 14.81–15.13 (M=14.97) per cent of standard length; base of dorsal 24.39–24.68 (M=24.54) percent; of anal 8.44–8.54 (M=8.49) per cent.

Caudal peduncle short and stout; its length 11.68–13.41 (M=12.55) per cent of standard length; its least height 86.36 (M=93.18) per cent of its length.

Sexual dimorphism: Males with suborbital flap.

Colour: Body crossed by about twenty half bars of a darkish grey. A dark ocellus surrounded by light margin at upper portion of base of caudal fin. Dorsal and caudal barred.

Size: Largest specimen examined 81.0 mm SL.

Affinities: An interesting species, taxonomically isolated, not closely related to any of the other members probably an early off shoot of the stock from which the other members of the subgenus were evolved and now confined to Assam (Brahamaputra basin).

Range: India: Assam (Brahamaputra basin).

Material examined: India: Assam: 2 specimens, ZSI F 2651/1 and 2652/1.

51. **Noemacheilus rubidipinnis** (Blyth)

(Figs. 6 & 7, Pl. 5)

1860. *Cobitis rubidipinnis* Blyth, *J. Asiat. Soc. Beng.*, **29:** 169 (Type locality Tenasserim).

1860. *Cobitis semizonata* Blyth, *J. Asiat. Soc. Beng.*, **29:** 170 (Type locality: Tenasserim).

1868. *Nemachilus rubidipinnis*, Günther, *Cat. Fish. Brit. Mus.*, **7:** 348 (Tenasserim).

1878. *Nemachilus rubidipinnis*, Day, *Fish India.*, p. 614, pl. 153, fig. 4.

1889. *Nemachilus rubidipinnis*, Day, *Faun. Brit. India, Fish.*, **1:** 226.

1890. *Nemachilus rubidipinnis*, Vinciguerra, *Ann. Mus. Civ. Stor. Nat. Genova*, **2(9)**: 208 (Mandalay, Kokarit and Meetan).

1921. *Nemachilus rubidipinnis*, Hora, *Rec. Indian Mus.*, **31:** 316, (Tenasserim, Meetan, Kokrait and Mandalay).

1948. *Nemachilus rubidipinnis*, Rendahl, *Ask. f. zool.*, Bd. 40A, No. 7, 12, fig. 7 & 8 (Tenasserim, Rangoon, Mandalay and Shweli Kyanug, Middle Burma).

1948. *Nemachilus rubidipinnis manda layensis* Randhal, *Ark. f. zool.*, Bd., 40A, N: **07:** 21 (Type locality: Mandalay).

Diagnosis: An *Acanthocobitis* species with 14–15 branched rays in the dorsal fin; a complete lateral line; vent close to anal fin; pelvic separated from the anal opening by a considerable distance; body marked by 12 to 16 irregular darkish bands descending from back and ending in dark spots below the lateral line.

Description: Based on 4 specimens, 60.0–80.0 mm SL from Pegu, S. Burma.

D. 3/14–15; P. 1/12; V 1/7; A. 2/5; C. 17.

A long and slender species. Depth of body 20.31–21.52 (M= 20.98); head almost as broad as high at occiput; its length 21.25–25.0 (M=23.17) per cent of standard length. Snout of moderate length, blunt, somewhat shorter than postorbital distance; its length 10.62–12.5 (M=11.29) per cent of standard length, 45.16–50.0 (M=48.79) per cent of head. Eye small, situated somewhat in the middle of head; its diameter 21.87–26.66 (M=24.46) per-cent of head length, 43.75–57.14 (M=50.32) per cent of length of snout. 58.33–80.0 (M=71.24) per cent of inter-orbital width. Nostrils close to each other, situated nearer to eye than tip of snout, anterior tubular, the inter-narial membrane prominent. Mouth inferior, semicircular; lips fleshy, lower lip interrupted in the middle and raised into two button-like projections. Dentiform process well developed. Barbels long and thread-like; inner rostral reaches eye, outer rostral and maxillary extend beyond eye.

Scales Body entirely covered with imbricate scales. Lateral line complete and extending to caudal base.

Fins. Base of dorsal fin much longer than head; origin of dorsal fin considerably in advance of pelvic; its origin much nearer to snout than base of caudal. Pectoral long, pointed, as long as or slightly shorter than head, extending to two-thirds of distance to pelvic. Pelic pointed, shorter than pectoral, separated from anal opening by a considerable distance. Anal fin small and not extending to caudal base. Caudal fin almost as long as or slightly longer than head; truncate posteriorly.

Pre-dorsal distance 43.75–46.87 (M=45.36) per cent of standard length; pre-pelvic distance 50.78–51.66 (M=51.27) per cent; pre-anal 77.5–81.25 (M=79.47) per cent; distance from pectoral to pelvic origin 25.83–29.68 (M=28.16) per cent. Vent a short distance from anal fin; distance from vent to anal fin 16 21–22.72 (M=19.52) per cent in that between anterior origins of pelvic and anal fins. Pectoral 18.75–20.83 (M=19.27), pelvic 15.62–18.33 (M=16.85) per cent of standard length; length of dorsal 17.96–20.13 (M=18.79) per cent; of anal 13.88–15.62 (M=14.64) per cent; base of dorsal 25.62–27.5 (M=26.32) per cent; of anal 8.12–10.15 (M=9.12) per cent; length of caudal 18.33–25.0 (M=22.31) per cent.

Caudal peduncle short and stout; its length 15.27–18.75 (M=16.57) per cent of standard length; its least height 66.66–90.90 (M=81.89) per cent of its length.

Sexual dimorphism. None.

Colour. "Reddish brown with 12 to 16 irregular darkish bands descending from back and ending in dark spots below lateral line; 4 to 6 oblique bands on the dorsal fin; 6 to 8 irregularly vertical bars on the caudal, which has black ocellus on the upper half of its base" Day.

Size. Largest specimen examined 80 mm SL.

Affinities. This species is close to *N. zonalternans.* However, *N. rubidipinnis* should stand out because of its relatively greater number of branched rays in the dorsal fin (14–15 *cf* 10).

Range. Burma: Mandalay to south as far as Meetan.

Material examined. Burma. 1 specimen, NRS/1934 809-3742, Kawkareik River, Tenasserim, Rangoon, Mandalay, Coll. R. Malaise, 1934. 7 specimens, NRS/1935 809–3743, Pegu (Rangoon), Coll. Thomsen, 1935.

Subgenus 3. *Noemacheilus* van Hasselt, 1823.

Diagnosis. A noemacheiline loach, much elongated; forked caudal; vent situated some distance in front of anal fin; pelvic not extending beyond anal opening; dorsal fin of moderate length with 7 or 8 branched rays; body marked with a single longitudinal stripe.

Though *N. anguilla* and *N. monilis* together form the *anguilla*-complex of species they show relationship to *N. ruppelli* in the forward position of the anal opening. *Noemacheilus* and *N. ruppelli* are the products of the recent orogenic movements of the Western Ghats (*vide* Menon, 1951).

Key to species of subgenus **Noemacheilus**

A. 7 branched rays in dorsal fin; a moniliform black band along lateral line (Nilgiris; Cauvery system).. *N. monilis*

B. 8 branched rays in dorsal fin; a black horizontal band along lateral line. (Maharashtra & Karnataka; Krishna system).. *N. anguilla*

52. **Noemachilus anguilla** Annandale

(Fig. 3, Pl. 6)

1919. *Noemachilus anguilla* Annnandale, *Rec. Indian Mus.*, **16:** 127, pl. 1, fig. 3, pl. 3, fig. 1 (Type locality; Yenna river, Kistna drainage, at Medha, Satara district, Maharashtra).

1949. *Nemachilus poonaensis* Menon, *Rec. Indian Mus.*, **47**: (1): 226 (Type locality: Moola-Mootha river, Kistna drainage, Poona).

1968. *Noemacheilus poonensis*, Banarescu and Nalbant, *Mitt. Hamburg. zool. Mus. Inst.* **65**: 330, 0l. 1, fig. 1, figs. 1, 2, (Anshi, Gangawali drainage, N. Canara).

Diagnosis. A *Noemacheilus* species characterised by a black horizontal band running from snout to caudal fin; 8 branched rays in the dorsal fin.

Description. Based on 3 specimens, 30.0–50.0 mm SL from Tunga River, Mysore (1), Yenna Valley, Satara, Dt., (1) and Indryani River, karla, Poona (1).

D. 3/8; P 14; V 1/7; A. 2/4; C. 19.

Elongate, body of uniform depth, dorsal profile sightly arched, ventral straight and horizontal. Depth of body 11.0–16.67 (M= 14.26); head slightly broader than high at occiput; its length 22.0–31.67 (M=25.64) per cent of standard length. Snout of moderate size; its length 10.0–10.47 (M=10.16) in standard length, 31.58–45.45 (M=40.68) per cent of head. Eye large, situated in the middle of head, somewhat visible from ventral surface; its diameter 27.27–31.58 (M=29.62) per cent of head length; 60.0–100.0 (M=75.56) per cent of length of snout, 100.0–150.0 (M=116.67) per cent of inter-oribital width. Nostrils close to each other, situated nearer to eye than to tip of snout, anterior nostril slightly tubular. Mouth semicircular; lips moderately fleshy, deeply furrowed, upper provided with a pair of barbel-like process, interrupted with a median incision, lower interrupted in the middle. Dentiform process moderately developed. Barbels relatively long, thread-like; outer rostral longest extending almost to margin of eye; maxillary reaching to perpendicular from middle of eye.

Scales. Small, imbricate, indistinct in the anterior part; absent on ventral surface. Lateral line almost complete, well marked up to tip of ventral fin.

Fins. Dorsal fin small, almost as high or slightly less than length of head; edge of dorsal straight; origin of dorsal fin almost equidistant between tip of snout and caudal base; origin of pelvic slightly behind that of dorsal. Pectoral longer or equal to head length, extends one-third of distance to pelvic. Pelvic shorter than pectoral extending to anal opening. Anal fin not reaching base of caudal. Caudal fin as long as or slightly shorter than head, deeply forked, lobes pointed and of equal length.

Pre-dorsal distance 46.0–53.49 (M=49.83) per cent of standard length; pre-pelvic distance 47.0–53.49 (M=51.27) per-cent; pre-anal 75.0–81.40 (M=77.69) per cent; distance from

pectoral to pelvic origin 28.0–30.23 (M=29.41) per cent. Vent a short distance from anal fin; distance from vent to anal fin 37.50–43.48 (M=41.10) per cent in that between anterior origins of pelvic and anal fins. Pectoral 18.0–22.09 (M=20.03), pelvic 15.0–20.93 (M=18.64) per cent of standard length; height of dorsal 17.00–20.00 (M=18.50)per cent, anal 15.0–16.67 (M=15.84) per cent; base of dorsal 12.79–20.0 (M=16.60) per cent; of anal 8.0–10.0 (M=9.0) per cent; caudal 26.0–33.33 (M=28.67) per cent.

Caudal peduncle short and stout; its length 15.0–18.60 (M=16.20) per cent of standard length; its least height 60.0–66.70 (M=63.06) per cent of its length.

Sexual dimorphism: None.

Colour: Head and body dull green yellow; about 19–20 saddle-shaped vertical bands as wide as white interspaces restricted to back; a row of large blackish spots or blotches running as a band along the mid-lateral line, sometimes coalescing, extending to caudal fin; dorsal with an anterior scarlet border; caudal broadly edged both above and below with red.

Affinities: *Noemacheilus anguilla* and *N. monilis* are recognised as forming the *anquilla*—species complex because of their similarities. *N. anguilla* can be readily distinguished by its 8 branched rays in the dorsal fin (7 in *N. monilis*), and its characteristic black lateral band.

Range: Western Ghats: Maharashtra and Karnataka (Krishna River Basin).

Material examined: *Peninsular India:* Maharashtra: 1 specimen, ZSI F 2692/1, (holotype of *N. anguilla*) Yenna River, at Medha, Satara District, Coll. A. Annandale, 27.xi.1918 to 30.xi.1918. 1 specimen ZSI F 242/2 (holotype of *N. poonaensis* Menon), Mula Mutha River, near Poona, Coll. A. G. K. Menon, xi. 1948. 7 specimens, ZSI F 243/2 (paratypes of *N. poonaensis*), taken along with the holotype. 1 specimen, WRS/ZSI Y/173, Indryani River, Poona, Coll. R. Tilak.

53. **Noemacheilus monilis** Hora

(Fig. 4, Pl. 6)

1921. *Noemachilus monilis* Hora, *Rec. Indian Mus.*, **22:** 19, (Type locality: Bhavani river, 10 miles from Mettupalayam, base of Nilgiris).

Diagnosis: A *Noemacheilus* species characterised by 7 branched dorsal fin rays; deeply forked caudal; the peculiar moniliform band

of black pigment running from tip of snout to caudal fin; and relatively long thread-like bardels.

Description: Based on a specimen 48.0 mm SL from Bhavani River, Mettupalayam.

D. 3/7; P. 10; V 8; A. 2/5; C. 19.

Elongate, body of uniform depth, dorsal profile slightly arched, ventral straight and horizontal. Depth of body 12.50; head slightly broader than high at occiput; its length 25.0 per cent of standard length. Snout of moderate length, bluntly pointed, longer than postorbital distance; its length 9.38 of standard length, 35.70 per cent of head. Eye small, situated in the posterior half of head, not visible from ventral surface; its diameter 25.0 per cent of head length, 66.67 per cent of length of snout, 85.71 per cent of interorbital width. Nostrils close to each other, situated closer to eye than tip of snout, anterior nostril somewhat tubular. Mouth semicircular, lips moderately fleshy, poorly furrowed, upper lip raised into a short proboscis in the middle, lower interrupted in the middle. Dentiform process moderately developed. Barbels long, thread-like, outer rostral longer than the inner extending to margin of eye, maxillary shorter than outer rostral extending to perpendicular from almost posterior border of eye.

Scales: Small, imbricate, indistinct, in the anterior part, absent on ventral surface. Lateral line complete.

Fins: Dorsal fin small, less than length of head; origin of dorsal somewhat nearer caudal base than tip of snout; insertion of pelvic opposite to that of dorsal. Pectoral shorter than head, extends about half distance to pelvic. Pelvic shorter than pectoral, separated from anal opening by a considerable distance. Anal fin not reaching base of caudal. Caudal fin as long as head, forked, lobes pointed and of equal length.

Pre-dorsal distance 54.17 per cent of standard length; prepelvic distance 52.08 per cent; pre-anal 77.08 per cent; distance from pectoral to pelvic origin 31.25 per cent. Vent a short distance from anal fin; distance from vent to anal fin 29.63 per cent in that between anterior origins of pelvic and anal fins. Pectoral 20.83, pelvic 14.58 per cent of standard length; height of dorsal 16.67 per cent; of anal 14.58 per cent; base of dorsal 16.67 per cent; of anal 9.38 per cent.

Caudal peduncle short and stout; height of caudal peduncle slightly less than its length; its length 14.58 per cent of standard length; its least height 78.57 per cent of its length.

Sexual dimorphism: Sub-orbital flap present in the males specimen examined.

Colour: A distinct moniliform black band along line from tip of snout to base of caudal fin, interrupted by eye in its course; the last component of black spots in the series is more prominent; the band continued as a black streak in the middle of the caudal fin. Body dirty white in colour somewhat infuseated along the back; fins whitish; barbels streaked with black.

Affinities: This species is quite close to *N. anguilla*, the only other member of the *anguilla* species complex. The two may be readily separated by their distinctive colouration and the number of branched rays in the dorsal fins (8 in *anguilla;* 7 in *monilis*).

Range: Western Ghats: Nilgiris: Mettupalayam (Bhavani River).

Material examined: Tamil Nadu: 1 specimen ZSI F 9981/1, (holotype of *N. monilis*) Bhavani River, 10 miles from Mettupalayam base o' Nilgiri Hills, Coll. A. Annandale, 1918. 1 specimen (paratype of *N. monilis*) taken along with holotype.

Subgenus 4. *Noemacheilichthys* Day

Type species *Cobitis ruppelli* Sykes, 1841

Diagnosis: A neomacheiline loach, much elongated with long pointed snout, longer than posterior portion of head; forked caudal; dorsal fin of moderate length with 10 branched rays; vent situated far forward; pelvics extending considerably beyond anal opening. Body marked with 18–19 narrow vertical bands not reaching below lateral line.

Range. Western Ghats: krishna basin.

Remarks. Though a distinct subgenus it is close to *Noemacheilus* s. str. The species of *Noemacheilus* s. str. *viz.*, *N. anguilla* and *N. monilis* and *N. ruppelli* are derivatives of the same ancestral stock.

54. **Noemacheilus ruppelli** (Sykes)

(Fig. 1; Pl. 12)

1841. *Cobitis ruppelli* Sykes, *Trans. zool. Soc. Lond.*, **2**: 366, pl. 64 fig. (Type locality: Dekkan).

1878. *Nemachilichthys ruppelli*, Day, *Fish. India.*, pl. 612, pl. 104, fig. 7 (Deccan).

1879. *Nemachilichthys rueppelli*, Day, *Faun. Brit. Ind., Fish.*, **1**: 224 (Deccan).

1920. *Nemachilichthys shimogensis* Rao, *Ann. Mag. nat. Hist. London*, (9): **6:** 62, pl. 2, figs. 5, 5a, 5b (Type locality: River Thunga, Shimoga Town, Mysore).

1968. *Noemacheilus rupelli*, Banarescu and Nalbant, *Mitt. Hamburg. zool. Mus., Inst.*, **65:** 329 (Poona, lake Fifa, upper Kistna drainage).

Diagnosis. A large-size *Noemacheilus* with elongate body; a long snout; prominent eyes; long barbels; 10 branched rays in the dorsal fin; deeply forked caudal; anal opening situated nearer ventral axis than to anal origin; body marked with 18–19 brownish vertical bands, reaching below lateral line but not ventral side.

Description. Based on 8 specimens, 36.0–74.0 mm SL from Shimoga (6) and Poona (2), Krishna River basin.

D. 3/10 (11); P. 13; V 1/7; A. 2/5; C. 19.

Body of almost uniform depth; dorsal profile not elevated, nearly horizontal; ventral horizontal and straight. Depth of body 15.28–20.0 (M=17.08), head broader than high at occiput, depressed; its length 23.46–27.78 (M=26.66) per cent of standard length. Snout long, pointed, longer than postorbital distance; its length 10.77–15.08 (M=13.07) of standard length, 39.13–55.13 (M=48.95) per cent of head. Eye prominent situated in the posterior half of head, not visible from ventral surface; its diameter 15.79–26.09 (M=19.64) per cent of head length, 29.55–66.67 (M=41.02) per cent of length of snout, 68.75–92.86 (M=79.47) per cent of inter-orbital width. Nostrils close to each other, situated closer to eye than tip of snout, anterior nostril slightly tubular. Mouth semicircular, lips moderately fleshy, deeply furrowed; upper uninterrupted, lower interrupted in middle, papillated. Dentiform process moderately developed. Barbels well developed; inner rostral shorter; outer rostral longer than maxillary, not reaching margin of eye; maxillary shorter than outer rostral, extending to perpendicular from anterior border of eye.

Scale: Imbricate all over body; absent on ventral side. Lateral line complete.

Fins: Dorsal fin small, less than length of head; edge of dorsal slightly concave; origin of dorsal fin equidistant between tip of snout and caudal base; origin of pelvic behind that of dorsal. Pectoral shorter than head, extends two thirds of distance to pelvic. Pelvic shorter than pectoral, extends considerably beyond anal opening. Anal fin reaching base of caudal. Caudal fin as long as head, deeply forked, lobes pointed, of equal length.

Pre-dorsal distance 49.23–53.52 (M=51.66) per cent of standard length; pre-pelvic distance 52.97–55.56 (M=54.20) per

cent; pre-anal 79.23–83.33 (M=80.69) per cent; distance from pectoral to pelvic origin 26.51–30.77 (M=29.01) per cent. Vent a considerable distance ahead of anal fin; distance from vent to anal fin 47.83–52.78 (M=50.70) per cent in that between anterior origins of pelvic and anal fins, pectoral 16.92–23.49 (M=20.27), pelvic 16.15–19.30 (M=18.10) per cent of standard length; height of dorsal 17.37–25.0 (M=20.39) per cent; of anal 12.50–17.46 (M=14.44) per cent; base of dorsal 20.61–23.81 (M=21.78) per cent; of anal 5.51–9.96 (M=8.09) per cent; caudal 25.30–30.56 (M=27.68) per cent.

Caudal peduncle short and stout; its length 9.15–14.41 (M= 11.36) per cent of standard length; its least height 76.47–100.0 (M=88.18) per cent of its length.

Sexual dimorphism: None.

Colour: Body greenish yellow above, white below with 18–19 narrow vertical bands, narrower than white interspaces, reaching below lateral line but not ventral side; short brown bands along lateral line forming a lateral strips. Dorsal with three rows of spots; caudal with 4–5 posteriorly directed V-shaped bands.

Size: The largest specimen examined 74.0 mm SL.

Affinities: This is a distinct form, easily separated comparatively large size, elongate body, distinctive colouration, and forward position of the anal opening. Though distinct, it is closer to *N. anguilla* and *N. monilis* than to any other species of the genus. These are derivatives of an ancestral species that spread to Peninsular India during the glacial periods of the Pleistocene.

Range: Western Ghats: Maharastra and Karnataka (Krishna River basin)

Material examined: India: Karnataka: Western Ghats: 3 specimens, ZSI F 9824/1 to 9826/1, (syntypes of *Noemacheilichthys shimogensis* Rao), Thunga River, Shimoga, Coll. R. Narayana Rao. 3 specimens, WRS/ZSI, V/504, Mula Mutha R., Sambhaji bridge, Poona, Coll. R. N. Chopra, 13–14.v.1964.

Subgenus 5. *Mesonoemacheilus* Banarescu & Nalbant, 1981.

Type species: *Noemacheilus triangularis* Day, 1865.

Diagnosis: Noemacheiline fishes with scaled body, incomplete lateral line; dorsal with 7, 8, or 10 branched rays; lips usually deeply furrowed, forked caudal fin; a well marked roundish spot in the middle of caudal base; colour pattern usually of an irregular

net of dark-brownish and whitish-yellow bars and stripes often split up into independent spots.

Key to species of subgenus **Mesonoemacheilus**

A.	Ten branched rays in dorsal fin...	*N. pulchellus* Day
B.	Less than ten branched rays in dorsal fin.	
1(a)	Body marked with two or three rows of large yellow spots edged with black..	*N. guentheri* Day
1(b)	Body banded	
2(a)	Body marked with 6–7 oblique yellow bands	*N. triangularis* Day
2(b)	Body marked with irregular vertical bands.	
3(a)	Lateral line complete (8–10 brown bands across back broken up into secondary bands below lateral line..	*N. sijuensis* sp. nov.
3(b)	Lateral line incomplete.	
4(a)	Lateral line ending below dorsal fin or slightly in front of it (a number of irregular V or Y shaped cross bars)	*N. reticulofasciatus* (Singh & Banarescu)
4(b)	Lateral line ending above end of base of anal (7–8 broad saddle-shaped black bands on back; sides marked by varying number of bands broken up into narrow bands anteriorly..	*N. petrubanarescui* Menon

55. **Noemacheilus guentheri** Day

(Fig. 9; Pl. 11)

1867. *Nemacheilus guentheri* Day, *Proc. zool. Soc., Lond.*, p. 285 (Type locality: Rivers along the lower slopes and base of the Neilgherry hills).

1868. *Nemachilus guntheri*, Günther, *Cat. Fish. Brit. Mus.*, **7**: 361 (Nilgherries).

1872. *Nemacheilus guentheri*, Day, *J. Asiat. Soc. Beng.*, **41** (2): 195.

1872. *Nemacheilus rubripinnis*, Day (nec Blyth), *J. Asiatic Soc., Beng.*, **41** (2): 197, Malabar.

1878. *Nemacheilus guentheri* Day, *Fish India*, p. 615, pl. 156, fig. 10.

1889. *Nemachilus guntheri*, Day, *Faun. Brit. Ind. Fish.*, **1**: 228, (Rivers along lower slopes and base of the Nilgiri hills).

1941. *Nemacheilus guentheri*, Hora, *Rec. Indian Mus.*, **43**: 250, Pampadampara, W. ghats, North Travancore).

1981. *Mesonoemacheilus herrei* Nalbant and Banarescu, *Trav. Mus. Hist. nat. Grigore Antipa*, **23**: 203, fig. 1–5 (Type locality: Anamalai hills, Valparai, Kerala state).

Diagnosis: A *Mesonoemacheilus* species with 8 branched dorsal fin rays; forked caudal; lateral line almost complete reaching up to tip of anal fin; body marked with 2 or 3 rows of large yellow spots edged with black; a deep short, vertical bar at base of caudal fin; suborbital flap in male.

Description: Based on 18 specimens, 31.0–56.0 mm SL from Sayivala, New Amarambalam, Kerala.

D. 3/8; P. 11; V 1/6–7; A. 2/5; C. 18.

Head and anterior part of body somewhat flattened; tail compressed; dorsal profile slightly arched, ventral almost straight and horizontal. Depth of body 12.90–20.0 (M=16.62); head broader than high at occiput; its length 22.0–26.19 (M=24.09) per cent of standard length. Snout of moderate length, shorter than postorbital distance; its length 7.95–11.84 (M=10.10) per cent of standard length, 31.81–50.0 (M=42.03) per cent of head. Eye small, situated almost in the middle of head or slightly nearer to tip of snout than to end of opercular border, not visible from the ventral surface; its diameter 21.73–31.57 (M=26.35) per cent of head length, 66.66–125.0 (M=93.31) per cent of length of snout, 50.0–71.42 (M=63.22) per cent of inter-orbital width. Nostrils close to each other, situated closer to eye than tip of snout. Mouth semicircular; lips fleshy and deeply furrowed, upper uninterrupted, lower interrupted in the middle. Dentiform process well developed. Barbels well developed; the inner rostral shorter; the outer rostral and maxillary sub-equal; outer rostral extending to anterior margin of eye; maxillary extending to perpendicular from middle of eye.

Scales: Small, imbricate in posterior third of body, isolated anteriorly in front of dorsal fin, absent on ventral side. Lateral line almost complete ending above anal fin.

Fins: Dorsal fin short, less than length of head; edge of dorsal straight; origin of dorsal equidistant between tip of snout and caudal base; pelvic origin slightly behind that of dorsal. Pectoral slightly shorter than head, extends half way to pelvic; the pelvic shorter than pectoral, separated from anal opening by a short distance. Anal fin not reaching base of caudal; caudal as long as or slightly shorter than head, forked, lobes pointed and of equal length.

Pre-dorsal distance 48.51–57.14 (M=51.51) per cent of standard length; pre-pelvic distance 50.47–59.52 (M=52.91) per cent; pre-anal 76.92–88.09 (M=79.61) per cent; distance from pectoral to pelvic origin 28.03–35.71 (M=29.81) per cent.

Vent a short distance from anal fin; distance from vent to anal fin 10.53–26.67 (M=18.55) per cent in that between anterior origin of pelvic and anal fins. Pectoral 17.50–24.19 (M=20.82), pelvic 16.98–20.0 (M=19.05) per cent of standard length; height of dorsal 14.03–20.0 (M=17.41) per cent; of anal 17.39–20.0 (M=15.61) per cent; base of dorsal 13.08–17.85 (M=16.07) per cent; of anal 7.31–11.25 (M=8.50) per cent; caudal 11.42–14.28 (M=12.91) per cent.

Caudal peduncle as long as high or slightly longer; its length 12.19–16.66 (M=14.55) per cent of standard length; its least height 75.0–100.0 (M=89.24) per cent of its length.

Sexual dimorphism: Males with suborbital flap, the rays of pectoral thickened with breeding tubercles.

Colour: Ground colour dark brown with three rows of whitish spots of different sizes and form. Dorsal and caudal fins with three to four rows of spots. A deep short vertical bar at base of caudal and a spot on dorsal origin.

Affinities: Close to *N. triangularis;* it is separated from *N. triangularis* by its distinguishing colouration (yellow oblique bands in *N. triangularis*).

Range: Peninsular India: Western Ghats: Kallar, Pamba, Periyar and Bharathapuzha rivers also the Cauvery system in Nilgiris and Mysore.

Material examined: India: Kerala: Western Ghats: 1 specimen, F 13587/1, Pambadampara, Coll. S. Jones, 1941. 1 specimen, F. 13588/1, Dhoni forest, Coll. E. Barnes, 1923. 1 specimen, SRS/ZSI, uncatalogued, New Amarambalam, Coll. K. R. Rao, 1979. 2 specimens, SRS/ZSI, uncatalogued, Poochapara, New Amarambalam, Coll. K. R. Rao, 1979. 1 specimen, SRS/ZSI, uncatalogued, Panjakolli, Nelambur, K. R. Rao, 1979. 1 specimen, SRS/ZSI, uncatalogued, Silent Valley, Coll. K. R. Rao, 1979. 3 specimens, SRS/ZSI, uncatalogued, Silent Valley, Coll. R. S. Pillai, 1980. 1 specimen, SRS/ZSI, uncatalogued, Meenmutty, New Amarambalam, Coll. T S. N. Murthy, 1979. 4 specimens, SRS/ZSI, uncatalogued, Sayivala, New Amarambalam, Coll. K. R. Rao, 1979. 5 specimens, SRS/ZSI, uncatalogued, Nedungayam, New Amarambalam, Coll. T S. N. Murthy, 1979. 11 specimens, ZSI/SRS, uncatalogued, New Amarambalam Survey, 1979. 6 specimens, ZSI F 13562/1, Manimala River, 4 furlongs north of Kanjirapally, Travancore, Coll. G. C. Jones, 1940. 8 specimens, ZSI F 13565/1, Kallar streams, Nedumangad Taluk, at the foot

of Ponmudi Hills, S. Travancore, Coll. S. Jones, April 1939. 4 specimens, ZSI F 13563/1, Achenkovil, River, 7 miles South east of Konni, Travancore, Coll. C. C. John, 1940.

Tamil Nadu: 2 specimens, ZSI F 13589/1, Bhavani River, base of Nilgiris.

Karnataka: 76 specimens, SRS/ZSI, uncatalogued, Hati Hola at Mokotlu, 12 km from Mercara, Coorg. Coll. A. G. K. Menon, 1983.

56. **Noemacheilus pulchellus** Day

(Fig. 4, Pl. 4; Fig. 5. Pl. 16)

1873. *Nemacheilus pulchellus* Day, *J. Linn. Soc. Lond.* (*zool.*), **11**: 528 (Type locality: Bhavani river, Nilgiris).

1878. *Nemacheilus pulchellus*, Day, *Fish. India*, p. 615, fig. 7, pl. 156 (Bhavani River, Nilgiris).

1889. *Nemachilus pulchellus*, Day, *Faun. Brit. Ind. Fish.*, **1**: 228.

Diagnosis: A *Mesonoemacheilus* species with 10 branched dorsal rays body marked with two rows of large vertical yellow spots having deep black margins; posterior to dorsal fin, these become wide vertical bands two-third as wide as the gound colour.

Description: Based on 5 specimens, 39.0–46.0 mm SL from Bhavani River, Day's collection.

D. 2/10; P. 11; V 1/7; A. 2/5; C. 19.

In this loach the dorsal profile gradually rises from tip of snout to origin of dorsal beyond which it descends gradually to base of caudal. The ventral profile straight and horizontal. Depth of body 21.5–23.75 (M=22.66); head almost as broad as high at occiput, its length 22.35–25.0 (M=23.47) per cent of standard length. Snout of moderate length; narrower anteriorly, somewhat equal to postorbital distance; its length 8.97–10.87 (M=9.80) in standard length; 38.89–47.62 (M=41.79) per cent of head. Eyes small, dorso-laterally placed, situated in the middle of head, not visible from ventral surface; its diameter 21.05–33.33 (M= 25.95) per cent of head length; 50.0–75.0 (M=60.15) per cent of length of snout; 75.0–88.84 (M=84.03) per cent of inter-orbital width. Nostrils close to each other, situated closer to eye than tip of snout, anterior nostrils slightly tubular. Mouth semicircular; lips moderately fleshy, deeply furrowed, upper interrupted with a median incision, lower interrupted in the middle. Dentiform

processes moderately developed. Barbels well developed; stumpy at base, thread like at the ends; inner rostral shorter, outer rostral shorter than maxillary extending to margin of eye; maxillary reaching to perpendicular from middle of eye.

Scales: Small, imbricate all over body, distinct posteriorly, absent on ventral side. Lateral line complete.

Fins: Dorsal fin short, less than length of head; edge of dorsal straight; origin of dorsal fin equidistant between tip of snout and caudal base or somewhat nearer to tip of snout than caudal base; origin of pelvic slightly behind that of dorsal. Pectoral longer than head, extends about two-third of distance to pelvic. Pelvic shorter than pectoral separated from anal opening by a very short distance. Anal fin almost reaching caudal base. Caudal fin longer than head, deeply forked, lobes pointed, of equal length.

Pre-dorsal distance 47.06–56.10 (M=52.08) per cent of standard length; pre-pelvic distance 54.12–57.50 (M=56.02) per cent; pre-anal 80.0–86.96 (M=82.47) per cent; distance from pectoral to pelvic origin 29.88–35.63 (M=32.83) per cent. Vent a short distance from anal fin; distance from vent to anal fin 13.33–17.78 (M=16.17) per cent in that between anterior origins of pelvic and anal fins. Pectoral 21.74–23.53 (M=22.65), pelvic 18.13–23.53 (M=18.24) per cent, of anal 15.0–18.82 (M=16.33) per cent; base of dorsal 21.95–24.39 (M=23.33) per cent; of anal 7.61–9.76 (M=8.60) per cent; caudal 26.25–29.27 (M=27.62) per cent.

Caudal peduncle short and stout; its length 10.0–14.13 (M=11.76) per cent of standard length; its least height 107.69–150.0 (M=128.79) per cent of its length.

Sexual dimorphism: None.

Colour: Body marked with two rows of oval yellow spots having deep black margins, restricted to upper two-thirds of body; behind dorsal fin these spots become vertical bands, two thirds as wide as the ground colour, extending to belly; a crescent shaped similar spot behind and below eye; one oblique along the opercle; caudal with three or four oblique black bands; a deep black spot at the centre of its base; dorsal with two wide black band along its centre, one across the anal.

Affinities: This species is a member of the *guentheri* complex being closely related to *N. guentheri*, *N. petrubanarescui* and *N. triangularis* as attested by the colour pattern and deeply forked caudal

fin; it can, however be easily separated by the larger number of branched dorsal fin rays (10 in *N. pulchellus;* 8 in all the other species of *Noemacheilus* in the Peninsula.

Range: Western Ghats: Bhavani river, base of Nilgiris.

Material examined: India: Western Ghats: Nilgiris: 10 specimens, BMNH 89. 2.1.1591–1600, Bhavany River, Coll. F Day.

57. **Noemacheilus petrubanarescui** Menon
(Fig. 8, Pl. 16)

1984. *Noemacheilus petrubanarescui* Menon, *Cybium,* **8** (2): 45.

Diagnosis: Small-sized *Mesonoemacheilus* with 8 banched dorsal rays; forked caudal; incomplete lateral line ending above base of anal fin; body marked with eight broad saddle-shaped black bands on back, varying number of bars on side, anterior ones broken up into number of narrow bands; no sexual dimorphism.

Description: Based on 4 type specimens, including holotype, 20.0–35.0 mm SL from Netravati River, Dharmasthala, Karnataka.

D. 3/8; P. 1/10; V 1/7; A. 2/5; C. 19.

Body of uniform depth with dorsal and ventral profiles slightly arched. Depth of body 15.0–17.4 (M=15.7); head almost as broad as high at occiput; its length 24.9–27.5 (M=26.0)per cent of standard length. Snout pointed, its length 7.8–11.3 (M=9.8) per cent of standard length, 29.4–45.4 (M=37.5) per cent of head. Eye small, situated almost middle of length of head, not visible from ventral surface, its diameter 5.7–10.0 (M=7.35) per cent of standard length, 66.6–100.0 (M=83.3) per cent of inter-orbital width. Nostrils close to each other, situated closer to eye than tip of snout, anterior tubular. Mouth semicircular, lips moderately fleshy, lower lip deeply furrowed, upper uninterrupted, lower interrupted in the middle. Dentiform process moderately developed. Barbels well developed, inner rostral shorter, outer rostral extending to anterior margin of eye; maxillary extending to perpendicular from middle of eye.

Scales: Small, imbricate, except on ventral side. Lateral line incomplete, extending up to end of base of anal fin or tip of anal fin.

Fins: Dorsal fin almost as high as length of head; origin of dorsal fin almost equidistant between tip of snout and caudal base; origin of pelvic slightly behind that of dorsal. Pectoral as long as head, extends about two-thirds of distance to pelvic. Pelvic shorter than pectoral, reaching anal opening. Anal fin not reaching base of caudal. Caudal fin as long as or slightly shorter than head; deeply forked; lobes pointed, upper lobe shorter than lower.

Pre-dorsal distance 49.0–53.10 (M=50.18) per cent of standard length; pre-pelvic distance 50.94–56.68 (M=52.38) per cent; pre-anal 74.47–80.0 (M=78.10) per cent; distance from pectoral to pelvic origin 28.30–31.25 (M=29.53) per cent. Vent a short distance from anal fin; distance from vent to anal fin 23.50–37.50 (M=29.8) per cent on that between anterior origins of pelvic and anal fins. Pectoral 20.00–27.50 (M=23.00), pelvic 17.50–18.86 (M=18.42) per cent of standard length; height of dorsal 20.00–25.00 (M=22.37) per cent; of anal 14.82–18.75 (M=19.66) per cent; base of dorsal 18.00–22.64 (M=17.14) per cent; of anal 7.5–11.32 (M=9.58) per cent; caudal 20.00–31.25 (M=26.0) per cent.

Caudal peduncle short and stout; upper side keeled posteriorly; its length 11.32–15.71 (M=14.41) per cent of standard length; its least height 66.60–100.0 (M=86.90) per cent of its length.

Sexual dimorphism: None.

Colour: 7–8 broad saddle-shaped black bands on back, posterior four extending as narrow bands a short distance below lateral line, sides marked by a varying number of bands, fairly broad behind dorsal fin, anteriorly broken up into a number of narrow bands. An intensively black rectangular patch at middle of caudal base, a row of dark spots on dorsal fin, two dark Σ-shaped bands on caudal fin.

Size: Largest specimen examined 35.0 mm SL.

Affinities: It was interesting to find that this fish is closely related to *N. reticulofasciatus* Singh and Banarescu, inhabiting the Brahmaputra basin, near Shillong, North-eastern India, than to any of the forms of Indian Peninsula. The ancestral stock from which the two species have evolved had crossed over the Garo-Rajmahal Gap to the Indian Peninsula and to the Western Ghats from its centre of origin in the South Chinese region during the glacial periods of the Pleistocene (*vide*, Menon, 1973).

Range: North India; Karnataka; Netravati River, Dharmasthala.

Material examined: India: Karnataka: 1 specimen SRS/ZSI F 559 (Holotype Netravathi River, Dharmastala, 2 specimens, SRS/ ZSI F 560 (Paratypes) Coll. A. G. K. Menon 28.iii.1982 taken along with holotype.

58. **Noemacheilus triangularis triangularis** Day

(Figs. 4, 5, & 8; pl. 11)

1865. *Nemacheilus triangularis*, Day, *Proc. zool. soc. Lond.*, p. 295 (Type locality: Mundikyum, Tranvancore).

1865. *Nemacheilus triangularis*, Day, *Fish Malabar*, p. 203, pl. 14, fig. 1.

1868. *Nemacheilus triangularis*, Günther, *Cat. Fish. Brit. Mus.*, **7**: 352 Travancore hills).

1872. *Nemacheilus tiangularis*, Day, *J. Asiat. Soc. Beng.*, **41**: 194.

1878. *Nemacheilus triangularis*, Day, *Fish. India*, p. 619, pl. 153, fig. 10.

1889. *Nemachilus triangularis*, Day, *Faun. Brit. Ind. Fish.*, **1**: 234 (Travancore hills).

1941. *Nemachilus triangularis*, Hora, *Rec. Indian Mus.*, **43**: 251 (Western Ghats; north, central and south Travancore hills).

Diagnosis: A *Mesonoemacheilus* with 8 branched dorsal rays; complete lateral line; position of vent situated at a distance from anal fin; distance from vent to anal fin about 4 times in the distance between pelvic and anal fin; 6–7 yellowish oblique bands edged with black on body; banded dorsal and caudal; a medium black patch at caudal base; a suborbital flap in male.

Description: Based on 26 specimens, 27.0 to 58.0 mm SL from Kollar Stream, S. Travancore, Kerala.

D. 2/8; P. 11; V 8; A. 2/5; C. 18.

Body almost sub cylinderical with head and anterior part slightly depressed. Depth of body 11.65–20.00 (M=14.99); head broader than high at occiput; its length 19.82–28.23 (M=23.58) per cent of standard length. Snout of moderate length somewhat bluntly pointed, almost equal to or slightly shorter than postorbital distance; its length 7.31–11.90 (M=9.21) of standard legth, 33.70–46.15 (M=37.55) per cent of head. Eye small, situated in the middle of head, not visible from ventral surface; its diameter— 12.0–26.66(M=19.56) per cent of length of snout; 21.81–136.36 (M=90.82) per cent of inter-orbital width. Nostrils sparated by a prominent flap, situated nearer to eye than to tip of snout. Mouth semicircular, lips fleshy, furrowed, upper uninterrupted, lower interrupted in middle. Dentiform process moderately developed.

Barbels, long, inner rostral shorter; outer rostral longer than maxillary, not extending to margin of eye; maxillary shorter than rostral, extending to perpendicular from anterior third of eye.

Scales: Distinct, imbricate all over body. Lateral line almost complete reaching upto caudal peduncle.

Fins: Dorsal fin small, less than length of head; edge of dorsal straight; origin of dorsal fin almost equidistant between tip of snout and caudal base; origin of pelvic slightly behind that of dorsal. Pectoral equal to head, extends about two-third distance to pelvic; pelvic slightly shorter than pectoral, separated from anal opening by a considerable distance. Anal fin reaching base of caudal fin, slightly longer than head, forked, lobes pointed, of equal length.

Pre-dorsal distance 45.07–56.6 (M=51.37) per cent of standard length; pre-pelvic distance 50.0–63.41 (M=55.25) per cent; distance from pectoral to pelvic origin 21.95–37.50 (M=32.64) per-cent. Vent a short distance from anal fin; distance from vent to anal fin 13.04–44.44 (M=23.66) per cent in that between anterior origins of pelvic and anal fins. Pectoral 13.59–22.97 (M=17.50), pelvic 12.62–18.84 (M=15.41) per cent of standard length; height of dorsal 12.67–25.97 (M=18.23) per cent; of anal 11.26–20.27 (M=14.96) per cent; base of dorsal 9.70–19.44 (M=15.47) per cent; of anal 5.17–14.81 (M=8.65) per cent; caudal 5.55–27.77 (M=18.63) per cent.

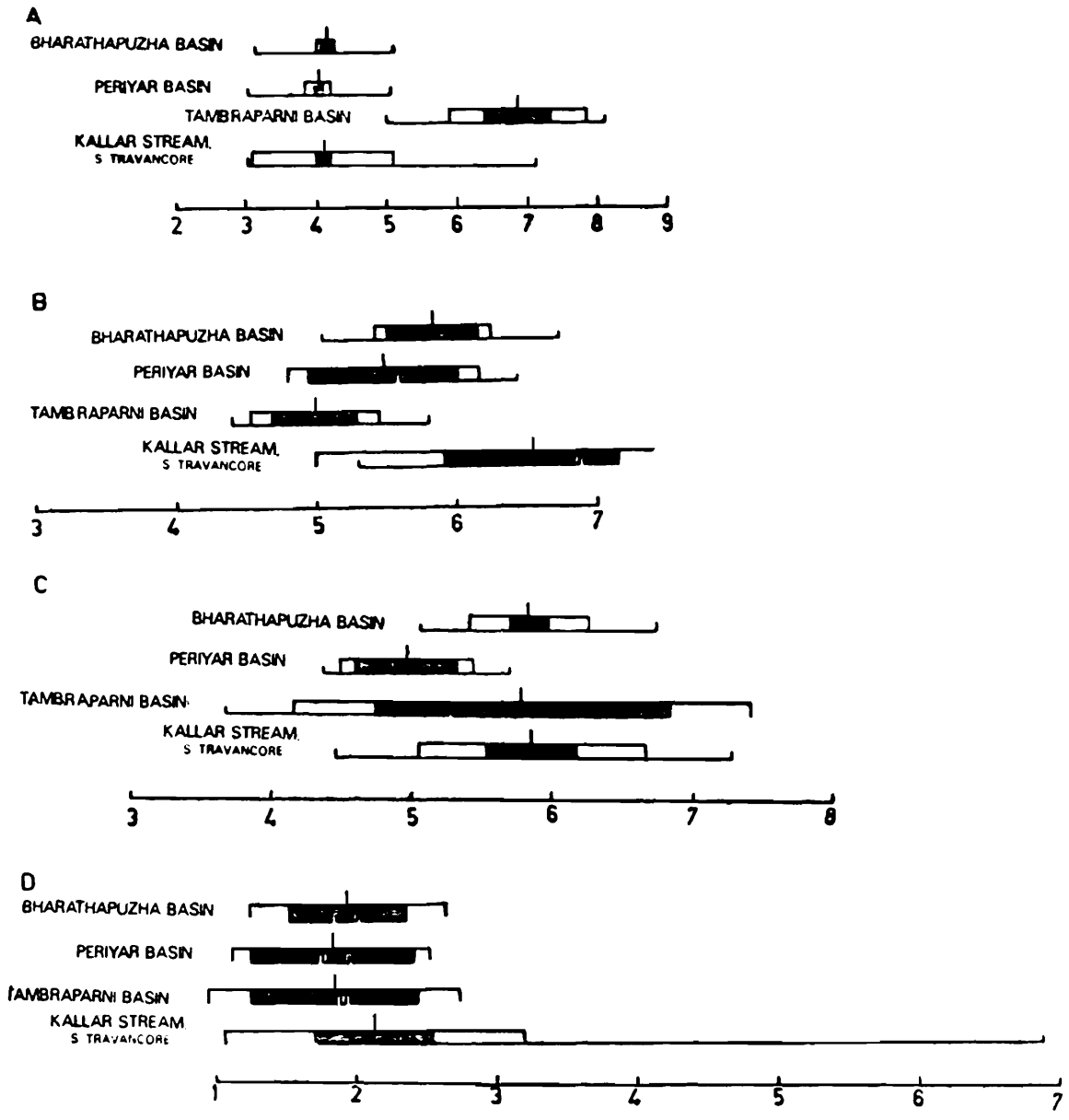
Caudal peduncle, short and stout; its length 8.53–23.37 (M=14.60) per cent of standard length; its least height 16.11–157.14 (M=93.17) per cent of its length.

Sexual dimorphism: Males with suborbital flap, pectoral fin rays thickened with breeding tubercles.

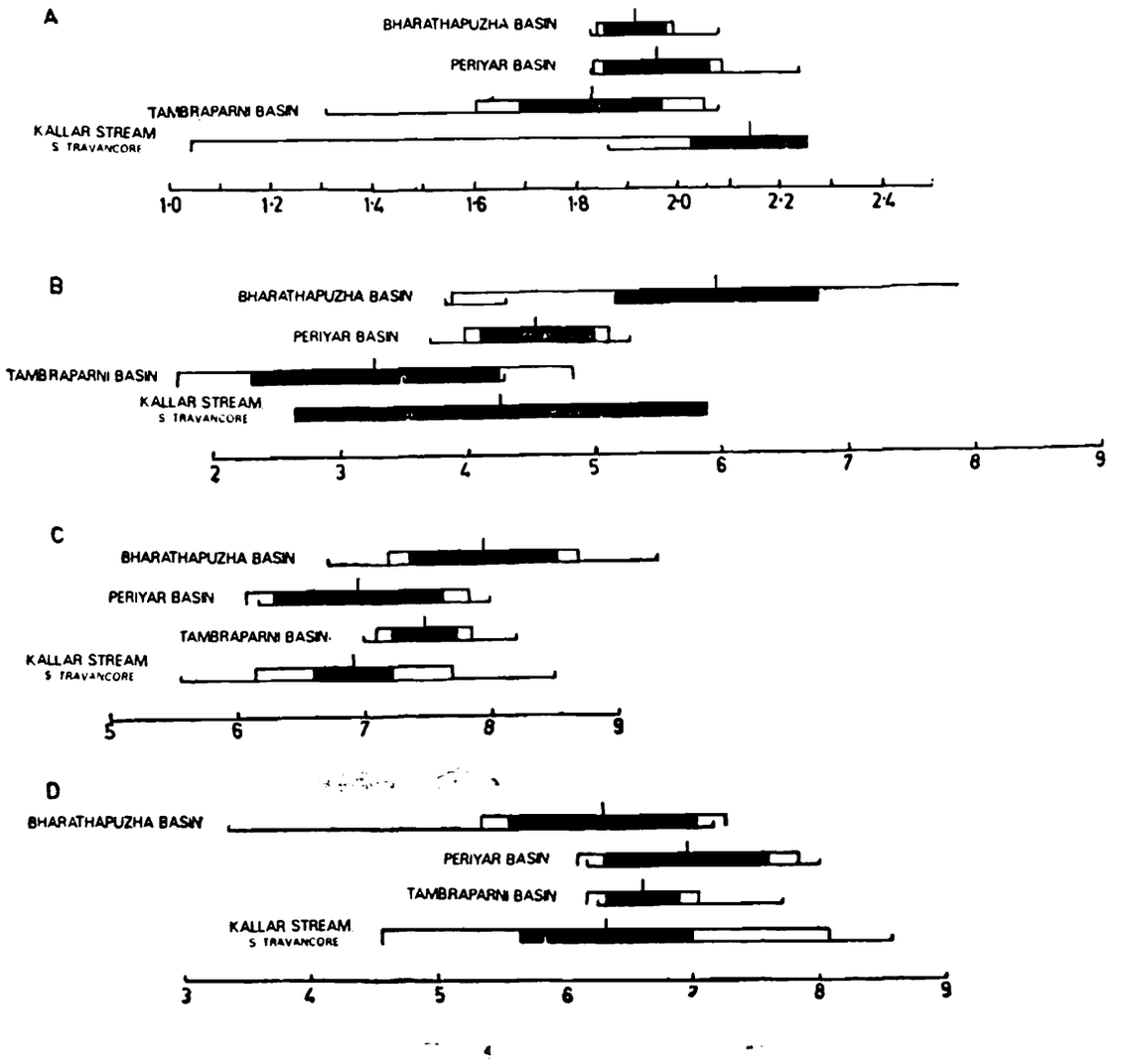
Colour: Varies considerably with age. Ground colour greyish, with yellowish bands edged with black bands on body; usually 7, the anterior 5 directed obliquely backwards, the last 2 vertical; a number of yellowish patches of different patterns above lateral line. Dorsal and caudal with two bands each, anal and pelvic with one each, a black blotch at base of caudal.

Size: Largest specimen examined 58 mm SL from Kallar, S. Trivancore.

Affinities: Close to *N. guentheri;* it is distinguished from *guentheri* by its characteristic colouration (basic colour dark with irregular white spots in *N. guentheri.* This sub-species can be readily separated from *N. tambaraparniensis* (*vide* graphs 3 & 4).



GRAPH 3. Variations in different populations of *N. triangularis* from the various river systems of the Peninsular India: A. Pre-dorsal distance in SL., B. Length of head in SL., C. Width of body in SL., D. Depth of body in SL.,



GRAPH 4. Variations in different populations of *N. triangularis* from various river systems of the Peninsular India. A. Distance from vent to anal fin in distance between pelvic and anal fins; B. Length of pelvic in SL., C. Length of pectoral in SL., D. Pre-pelvic distance in SL., Note that the vent in the Tambaraparni form is placed more close to anal fin than in the other forms.

Range: Peninsular India: Western Ghats; Kallar, Pamba, Periyar and Bharathapuzha drainages.

Material examined: India: Kerala: Western Ghats: 30 specimens, SRS/ZSI, uncatalogued, Trichur (Bharathapuzha drainage), Coll. M. P. Thobias. 11 specimens, SRS/ZSI F 490, Silent Valley, Coll. R. S. Pillai, 1979.

59. Noemacheilus triangularis tambaraparniensis, subsp. nov.

1941. *Nemachilus triangularis* (in part) Hora, *Rec Indian Mus.*, **43,** pl. 9, fig. 6, 7, 8 (Courtalum, Tambaraparni drainage, Travancore, now Tirunelveli District, Tamil Nadu).

Diagnosis A *Mesonoemacheilus* with 8 branched dorsal rays; complete lateral line; position of vent somewhat nearer to anal fin;

distance from vent to anal fin origin about 6 times in the distance between pelvic and anal fins; 6–7 yellowish bands edged with black on body; banded dorsal and caudal; a medium black patch at caudal base; a suborbital flap in males.

Description: Based on 10 specimens, 20.0–58.0 mm SL from Chittaruvi forest, Courtalam (Tambaraparni basin), Tamil Nadu.

D. 2/8; P. 11; V 8; A. 2/5; C. 18.

Body almost subcylindrical with head and anterior part depressed slightly. Depth of body 12.96–16.07 (M=15.18); head slightly broader than high at occiput; its length 23.28–28.57 (M=25.53) per cent of standard length. Snout of moderate length, somewhat conical and bluntly pointed, almost equal or slightly shorter than postorbital length; its length 8.70–13.64 (M=10.74) per cent of standard length, 35.71–50.00 (M=41.97) per cent of head. Eye small, situated in the middle of head, not visible from ventral surface; its diameter 18.18–33.33 (M=25.68) per cent of head length, 44.44–66.67 (M=62.16) per-cent of length of snout; 57.14–100.0 (M=81.62) per cent of inter-orbital width. Nostril separated by a prominent flap, situated nearer to eye than to tip of snout. Mouth semicircular, lips fleshy, furrowed, upper uninterrupted, lower interrupted in middle. Dentiform process moderately developed. Barbels, long, inner rostral shorter; outer rostral longer than the maxillary not extending to margin of eye; maxillary shorter than outer rostral extending to perpendicular from anterior third of eye.

Scales: Distinct, imbricate all over body; lateral line almost complete, reaching up to caudal peduncle.

Fins: Dorsal fin small, less than length of head; edge of dorsal straight; origin of dorsal equidistant between tip of snout and caudal base; insertion of pelvic slightly behind that of dorsal. Pectoral equal to head, extends about two-third of distance to pelvic; pelvic slightly shorter than pectoral separated from anal opening by a considerable distance. Anal fin reaching base of caudal fin, slightly longer than head, forked; lobes pointed and of equal length.

Pre-dorsal distance 48.0–60.71 (M=53.34) per cent of standard length, pre-pelvic distance 52.0–59.09 (M=54.40) per cent; pre-anal 76.0–92.86 (M=82.64) per cent; distance from vent to anal fin 11.53–16.67 (M=14.10) per cent in that between anterior origins of pelvic and anal fin. Pectoral 18.97–27.27 (M=23.34), pelvic 17.24–22.73 (M=20.21) per cent of standard length; height of dorsal 18.52–25.0 (M=20.47) per cent; anal 12.90–20.37 (M=

17.15); base of dorsal 16.52–19.05 (M=17.88) per cent; of anal 8.60–13.64 (M=10.70) per cent; caudal 24.00–42.86 (M=30.07) per cent.

Caudal peduncle short and stout; its length 11.11–17.46 (M=13.68) per cent of standard length; its least height 63.64–106.00 (M=96.98) per cent of its length.

Sexual dimorphism: Males with suborbital flap; pectoral fin rays thickened with breeding tubercles.

Colour: Varies considerably with age. Ground colour greyish with 7 yellowish bands edged with black on body, anterior 5 obliquely directed backwards, the last 2 vertical, a number of yellowish patches of different patterns above lateral line. Dorsal and caudal with two bands each, anal and pelvic with one each. A dark vertical patch at base of caudal.

Size: Largest specimen examined 58 mm SL from Chittaruvi forest, Courtalam (Thambaraparani drainage).

Affinities: This subspecies can be readily separated from the typical subspecies by its more posteriorly placed anal opening (see graph).

Range: Peninsular India: Western Ghats: Tambaraparni drainage near Courtalam, Tamil Nadu.

Holotype: 58.0 mm SL, Chittaruvi forest; Courtalam (Tambaraparni basin), Tamil Nadu, Coll. K. Mathew, 15.xi.1973, SRS/ZSI F 576.

Paratypes: 20, 20.0–58.0 mm SL., data as above SRS/ZSI F 577.

60. **Noemacheilus reticulofasciatus** (Singh & Banarescu) (Fig. 2, Pl. 12)

1981. *Mesonoemacheilus reticulofasciatus* Singh and Banarescu, *Trav. Mus. Hist. nat. Grigore Antipa*, **23**, 206, (Type locality: Barani, 20 km from Shillong).

Diagnosis: A species of *Mesonoemacheilus* with small compressed head; 8 branched dorsal fin rays; short lateral line; a number of irregular black crossbars on body, the anterior ones reticulated.

Description: Based on 6 specimens, 25.0–38.0 mm from Khri River, Jaintia Hills, Meghalaya.

D. 3/8; P. 10; V 1/6-7; A. 2-3/5; C. 18.

Body almost cylinderical with the dorsal profile slightly arched, ventral horizontal; tail compressed. Depth of body 16.0–19.73 (M=17.87); head almost as broad as high at occiput; its length 21.05–24.07 (M=22.73) per cent of standard length. Snout of moderate length, narrower anteriorly equal to postorbital distance; its length 8.06–12.03 (M=9.42) of standard length, 35.71–50.0 (M=41.37) per cent of head. Eye small, situated slightly in the anterior half of head, not visible from ventral surface; its diameter 15.62–30.76 (M=22.31) per cent of head length, 38.46–70.0 (M=53.60) per cent of length of snout; 41.66–88.88 (M=63.28) per cent of the inter-orbital width. Nostrils close to each other, situated closer to eye than tip of snout, anterior tubular. Mouth semicircular, lips moderately furrowed, upper uninterrupted, lower interrupted in middle. Dentiform processes feeble. Barbels well developed; inner rostral shorter; outer rostral equal to maxillary, not extending to margin of eye; maxillary extending to perpendicular from middle of eye or a little beyond the middle.

Scales: Small, imbricated in the posterior third of body, isolated anteriorly. Lateral line short, ending below anterior part of dorsal fin or slightly in front of it.

Fins: Dorsal fin small, less than length of head; edge of dorsal slightly convex; origin of dorsal almost equidistant between tip of snout and caudal base; origin of pelvic slightly behind that of dorsal. Pectoral shorter than head, extends half distance to pelvic. Pelvic shorter than pectoral, reaching the anal opening in smaller specimens, but falling short of it in bigger ones. Anal fin not reaching caudal base. Caudal fin longer than head, forked, lobes bluntly pointed, of almost equal length.

Pre-dorsal distance 51.31–55.88 (M=53.13) per cent of standard length; pre-pelvic distance 53.70–61.76 (M=56.96) per cent; pre-anal 77.77–85.29 (M=80.10) per cent; distance from pectoral to pelvic origin 33.33–38.97 (M=35.57) per cent. Vent a short distance from anal fin; distance from vent to anal fin 18.18–29.41 (M=24.57) per cent in that between anterior origins of pelvic and anal fins. Pectoral 18.42–22.22 (M=20.31), pelvic 14.47–18.18 (M=16.90) per cent of standard length; height of dorsal 16.17–21.0 (M=18.19) per cent; of anal 11.84–14.81 (M=13.50) per cent; base of dorsal 11.29–16.66 (M=15.04) per cent; of anal 7.27–10.00 (M=8.42) per cent; caudal 22.22–26.47 (M=24.30) per cent.

Caudal peduncle short and stout; its length 10.29–14.81 (M= 13.06) per cent of standard length; its least height 71.42–100.0 (M=85.05) per cent of its length

Sexual dimorphism: None

Colour: Body light yellowish, with a number of black irregular V or Y—shaped crossbars, the anterior ones reticulated. A black spot on dorsal origin; a round or somewhat vertical black blotch in the middle of the caudal base; a dark stripe from eye to tip of snout; a row of spots on dorsal fin, two or three on the caudal

Size: Largest specimen examined 38.0 mm SL.

Affinities: Included in the subgenus *Mesonoemacheilus* are two species complexes: the *guentheri* complex and the *reticulofasciatus* complex. The closest relative of *reticulafasciatus* is *N. sijuensis*. The *reticulofasciatus* and its derivative and the *guentheri* complex of species have evidently evolved from a common ancestor though their revolutionary centres are far removed to-day in the North-eastern part of India on the one hand and Western Ghats of the Indian Peninsula on the other.

Range: India: North Meghalaya: Jaintia Hills (Brahmaputra basin).

Material examined: India: Meghalaya: 1 specimen V/ERS 3062, (holotype, Barani, 20 km from Shillong, Brahmaputra basin. 2 specimens, V/ERS 3064 and 3065 (Paratypes, taken along with the holotype, Also 3 specimens, NRS/ZSI 2839 Sangsak Garo Hills, Coll. K. P. Singh. 3 specimen, NRS/ZSI, uncatalogued, Rongrank, Garo Hills, Coll. K. P. Singh, 3.i.78. 3 specimens, NRS/ZSI, uncatalogued, Sangsak, Garo Hills, Coll. K. P. Singh, 12.ii.78. 3 specimens, GUC, uncatalogued, Khri River, Jaintia Hills, Coll. S. C. Dey.

61. **Noemacheilus sijuensis,** sp. nov.

(Fig. 2, Pl. 6)

1924. *Nemachilus* sp., Hora, *Rec. Indian Mus.*, **26:** 28, fig. 1a, & 1b (Siju cave, Garo hills, Assam, now Meghalaya).

1935. *Nemachilus beavani,* Hora (nec Günther), *Rec. Indian Mus.*, **37:** 63.

Diagnosis: A *Mesonoemacheilus* species with 8 branched rays; complete lateral line; forked caudal; body with 8 to 10 brown bands across the back; the bands break up into secondary bands below lateral line; males with suborbital spine.

Description: Based on 8 specimens from Siju Cave, Garo-Hills, Meghalaya.

D. 2/8; P. 11; V 1/7; A. 2/5; C. 18.

A small, stoutly-built species, the dorsal profile gradually rises from the tip of snout to origin of dor sal and slopes gradually to the caudal base.; Ventral almost horizontal. Depth of body 15.0–20.0 (M=16.54); head about two-thirds as broad as long; its length 21.43–25.76 (M=23.97) per cent of standard length. Snout narrower anteriorly, somewhat longer than posterior portion of head; its length 7.86–10.0 (M=9.05) of standard length, 32.35–44.44 (M=37.89) per cent of head. Eye small, dorso-lateral in position, situated in the middle of body, not visible from the ventral surface; its diameter 13.33–21.43 (M=17.44) per cent of head length, 36.36–57.14 (M=46.48) per cent of length of snout, 36.36–90.0 (M=67.04) per cent of inter-orbital width. Nostrils close to each other, situated closer to eye than to tip of snout, anterior nostril tubular. Mouth semicircular, lips fleshy, poorly furrowed, upper uninterrupted, lower interrupted in the middle. Dentiform process well developed. Barbels well developed, the inner rostral shorter than outer rostral; the maxillary reaches below the posterior limit of the orbit or beyond.

Scales: Small, imbricate, more prominent in the posterior part of body, absent on ventral surface. Lateral line complete.

Fins: Dorsal fin small, equal to depth of body below it; edge of dossal fin somewhat convex; origin of dorsal fin somewhat nearer to base of cauda than to tip of snout. Origin of pelvic opposite to that of dorsal, pectoral almost as long as head and is separated from the pelvic by a considerable distance. Pelvic as long as pectoral, raching the anal opening. Anal fin not reaching base of caudal. Caudal forked with the lower lobe slightly longer than upper.

Pre-dorsal distance 49.38–57.50 (M=52.15) per cent or standard length; pre-pelvic distance 49.38–56.25 (M=53.01) pef cent; pre-anal 76.67–81.43 (M=79.67) per cent; distance from pectoral to pelvic origin 28.83–34.29 (M=30.76) per cent. Vent a short distance from anal fin; distance from vent to anal fin 14.58–30.43 (M=24.29) per cent in that between anterior origins of pelvic and anal fins. Pectoral 19.75–22.89 (M=21.26); pelvic 15.43–20.63 (M=18.59) per cent of standard length; height of dorsal 14.81–22.50 (M=18.49) per cent; of anal 12.96–17.50 (M=14.97) per cent; base of dorsal 14.81–18.07 (M=16.20) per cent; of anal 7.41–10.00 (M=8.65) per cent; caudal 21.67–28.57 (M=25.69) per cent.

Caudal peduncle short and stout; its length 11.45–15.00 (M=12.47) per cent of standard length; its least height 76.47–100.00 (M=92.05) per cent of its length.

Sexual dimorphism: Males with suborbital flap.

Colour: In preserved specimens, body with 8–10 short light grey bands across the back; the bands break up into secondary bands below the lateral line; upper surface of head marked with a few spots; a short grey band at base of caudal; two V-shaped bands on caudal. A cave specimen found 1700 ft. from the entrance is uniformly pale in colour.

Size: Largest specimen examined 41.5 mm SL.

Affinities: This species is close to *N. reticulofasciatus*; it is readily separated from *N. reticulofasciatus* by its colouration (the bands anterior to origin of dorsal fin are irregular and appear reticulated in *N. reticulofasciatus*).

Holotype: 51.5 mm SL., Siju Cave, 100 ft. from entrance Garo-Hills, Meghalaya, SRS/ZSI F 570.

Paratype: (14), 25.0–41.5 mm SL., data same as above. SRS/ZSI F 571.

Other material examined: 2 specimens, Siju cave, 1700 ft. from entrance, Siju Cave, Garo Hills.

Subgenus 6. *Infundibulatus*, subgen. nov.

Type species: *Noemacheilus peguensis* Hora, 1929

Diagnosis: Noemacheiline loaches, small and slender; forked caudal; lateral line complete; anterior lip hypertrophied; its edges raised forming a funnel-shaped structure; posterior lip represented by two thick pads separated along the middle; both the lips continuous at the angles.

Range: Pegu Yoma and Assam (Brahmaputra basin).

Key to species of subgenus **Infundibulatus**

A. 7 branched rays in dorsal fin; 18 vertical black bars (Pegu Yoma). *N. peguensis* Hora

B. 8 branched rays in dorsal fin; 21 vertical black bars (Assam).. *N. assamensis* sp. nov.

62. **Noemacheilus peguensis** Hora

(Figs. 7 & 8, Pl. 6)

1929. *Nemachilus peguensis* Hora, *Rec. Indian Mus.*, **31**: 520, pl. 15, figs 1 &2 (Type locality: Pegu Yoma, Burma).

Diagnosis: A species of *Infundibulatus* with 9 branched rays; forked caudal; complete lateral line; body marked with 18–20 vertical bars.

Description: Based on 2 specimens 36.0–41.0 mm SL from Konga River drainage, Chindwani, Irrawadi basin at 5 miles south of Moirang, Manipur.

D. 3/9; P. 11; V 1/7; A. 3/5; C. 19.

A small slender species with both dorsal and ventral profiles somewhat arched. Ventral surface in front of ventrals flattened, tail compressed. Depth of body 15.28–17.68 (M=16.48); head pointed slightly broader than high at occiput; its length 25.61–26.39 (M=26.0) per cent of standard length. Snout of moderate length, narrower anteriorly, somewhat longer than postorbital distance; its length 7.93–11.11 (M=9.52) of standard length, 30.95–42.11 (M=36.53) per cent of head. Eye small, situated somewhat in the posterior half of head, not visible from ventral surface; its diameter 21.05–28.57 (M=24.81) per cent of head length, 50.0–92.31 (M=71.16) per cent of length of snout, 61.54–100.0 (M=80.77) per cent of inter-orbital width. Nostrils close to each other, situated close to dorso-anterior border of eye, closer to eye than tip of snout, anterior slightly tubular. Mouth semicircular, situated in a cup-shaped structure formed by the lips, placed considerably behind tip of snout. The anterior lip is greatly hypertrophied and its edges are raised, forming a funnel-shaped structure; on the inner side it is lined with a horny substance; the lower lip is represented by two thick pads separated by a deep, narrow groove in the mid-line. Dentiform process moderately developed. Barbels thread-like; inner rostral slightly shorter; outer rostral longer than maxillary, extending to all most middle of eye; maxillary extending to perpendicular from posterior border of eye.

Scales: Minute, imbricate all over body, absent on ventral surface. Lateral line complete.

Fins: Dorsal small, slightly less than length of head; edge of dorsal straight; origin of dorsal fin equidistant between tip of snout and caudal base; origin of pelvic slightly behind that of dorsal. Pectoral shorter than head, extends about two-thirds of distance to pelvic. Pelvic shorter than pectoral, extending considerably beyond anal opening. Anal fin s long as or slightly shorter than head, forked lobes pointed and of equal length.

Pre-dorsal distance 50.00–51.22 (M=50.61) per cent of standard length; prepelvic distance 54.86–84.88 (M=54.82) per cent; pre-anal 80.56–81.71 (M=81.14) per cent; distance from pectoral to pelivc insertion 28.47–30.49 (M=29.48) per cent. Vent a short distance from anal fin; distance from vent to anal fin 36.11–43.90 (M=40.01) per cent in that between anterior origins of pelvic and anal fins. Pectoral 20.83–23.17 (M=22.00), pelvic 17.68–18.06 (M=17.87) per cent of standard length; height of dorsal 20.83—per cent; of anal 14.58–15.85 (M=15.22) per cent; base of dorsal 19.44–19.51 (M=19.48) per cent; of anal 9.15–9.72 (M=9.44) per cent; caudal 24.39–27.78 (M=26.09) per cent

Caudal peduncle short and stout; its length 12.20–12.50 (M=12.35) per cent of standard length; its least height 88.89–90.00 (M=89 45) per cent of its length

Sexual dimorphism: Males with suborbital flap.

Colour: 18–20 vertical black bars descending from back to ventral surface of body; fins unspotted.

Size: Largest specimen examined 41.0 mm SL.

Affinities: A very distinct form and it is readily separated by the cup-shaped structure of its lips; it is separated from the other member of the subgenus *N. assamensis* by the number of branched rays in the dorsal fin (9 in *N. peguensis;* 8 in *N. assamensis*).

Range: India: Manipur (Chindwin drainage); Burma: Pegu Yoma.

Material examined: Burma: 1 specimen ZSI F 11057/1, (holotype) Pegu Yoma Hills, Coll. J. P. Cook. *India:* Manipur: 2 specimens, ZSI, uncatalogued, Konga River, 5 miles south of Moirang, Manipur, 1.iv.53.

63. **Noemacheilus assamensis** sp. nov.

Diagnosis: A member of the subgenus *Infundibulatus,* with 8 branched rays in the dorsal fin; forked caudal; complete lateral line; body marked with 20–21 narrow vertical bars.

Description: Based on 1 specimens, 48.50 mm SL from Pagladia River, Assam.

D. 3/8; P. 11; V 1/7; A. 2/5; C. 20.

A small slender loach with both dorsal and ventral profiles slightly arched. Ventral surface in front of pelvics flattened, tail compressed. Depth of body 17.01; head slightly broader than high at occiput; its length 25.77 per cent of standard length. Snout of moderate length, rounded, somewhat longer than posterior portion of head; its length 10.31 of standard length, 40.0 per cent of head. Eye small, situated in the middle of head, not visible from ventral surface; its diameter 20.0 per cent of head length; 50.0 per cent of length of snout; 83.33 per cent of inter-orbital width. Nostrils close to each other, situated closer to eye than tip of snout, anterior tubular. Mouth semicircular, situated in cup-shaped structure formed by lips placed considerably behind tip of snout. The anterior lip is greatly hypertrophied and its edges are raised, forming a funnel-shaped structure; on the inner side it is lined with a horny structure; the lower lip is represented by two thick pads separated by a deep, narrow groove in the mid-line. Dentiform process moderately developed. Barbels well developed, thread-like, inner rostral shorter than outer rostral; outer shorter than maxillary, not extending to margin of eye; maxillary extending to perpendicular from posterior border of eye.

Scales: Minute, imbricate all over body, absent on ventral side. Lateral line complete.

Fins: Dorsal small, less than length of head; edge of dorsal straight; origin of dorsal fin equidistant between tip of snout and base of caudal; insertion of pelvic well behind that of dorsal. Pectoral shorter than head, extends slightly more than half distance to pelvic, shorter than pectorals, extends considerably beyond anal opening. Anal fin not reachig base of caudal. Caudal fin as long as or slightly shorter than head, forked, lobes pointed, of equal length.

Pre-dorsal distance 52.06 per cent of standard length; pre-pelvic distance 58.25 per cent; pre-anal 78.87 per cent; distance from pectoral to pelvic insertion 32.99 per cent. Vent a short distance from anal fin; distance from vent to anal fin 40.00 per cent in that between anterior origins of pelvic and anal fins. Pectoral 20.62 per cent, pelvic 17.01 per cent of standard length; height of dorsal 18.56 per cent; of anal 13.40 per cent; base of dorsal 18.56 per cent; of anal 9.28 per cent; caudal 23.71 per cent.

Caudal peduncle short and stout; its length 12.37 per cent of standard length; its least height 83.33 per cent of its length.

Sexual dimorphism: None.

Colour: 20–21 indistinct narrow vertical black bands descending from back to ventral side; fins unspotted.

Size: Largest specimen examined 48.5 mm SL.

Affinities: It is readily separated from the other species of the subgenus, *N. peguensis*, by the number of branched rays in the dorsal fin (8 in *N. assamensis;* 9 in *N. peguensis*).

Range: India: Assam (Brahmaputra drainage).

Holotype: 48.50 mm SL from Pagladia River, Assam, SRS/ ZSI F 578.

Paratype: 1, 30.0 mm SL., data as above.

Subgenus 7 *Petruichthys* subgen. nov.

Type species: *Noemacheilus brevis* Boulenger, 1893

Diagnosis: Noemacheline loaches with deep body; eyes large, bulging, visible from ventral surface; barbels long, maxillary extending to preopercular border; anterior nostril long and tubular; body covered with imbricate scales; lateral line incomplete; female spotted with black spots on sides; males with a striking longitudinal band along lateral line, in addition to short black vertical bars of varying number and shape; second free chamber of air bladder well developed; males with suborbital pad.

Petruichthys is closer to *Schistura* but the deep body, less than 4 times in standard length, large bulging eyes visible from ventral surface and long maxillary barbel, all adaptations for life in lacustrine habitat are distinctive characters of the subgenus not shared by *Schistura*.

64. **Noemacheilus brevis** Boulenger

(Figs. 3 & 4, Pl. 7)

1893. *Nemachilus brevis* Boulenger, *Ann. Mag. nat. Hist.* (6) **22**: 203 (Type locality: Inle lake at Fort Stedman).

1918. *Nemachilus brevis*, Annandale, *Rec. Indian Mus.*, **14**: 43, pl. 2, fig. 1, 1a.

1929. *Nemachilus brevis*, Hora, *Rec. Indian Mus.*, **31**: 319, pl. 15. fig. 10.

Diagnosis: The only representative of the subgenus *Petruichthys* is characterised by a deep body (depth 21.67–22.27) per cent of standard length); 8 branched rays in the dorsal fin; incomplete

lateral line ending above middle of pectoral fin; black spots on sides in females; a striking longitudinal band in addition to short black vertical bars in males; a suborbital pad in males.

Description: Based on 6 specimens, 30.0–47.0 mm SL from Inle Lake, South Shan States, Burma.

D. 3/8; P. 1/10; V 1/7; A. 2/5; C. 19.

A small, bottom fish with deep, laterally compressed body with dorsal and ventral profiles arched. Depth of body 21.67–27.27 (M=24.71); head almost as broad as high at occiput; its length 27.94–30.30 (M=28.0) per cent of standard length. Snout of moderate length, narrower anteriorly, somewhat shorter than posterior portion of head; its length 8.82–10.64 (M=9.72) in standard length, 30.0–36.0 (M=33.43) per cent of head. Eye large, situated in the anterior half of head, visible from ventral surface, its diameter 21.43–26.32 (M=24.21) per cent of head length, 60.0–83.33 (M=71.54) per cent of length of snout, 64.29–83.33 (M=71.88) per cent of inter-orbital width. Nostrils somewhat distinct from one another situated closer to eye than to tip of snout, anterior nostril long and tubular. Mouth semicircular, lips fleshy, deeply furrowed, upper lip not interrupted, lower interrupted in the mid-line. Dentiform process moderately developed. Barbels well developed, maxillary barbel extends to pre-opercular border, outer rostral barbel to centre of eye.

Scales: Small, imbricate scales all over body. Lateral line incomplete, ending middle of pectoral fin.

Fins: Dorsal fin small, less than length of head; edge of dorsal slightly convex; origin of dorsal fin equidistant between tip of snout and caudal base; origin of pelvic opposite to that of dorsal. Pectoral shorter than head extends about two-thirds of distance to pelvic. Pelvic shorter than pectoral, not reaching anal opening. Anal fin not reaching base of caudal. Caudal fin shorter than head, forked, lobes pointed and of equal length.

Pre-dorsal distance 51.67–56.06 (M=53.56) per cent of standard length; pre-pelvic distance 54.17–58.51 (M=55.20) per cent; pre-anal 77.14–80.00 (M=78.86) per cent; distance from pectoral to pelvic origin 25.00–31.06 (M=27.16) per cent. Vent a short distance from anal fin; distance from vent to anal fin 13.33–15.63 (M=14.86) per cent in that between anterior origins of pelvic and anal fins. Pectoral 18.60–23.53 (M=21.41), pelvic 15.96–19.12 (M=17.89) per cent of standard length; height of dorsal 18.57–23.53 (M=21.33) per cent; of anal 15.43–19.70

(M=14.34) per cent; base of dorsal 16.67–21.21 (M=18.28) per cent; of anal 9.85–14.29 (M=11.75) per cent; caudal 20.53–23.53 (M=22.23) per cent.

Caudal peduncle short and stout; its length 11.70–15.00 (M=13.84) per cent of standard length; its least height 76.19–100.0 (M=88.59) per cent of its length.

Sexual dimorphism: Males with suborbital flap; smaller in size with relatively longer fins, and with a striking longitudinal band along the lateral line in addition to short black vertical bars. Body spotted with black in females.

Colour: Body spotted or mottled on the sides in females; males with a number of short black vertical bars of varying size and shape and an irregular longitudinal bar along the lateral line. A small blotch at base of caudal.

Size: Largest specimen examined 47 mm SL.

Range: Burma: South Shan States: Inle Lake, in still and slow running waters.

Material examined: Burma: South Shan State: 6 specimens, F 9395/1, between Fort Stedman and Linkin, middle of Inle Lake, Coll. N. Annandale. 2 specimens, ZSI F 9392/1, Fort Stedman, Inle Lake. 4 specimens, ZSI 11071/1, white-crow tank, Coll. S. K. Hora. 18 specimens, ZSI F 9398, Yawnghwe. 2 specimens, F 9394/1, Inle Lake. 3 specimens, ZSI F 9396/1–9397/1, at edge of floating island, off Fort Stedman, Inle Lake. 2 specimens, ZSI F 9399/1, stream flowing out of Heho marsh.

Subgenus 8. *Aborichthys* Chaudhuri, 1913

Type species: *Aborichthys kempi* Chaudhuri, 1913

Diagnosis: Noemacheiline loach greatly elongated; tail compressed; the body and tail of uniform height throughout; rounded caudal; vent situated far forwards; ventrals situated slightly in advance of dorsal, extending considerably beyond anal opening. All fins greatly removed from one another. Body marked with oblique, narrow stripes; a black spot at upper end of base of caudal fin; caudal fin usually marked with concentric rings of black colour.

Aborichthys is close to *Noemacheilus* s. s. in the Western Ghats in the forward position of the anus and ventrals extending beyond the anal opening; both *Aborichthys* and *Noemacheilus* have probably

descended from a common ancestor during recent time, geologically speaking. The gradual shifting forward of the vent provides the fish with a longer tail for life in swift current. Most of the species of *Noemacheilus* inhabit rapid running water, but they seek shelter from the swift current either by hiding themselves under stones or by living at the bottom of deeper pools in course of streams. *Aborichthys* is adapted for life in torrents.

Key to species of subgenus **Aborichthys**

1(a) Vent equidistant between tip of snout and base of caudal or slightly nearer to former than latter (Garo Hills). *N. garoensis*

1(b) Vent distinctly nearer base of caudal than tip of snout.

2(a) Body marked with a number of broad black rings alternating with narrow yellowish bands (Darjeeling) *N. elongatus*

2(b) Body marked with oblique black strips, indistinct in the posterior third of body (N. E. India and U. Burma). *N. kempi*

65. Noemacheiline elongatus (Hora)

(Fig. 6, Pl. 7)

1921. *Aborichthys elongatus* Hora, *Rec. Indian Mus.*, **22**: 735, fig. (Type locality: base of Darjeeling Himalayas).

1925. *Aborichthys elongatus*, Hora, *Rec. Indian Mus.*, **27**: 233.

1937. *Aborichthys elongatus*, Shaw and Shebbeare, *Journ. As. Soc. Bengal*, **3**: 63 (Riyang River, N. Bengal).

1974. *Aborichthys elongatus*, Menon, *Inl. Fisheries Soc. India*, special publication, **1**: 49 (Darjeeling Himalayas).

Diagnosis: A species of *Aborichthys* with vent situated nearer base of caudal than tip of snout, and body marked from behind the origin of dorsal fin with a number of black rings with narrower yellowish bands in between.

Description: Based on 9 specimens, 35.0–54.0 mm SL from Rujong River, Tista Valley.

D. 3/7; P. 10; V 1/7; A. 1/5; C. 18.

A greatly elongated and compressed form with both dorsal and ventral profiles straight and horizontal behind pectoral fin. Depth of body 12.79–14.77 (M=13.74); head rounded and cylindrical; its legnth 18.52–22.86 (M=21.27) per cent of standard

length. Snout somewhat rounded, almost equal to the postorbital distance; its length 6.48–9.15 (M=8.10) in standard length, 34.21–43.74 (M=32.08) per cent of head. Eye small, situated on dorsal side in the middle of head, not visible from ventral surface; its diameter 15.79–21.05 (M=18.36) per cent of head length, 42.86–57.14 (M=48.41) per cent of length of snout, 54.44–80.0 (M=65.20) per cent of inter-orbital width. Nostrils close to each other, closer to eye than tip of snout, anterior tubular membranous fold between the two produced into a barbel like process. Mouth semicircular; lips moderately fleshy, not furrowed, upper interrupted by a small notch, lower interrupted in middle. Dentiform process feebly developed. Barbels not so well developed, short inner-rostral shorter, outer subequal to maxillary, not extending to margin of eye; maxillary extending to perpendicular from anterior border of eye.

Scales: Minute, embedded. Lateral line complete.

Fins: Dorsal small, less than length of head; edge of dorsal straight; origin of dorsal fin equidistant between tip of snout and caudal base; origin of pelvic slightly before that of dorsal. Pectoral shorter than head, extends half way the distance to pelvic. Pelvic shorter than pectoral extending considerably beyond anal opening. Anal fin not reaching base of caudal. Caudal fin slightly shorter than head, rounded.

Pre-dorsal distance 50.93–54.88 (M=52.57) per cent of standard length; pre-pelvic distance 47.92–52.86 (M=51.56) per cent; pre-anal 75.71–80.49 (M=78.34) per cent; distance from pectoral to pelvic origin 29.55–33.33 (M=31.69) per cent. Vent a short distance from anal fin; distance from vent to anal fin; 53.06–65.52 (M=57.72) per cent in that between anterior origins of pelvic and anal fins. Pectoral 16.67–20.73 (M=19.59), pelvic 15.28–18.29 (M=16.93) per cent of standard length; height of dorsal 12.79–16.67 (M=14.65) per cent; of anal 11.57–14.47 (M=13.21) per cent; base of dorsal 11.46–13.51 (M=12.66) per cent; of anal 6.82–9.76 (M=8.20) per cent; caudal 14.29–21.95 (M=18.83) per cent.

Caudal peduncle long and broad; its length 13.41–17.07 (M=15.02) per cent of standard length; its least height 71.43–95.45 (M=83.92) per cent of its length.

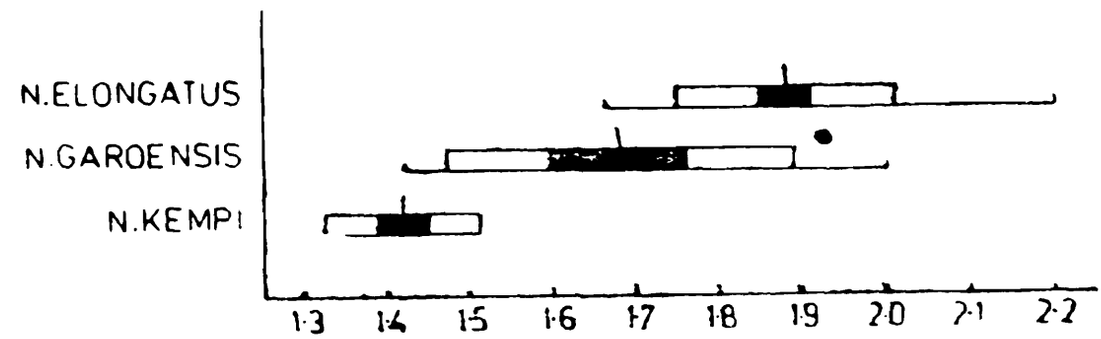
Sexual dimorphism: None.

Colour: Upper surface of head and body in front of dorsal fin dusky, under surface white or dull olivaceous. From behind origin of dorsal fin to caudal base body marked with a number

of broad black rings alternating with narrow bands of yellowish organge; pectoral, ventral, anal dull white, dorsal streaked with black along rays, caudal dusky with whitish margin and two short whitish bands in the midde; an intensive black ocellus at upper corner of caudal base.

Size: Largest specimen examined 54 mm SL.

Affinities: The species can be readiy distinguished by its distinctive colouration, in the position of vent nearer to tip of caudal than to tip of snout (position nearer to tip of snout than to end of caudal in other members), broad black rings on body similar to those of some species of *schistura* point to the primitive nature of *N. elongatus*.



GRAPH 5. *N.* (*Aborichthys*) *elongatus* compared with *N*(*Aborichthys*) *garoensis* and *N* (*Aborichthys*) *kempi* with respect to the vent position in the distance between pelvic and anal fins. Note that in the case of the more specialised species (*kempi*) the vent is pushed far forward.

Range: India: Darjeeling Himalayas.

Material examined: India: Darjeeling; 3 specimens, ZSI F 10087/1, (Syntypes Reang River, 2000 ft., Coll. G. C. Shaw. 20 speimens, ZSI F 11381/1, Rivang River, Teesta Valley, Coll G. E. Shaw & E. O. Shebbeare.

66. **Noemacheilus garoensis** (Hora)

(Fig. 6, Pl. 6)

1925. *Aborichthys garoensis* Hora, *Rec. Indian Mus.*, **72:** 233, figs. 1, 1a. 1b, (Type locality: Tura Garo Hills).

1974. *Aborichthys garoensis*, Menon, *Inl. Fisheries Soc. India*, special publications, **1:** 49 (Garo Hills).

Diagnosis: A species of *Aborichthys* with vent situated far forward, midway between tip of snout and base of caudal, and body marked with 30 to 35 backwardly inclined narrow bands.

Description: Based on 5 specimens, 25.0–38 mm SL from Garo Hills, Meghalaya.

D. 3/7; P. 1/10; V 1/6; A. 2/5; C. 18.

A greatly elongated loach with body and tail compressed, dorsal and ventral profiles almost parallel and horizontal. Depth of body 14.0–15.52 (M=14.55); head somewhat depressed; its height at occiput lower than the depth of body and least height of caudal peduncle; its length 21.88–24.14 (M=23.24) per cent of standard length. Snout of moderate length, broadly rounded, almost equal to the postorbital distance; its length 8.45–10.34 (M=9.13) in standard length, 36.11–42.86 (M=39.26) per cent of head. Eye small, situated in middle of head, not visible from ventral surface; its diameter 13.89–20.08 (M=18.09) per cent of head length, 38.40–54.55 (M=44.54) per cent of length of snout, 45.45–75.0 (M=55.43) per cent of inter-orbital width. Nostrils close to each other, the membrane between the two nostrils produced into a short barbel like process, situated closer to eye than tip of snout, anterior tubular. Mouth semicircular, lips fleshy, furrowed, upper uninterrupted, lower interrupted in middle, papillated. Dentiform process moderately developed. Barbels well developed, of equal length, outer rostral not extending to margin of eye; maxillary extending to perpendicular from middle of eye.

Scales: Small eliptical scales, more prominent posteriorly, absent on chest. Lateral line incomplete ending slightly behind tip of pectoral fin.

Fins: Dorsal fin small, less than length of head, edge of dorsal slightly convex; origin of dorsal fin nearer to the tip of snout than caudal fin base; origin of pelvic slightly before that of dorsal. Pectoral shorter than head, horizontally placed, when depressed extends less than half way of distance to pelvic. Pelvic shorter than pectoral, extends considerably beyond anal opening. Anal fin not reaching base of caudal. Caudal fin long, as long as or slightly shorter than head, rounded, rays of upper half longer than those of lower.

Pre-dorsal distance 48.44–53.45 (M=50.88) per cent of standard length; pre-pelvic distance 45.31–50.00 (M=47.77) per cent; pre-anal 73.44–79.31 (M=76.31) per cent; distance from pectoral to pelvic origin 26.56–28.57 (M=27.88) per cent. Vent a short distance from anal fin; distance from vent to anal fin 52.94–68.29 (M=63.62) per cent in that between anterior origins of pelvic and anal fins. Pectoral 19.08–25.89 (M=22.66), pelvic 17.19–20.69 (M=18.71) per cent of standard length; height

of dorsal 13.82–21.00 (M=18.17) per cent; of anal 13.16–14.66 (M=13.62) per cent; of anal 7.81–11.62 (M=9.25) per cent; caudal 18.42–25.00 (M=21.09) per cent.

Caudal peduncle long and broad; its length 13.79–15.49 (M=14.35) per cent of standard length; its least height 81.82–100.00 (M=94.27) per cent of its length.

Sexual dimorphism: None.

Colour: Upper surface of head marked with short black lines anastomosing with one another; body marked with 30 to 35 black fork-shaped bands, inclined backwards, narrower than interspaces; bands broader above, thinner below, not extending to ventral surface. A dark black-spot at upper end of base of caudal; pectorals, ventrals and anal fins dull white; dorsal banded with two or three rows of black spots, a greyish blotch at base of two or three anterior rays, caudal dull grey with dark black margin posteriorly.

Size: Largest specimen examined 38.0 mm SL.

Affinities: Aborichthys can be readily separated of the other by the more anterior position of vent, situated midway between tip of snout and base of caudal (vent nearer to base of caudal in the other members).

Range: India: Garo Hills, Meghalaya.

Material examined: India: Meghalaya: 2 specimens, ZSI F 10669/1, (Syntypes) Tura, Garo Hills, Coll. S. W Kemp. 8 specimens, ZSI F 10727/1, Tura, Garo Hills, Coll. S. W Kemp. 1 specimens, ERS/ZSI, Sim Sangiri, Garo Hills, Coll. K. P Singh, 5.xi.78.

67. **Noemacheilus kepi** (Chaudhuri)

(Fig. 5, Pl. 7)

1913. *Aborichthys kempi*, Chaudhuri, *Rec. Indian Mus.*, **8**: 245, pl. 7, fig. 1, 1a, 1b (Type locality: Renging, Eotung and Yenbung, Abor Hills).

1925. *Aborichthys kempi*, Hora, *Rec. Indian Mus.*, **27**: 232.

Diagnosis: An *Aborichthys* species with vent placed nearer caudal base than tip of snout; incomplete lateral line; body striped with 18 to 21 dark brown transverse stripes from gill openings to above anal fin, inclined backwards, on a yellowish background.

Description: Based on 4 specimens, 40.0–80.0 mm SL from Putao plain, N. E. Burma.

D. 3/7; P. 1/10; V 1/6; A. 2/5; C. 16.

Body elongated, with strongly compressed body, and of uniform depth; depth of body 12.50–15.63 (M=13.83); head depressed; its length 19.38–23.75 (M=21.31) per cent of standard length. Snout of moderate length, little shorter than the postorbital distance; its length 7.5–9.06 (M=8.46) of standard length and 36.84–50.0 (M=40.76) per cent of head. Eye small, situated in the middle of head, not visible from ventral surface; its diameter 12.50–16.13 (M=14.08) per cent of head length, 33.33–37.50 (M=35.26) per cent of length of snout, 50.0 per cent of interorbital width. Nostrils close to each other, situated closer to eye than tip of snout, anterior nostril tubular. Mouth semicircular, lips moderately fleshy, deeply furrowed in two rows, upper uninterrupted, lower interrupted in the middle. Dentiform processes well developed. Barbels short, subequal with thread like tips; maxillary extending perpendicular to middle of eye.

Scales: Minute, embedded. Lateral line incomplete ending before dorsal fin.

Fins: Dorsal small, less than length of head; edge of dorsal straight; origin of dorsal nearer caudal base than tip of snout; insertion of pelvic well before that of dorsal. Pectoral shorter than head, extends about half way of distance pelvic. Pelvic shorter than pectoral extends considerably beyond anal opening. Anal fin not reaching base of caudal. Caudal fin as long as or slightly shorter than head, rounded.

Pre-dorsal distance 47.50–52.27 (M=49.32) per cent of standard length; pre-pelvic distance 43.75–50.00 (M=47.37) per cent; pre-anal 73.13–77.50 (M=75.88) per cent; distance from pectoral to pelvic insertion 25.63–31.25 (M=29.11) per cent. Vent a short distance from anal fin; distance from vent to anal fin 65.52–73.91 (M=68.36) per cent in that between anterior origins of pelvic and anal fins. Pectoral 15.0 0–22.50 (M=19.15), pelvic 15.00–20.00 (M=17.12) per cent of standard length; height of dorsal 13.64–15.00 (M=14.51) per cent; of anal 10.63–14.77 (M=12.45) per cent; base of dorsal 10.63–12.50) (M=11.67) per cent; of anal 8.75–10.00 (M=9.31) per cent; caudal 15.00–21.25 (M=17.73) per cent.

Caudal peduncle short and stout; its length 12.50–18.75 (M=15.31) per cent of standard length; its least height 80.00–90.91 (M=85.30) per cent of its length.

Sexual dimorphism: None.

Colour: Body striped, from gill opening to above anal fin, with 18–21 dark brown transverse bands, inclined backwards, on an yellow whitish background, not extending to the ventral surface. Dorsal fin banded with dark brown spots; an irregular blotch at upper surface of the base of caudal; caudal fin banded with two broad black concentric curves, one above middle and the other bordering the margin leaving a narrow white fringe.

Size: Largest specimen examined 80 mm SL.

Affinities: This species is close to *N. garoensis* and *N. elongatus;* it can be separated by the position of vent which is nearer to the caudal base than tip of snout (nearer tip of snout in *N. garoensis*). *N. elongatus* is a more primitive species than *kempi* (the position of vent in *N. elongatus* is nearer to the caudal base than to posterior margin of eye; equidistant in *N. kempi*).

Material examined: India: 11 specimens, ZSI F 7721/1 to 7723/1, F 7778/1 to 7779/1, 7878/1 to 7879/1 and F 8297/1 to 8298/1, (syntypes) Egar stream between Renging and Rotung, Abor, Coll. S. W Kemp, 1812. 3 specimens, ZSI F 7725/1 to 7727/1 (syntypes) Sirpo River, near Renging, Abor, Coll. S. W Kemp, 1912. 2 specimens ZSI F 7769/1 to 7770/1 (syntypes), Yambang East side of Dhang River, Abor, Coll. S. W Kemp, 1912. 2 specimens, ZSI F 2474/2, a rock pool at Norgum River, Bitselling, Kemeng Frontier Division, NEFA (now Arunachal pradesh), Coll. K. C. Jayaramakrishnan, 16.v.1961. 2 specimens, ZSI F 9744/1 and 9745/1, Putao Plains. N. E. Burma, near Tibetan Frontier, Coll. Murry Stuart.

Subgenus 9. *Indoreonectes* Rita & Banarescu

Type species: *Oreonectes keralensis* Rita and Nalbant

Diagnosis: Noemacheiline fishes with rounded caudal; short lateral line; long nasal barbels; a number of vertical bands often split up into stripes and blotches on sides of body.

Range: South west India: Western Ghats.

Remarks: Banarescu and Nalbant (1969) pointed out a close affinity between *N. evezardi* and fishes of the genus *Lefua* but Sawada (1982) refuted such relationships. I have, however, considered the Western Ghats forms as a distinct subgenus of *Noemacheilus* and adapted the subgeneric name *Indoreonectes* proposed by

Rita and Banarescu. The Western Ghats forms have most probably evolved from the same ancestral form which had given rise to *Lefua* probably in recent times, geologically speaking.

Key to species of sugqenus **Indoreonectes**

A. Crossbars wider, well delimited, and regular. (Krishna & Godavari basins).. *N. (Indoreonectes) evezardi*

B. Crossbars narrower, ill defined, split up below lateral line (Rita & Nalbant) (Western Ghats, Kerala).. .. *N. (Indeoreonectes) keralensis*

68. **Noemacheilus evezardi,** Day

(Figs. 1 & 2, Pl. 4 & Fig. 1, Pl. 10)

1878. *Nemacheilus evezardi* Day, *Fish India*, p. 613, pl. 153, fig. 11 (Type locality: Poona).

Diagnosis: A small subcylindrical form with well developed nasal barbels. Caudal fin rounded. Lateral line short. Dorsal fin with 7 branched rays, posteriorly situated, nearer caudal base than tip of snout. Well developed, imbricate scales cover the whole body including breast. Colouration variable but characteristic, usually with a number of dark vertical blotches.

Description: Based on 20 specimens, 23.0–39.0 mm SL from Poona.

D. 3/7; P. 11; V 1/6; A. 2/5; C. 18.

Body subcylindrical, of almost uniform depth. Depth of body 11.53–17.39 (M=13.77); head broad depressed; its length 21.73–27.27 (M=24.14) per cent of standard length. Snout rounded, somewhat equal to postorbital distance; its length 7.57–12.0 (M=9.78) of standard length; 31.25–50.0 (M=40.47) per cent of head. Eye small situated in the middle of head, not visible from ventral surface; its diameter 11.11–30.0 (M=20.55) per cent of head length 28.57–60.0 (M=40.85) per cent of length of snout; 33.33–60.0 (M=51.08) per cent of inter-orbital width. Nostrils closer to eye than tip of snout, anterior barbel-like. Inter-orbital space flat. Mouth semicircular; lips fleshy moderately furrowed, both lower and upper interrupted in the middle, interruption of lower lip broader than upper. Dentiform processes moderately developed. Barbels well developed, both pairs of rostral barbels almost equally long, the inner pair extending to below eye, outer slightly beyond; maxillary is largest extending to beyond perpendicular from posterior border of eye. Nasal barbels reach beyond middle of eye, usually not to hind margin of eye.

Scales: Small, well developed, imbricate, cover the whole body including breast and neck. Lateral line short, ending above middle of pectoral fin.

Fins: Dorsal fin small, less than length of head; edge of dorsal rounded; origin of dorsal fin nearer caudal base than tip of snout; origin of pelvic opposite or slightly in advance of that of dorsal. Pectoral short, equal to head length, extends to about two-thirds of distance to pelvic. Pelvic shorter than pectoral, not extending to anal opening. Anal fin not reaching caudal base. Caudal fin as long as or slightly shorter than head, rounded.

Pre-dorsal distance 48.27–56.89 (M=52.96) per cent of standard length; pre-pelvic distance 50.0–58.62 (M=52.18) per cent; pre-anal 68.96–81.81 (M=74.10) per cent; distance from pectoral to pelvic origin 26.31–39.13 (M=30.11) per cent. Vent a short distance from anal fin; distance from vent to anal fin 15.0–25.0 (M=19.42) per cent in that of between anterior origins of pelvic and anal fins. Pectoral 15.51–24.0 (M=18.97), pelvic 15.0–21.73 (M=17.50) per cent of standard length; height of dorsal 15.51–22.41 (M=18.28) per cent; of anal 13.63–19.69 (M=15.73) per cent; base of dorsal 10.86–17.10 (M=12.28) per cent; of anal 8.62–14.54 (M=10.86) per cent; caudal 13.63–27.27 (M=20.90) per cent.

Caudal peduncle short and stout with an adipose keel on upper part; its length 10.34–17.24 (M=13.04) per cent of standard length; its least height 10.34–18.96 (M=12.60) per cent of its length.

Sexual dimorphism: None.

Colour: Body greenish or yellowish with 9–18 (usually 14 or 15) brown vertical stripes from back to ventral side; shape of these stripes variable, some interrupted or incomplete, some more or less curved and oblique, others V or Y shaped. Big round spots on head; a vertical dark stripe at base of caudal: a small black spot at base of dorsal origin; 3–4 rows of spots on caudal fin; 2–3 rows of paler ones on dorsal; other fins unspotted.

Size: Largest specimen examined 38.0 mm SL.

Affinities: This little fish is easily distinguished from the other member of the subgenus, confined to southern part of Western Ghats, by its characteristic colouration (black vertical stripes on body are wider, regular and well delineated in *N. evezardi*; narrower, often split up below lateral line into number of smaller streaks or spots in *N. karalensis*).

Range: India: Western Ghats: Krishna and Godavari basins; Satpura range: Pachmari Hills.

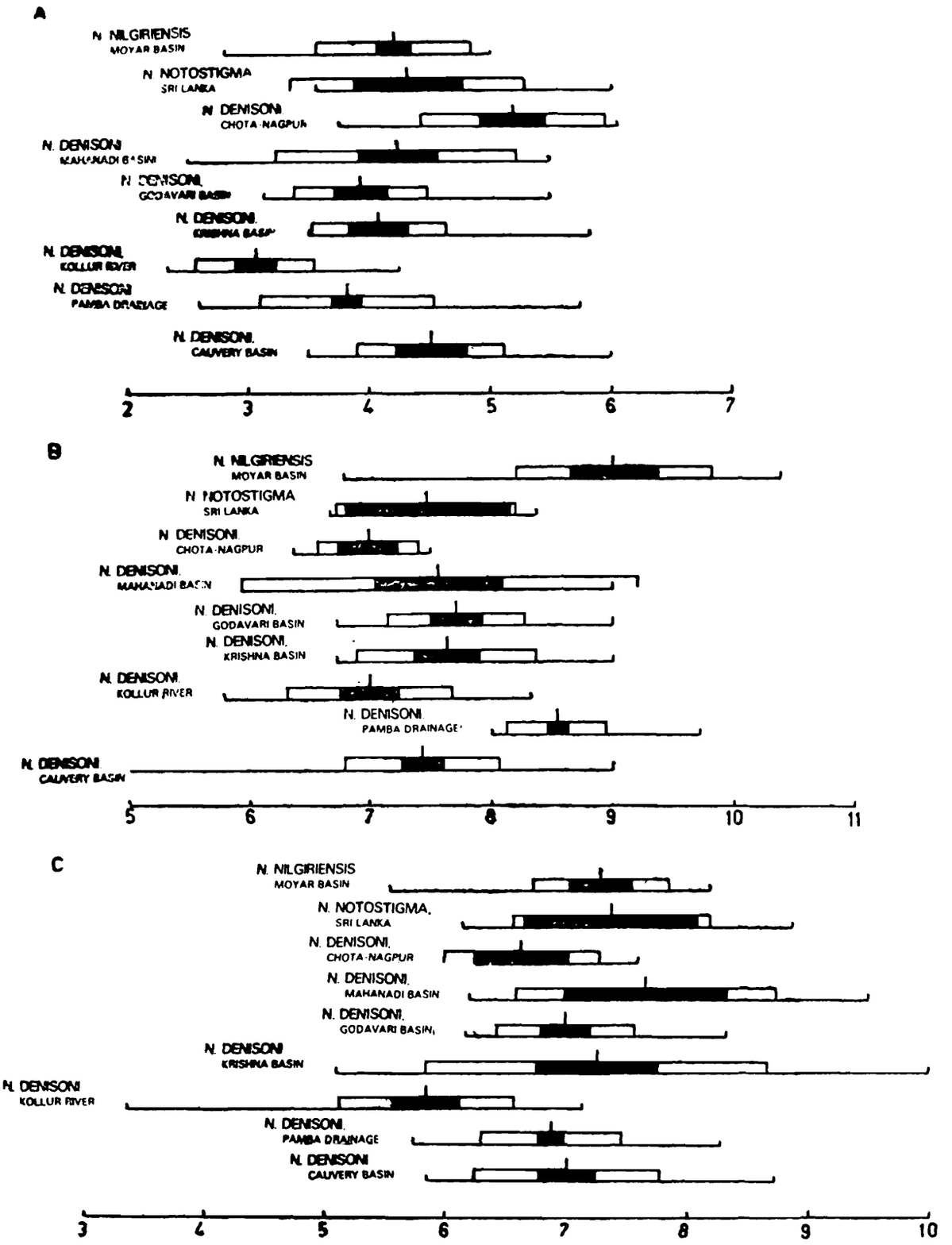
Material examined: India: Maharashtra: Western Ghats: (Krishna drainage): 15 specimens, WRS/ZSI/P/761, Coll. R. M. Chopra, 5.iii.1968. 15 specimens, WRS/ZSI/P/678, Nasik, Coll. M. B. Rao, 16.x.1973. 61 specimens, WRS/ZSI/8120, Shindiwadi, Pune, Coll. B. S. Lamba, 3.x.1969. 2 specimens, WRS/ZSI/V/1342, Pirangut, Coll. Raj Tilak, 29.xi.1966. 22 specimens, WRS/ZSI/V1623, Godavari River, Trimbak, Nasik, Coll. M. B. Rao, 18.x.1973. 1 specimen, WRS/ZSI/V/1071, Vadagaon, Pune, Coll. Raj Tilak, 29.ix.1965. 2 specimens, WRS/ZSI/V/1142, Coll. Raj Tilak, 3.xi.1966. 2 specimens, uncatalogued, BNHS, 12.iii.82. 2 specimens, ZSI/WRS/V/559, Sinhgad, Poona, Coll. R. M. Chopra, 28.ii.1966. 1 specimen, WRS/ZSI/V/506, Khadakwasla, Pune, Coll. S. M. Ketkar, 4.xii.1965. 2 specimens, WRS/ZSI/P/793, Khed Shivapur, Poona, Coll. B. S. Lamba, 2.vi.1970. 15 specimens, SRS/ZSI/KFS/PL 73/74, Pamuleti, Coll. T S. N. Murthy & Party, 4.i.1983. 10 specimens, WRS/ZSI/V/1946, Pundinalla, Trimbak, Nasik, Coll. M. B. Rao, 17.x.1973. 1 specimen, WRS/ZSI/V/1127, Vadagaon, Pune, Coll. B. S. Lamba, 31.x.1966. 19 specimens, ZSI/V/181, stream at Khandala, Poona, Coll. B. K. Tikader, 14.xi.1963. 13 specimens, WRS/ZSI/V/1499, Bhaje Cave, Karla, Poona, Coll. M. B. Rao, 15.x.1973. 13 specimens, ZSI F 9702/1, Khandala, Pune, Coll. A. Annandale. 1 specimen, WRS/ZSI/V/1043, Velhe River, Velhe, Coll. B. S. Lamba, 24.iii.1965. 3 specimens, WRS/ZSI/V/152, Bhaje Cave, Karla, Pune, Coll. B. K. Tikader, 5.xi.1963. 9 specimens, WRS/ZSI/V/1242, Vadagaon, Pune, Coll. B. S. Lamba, 12.x.1966. 8 specimens, WRS/ZSI/V/188, Nala near Tata Water Pump Station, Khadakwasla, Coll. B. K. Tikader, 12.xi.1963. 1 specimen, WRS/ZSI/V/1007, Nala near Pirangut, Pune, Coll. B. S. Lamba, 8.ix.1965. 22 specimens uncatalogued, BNHS, Borivilli National park, Coll. V K. Chari, 20.iv. 1952. 2 specimens, WRS/ZSI/7259, Khed, Pune, Coll. B. S. Lamba, 30.i. 1969. 15 specimens, WRS/ZSI/7198, Shindewadi Pune Coll. M. M. Chatterjee, 7.i.1969. 5 specimens, WRS/ZSI/7111, Khed Shivapur Pune, Coll. B. S. Lamba, 21.xi.1968.

69. **Noemacheilus keralensis** (Rita and Nalbant)

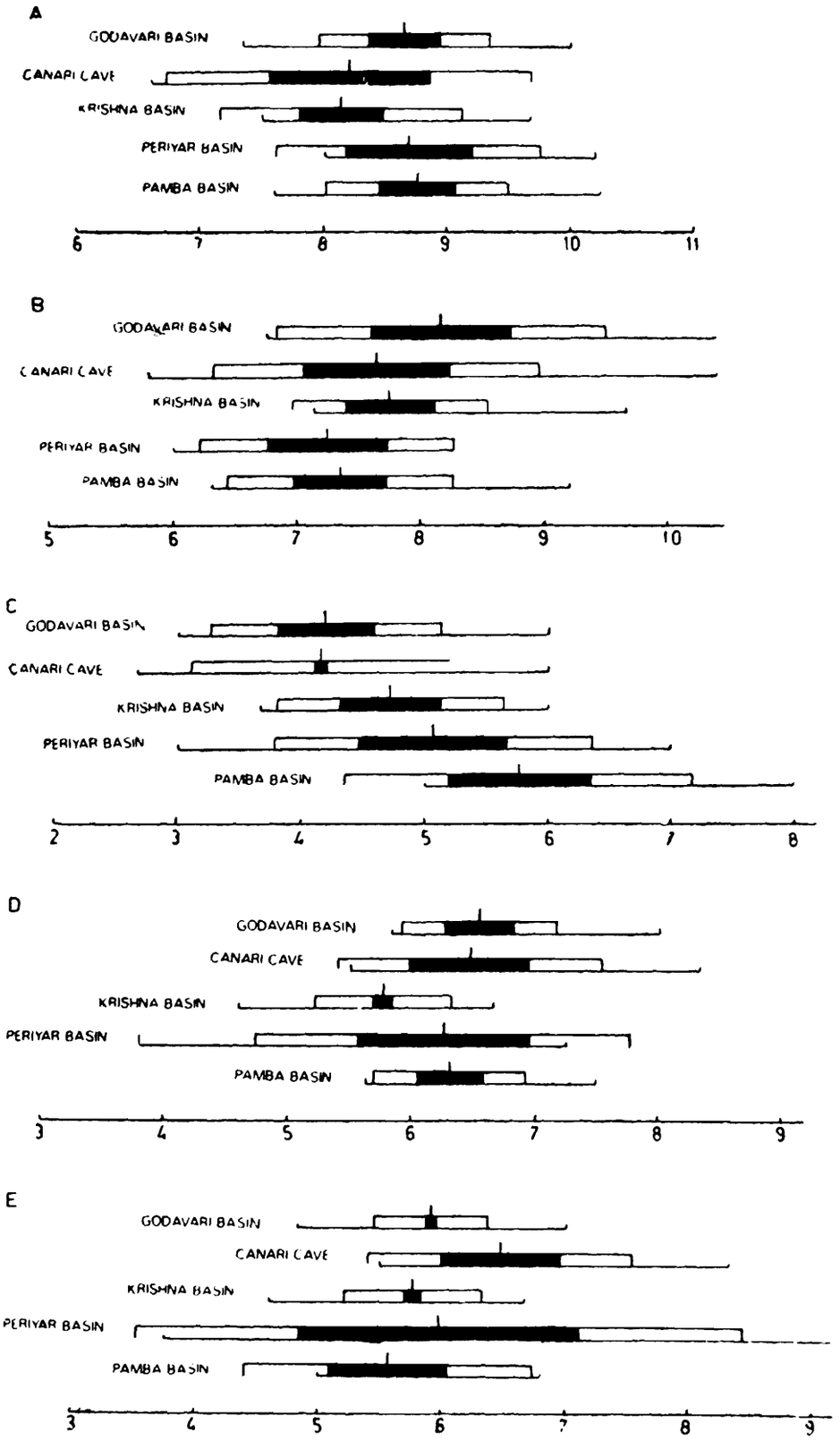
(Fig. 2, Pl. 10)

1978. *Oreonectes keralensis* Rita & Nalbant, *Trans. Mus., nat. Grigore Antipa,* **19:** 186 (Type locality: Pampadampara, Kerala).

Diagnosis: A *Indoreonectes* species with comparatively shorter nasal barbels and narrower black vertical bands often split up below lateral line into numerous stripes or spots.



GRAPH 6. Variations in different populations of *N. evezardi* from the various drainages of the Peninsular India. A. Pre-pelvic distance in SL., B. Pre-dorsal distance in SL., C. Width of body in SL., D. Depth of body in SL., Note that in none of the characters the Pamba-Periyar form differs specifically from the Krishna, Cauvery or the Godavari form.



GRAPH 7. Variations in different populations of *N. evezardi* from the river systems of Peninsular India. A. Height of caudal peduncle in SL., B. Length of caudal peduncle in SL., C. Distance from vent to anal fin in distance from pelvic to anal fins; D. Length of pelvic in SL., E. Length of pectoral in SL.,

Note that in none of the characters the Pamba-Periyar form differs from the rest.

Description: Based on 11 specimens, 38.0–53.0 mm SL from Pamba drainage in Sabirigiri, Western Ghats of Kerala.

D. 3/7; P 11; V 1/6–7; A 2/5; C. 18.

Body subcylindrical, of uniform depth. Depth of body 13.21–17.65 (M=14.85); head broad, depressed, its length 19.51–25.0 (M=21.82) per cent of standard length. Snout rounded, some what equal to postorbital distance, its length 7.32–10.0 (M=8.84) of standard length, 33.33–45.0 (M=40.61) per cent of head. Eye small, situated in middle of head, not visible from ventral surface; its diameter 14.29–21.05 (M=16.94) per cent of head length, 33.33–50.0 (M=41.99) per cent of length of snout, 30.0–57.14 (M=40.07) per cent of inter-orbital width. Nostrils close to each other, situated closer to eye than tip of snout, anterior barbel-like. Mouth semicircular; lips fleshy, upper uninterrupted, lower incompletely interrupted in the middle by a narrow groove. Dentiform processes moderately developed. Barbels well developed; inner rostral shorter than outer rostral; outer rostral slightly shorter than maxillary extending to margin of eye; maxillary extending to perpendicular from posterior border of eye.

Scales: Small, well developed, imbricate scales all over body. Lateral line short, ending above middle of pectoral.

Fins: Dorsal fin small, less than length of head; edge of dorsal rounded, origin of dorsal fin nearer caudal base than tip of snout; insertion of pelvic in advance of that of dorsal. Pectoral shorter than head, extends half way distance to pelvic. Pelvic shorter than pectoral not reaching base of caudal. Caudal fin as long as or slightly shorter than head, rounded.

Pre-dorsal distance 50.00–82.35 (M=56.52) per cent of standard length; pre-pelvic distance 48.78–52.94 (M=50.41) per cent; pre-anal 71.67–77.78 (M=74.36) per cent; distance from pectoral to pelvic origin 28.05–32.22 (M=29.81) per cent. Vent a short distance from anal fin; distance from vent to anal fin 13.04–20.00 (M=16.22) per cent in that between anterior origins of pelvic and anal fins. Pectoral 15.85–20.00 (M=18.02), pelvic 14.71–17.86 (M=16.44) per cent of standard length; height of dorsal 14.63–20.73 (M=18.95) per cent; of anal 14.63–17.07 (M=15.49) per cent; base of dorsal 9.43–13.41 (M=11.47) per cent; of anal 7.32–10.00 (M=8.93) per cent; caudal 16.98–21.43 (M=19.64) per cent.

Caudal peduncle short and stout, with an adipose keel on upper part; its length 12.20–15.84 (M=14.17) per cent of standard length; its least height 76.92–91.67 (M=85.38) per cent of its length.

Sexual dimorphism: None.

Colour: Body marked with very narrow, ill-defined bands extending from dorsal to ventral surface often split up below lateral line into more number of streaks or spots. Sometimes the bands coalesce to form uniform dark colour with wavy margins at the ventral side. A black mark at the base of dorsal origin, lying somewhat high; a narrow stripe or two distant spots on caudal base; a few irregular spots on caudal fin; other fins unspotted.

Affinities: This small species is quite closely related to the other species in the subgenus, *N. evezardi* Day, but is readily separated by means of its colouration (*vide* affinities under description of *N. evezardi*).

Range: Western Ghats: Southern parts (Periyar & Pamba basins).

Material examined: Peninsular India: Kerala: 16 specimens, SRS/ZSI, uncatalogued, 3 km. North West of I.B. Sabarigiri, alt. 1100 M., Coll. R. S. Pillai & Party, 2.v.1981 2 specimens, SRS/ZSI, uncatalogued, Karadikkavala, Thekkady, Coll. R. S. Pillai & Party, 21.ii.1981. 2 specimens, SRS/ZSI F 561, East Cheriya Kanam, Coll. R. S. Pillai, 17.ii.81. 1 specimen, SRS/ZSI, uncatalogued, Angururi, Thekkady Expedition, Coll. R. S. Pillai, 14.ii.1981. 28 specimens, SRS/ZSI, uncatalogued, Near Dynamite House, Alt. 980 M., Sabarigiri Expedition, Coll. R. S. Pillai & Party. 1 specimen, SRS/ZSI, uncatalogued, Sabarigiri Expedition, Tunnel Phase, Coll. R. S. Pillai, 4.v.1981. 48 specimens, SRS/ZSI, uncatalogued, Sabarigiri Expedition, Alt. 980 M., Coll. R. S. Pillai & Party. 10 specimens, SRS/ZSI, uncatalogued, Sabarigiri Expedition, Alt. 1100 M., Coll. R. S. Pillai & Party, 3.v.1981 99. specimens, SRS/ZSI, uncatalogued, S. East of Pamba, Alt. 980 M., Coll. R. S. Pillai & Party, 24.iv.1981. 21 specimens, BNHS collections, uncatalogued, Borivilli Park, Bombay. 83 specimens, BNHS, uncatalogued, Kanneri Cave, Bombay, 18.vi.1945.

Genus 2. *Triplophysa* Rendahl, 1933

Type species: *Noemacheilus* (*T*) *hutjertjuensis* (Rendahl)

1874. *Diplophysa* Kessler, in *Nachr. Ges. Mosc.*, **11** (5): 57 (Type species: *D. strauchi* Kessler; nomen preoccupatum).

1833. *Triplophysa* (subgen.) Rendahl, *Ark. Zool.*, **25A** (11): 21 (Type species: *Nemacheilus hutjertjuensis* Rendahl).

1933. *Tauphysa* (subgen.) Rendahl. *Ark. Zool.* **25A** (11): 22 (Type species: *Diplophysa kungessana* Kessler 1879=*Cobitis dorsalisk* Kessler 1872).

1933. *Deuterophysa* (subgen.) Rendahl, *Ark. Zool.*, **25A** (11): 23, (Type species: *Diplophysa strauchii* Kessler; nomen preoccupatum).

Diagnosis: Large size; body elongated; caudal peduncle slightly compressed or very depressed, whip-like (in some); scales totally absent; lateral line complete or incomplete (in a few species); no processus dentiformis in upper jaw; branched dorsal rays 7, 8 or 9, not exceeding, 11; a mottled colour pattern on sides. Males exhibit well defined secondary sexual characters in the form of raised tuberculate area below nares, commencing at corner of lips and extending to anterior border of eye and thickened tuberculated pads on dorsal side of pectoral fin rays. Pharyngeal teeth in one row not exceeding 20. Posterior chamber of air bladder rudimentary or with a secondarily developed bladder lying free in abdominal cavity. Intestine short or long, in the shape of "Z" or spiral.

Remarks: In *Triplophysa* a secondary sexual character is exhibited by the male; it consists of a raised tuberculate area below the nares, separated ventrally by a groove from the adjacent parts of the skin. Also pectoral fin rays are provided with thickened tuberculate pads on their dorsal aspect. The rest of the Noemachei-

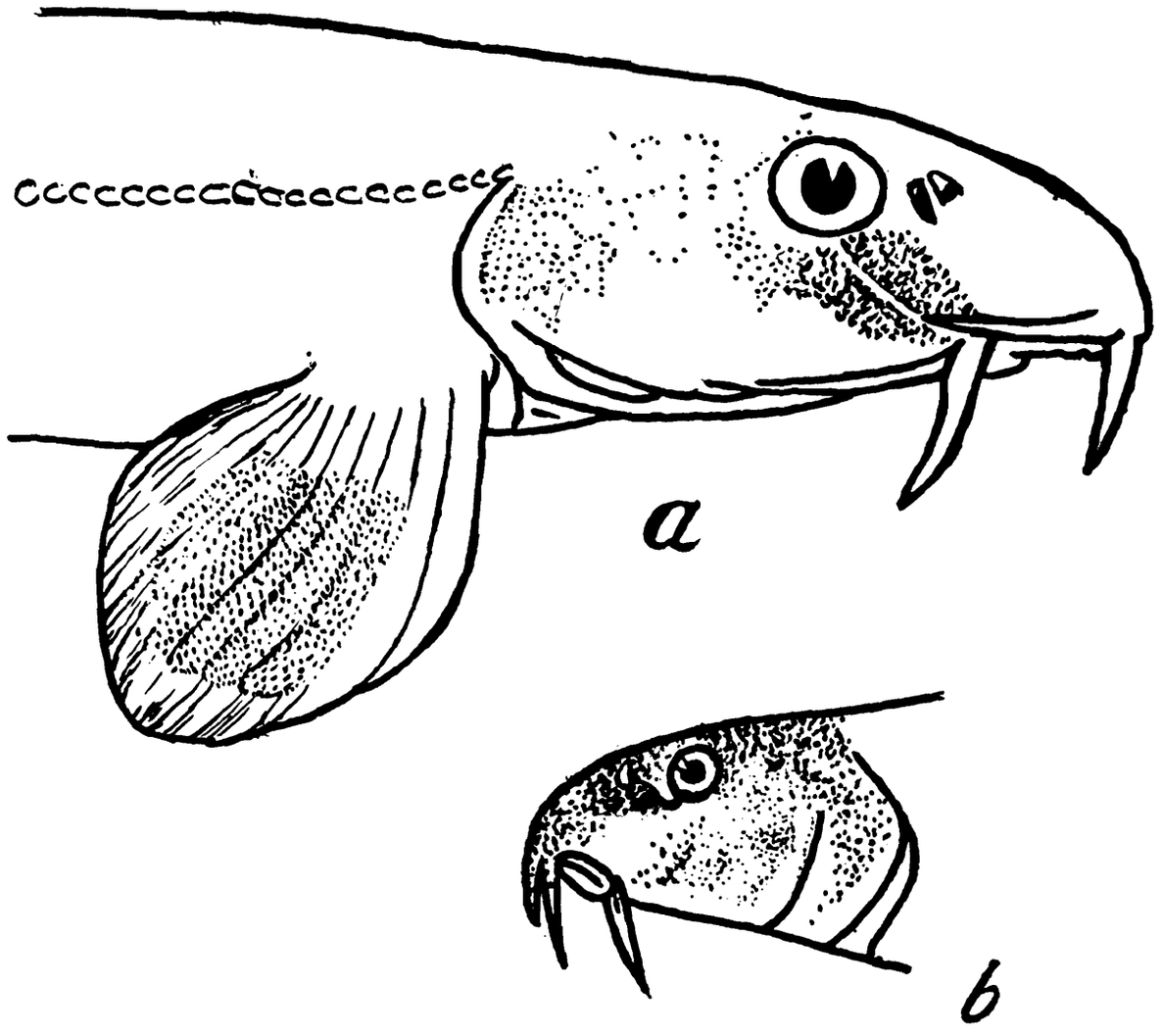


FIG. 4. Secondary sexual characters of the Noemacheiline fishes.
A. thicked upper surface of the pectoral fin and tuberculated area of head of a species of *Triplophysa;* B. the suborbital map of a species of *Noemacheilus.*

linae does not possess this type of secondary sexual characters. Amongst the genus *Noemacheilus* some of the species exhibit the thickened tuberculate pads on dorsal side of the pectoral fin rays but not this type of tuberculate area below the eyes. *Noemacheilus* has a suborbital flap in the males of some species. The free air bladder of most members of *Triplophysa* is rudimentary but in a few species living in lakes and other deeper waters a secondary air bladder is developed in the abdominal cavity. The free air bladder is always rudimentary in the genus *Noemacheilus*.

Most of the species of *Triplophysa* are distributed in the Qinghai —Xizang (Tibetan) plateau and adjacent territories. A few are found in North China, Central Asia, Kashmir and Pakistan. None of them found in the southern face of the Himalayas, in India, Bhutan, Nepal, etc.,

Key to species of the genus **Triplophysa**

1(a) Caudal fin rounded or truncate

2(a) Caudal fin rounded (lateral line short ending shortly after commencement; 7 branched dorsal fin rays).. *T marmorata*

2(b) Caudal fin truncate.

3(a) Dorsal with 7 branched rays.

4(a) Dorsal origin midway between tip of snout and base of caudal.

5(a) Lateral line complete; body greyish above, olivaceous below *T griffithi*

5(b) Lateral line incomplete; ending shortly after commencement; body marked with 20–22 irregular browish stripes.. .. *T shehensis*

4(b) Dorsal origin not midway between tip of snout and base of caudal.

6(a) Dorsal origin nearer to base of caudal than tip of snout.

7(a) Lateral line incomplete.. *T microps*

7(b) Lateral line complete. *T gracilis*

6(b) Dorsal origin nearer to tip of snout than to caudal base. *T ladacensis*

3(b) Dorsal with 9 brached rays. *T tenuicauda*

1(b) Caudal fin emarginate.

8(a) Dorsal origin midway between tip of snout and caudal fin base.

9(a) Least height of caudal peduncle about 3 times in its length. *T. yasinensis*

9(b) Least height of caudal peduncle about 5 times in its length. *T choprai*

8(b) Dorsal origin distinctly nearer to base of caudal than to tip of snout.... *T stoliczkae*

70. **Triplophysa choprai** (Hora)

1934. *Nemachilus choprai* Hora, *Rec. Indian Mus.*, **37:** 310. (Type locality Chitral valley).

1980. *Noemacheilus stenurus choprai*, Mirza, *Proc. 1st Pakistan Congr. zool.*, p. 22 (NWFP)

1981. *Noemacheilus (Triplophysa) choprai*, Coad, *Nat. Mus. Nat. Hist., Ottawa, Pub. zool.*, **14:** 14. (Chitral and Swat drainages, Pakistan).

Diagnosis: A large-sized species of *Tripolophysa* with long, whip-like caudal peduncle; 8 branched dorsal fin rays; emarginate caudal fin; males with well marked secondary sexual characters.

Description: Based on 15 specimens, 116.0–140 mm SL from Lutkuh River, near Hot springs, Chitral.

D. 3/8; P. 11–12; V 8; A. 2/5; C. 19.

T choprai is a large and stoutly built species with body tapering on both ends, markedly towards tail. Dorsal profile greatly arched, ventral flat and horizontal; caudal peduncle long, narrow, whip-like. Depth of body 12.86–16.73 (M=14.47); head depressed and flattened on ventral surface; its length 19.29–22.41 (M=21.24) per cent of standard length. Snout of moderate length, rounded; its length 8.47–10.78 (M=9.62) per cent of standard length, 41.18–49.11 (M=45.25) per cent of head. Eye small, placed dorsolaterally in the posterior half of head, not visible from ventral surface; its diameter 12.73–17.24 (M=14.35) per cent of head length, 28.0–35.7 (M=31.72) per cent of length of snout; 52.0–66.67 (M=55.53) per cent of inter-orbital width. Nostrils close to each other, a well marked flap between them, placed nearer to eye than to tip of snout. Mouth small, lunate; lips continuous at the angles of mouth, not furrowed; lower lip interrupted in the middle; Barbels well developed, much longer than the diameter of eye.

Scale: Absent, lateral line complete.

Fins: Dorsal small, shorter than depth of body; its upper margin notched with anterior upper corner rounded. Pectoral fin shorter than head, extends about three fifths of distance to ventral. Ventral shorter than pectoral, extend to or beyond the

anal opening, followed by a deep groove. Males with a well marked papilla in the groove. Anal fin short, not extending to caudal base. Caudal fin shorter than head, deeply emarginate with rounded lobes.

Pre-dorsal distance 48.85–51.82 (M=50.12) per cent of standard length; pre-pelvic distance 48.57–52.80 (M=51.37) per cent; pre-anal 63.93–70.97 (M=68.31) per cent; distance from pectoral to pelvic origin 28.23–33.43 (M=30.91) per cent. Vent a short distance from anal fin; distance from vent to anal fin 15.48–23.81 (M=19.69) per cent in that between anterior origins of pelvic and anal fins. Pectoral 17.34–20.16 (M=18.25), pelvic 14.81–16.94 (M=16.0) per cent of standard length; height of dorsal 15.36–19.77 (M=16.92) per cent; of anal 11.72–16.28 (M=14.54) per cent; base of dorsal 13.28–16.8 (M=14.90) per cent; of anal 6.15–9.48 (M=8.15) per cent; caudal 14.39 20.0 (M=17.02) per cent.

Caudal peduncle long and narrow; its length 21.88–27.05 (M=24.53) per cent of standard length; its least height 19.15–36.51 (M=22.66) per cent of length.

Sexual dimorphism: Males with usual secondary sexual characters; a raised tuberculate area below nares, separated ventrally by a groove with a second tuberculate area below pectoral rays with thickened tuberculate pads on dorsal surface. Males with larger pelvic fins reaching anal fin.

Colour: Ground colour pale olivaceous, ventral lighter; dorsal surface and sides are clouded with black patches, more above lateral line; pectoral, ventral and anal fins without markings; caudal and dorsal fins irregularly marked with a number of bands. Five dark spots on the undivided rays of dorsal fin.

Size: Largest specimen 140.00 mm SL, a male.

Affinities: It is closely allied to *T stoliczkae* (Steind.) and *T yasinensis* (Alcock) but is readily separated by its longer, whip-like tail (tail less than 4 times in SL *cf.* 4 or more in others).

Range: Pakistan: Chitral: Chitral River (a tributary of the Kabul River) and tributaries.

Material examined: Pakistan: Chitral: 39 specimens, ZSI F 11302/1 Lutkul River, near Hot springs, Coll. B. N. Chopra.

71. **Triplophysa gracilis** (Day)

1876. *Nemachilus gracilis* Day, *Proc. Zool. Soc. Lond.*, p. 798 (Type locality: Basgo, headwaters of Indus).

1878. *Nemachilus gracilis*, Day, *Sci. Res. 2nd Yarkand Mission Ichthyol.*, p. 16, pl. 4, fig. 5.

1878. *Nemachilus gracilis*, Day, *Fish India*, 2, p. 621.

1889. *Nemachilus gracilis*, Day, *Faun. Brit. Ind. Fish.*, 1, p. 237.

1898. *Nemachilus stoliczkae*, Alcock (nec Steind.), *Rep. nat. Hist. Res. Pamir. Bound. Comm.* p. 38.

1922. *Nemachilus gracilis*, Hora, *Rec. Indian Mus.*, **24**: 74.

1933. *Nemachilus gracilis*, Hora, *Rec. Indian Mus.*, **35**: 189.

1935. *Nemachilus gracilis*, Hora and Mukerji, *Visser's Karakorum*, 1,p. 430, pl. 4, fig. 2.

Diagnosis: A long and slender *Triplophysa* species with long and narrow caudal peduncle; slghtly emarginate caudal fin; 7 branched dorsal fin rays; complete lateral line; dorsal originating midway between tip of snout and caudal base or slightly nearer caudal base than to tip of snout; origin of pelvic before that of dorsal; pelvic terminating a considerable distance in front of anal opening in adult specimens.

Description: Based on 34 specimens, 31.0–110.0 mm SL from Kashmir.

D. 3/7; P. 12; V 8; A. 3/5; C. 19.

A long and slender species with head and anterior part depressed, tail compressed. Body of uniform depth, the dorsal profile slightly arched, ventral straight. Depth of body 10.0–16.36 (M=12.87); head long, narrow; its length 17.20–27.27 (M=19.92) per cent of standard length. Snout rounded, slightly shorter than postorbital distance, its length 6.73–10.42 (M=8.77) per cent of standard length, 33.33–50.0 (M=44.19) per cent of head. Eye small, situated dorsolaterally and in the middle of head, not visible from ventral surface; its diameter 11.67–23.08 (M=16.69) per cent of head length, 23.33–60 00 (M=38 06) per cent of length of snout; 42.0–100.0 (M=64.72) per cent of inter-orbital width. Nostrils close to each other, situated closer to eye than tip of snout. Mouth considerably behind tip of snout, lunate, horizontal. Lips thick, lower lip widely interrupted in the middle and thrown into a longitudinal fold on either side. Barbels short, stumpy, maxillary twice as long as eye; outer rostral reaches the hind nostril, inner shorter.

Scales: Absent. Lateral line complete, clearly seen up to end of pectoral, thence somewhat interrupted or diffused.

Fins: Dorsal small, shorter than head; origin of dorsal equidistant between tip of snout and caudal base or slightly towards the caudal base. Origin of pelvic slightly before that of dorsal. Pectoral shorter than head, extends half way to pelvic. Ventral terminating a considerable distance in front of anal opening in fully-grown specimens; in young specimens ventral touches the anal opening. Anal fin separated from caudal. Caudal fin as long as head, slightly emarginate posteriorly.

Pre-dorsal distance 48.28–57.50 (M=53.59) per cent of standard length; pre-pelvic distance 45.19–54.23 (M=50.34) per cent; pre-anal 67.06–75.68 (M=71.16) per cent; distance from pectoral to pelvic insertion 21.94–32.53 (M=29.21) per cent. Vent a short distance from anal fin; distance from vent to anal fin 9.26–25.0 (M=16.64) per cent in that between anterior origins of pelvic and pectoral fins. Pectoral 13.30–19.79 (M=16.47), pelvic 12.50–16.92 (M=14.51) per cent of standard length; height of dorsal 12.33–19.35 (M=16.75) per cent; of anal 12.16–16.44 (M=14.72) per cent; base of dorsal 8.16–10.92 (M=9.62) per cent; of anal 6.06–8.75 (M=7.56) per cent; caudal 16.33–25.00 (M=19.91) per cent.

Caudal peduncle long and narrow, its length 17.50–22.73 (M=20.18) per cent of standard length; its least height 30.77–47.37 (M=38.99) per cent of its length.

Sexual dimorphism: None.

Colour: Brownish above and sides, yellowish beneath; dorsal and caudal spotted.

Size: Largest specimens examined 110.0 mm SL.

Affinities: This species is close to *T microps;* it is readily separated by the complete lateral line (lateral line incomplete ending above tip of pectoral in *T microps*).

Range: Ladakh and Karakash Valley (Tarim basin). Found in the Indus from the headwaters as far down in the Indus as Attock and Jhelum and Sutlej basins.

Material examined: India: Punjab: 2 specimens, PUC, uncatalogued, Ropar, Sutlej basin, 1969.

Kashmir: Kashmir Valley: 47 specimens, ZSI, uncatalogued. An enclosed lake, 4 miles from Sonamarg, Coll. Kashmir Survey, 22–23.vi.1921.

Ladakh: 4 specimens, SRS/ZSI, uncatalogued, Suru River, Zanskar, 3900 M., doner H. S. Raina, Feb. 82. 2 specimens, ZSI, uncatalogued, Kinghan, Netherland Karakoram expedition, Coll. J. A. Sillen, 14.v.1930. 5 specimens, ZSI F 11359/1, Leh. 10 specimens, ZSI F 12188/1, Coll. Yale North India Expedition. 1 specimen, ZSI F 11358/1, side valley, Bod Kharbu, 3300 M., Coll. J. A. Sillen, 2.viii.1930.

Nubra Valley: 2 specimens, ZSI F 11360/1, Panamik, 15.vii. 1929. 1 specimen, ZSI F 11361/1, Gonpa.

72. **Triplophysa griffithi** Günther

(Fig. 6 & 7, Pl. 8)

1868. *Nemachilus griffithi* Günther, *Cat. Fish. Brit. Mus.*, **7:** 360, (Type locality: Arghandab River; near Kandahar, Seistan (*vide* Hara, *J. Asiat. Soc. Beng.*, **24:** 481–484, 1929).

1912. *Nemachilus brahui*, Zugmayer, *Ann. Mag. nat. Hist.*, (**8**): 10.

1933. *Nemachilus griffithi*, Hora, *J. Bombay nat. Hist. Soc.* **36:** No. **3:** 697 (Paghman River, a tributary of the Kabul River, Kabul, Afghanistan).

1935. *Nemachilus griffithi* var. *afghana*, Hora, *J. Bombay nat. Hist. Soc.*, 37, No. **4:** 799 (Type locality: Chahiltran stream, tributary of the Kabul River, West Kabul City).

1963. *Noemacheilus griffithil naziri* Ahmad and Mirza, *Pakistan J. Sci.*, **15:** 75 (Swat River, Pakistan).

1975. *Noemacheilus griffithi hazaraensis* Omer and Mirza, *Biologia* (Pakistan) **22:** 200 (Hazara District, NWFP., Pakistan).

Diagnosis: A long and narrow *Triplophysa* with 7 branched rays in the dorsal fin; almost complete lateral line; dorsal fin insertion almost equidistant between tip of snout and base of caudal fin; a deep caudal peduncle (about half as high as long).

Description: Based on 4 specimens, 43.0–83.0 mm SL from Sar-i-Chashma, in the Raghnam River, a tributary of the Kabul River, near Kabul, Afghanistan.

D. 2/7; P. 10; V 8; A. 2/5; C. 16.

Body long and narrow, (besides several rays at the sides) with the head markedly pointed anteriorly; body tapering gradually towards the posterior end. Depth of body 12.27–17.09 (M=14.95); head broader than high, depressed and somewhat flattish both on dorsal and on ventral surface; its length 19.88–26.74 (M=23.49) per cent of standard length. Snout obtuse, somewhat longer than the posterior part of head, its length 8.43–11.04 (M=9.86) in

standard length, 39.13–45 0 (M=42.06) per cent of head. Eyes small, dorsolateral in position situated in the middle of head, not visible from ventral surface; its diameter 19.44–26.09 (M=22.44) per cent of head length, 44.4–66.67 (M=55.73) per cent of length of snout, 70.0–100.0 (M=87.5) per cent of interorbital width. Nostrils situated immediately in front of the eyes; the posterior nares well marked, the anterior tubular one hidden beneath a broad triangular process. Mouth small, lunate with fleshy lips continuous at angle of mouth; the lower interrupted in middle. Dentiform processes moderately developed. Barbels well developed, thin and long; the outer rostral and the maxillary are subequal; the maxillary extending to perpendicular from middle of eye.

Scales: Absent. Lateral line is almost complete.

Fins: Dorsal fin small, less than length of head; edge of dorsal fin oblique and straight, with the upper corner slightly rounded; orgin of dorsal fin equidistant between tip of snout and caudal base; origin of pelvic well behind that of dorsal. Pectoral shorter than head, extending about half way to pelvic base. Pelvic long and narrow, extending considerably beyond anal opening and separated from anal fin by a short distance. Caudal fin as long as or slightly shorter than head, obliquely truncate with upper portion slightly longer; it is preceeded, both above and below, by a number of small rays: truncate posteriorly.

Pre-dorsal distance 42.17–53.49 (M=48.69) per cent of standard length; pre-pelvic distance 47.59–58.14 (M=53.53) per cent; pre-anal 61.45–76.74 (M=69.43) per cent; distance from pectoral to pelvic origin 25.9–30.38 (M=28.68) per cent. Vent a short distance from anal fin; distance from vent to anal fin 18.75–27.27 (M=22.83) per cent in that between anterior origins of pelvic and anal fins. Pectoral 13.86–22.09 (M=18.02), pelvic 13.25–15.12 (M=14.36) per cent of standard length; height of dorsal 10.76–17.18 (M=12.91) per cent, of anal 10.84–16.28 (M=13.01) per cent; base of dorsal 8.43–11.63 (M=10.16) per cent; of anal 6.02–8.14 (M=7.28) per cent; caudal 16.87–20.93 (M=18.51) per cent.

Caudal peduncle short and somewhat broad; its length 15.66–24.05 (M=19.27) per cent of standard length; its least height 40.0–50.0 (M=43.61) per cent of its length.

Sexual dimorphism: In two male specimens examined, a shallow groove is present in front of eye, but the tubercular pad associated with it is absent; the four outer rays of pectoral fin are broad, bony and curved but tubercular pads on the dorsal surface are absent.

Colour: Greyish above, olivaceous below with 12–13 faint saddle-shaped bands on back. Dorsal surface of head speckled with small black dots; caudal, dorsal and pectoral fins are marked with irregular black bands forming a series of blotches; ventral with one series of spots across it; anal with two similar series.

Affinities: A distinct species not related to any other known species of *Triplophysa;* it can be easily separated by the deeper caudal peduncle; its least height 40.0–50.0 (M=43.6) per cent of its length (caudal peduncle narrow and elongated in others).

Range: Afghanistan: Kabul and Helmand drainages; Pakistan: Baluchistan.

Material examined: Afghanistan: 2 specimens, ZSI F 11526/1, (paratypes of *N. griffithi afghana* Hora) Sar-i-Chahma, Afghanistan, Coll. A. E. Farewell.

Pakistan: 1 specimen, ISSB 1234 (paratype of *T naziri* Ahmed and Mirza), Madyan stream near Madhyan, Swat State.

73. **Triploohysa ladacensis** (Günther)

1868. *Nemachilus ladacensis* Günther, *Cat. Fish. Brit. Mus., Fish.* **7:** 356 (Type locality: Ladakh).

1922. *Nemachilus ladacensis*, Hora, *Rec. Indian Mus.*, **24:** 78 (Ladakh).

Diagnosis: A small sized *Triplophysa* species with caudal fin truncate posteriorly; dorsal origin nearer to snout than to base of caudal; lateral line complete; long whip-like tail; its depth more than one-fourth of its length.

Description: Based on 7 specimens, 42.0–105.0 mm SL from Chasked, Ladakh (5), Alenagar Karghan, Karkasi Valley (2).

D. 3/7; P. 1/10; V 1/7; A. 3/5; C. 15.

Body long and narrow with head markedly pointed; dorsal profile arched, ventral straight and horizontal. Depth of body 11.43–16.0 (M=13.31); head slightly broader than high at occiput, depressed; its length 13.33–24.44 (M=20.63) per cent of standard length. Snout moderately produced, obtuse, as long as postorbital distance. Eye not very small, situated dorso-laterally in the middle of head, not visible from ventral surface; its diameter 23.08–30.0 (M=26.81) per cent of head length, 33.3–75.61 (M=58.18) per cent of length of snout; 53.85–100.0 (M=89.84) per cent of interorbital width. Nostrils close to one another situated closer to eye than tip of snout. Mouth semicircular, lips fleshy, deeply furrowed,

upper uninterrupted, lower interrupted in the middle. Barbels well developed, inner rostral shorter, outer rostral equal to maxillary not extending to nasal opening; maxillary extending perpendicular to posterior border of eye.

Scales: Absent. Lateral line complete.

Fins: Dorsal fin moderately high, almost as high as length of head; edge of dorsal slightly convex; origin of dorsal fin nearer tip of snout than caudal base; insertion of pelvic slightly behind that of dorsal. Pectoral slightly shorter than head, extends much more than half of distance to base of ventral. All the fins rather elongate. Pelvic extends considerably beyond anal opening, in smaller specimens extends to the base of anal. Anal fin not reaching base of caudal. Caudal fin as long as head length; truncate.

Pre-dorsal distance 45.35–50.0 (M=48.15) per cent of standard length; pre-pelvic distance 47.62–55.24 (M=50.15) per cent; pre-anal 63.95–70.48 (M=65.80) per cent; distance from pectoral to pelvic insertion 24.00–30.48 (M=26.47) per cent. Vent a short distance from anal fin; distance from vent to anal fin 11.54–25.00 (M=20.11) per cent in that between anterior origins of pelvic and anal fins. Pectoral 17.14–21.00 (M=19.31), pelvic 14.29–18.00 (M=16.55) per cent of standard length; height of dorsal 20.00–25.00 (M=22.24) per cent; of anal 15.24–81.60 (M=16.28) per cent; base of dorsal 11.90–15.24 (M=13.42) per cent; of anal 5.71–9.52 (M=7.54) per cent; caudal 18.10–24.00 (M=20.39) per cent.

Caudal peduncle long and narrow; its length 17.14–26.67 (M=23.79) per cent of standard length; its least height 20.83–27.78 (M=22.22) per cent of its length.

Sexual dimorphism: In males, pectoral rays with thickened tuberculate pads on dorsal surface; raised tuberculate area below nares absent.

Colour: "Reddish oblive, with about nine blackish bars across the back, and a few small scattered spots on the side and caudal fin " according to Günther (1868).

Size: Largest specimen examined 105.0 mm SL.

Affinities: This species is close to *T tenuicauda;* it can be separated by the position of dorsal fin. (dorsal origin nearer to tip of snout than caudal base, *cf* nearer to caudal base than tip of snout in *T tenuicauda*).

Range: India: Ladakh.

Material examined: Kashmir: Ladakh: 1 specimen, ZSI F 11365/1, Alenaza Kirghan, Karakash Valley, Coll. Netherland Karakorum Expedition, 1929–30. 1 specimen, ZSI, uncatalogued, no history. 5 specimen, ZSI F 1068, Chushul, Ladakh, Coll. B. Biswas, 6.vii.1976.

74. **Triplophysa marmorata** (Heckel)

(Fig. 7 Pl. 7)

1838. *Cobitis marmorata* Heckel *Fische Kaschm.* p. 76, pl. 12, figs. 1 & 2 (Type locality: Kashmir lakes).

1838. *Cobitis vittatus* Heckel, *Fische Kaschm.*, pl. 80, pl. 12, figs. 3 & 4 (Type locality: Kashmir lakes).

1844. *Cobitis marmorata*, Heckel, in Hugel's *Kaschmir*, **4**: 380.

1844. *Cobitis vittata*, Heckel, in Hugel's *Kaschmir*, **14**: 382.

1868. *Nemachilus marmoratus*, Gunther, *Cat. Fish. Brit. Mus.*, **2**: 356.

1878. *Nemachilus marmoratus*, Day, *Fish India*, p. 620, p. 155, fig. 6.

1889. *Nemachilus marmoratus*, Day, *Faun. Brit. Ind. Fish.*, **1**: 235.

1922. *Nemachilus marmoratus*, Hora, *Rec. Indian Mus.*, **24**: 79.

1922. *Nemachilus vittatus*, Hora, *Rec. Indian Mus.*, **24**: 74.

1936. *Nemachilus vittatus*, Hora, *Mem. Conn. Acad.*, 10, 311.

Diagnosis: A *Triplophysa* species with rounded caudal fin, origin of dorsal midway between tip of snout and caudal base; 7 branched rays in dorsal fin; caudal peduncle short; lateral line well developed; males with sexual dimorphism present.

Description: Based on 30 specimens, 35.0–80.0 mm SL from Wular Lake, and Streams in Kashmir Valley.

D. 3/6–7; P. 1/9; V 1/7; A. 3/5; C. 17

A *Triplophysa* species of moderately large size with dorsal profile slightly arched, ventral somewhat straight and horizontal. Depth of body 9.09–18.60 (M=14.08); head slightly broader than high at occiput; its length 21.04–27.97 (M=24.03) per cent of standard length. Snout rounded, as long as or slightly shorter than postorbital distance; its length 7.88–10.79 (M=9.57) per cent of standard length, 31.54–46.15 (M=39.73) per cent of head. Eyes small, situated in the middle of head, not visible from the ventral surface; its diameter 15.0–27.78 (M=22.32) per cent of head length, 37.50–73.17 (M=56.24) per cent of length of snout, 50.0–100.0 (M=78.25) per cent of inter-orbital width. Nostrils close to each other, situated closer to eye than to tip of snout. Mouth inferior, lunate, horizontal. Lips thick continuous, furrowed. Barbels short, stumpy, longer than diameter of eye.

Scales: Absent. Lateral line incomplete ending before dorsal fin.

Fins: Dorsal small, less than length of head; edge of dorsal fin slightly convex, origin of dorsal midway between tip of snout and base of caudal; origin of pelvic slightly behind that of dorsal. Pectoral shorter than head, extends half way distance to pelvic. Pelvic shorter than pectoral, separated from anal fin by a short distance. Anal fin not reaching base of caudal. Caudal fin as long as or slightly shorter than head, truncate.

Pre-dorsal distance 46.97–54.17 (M=51.52) per cent of standard length; pre-pelvic distance 50.00–57.34 (M=53.67) per cent; pre-anal 68.00–77.62 (M=72.46) per cent; distance from pectoral to pelvic origin 24.21–33.78 (M=28.48) per cent. Vent a short distance from anal fin; distance from vent to anal fin 12.50–31.58 (M=19.86) per cent in that between anterior origins of pelvic and anal fins. Pectoral 12.84–22.73 (M=17.51), pelvic 11.25–18.94 (M=14.26) per cent of standard length; height of dorsal 9.46–23.08 (M=16.75) per cent; of anal 11.70–18.18 (M=14.92) per cent; base of dorsal 9.17–13.16 (M=10.85) per cent; of anal 5.79–9.30 (M=7.92) per cent; caudal 13.64–24.32 (M=20.57) per cent.

Caudal peduncle short, its length 12.93–22.81 (M=18.55) per cent of standard length; its least height 31.03–66.67 (M=47.61) per cent of its length.

Sexual dimorphism: Sexual characters of the males well marked, similar to other *Triplophysa* species.

Colour: General colour dark above and on sides, lighter below; head and body mottled with brown. Fins spotted. In some specimens a dark band along the body and bands across back and tail; these have been described as *C. vittata* Heckel.

Size: Largest specimen examined 80.0 mm SL.

Affinities: This is a very distinct species. Because of the deep caudal peduncle, (caudal peduncle more narrow and elongated in *T stoliczkae*), rounded caudal fin, commencement of dorsal mid-way between tip of snout and caudal base. *T marmorata* apparently closer to *griffithi* and *shehensis* than to *stoliczkae*.

Range: Endemic to Kashmir lakes.

Material examined: India: Kashmir: 9 specimens, SRS/ZSI, uncatalogued, Lake, Srinagar, donor, H. S. Raina, 1983. 14

specimens, SRS/ZSI, uncatalogued, doner, H. S. Raina, 17 specimens, ZSI F 12198/1, Wular Lake. 6 specimens, ZSI, uncatalogued, Tawi River, $2\frac{1}{2}$ miles upstream Dudu Road Bridge, Chinene, Tehsil Udampur, Coll. ZSI Jammu Survey, Sep-Oct. 1964. 1 specimen ZSI F 1066, purchased from Day. 22 specimens, ZSI F 10125/1. 23 specimens, ZSI F 10124/1, Ponds on the Ichakal–Mortand Road.

75. **Triplophysa microps** (Steindachner)

(Fig. 4, Pl. 8)

1866. *Cobitis microps* Steindachner, *Verh. Zool-bot. Gest. Wien* **16:** 794, pl. 12, fig. 3 (Type locality: Leh).

1868. *Nemachilus microps*, Günther, *Cat. Fish. Brit. Mus.*, **7:** 357 (Tibet).

1878. *Nemachilus microps*, Day, *Sci. Res. 2nd Yarkand Miss. Ichthyology*, p. 17.

1922. *Nemachilus microps*, Hora, *Rec. Indian Mus.*, **24:** 80 (Mecma from Yarkand Mission collection of Dr. Stoliczka).

1935. *Nemachilus microps*, Hora and Mukerji, in Visser's *Karakorum*, **1:** 430, pl. 4, fig. 3.

1936. *Nemachilus microps*, Hora, *Mem. Conn. Acad.*, **10:** 310, (Tso-Mpriri Lake).

Diagnosis: A *Triplophysa* species with truncate caudal fin; 7 branched dorsal rays; dorsal placed nearer to base of caudal than to tip of snout; lateral line incomplete; caudal peduncle as long as head; body with numerous vermiculated narrow stripes on sides; 16–17 broad crossbands on back.

Description: Based on 13 specimens, 42.0–68.0 mm SL from Kaya, Lahul and Spiti, Himachal Pradesh.

D. 2/7; P. 1/9; V 1/7; A. 2/5; C. 13.

A long, slender species with head and anterior part depressed, tail compressed. Body of uniform depth; dorsal profile gently arched, ventral profile straight and horizontal. Depth of body 10.93–14.68 (M=12.54). Head slightly broader than high at occiput, depressed, its length 20.83–25.0 (M=22.71) per cent of standard length. Snout thick, as long as postorbital distance; its length 7.29–9.72 (M=8.72) per cent of standard length; 24.0–36.5 (M=28.49) per cent of head. Eye small, situated dorso-laterally in the middle of head, not visible from ventral surface; its diameter 12.0–21.42 (M=15.31) per cent of head length, 28.57–54.54 (M=40.02) per cent of length of snout; 50.0–85.71 (M=61.50) per cent of interorbital width. Nostrils close to each other, situated closer to eye than to tip of snout. Mouth considerably

behind tip of snout, lunate, horizontal. Lips thick, continuous, greatly furrowed. Barbels short, stumpy, longer than diameter of eye.

Scales: Absent. Lateral line incomplete, ending above tip of pectoral.

Fins: Dorsal fin small, less than length of head; edge of dorsal slightly concave; origin of dorsal fin nearer base of caudal than tip of snout; insertion of pelvic almost opposite to that of dorsal. Pectoral shorter than head, extends about half way distance to pelvic. Pelvic shorter than pectoral, extends a little beyond anal opening. Anal fin not reaching base of caudal. Caudal fin as long as or slightly shorter than head, truncate posteriorly.

Pre-dorsal distance 53.33–57.75 (M=55.46) per cent of standard length; pre-pelvic distance 51.11–56.09 (M=53.69) per cent; pre-anal 70.0–76.19 (M=72.96) per cent; distance from pectoral to pelvic origin 30.09–35.71 (M=32.21) per cent. Vent a short distance from anal fin; distance from vent to anal fin 8.57–15.0 (M=12.41) per cent in that between anterior origins of pelvic and anal fins. Pectoral 16.67–21.11 (M=19.06), pelvic 15.04–20.24 (M=16.55) per cent of standard length; height of dorsal 14.66–19.44 (M=17.40) per cent ; of anal 12.93–17.78 (M=15.37) per cent; base of dorsal 8.13–12.50 (M=10.08) per cent; of anal 6.10–10.12 (M=7.75) per cent; caudal 15.56–23.81 (M=20.14) per cent.

Caudal peduncle long and narrow; its length 15.63–20.0 (M=18.66) per cent of standard length; its least height 33.33–46.67 (M=39.81) per cent of its length.

Sexual dimorphism: Males with usual secondary sexual characters, a raised tuberculate area below nares, separated by a groove with a second tuberculate area below, pectoral rays with tuberculate pads on dorsal surface.

Colour: Body with numerous vermiculated narrow transverse stripes; 16–17 broad black cross bands on the back.

Size: Largest specimen examined 68.0 mm SL.

Affinities: The short lateral line is characteristic of the species. The general morphology points to its relationship with *T gracilis.*

Range: India: Ladakh and Lahul—Spiti.

Material examined: India: Kashmir: Ladakh: 55 specimens, ZSI, uncatalogued, Drass nala, Drass. 28 specimens, ZSI, uncatalogued, Surn River, Kargil. 20 specimens, ZSI, uncatalogued, Chawalgoan stream, Kulgam. 1 specimen, ZSI F 12196/1, Tso Moravi, Yale North India Expedition, 27.viii.1932. Nubra Valley: 2 specimens, ZSI F 11354/1, Panamik.

Himachal Pradesh: 20 specimens, HAZFS/ZSI, 182, Kaya, Lahul & Spiti. Coll. K. K. Mahajan & Party, 28.vii.1971.

76. **Triplophysa shehensis** (Tilak)

(Fig. 9, Pl. 16)

1984. *Triplophysa shehensis* Tilak, *Bull. zool. Surv. India* (in press).

Diagnosis: A deeper form of *Triplophysa* with caudal truncate; 7 branched dorsal fin rays; incomplete lateral line, ending above the middle of pectoral fin; lips continuous, lower lip not interrupted; 20–22 irregular black lateral bands on the sides.

Description: Based on a single specimen 136 mm SL, female, from Ladakh.

D. 3/7; P. 12; V 8; A. 2/5; C. 17

Body long and somewhat deep, with head pointed anteriorly and body tapering gradually towards posterior end. Depth of body 23.13, head as broad as high at occiput; depressed; its length 25.73 per cent of standard length. Snout obtuse, shorter than postorbital distance; its length 10.29 per cent of standard length; 40.0 per cent of head. Eye small situated dorso-laterally in the middle of head; its diameter 15.71 per cent of head length, 39.28 per cent of length of snout; 34.37 per cent of inter-orbital width. Nostrils situated a short distance in front of eye; posterior nares well marked, the anterior tubular one hidden beneath a broad triangular process. Mouth small, lunate, with fleshy lips, continuous at angle of mouth, deeply furrowed; the lower not interrupted. Barbels well developed, thick and stumpy; inner and outer rostral subequal, shorter than diameter of eye; maxillary longer extending perpendicular to the anterior margin of eye.

Scales: Absent. Lateral line incomplete, ending above middle of pectoral fin.

Fins: Dorsal fin small, less than length of head; edge of dorsal oblique, straight, with upper corner slightly rounded; origin of dorsal fin somewhat nearer to the base of caudal fin than to the tip of snout; origin of pelvic slightly behind that of dorsal.

Pectoral shorter than head, extends three-fourth of distance to pelvic. Pelvic long and narrow extending upto anal opening and separated from anal by a short distance. Caudal shorter than head; it is preceded, both above and below by a number of small rays; truncate posteriorly.

Pre-dorsal distance 53.67 per cent of standard length; pre-pelvic distance 54.41 per cent; pre-anal 70.58 per cent; distance from pectoral to pelvic 29.41 per cent. Vent a short distance from anal fin; distance from vent to anal fin 14.28 per cent in that between anterior origins of pelvic and anal fins. Pectoral 15.07; pelvic 13.23 per cent of standard length; height of dorsal 16.17 per cent; of anal 13.97 per cent; base of dorsal 10.66 per cent; of anal 6.61 per cent; caudal 11.02 per cent.

Caudal peduncle short and somewhat deep, its length 22.05 per cent of standard length; its least height 33.33 per cent of its length.

Sexual dimorphism: None.

Colour: Greyish above, olivaceous below with 20–22 irregular bands on sides; dorsal surface of head speckled with black spots; four dark bands across dorsal fin; five bands on caudal; five bands on pectoral, one each on ventral and anal.

Size: Largest specimen examined 136 mm SL.

Affinities: A distinct species related *T stoliczkae*; it can be easily separated by its distinctive colouration and characters listed in the key.

Range: India: Ladakh.

Material examined: India: Kashmir: 1 specimen, NRS/ZSI, uncatalogued, Irrigation Canal, Sheh, Ladakh, Coll. Raj Tilak.

77. **Triplophysa stoliczkae** (Steindachner)
(Fig. 3, Pl. 8)

1866. *Cobitis stoliczkae* Steindachner, *Verh. zool. Bot. — Ges. Wien*, p. 793, pl. 14, fig. 2 (Type locality: Tsho Morarai (Tso Moriri), a lake in Rupshu Province, W. Tibet).

1868. *Nemachilus stoliczkae*, Günther, *Cat. Fish. Brit. Mus.*, **7**: 360.

1876. *Nemacheilus stoliczkae*, Day (in part), *Proc. Zool. Soc. Lond.*, p. 795.

1878. *Nemacheilus stoliczkae*, Day (in part), *Sci. Res. 2nd Yarkand Miss-Kchthyol.*, p. 14, pl. 5 fig. 2.

1878. *Nemacheilus stoliczkae*, Day (in part) *Fish. India*, p. 260, pl. 45, fig. 10.

1878. *Nemacheilus stoliczkae*, Day (in part), *Faun. Brit. ind. Fish.* 1, p. 235, fig. 84.

1922. *Nemachilus stoliczkae*, Hora, *Rec. Indian Mus.*, **24**: 78.

1935. *Nemachilus stoliczkae*, Hora and Mukerji, *Visser's Karakorum*, **1**: 429, pl. 4, fig. 4.

1936. *Nemachilus stoliczkae*, Hora, *Mem. Conn. Acad.*, **10**: 306.

Diagnosis: A long and slender *Triplophysa* species with long and narrow caudal peduncle; emarginate caudal fin; 8 branched dorsal fin rays; complete lateral line; dorsal fin originating nearer to base of caudal than to tip of snout; males with marked sexual dimorphism.

Description: Based on 27 specimens, 33.0–120.0 mm SL head waters of Indus River and Karakush Valley.

D. 3/8; P. 13; V 8; A. 3/5; C. 19.

A long and slender species with head and anterior part depressed, tail compressed, whip-like. Dorsal profile gently but slightly arched, ventral profile straight and horizontal. Depth of body 10.0–18.18 (M=13.73); head long, narrow and broadly pointed; its length 19.72–25.0 (M=22.23) per cent of standard length. Snout somewhat rounded, shorter than postorbital distance; its length 7.45–10.61 (M=8.96) per cent of standard length, 25.27–45.0 (M=39.39) per cent of head. Eye situated almost in the middle of head; its diameter 11.49–24.0 (M=18.06) per cent of head length; 27.03–66.67 (M=46.19) per cent of length of snout, 50.0–100.0 (M=72.20) per cent of the inter-orbital width. Nostrils close to each other, situated closer to eye than tip of snout. Mouth considerably behind tip of snout, lunate, horizontal. Lips thick, continuous, greatly papillated. Barbels short, stumpy, longer than diameter of eye.

Scales: Absent. Lateral line complete.

Fins: Dorsal fin moderate, higher than depth below; its origin distinctly nearer base of caudal than tip of snout. The paired fins, broad, rounded and horizontally placed. Pectoral shorter than head, extends half way to ventral. Ventral extend beyond anal opening or even beyond to anal fin in some. Anal fin separated from caudal. Caudal fin as long as or slightly longer than the head; emarginate.

Pre-dorsal distance 48.95–60.61 (M=53.08) per cent of standard length; pre-pelvic distance 46.15–64.44 (M=52.48)

per cent; pre-anal 66.39–84.85 (M=72.76) per cent; distance from pectoral to pelvic insertion 25.00–35.19 (M=30.87) per cent. Vent a short distance from anal fin; distance from vent to anal fin 12.50–25.00 (M=18.17) per cent in that between anterior origins of pelvic and anal fins. Pectoral 15.63–24.24 (M=19.00); pelvic 12.86–21.2 (M=16.28) per cent of standard length; height of dorsal 7.34–30.30 (M=19.33) per cent; of anal 12.14–19.67 (M=15.33) per cent; base of dorsal 8.33–16.67 (M=12.43) per cent; of anal 4.55–10.81 (M=7.81) per cent; caudal 10.64–24.24 (M=19.45) per cent.

Caudal peduncle long and narrow; its length 13.51–24.69 (M=18.70) per cent of standard length; its least height 17.50–80.00 (M=44.65) per cent of its length.

Sexual dimorphism: Males with usual secondary sexual characters, a raised tuberculate area below nares, separated by a groove with a tuberculate area below., pectoral rays with tuberculate pads on dorsal surface.

Colour: Dark above and sides, lighter below, head and body mottled with numerous black spots; saddle-shaped, black bands along dorsal surface, especially in tail region distinguishable in some specimens. Dorsal and caudal fins spotted; anterior ray of dorsal fin, dorsal surface of outer rays of paired fins spotted.

Size: Largest specimens examined 120 mm SL.

Range: India: Ladakh (headwaters of Indus); China: Karakush Valley (head waters of the Tarim River).

Material examined: India: 5 specimens, ZSI F 11355/1, Nungstet, Nubra Valley, 3500 M, Coll. J. A. Sillem, Netherland Karakoram Expedition, 4.vii.1929. 2 specimens, ZSI, uncatalogued, Leh, 3700 M., Coll. Netherland Karakoram Expedition, 27.vii. 1930. 6 specimens, ZSI, uncatalogued, Inans River, Sheh, Ladakh, 1 specimen, ZSI 1227, Chagra, purchased from F Day. 1 specimen, ZSI 758, Lucking Stream, purchased from F Day. 1 specimen, ZSI 1465, Leh, Coll. F Day. 3 specimens, ZSI F 11665/1, Indus River, Chaspa, Ladakh.

China: 2 specimens, ZSI, uncatalogued, Karakash Valley, 3000 M., Coll. Netherland Karakoram Expedition, Coll. J. A. Sillen, 28.v.1930.

78. **Triplophysa tenuicauda,** (Steindachner)

(Fig. 5, Pl. 8)

1866. *Cobitis tenuicauda* Steindachner, *Verh. Zool-bot. Ges. Wien.* **16:** 792, pl. 17, fig. 3 (Type locality: a small stream in Western Tibet).

1868. *Nemachilus tenuicauda,* Günther, *Cat. Fish., Brit. Mus.,* **7:** 357 (Ladakh).

1922. *Nemachilus tenuicauda,* Hora, *Rec. Indian Mus.,* **24:** 79 (Leh).

1935. *Nemachilus tenuicauda,* Hora and Mukerji, in *Visser's Karakorum,* **1:** 430.

1936. *Nemachilus tenuicaude,* Hora, *Mem, Conn. Acad.,* **10:** 311

Diagnosis: A small size *Triplophysa* species, with caudal truncate; 9 branched dorsal fin rays; dorsal origin nearer to base of caudal than to tip of snout; lateral line complete; long, whip-like tail, its depth less than one-third of its length.

Description: Based on 3 specimens, each 60.0 mm SL from Leh.

D. 3/9; P. 1/12; V 8; A. 2/5; C. 15.

Body long and narrow with head pointed; body uniform depth with dorsal profile gently arched to base of dorsal; ventral profile straight and horizontal. Depth of body 12.50–14.58 (M= 13.61); head slightly broader than high, depressed; its length 10.42–12.08 (M=11.11) per cent of standard length, 45.61–48.33 (M=46.75) per cent of head. Snout moderately long, obtuse, as long as postorbital distance. Eye not very small, situated dorso-laterally in the middle of head, not visible from ventral surface; its diameter 15.75–16.67 (M=16.38) per cent of head length, 34.48–36.0 (M=35.03) per cent of length of snout, 56.25–69.3 (M=62.66) per cent of interorbital width. Nostrils close to each other situated closer to eye than tip of snout. Mouth semicircular, lips fleshy, deeply furrowed upper lip uninterrupted, lower interrupted in the middle. Barbels well developed, inner rostral shorter, outer rostral and maxillary of equal length, outer rostral extending up to narial opening, maxillary reaching perpendicular to middle of eye.

Scales: Absent. Lateral line complete.

Fins: Dorsal fin small, less than length of head; edge of dorsal straight; origin of dorsal fin nearer to base of caudal fin than tip of snout. Origin of pelvic opposite to that of dorsal.Pectoral as long as length of head, extends two-thirds of the distance to the base of ventral. Pelvic extends to the base of the anal fin. Anal not reaching the base of caudal. Caudal fin as long as head; truncate.

Pre-dorsal distance 50.00–53.33 (M=51.94) per cent of standard length; pre-pelvic distance 50.83–53.75 (M=52.64) per cent; pre-anal 70.00–72.50 (M=71.11) per cent; distance from pectoral to pelvic origin 28.75–31.67 (M=30.14) per cent. Vent a short distance from anal fin; distance from vent to anal fin 12.50 per cent in that between anterior origins of pelvic and anal fins. Pectoral 18.75–22.50 (M=20.97), pelvic 18.33–19.17 (M=18.61) per cent of standard length; height of dorsal 15.83–17.50 (M=16.80) per cent; of anal 13.33–15.00 (M=13.89) per cent; base of dorsal 17.50–18.33 (M=18.05) per cent; of anal 6.25–8.75 (M=7.36) per cent; caudal 13.33–18.33 (M=15.55) per cent.

Caudal peduncle long and narrow; its length 21.67–22.50 (M=22.08) per cent of standard length; its least height 20.37–23.08 (M=22.03) per cent of its length.

Sexual dimorphism: Pectoral rays with thickened tuberculate pads on dorsal surface in males; raised tuberculate area below nares absent in the specimens examined.

Colour: "Upper part of the side, and dorsal and caudal fins, irregularly mettled with brown; a more or less distinct series of spots along the lateral line" according to Günther.

Size: Largest specimen examined 60 mm SL.

Affinities: This species is close to *T ladacensis* (see affinities of *T ladacensis*).

Range: India: Ladakh.

Material examined: India: Ladakh: 3 specimens, ZSI F/11363/1 Leh.

79. **Triplophysa yasinensis** (Alcock)

(Fig. 1 & Pl. 8)

1876. *Nemacheilus rupicola*, Day (nec McClelland), *Proc. Zool. Soc., Lond.* p. 759.

1878. *Nemacheilus rupicola*, Day (nec McClelland), *Sci. Res. 2nd Yarkand Mission Ichthyology*, p. 17.

1898. *Nemachilus yasinensis* Alcock, *Rep. Nat. Hist., Res. Pamir. Bound. Comm.*, p. 38, pl. 2, fig. 2, 2a (Type locality: Yasin River).

1934. *Nemachilus Kashmirensis* Hora, *Rec. Indian mus.*, **36:** 316. (Type locality: Kashmir valley).

Diagnosis: A *Triplophysa* with forked caudal fin; 8 branched dorsal fin rays; lateral line complete and well marked; dorsal origin midway between tip of snout and caudal base; a few black bands across the back.

Description: Based on 32 specimens 33.50–83.0 mm SL from a stream flowing into the Sind River.

D. 3/8; P 12; V 1/7; A. 2/5; C. 18.

An elongated strongly-built fish with a long and narrow caudal peduncle, dorsal profile greatly arched, body tapering towards both sides, ventral surface flattened. Depth of body 12.50–16.67 (M=14.77); head slightly broader than high at occiput, its length 20.13–26.87 (M=23.09) per cent of standard length. Snout of moderate length, somewhat equal to posterior portion of head, its length 7.19–25.0 (M=10.29) per cent of standard length, 32.43–63.16 (M=43.31) per cent of head. Eye small, situated dorso-laterally in the middle of head, not visible from the ventral surface; its diameter 17.24–31.58 (M=21.05) per cent of head length, 38.89–66.67 (M=49.26) per cent of length of snout, 57.14–100.0 (M=70.96) per cent of inter-orbital width. Nostrils close to each other situated closed to eye than tip of snout. Mouth inferior bordered by well developed lips, continuous at the angles of mouth, upper not interrupted, lower interrupted in the middle, poorly fimbriated. Barbels well developed, short and stumpy, longer than diameter of eye; maxillary extending perpendicular to anterior border of eye.

Scales: Absent. Lateral line complete, well marked throughout.

Fins: Dorsal fin small, a little less than length of head; edge of dorsal straight, origin of dorsal fin almost equidistant between tip of snout and caudal base; origin of pelvic slightly behind that of dorsal. Pectoral shorter than head, extend about half way distance to pelvic. Pelvic shorter than pectoral, extends considerably beyond the anal opening. Anal fin short. separated from base of caudal by a considerable distance. Caudal fin shorter than head, forked, with somewhat rounded lobes.

Pre-dorsal distance 47.10–55.42 (M=50.76) per cent of standard length; pre-pelvic distance 46.94–56.63 (M=51.33) per cent; pre-anal 51.15–74.70 (M=68.92) per cent; distance from pectoral to pelvic insertion 18.37–52.18 (M=29.68) per cent. Vent a short distance from anal fin; distance from vent to anal fin 15.00–29.41 (M=21.76) per cent in that between anterior origins of pelvic and anal fins. Pectoral 14.81–25.00 (M=21.22),

pelvic 12.59–20.00 (M=17.05) per cent of standard length; height of dorsal 14.55–24.64 (M=20.38) per cent; of anal 13.04–20.62 (M=16.77) per cent; base of dorsal 8.96–16.36 (M=12.91) per cent; of anal 5.56–10.45 (M=8.06) per cent; caudal 15.94–26.51 (M=20.73) per cent.

Caudal peduncle long and narrow, its length 16.42–27.71 (M=21.16) per cent of standard length; its least height 17.39–54.55 (M=33.16) per cent of its length.

Sexual dimorphism: In males pectoral fin rays not thickened with breeding tubercles. The rays of the pectoral fins are broad and bony in the males, without tuberculated thickenings; a slit-like groove in front of the eye, without tuberculated pad.

Colour: Body dark mottled above and below lateral line; upper surface of head greyish, ventral pale-olivaceous; adults with black bands on dorsal surface of body, more marked in tail region extending to the sides, anteriorly merged with the mottled colouration. Three bands on dorsal fin; three wavy bands on caudal; ventral and anal spotted. The general surface of body specked with black dots.

Affinities: This species is close to *T choprai* Hora; it can be separated by its shorter tail (see above paragraph on affinities under *T choprai*).

Range: India: Ladakh.

Material examined: Pakistan: ZSI F 14181, (holotype) Yasin River, Coll. Pamir Boundary Commission. 7 specimen, ZSI F 10122/1, (Syntype of *N. kashmirensis*), Harwan, Kashmir, Coll. ZSI Kashmir Survey. F 10121/1, (syntypes of *N. kashmirensis*), streams flowing from Kulkarnag spring, Kashmir.

Jammu & Kashmir: 3 specimens, SRS/ZSI, uncatalogued, Chawalgoan stream, near Kulgam, doner, H. Raina,. 5 specimens, NRS/ZSI, Surankot stream, Poonch, Coll. R. Tilak. 10 specimens, SRS/ZSI, uncatalogued, Kashmir Valley, doner, H. Raina. 9 specimens, NRS/ZSI, uncatalogued., Sind River, Woyil, Ganderbal, Coll. R. Tilak. 5 specimens, NRS/ZSI, uncatalogued, Isthabal nala, Kulgam, Kashmir, Coll. R. Tilak. 3 specimens, NRS/ZSI, uncatalogued, Tawi River, Coll. R. Tilak, Kashmir Survey, 1954. 3 specimens, SRS/ZSI, uncatalogued, upper stream of Dal Lake, Srinagar, doner, H. Raina. 26 specimens, ZSI F 10120/1, a small stream flowing into Sind River, Kashmir, Kashmir Survey. 2 specimens, NRS/ZSI, uncatalogued, Tawi River, 2½ miles upstream from Dudu Road Bridge, Udampur, Coll. R. Tilak. 15 specimens, ZSI F 10123/1 Kashmir.

II. Subfamily HOMALOPTERINAE

Small hill stream fishes; body generally greatly depressed and ventral surface flattened. Paired fins horizontally placed; outer rays of paired fins with adhesive pads on ventral surface. Eyes small, dorso-lateral. Mouth subterminal or inferior. Dorsal and anal fins short. Scales on body, absent on head and ventral surface. Lateral line well marked, complete. Gill openings either greatly restricted, above the base of pectoral, or moderate extending to ventral surface for a short distance. Gill membrannes united with isthmus. Pseudobranchiae absent. Pharyngeal teeth arranged in a single row. Air bladder reduced, resembles that of Cobitidae, enclosed in a capsule formed by dorsal ribs of 2nd and 4th vertebrae.

Key to the genera of subfamily **Homalopterinae**

1(a) Gill openings small and situated anteriorly above base of pectoral (6 to 8 anterior rays of pectoral simple.) ... *Bhavania* (*B. australis*)

1(b) Gill openings of moderate size, extending to ventral surface for a short distance.

2(b) Rostral groove in front of mouth absent or very poorly developed; rostral fold absent or poorly developed; (3 to 8 anterior rays of pectoral simple) *Homaloptera* (4 species)

2(b) Deep rostral groove in front of mouth overhund by rostral fold.

3(a) Rostral barbel 7; (6 anterior rays of pectoral simple).. *Travancoria* (*T. jonesi*)

3(b) Rostral barbels 4; (9 to 10 anterior rays of pectoral simple). *Balitora* (2 species)

Genus 3. *Homaloptera*, van Hasselt emendet by van der Hoeven

1823. *Homaloptera*, van Hasselt, *Alg. Konst. Letterbode*, **2:** 133 (Type species: *Homaloptera ocellata* van der Hoeven).

1890. *Helgia*, Vincigeuerra, *Ann. Mus. Civ. Stor. Nat. Genova*, **29:** 200.

1905. *Homalopteroides*, Fowler, *Proc. Acad. Nat. Sci. Phild.*, (2) **57:** 476.

1929. *Chopria*, Prashad & Mukerji, *Rec. Indian Mus.*, **31:** 188. (Type species: *Chopria rupicola*, Prashad & Mukerji).

Diagnosis: Eyes laterally placed (eyes on the dorsal aspect in *Balitora*) characterised by the shape of body; instead of being flat as in *Balitora*, *Bhavania* and *Travancoria* body is subcylindrical; head depressed but not flattened as in other genera of this subfamily. Snout long and pointed; mouth inferior; rostral groove

in front of mouth absent. Lips continuous at angles of mouth; not papillated. Three pairs of barbels, 2 rostral, 1 at angle of mouth. Gill openings oblique extending to ventral surface for some distance. Body covered with scales, absent on head and parts of ventral surface. Pectorals may or may not overlap pelvics. Pectoral with 19 to 20 rays, 3 to 8 outer rays are simple. Pelvic with 8–10 rays, 2 outer rays simple. Caudal peduncle short and stout. Caudal fin emarginate or deeply forked. Dorsal commences in advance of pelvics, opposite or slightly behind.

Key to species of the genus **Homaloptera**

1(a)	Origin of dorsal behind origin of pelvic (*Homalopteroides*).	
2(a)	Origin of dorsal equidistant between tip of snout and base of caudal.	
3(a)	Lateral line scales 40–45.	*H. rupicola* (*Myitkyina*)
3(b)	Laterial line scales more than 45 (70–72)..	*H. montana* (Western Ghats)
2(b)	Origin of dorsal nearer to tip of snout than base of caudal...	*H. modesta* (Thailand & Tenasserim)
1(b)	Origin of dorsal opposite to or in front of pelvic fin (*Homaloptera*).	*H bilineata* (Tenasserim)

80. **Homaloptera bilineata** Blyth

(Fig. 8, Pl. 8)

1860. *Homaloptera bilineata* Blyth, *J. Asiat. Soc. Beng.*, **24**: 172 (Type locality: Meetan, Burma).

1888. *Homaloptera bilineata*, Day, *Fauna. Brit. Ind. Fish.*, **2**: 526, pl. 121, fig. 8.

1889. *Homaloptera bilineata*, Day, *Faun. Brit. Ind. Fish.* **1**: 244.

1932. *Homaloptera bilineata*, Hora, *Mem. Ind. Mus.*, **12**: 288, pl. 10, fig. 3.

1952. *Homaloptera bilineata*, Silas, *Rec. Indian Mus.*, **50**: 200.

Diagnosis: A species of *Homaloptera* with dorsal commencing opposite to or ahead of pelvic; the origin of dorsal closer to tip of snout than to base of caudal. Pectoral separated from pelvic by considerable distance. Pelvics separated from anal opening by a short distance; anal commences closer to origin of pelvics than to base of caudal. A brown stripe from margin of eye to base of dorsal fin. 64 scales along lateral line.

Description: Based on 2 specimens, 32.6–40.0 mm SL from Meetan, Burma.

D. 2/8; P. 4/10; V 2/7; A. 2/5; L. l 64; L. tr. 12/17

Depth of body 12.31–12.50 (M=12.41) per cent. Head much longer than broad, its length 23.75–24.62 (M=24.19) per cent of standard length. Depth of head at occiput equal half its length. Snout more than half length of head; its length, 12.31–12.50 (M=13.41) of standard length, 50.0–52.13 (M=51.32) per cent of head. Eye moderately large, dorso-lateral, situated in the posterior half of head, not visible from ventral surface; its diameter 25.0–26.32 (M=25.66) per cent of head length; 50 per cent of length of snout; 66.67–71.43 (M=69.05) per cent of inter-orbital width. Inter-orbital space equals about length of post-orbital part of head. Nostrils situated nearer to anterior border of eye; anterior nostril in a flap. Mouth small, inferior, slightly arched, fringed by thick plain lips, continuous at angles. Labial groove widely interrupted; barbels short, stout and equal in length.

Scales: Small, nearly three-fourth as broad as long, with bluntly pointed apical region and broad basal portion, absent on head and chest. Lateral line complete; 64 scales along lateral line.

Fins: Dorsal fin short and commences ahead of pelvic; its origin closer to tip of snout than to base of caudal. Pectorals shorter than head, separated from pelvics by considerable distance. Pelvic shorter than pectoral, extends half way to anal; separated from anal opening by a short distance. Caudal fin slightly shorter than head, deeply emarginate; its length 63.16–93.75 (M=78.46) per cent of head length.

Pre-dorsal distance 45.00–46.15 (M=45.58) per cent of standard length; pre-pelvic distance 47.50–47.69 (M=47.60) per cent; pre-anal 72.31–72.50 (M=72.41). Vent a short distance from anal fin; distance from vent to anal fin 18.75–20.00 (M=19.38) per cent in that between anterior origins of pelvic and anal fins. Pectoral 18.75–21.54 (M=20.15), pelvic 15.00–16.92 (M=15.96) per cent of standard length; height of doral 23.08–23.75 (M=23.42) per cent; of anal 12.31–12.50 (M=12.41) per cent; length of caudal 15.00–23.03 (M=19.04) per cent of standard length.

Caudal peduncle short and stout; its length 21.25–24.62 (M=22.94) per cent of standard length; its least height 37.50–41.18 (M=39.34) per cent of its length.

Colour: Brownish, with a brown stripe from the margin of eye to base of dorsal fin. Dorsal with a black centre; caudal deep brown with white margins; a black bar at base of ventrals.

Size: Largest specimen examined 40.0 mm SL.

Affinities: See affinities of *H. montana.*

Range: Burma: Meetan, Tenasserim.

Material examined: Burma: 1 specimen, ZSI F 1226, (Day's original of pl cxxi, fig. 8), Tenasserim. 1 specimen, ZSI F 11041/1, Meetan, Coll. Genova Museum.

81. **Homaloptera modesta** (Vinciguerra)

1890. *Helgia modesta* Vinciguerra, *Ann. Mus. Civ. Stor. Nat. Genova*, (2) **9:** 202, pl. 2, fig. 12 (Type localities: Meekalan, Meetan, Burma)

1932. *Homaloptera modesta*, Hora, *Mem. Ind. Mus.*, **12:** 288.

1945. *Homaloptera modesta*, Smith, *Bull. U.S. nat. Mus.*, **188:** 275.

1952. *Homaloptera modesta*, Silas, *Rec. Indian Mus.*, **50:** 194.

Diagnosis: A species of *Homaloptera* with dorsal commencing behind pelvic; its origin nearer tip of snout than base of caudal. Pectoral separated from pelvic by a considerable distance; back and sides with numerous irregular black and brown spots. 47 scales along lateral line.

Description: Based on 2 specimens, 20.0–21.0 mm SL from Meetan, Burma.

D. 2/7; P. 5–6/8; V 2/6; A. 6–7; L. l 47

Depth of body 12.50–14.29 (M=13.40); head much longer than broad, its length 25.0–28.57 (M=26.79) per cent of standard length; width of head about length of head from tip of snout to posterior border of orbit. Height at occiput about 50 per cent of length of head. Snout about half length of head; its length 12.50–14.29 (M=13.40) of standard length, 50 per cent of head. Eye moderately large, dorso-lateral situated in the posterior half of head, not visible from ventral surface; its diameter 33.33–40.0 (M=36.67) per cent of head length; 66.67–80.0 (M=73.34) per cent of length of snout; 100.0–133.33 (M=116.57) per cent of inter-orbital width. Nostrils situated nearer to anterior border of eye; anterior in a flap. Mouth small, inferior, slightly arched, fringed by thick plain lips, continuous at angle. Labial groove widely interrupted; barbels short, stout and equal in length.

Scales: Small, absent on head and chest. Lateral line complete; 47 scales along lateral line.

Fins: Dorsal fin short commences behind pelvic; its origin nearer tip of snout than base of caudal. Pectorals as long as head separated from pelvics by a short distance. Pelvic shorter than pectoral, extends half way to anal. Caudal fin shorter than head, deeply emarginate; its length 60.0–75.0 (M=67.5) per cent of head length.

Pre-dorsal distance 50.00–54.76 (M=52.38) per cent of standard length; pre-pelvic distance 45.00–50.00 (M=47.50) per cent; pre-anal 75.00–83.33 (M=79.17) per cent; Vent a short distance from anal fin; distance from vent to anal fin 16.67–21.43 (M=19.05) per cent in that between anterior origins of pelvic and anal fins. Pectoral 25.0–34.8 (M=29.9), pelvic 20.00–23.81 (M=21.91) per cent of standard length; height of dorsal 16.67–17.50 (M=17.09) per cent; of anal 14.29–15.00 (M=14.65) per cent; length of caudal 15.00–21.43 (M=18.22) per cent of standard length.

Caudal peduncle short and stout; its length 17.50–19.05 (M=18.28) per cent of standard length; its least height 42.86–50.00 (M=46.43) per cent of its length.

Colour: Back and sides with numerous irregularly disposed spots of various sizes and shapes. Three black spots on side of head below eye; all fins barred with black.

Size: Largest specimen examined 21.0 mm SL.

Affinities: See affinities of *H. montana.*

Range: Burma: Lower Burma: Meekalan, Meetan.

Material examined: Burma: 2 specimens, ZSI F 11040/1 Meetan.

82. **Homaloptera rupicola** (Prashad and Mukerji) (Fig. 2. Pl. 9)

1929. *Chopraia rupicola* Prashad and Mukerji, *Rec. Indian Mus.*, **31:** 188, pl. 8, fig. 3 (Type locality: Kamaing, Myitkyina Dt., Northern Burma).

1932. *Homaloptera rupicola,* Hora, *Mem. Indian Mus.*, **12:** 288.

1951. *Homaloptera rupicola,* Silas, *Journ. Zool. Soc. India,* **3:**10.

1952. *Homaloptera rupicola,* Silas, *Rec. Indian Mus.*, **50:** 192. (Myitkyina, upper Burma).

Diagnosis: A *Homaloptera* species with dorsal commencing behind pelvic; origin of dorsal equidistant between tip of snout and base of caudal; pectoral reaching ventrals; caudal fin slightly emarginate with lower lobe slightly longer.

Description: Based on 4 specimens, 20.5–25.0 mm SL from Kamaing, Myitkyina, Burma.

D. 2/7; P. 5/11; V 2/6; A. 2/5; C. 27–28; L. l. 42–45; L. tr. 12.

Dorsal profile moderately arched, ventral somewhat horizontal. Depth of body 14.0–19.57 (M=16.05); head moderately long, its length 26.0–30.43 (M=27.93) per cent of standard length. Snout narrowly rounded, slightly shorter than posterior portion of head; its length 12.0–15.22 (M=13.36) of standard length, 41.67–53.85 (M=47.92) per cent of head. Eye large, dorso-lateral in position, slightly smaller than the inter-orbital width, ot visible from ventral surface; its diameter 28.57–33.33 (M=30.86) per cent of head length, 57.14–80.0 (M=65.24) per cent of length of snout, 100.0 per cent of inter-orbital width. Nostrils situated nearer to anterior border or eye; anterior nostril forming a flap. Mouth semicircular with thick fleshy lips; upper better developed, overhanging the lower. No tubercles either on lips or the area behind mouth. Barbels short, stout and equal in length.

Scales: Small, absent on head and chest. Lateral line complete, with 42–45 scales.

Fins: Dorsal fin short originating behind pelvic; its origin equidistant between tip of snout and caudal base. Pectorals longer than head and reach pelvics. Pelvic shorter, about half as long as pectoral. The caudal fin slightly emarginate with lower lobe longer than upper. Caudal fin slightly shorter than head; its length 61.54–91.67 (M=75.39) per cent of head.

Pre-dorsal distance 50.00–54.35 (M=52.50) per cent of standard length; pre-pelvic distance 43.48–44.00 (M=43.83) per cent; pre-anal 73.91–80.00 (M=75.97) per cent. Vent a short distance from anal fin; distance from vent to anal fin 13.33–21.43 (M=17.05) per cent in that between anterior origins of pelvic and anal fins. Pectoral 24.00–26.09 (M=24.62); pelvic 16.00–20.00 (M=18.23) per cent of standard length; height of dorsal 18.00–21.85 (M=19.92) per cent; of anal 12.00–15.22 (M=13.74) per cent; caudal 16.00–26.83 (M=21.14) per cent of standard length.

Caudal peduncle short and stout; its length 14.00–18.00 (M=16.01) per cent of standard length; its least height 50.00–71.43 (M=57.09) per cent of its length.

Colour: Ground colour light yellow, with five indistinct vertical bands along side. 1 to 2 vertical black bands on all fins.

Sise: Largest specimen examined 25.0 mm SL.

Affinities: This species is closely related to *H. modesta* found in Meekalan and Meetan, Lower Burma and *H. montana* of Western Ghats of Peninsular India (see affinities of *H. montana*).

Range: Burma: upper Burma: Myitkyina District.

Material examined: Burma: Myitkyina District: 1 specimen, F ZSI 10879/1, (holotype of *H. rupicola*) Kamaing, U. Burma, Coll. B. N. Chopra.

83. **Homaloptera montana** Herre

(Fig. 1, Pl. 9)

1945. *Homaloptera montana* Herre, *Journ. Washington Biol. Soc.* **20:** 399, (Type locality: Anamalai Hills in Peninsular India).

1950. *Homaloptera montana*, Hora, *Rec. Indian Mus.*, **48:** 54.

1951. *Homaloptera montana*, Silas, *J. Bombay nat. Hist. Soc* **49:** 979.

1952. *Homaloptera montana*, Silas, *Rec. Indian Mus.*, **50:** 198.

1984. *Homaloptera pillai* Indira & Remadevi, *Bull. Zool. Surv. India*, **4**(1): 67 (Type locality: River Kunthi, Silent Valley, Kerala).

Diagnosis: A species of *Homaloptera* with dorsal fin commencing well behind origin of pelvic; its origin almost equidistant between tip of snout and base of caudal fin. Pectoral reaching pelvic base. Pelvic fall short of anal opening. Caudal slightly emarginate posteriorly. Head and entire ventral surface back to a little behind pelvic base scaleless. 72 scales along lateral line.

Description: Based on 4 specimens, 48.5 to 73.0 mm SL from Vellathodu, Silent Valley, Western Ghats, Kerala.

D. 2/6; P. 4/8; V 2–3/6–7; A. 1/5; L. l 72; Ltr. 16–1–12.

Body slender; dorsal profile little elevated, ventral horizontal. Dept of body 11.71–15.75 (M=13.39), head moderately long; its length 19.84–27.39 (M=23.97) per cent of standard length. Snout long, descends steeply narrower anteriorly, longer than posterior portion of head; its length 10.68–13.69 (M=12.26) per cent of standard length; 50.0–53.84 (M=51.34) per cent of head. Eye moderately large, situated dorso-laterally somewhat in the posterior half of head, not visible from ventral surface; its diameter 10.0–16.66 (M=14.30) per cent of head length; 20.0–33.33 (M=27.82) per cent of length of snout; 26.66–40.0 (M=35.59) per cent of inter-orbital width. Nostrils situated

nearer to anterior border of eye; anterior nostrils in a flap. Mouth small, slightly arched with fleshy lips; upper well developed, overhanging the lower; without tubercles either on lips or the area behind mouth. Barbels small, inconspicuous.

Scales: Small, absent on head and entire ventral surface back to a little behind pelvic base. Lateral line complete with 72 scales.

Fins: Dorsal fin short, origin commencing behind that of pelvic; origin almost equidistant between tip of snout and caudal base. Pectoral reaching pelvic base. Pelvic fall short of anal opening. Caudal slightly emarginate posteriorly.

Pre-dorsal distance 42.74–52.73 (M=49.35) per cent of standard length. Vent noticeably in advance of anal fin; distance from vent to anal fin 8.0–10.52 (M=9.47) per cent in that between anterior origins of pelvic and anal fins. Pectoral 21.37–24.73 (M=22.98), pelvic 19.56–29.00 (M=21.74) per cent of standard length; height of dorsal 13.69–20.28 (M=16.43) per cent; of anal 15.26–21.64 (M=18.20) per cent.

Caudal peduncle short and stout; its length 11.45–14.49 (M=13.26) per cent of standard length; its least height 60.0–76.92 (M=67.98) per cent of its length.

Colour: In preserved specimens brownish above, yellowish underside; 10 dark short bars across the back, not extending to lateral line; a faint dark longitudinal stripe below lateral line from eye to caudal base; caudal with a blackish blotch on its base, another near its tip; other fins unspotted.

Size: Largest specimen examined 73.0 mm SL.

Affinities: This species is close to *H. modesta*, *H. rupicola* and *H. bilineata* all found in Burma; it can be separated from its allied forms by characters listed in the key. They have evolved from a common ancestral stock. As a group, the Homalopteridae are extensively distributed in the hills of south-eastern Asia. In India, proper, they are found in the hills of Meghalaya and along the Eastern Himalayas as far as the Tista and Kosi drainages on the one hand and the Western Ghats of Peninsular India on the other. The spread of torrential fishes like *Homaloptera* from north-east to south-west occurred during the glacial periods of the Pleistocene along the Garo-Rajmahal hills and the Satpura trend of mountains (Hora, 1949).

Range: Peninsular India: Kerala: Western Ghats; Anamalai Hills, Silent Valley and Sayivala, New Amarambalam (Bharathapuzha basin).

Material examined: India: Kerala: Western Ghats: 1 specimen, SRS/ZSI 462 (holotype of *H. pillai*), Vellathodu, Silent Valley, Coll. R. S. Pillai, 19.i.79. 17 specimens, (paratypes of *H. pillai*), collected along with the holotype. 3 specimens, SRS/ZSI 463, (paratypes of *H. pillai*), Sayivala, New Amarambalam, Coll. K. R. Rao, 19.iii.79.

Genus 4. *Balitora* Gray

1832. *Balitora* Gray, *Ill. Ind. Zool.*, 1, pl. 88, fig. 1, 2. (Type species: *Balitora brucei* Gray).

Diagnosis: Head and body greatly depressed; head broad and short; snout semicircular; trenchant; eyes small situated almost on dorsal aspect of head; mouth crescentic, with tubercular lips; a deep rostral groove in front of mouth overhung by rostral fold; six short, stout barbels; pectorals and pelvics greatly expanded; pectoral with 21 rays, 9 or 10 anterior rays simple; pelvic with 11 rays, 2 anterior rays simple.

Key to species of the genus **Balitora**

A. Length of head 4 times in SL., distance between vent and anal fin 4 times in distance between pelvic and anal fins; scales along lateral line 64–65....	*B. mysorensis* (Mysore Plateau)
B. Length of head 5 times in SL., distance between vent and anal fin 5 times in distance between pelvic and anal fins; scales along lateral line 62–70.	*B. brucei* (N. E. India & Burma)

84. **Balitora brucei** Gray

(Figs. 3 & 4 Pl. 9)

1832. *Balitora brucei* Gray, *Ill. Ind. Zool.*, 1, pl. 88, fig. 1. (Type locality: Mountain streams, India).

1832. *Balitora maculata* Gray, *Ill. Ind. Zool.*, 1, pl. 88, fig. 2, 2a (Type locality: Mountain streams, India).

1839. *Balitora brucei*, McClelland, *Asiat. Res.*, **19:** 299, 428, pl. 49 fig.

1842. *Platycara anisura* McClelland, *Calcutta Journ. Nat. Hist.* **2:** 587, pl. 68 (Type locality: Kasyah mountains).

1939. *Platycara maculata*, McClelland, *Asiat. Res.*, **19:** 229, 427, pl. 49, fig. 2 (from Gray & Hard.)

1848. *Balitora brucei*, Valenciennes (in C. & V.), *Hist. Nat., Poiss.*, **18:** 101.

1846. *Balitora maculata*, Valenciennes (in C. & V.), *Hist. Nat. Poiss.*, **18:** 102.

1867. *Homaloptera brucei*, Day, *Proc. Zool. Soc. Lond.*, p. 348.

1868. *Homaloptera brucei*, Günther, *Cat. Fish. Brit. Mus.*, **7:** 340.

1877. *Homaloptera brucei*, Day (in part), *Fish India*, p. 526, pl. 122 (fig. 1).

1889. *Homaloptera brucei*, Day (in part), *Fauna. Brit. Ind. Fish.*, 1, p. 243, fig. 85.

1889. *Homaloptera maculata*, Day (in part), *Faun. Brit. Indi. Fish.*, 1, p. 243.

1889. *Homaloptera brucei*, Vinciguerra, *Ann. Mus. Stor. Nat. Genova*, **29:** 323.

1889. *Homaloptera brucei*, Vinciguerra, *Calcutta Journ. Nat. Hist.*, 2, p. 323.

1920. *Balitora brucei*, Hora, *Rec. Indian Mus.*, **19:** 197.

1920. *Balitora maculata*, Hora, *Rec. Indian Mus.*, **19:** 199, fig. 2, pl. 11, fig. 1.

1932. *Balitora brucei*, Hora, *Mem. Indian Mus.*, **12:** 291, pl. 10, fig. 1, pl. 11, fig. 5, pl. 12, fig. 2.

1932. *Balitora maculata*, Hora, *Mem. Indian Mus.*, **12:** 291.

1932. *Balitora brucei var. burmanicus*, Hora, *Mem. Indian Mus.*, **12:** 291.

1932. *Balitora brucei var. melanosoma*, Hora, *Mem. Indian Mus.*, **12:** 291.

1952. *Balitora brucei*, Silas, *Rec. Indian Mus.*, **50:** 206.

1952. *Balitora brucei var. burmanicus*, Silas, *Rec. Indian Mus.*, **50:** 207.

1952. *Balitora brucei var. melanosoma*, Silas, *Rec. Indian Mus.*, **50:** 207.

1974. *Balitora brucei*, Menon, *Inl. Fish. Soc. India*, special publication, **1:** 48.

1974. *Balitora maculata*, Menon, *Inl. Fish. Soc. India*, special publication, **1:** 49.

Description: Based on 6 specimens, 35.0–90.5 mm SL from Hong Piang stream, Cherapungi, Khasi Hills (3) Tong Siam Stream, Assam (3).

D. 3/8; P. 10/11–12; V 2/9; A. 2/5; C. 17; L. 1.70; L.tr.10/7

Head and body greatly depressed; dorsal profile slightly arched, ventral horizontal. Depth of body 10.0–12.50 (M=10.96); Head broader than high at occiput; its length 18.45–20.0 (M= 19.33) per cent of standard length; its width 85.71–100.0 (M= 94.00), height 39.39–42.86 (M=41.53) per cent of head. Snout semicircular with trenchant margins; its length 11.18–13.17 (M= 12.01) per cent of standard length, 57.14–67.74 (M=62.16) per cent of head. Eye small, dorso-lateral; its diameter 13.79–21.43

(M=16.06) per cent of head, 22.22–37.50 (M=26.07) per cent of length of snout, 33.33–50.0 (M=36.61) per cent of inter-orbital width; inter-orbital 41.37-45.45 (M=44.07). Nostrils close to each other, situated closer to eye than to tip of snout. Mouth crescentic, provided with thick tubercular lips, upper uninterrupted, lower interrupted in the middle line. Barbels well developed, four rostral one at angle of mouth; integument of the spaces between barbels thickened and it becomes difficult to see them; those near the angles sunk in grooves and imperceptible.

Scales: Small, absent on chest and belly. Lateral line complete with 62 to 70 scales along it.

Fins: Dorsal small; pectoral and pelvic fins greatly expanded with thick cushion-like longitudinal pad of muscles on ventral aspect of simple rays. Pectoral with 21 rays, 9 or 10 simple; the simple rays greatly expanded and horizontally situated. Pelvic with 11 rays, first two simple. Pectoral longer than head, 124.14–150.0 (M=135.25) per cent of head length, extending to pelvic or even slightly beyond commencement of pelvic. Pelvic shorter than pectorals not extending to anal fin. Anal fin not reaching base of caudal. Caudal fin slightly shorter than head; its length 48.78–114.29 (M=70.94) per cent of head length, emarginate, lobes unequal, lower much longer.

Pre-dorsal distance 43.53–45.51 (M=44.46) of standard length. Vent a short distance from anal fin; distance between vent to anal fin 17.54–25.00 (M=20.19) per cent in that between anterior origins of pelvic and anal fins. Pectoral 24.32–28.18 (M=26.11), pelvic 18.92–21.56 (M=20.58) per cent of standard length; height of dorsal 12.86–19.76 (M=16.91) per cent; of anal 9.52–12.16 (M=10.65) per cent; caudal 9.39–22.86 (M=13.73) per cent.

Caudal peduncle short and stout; its length 17.86–25.71 (M=21.02) per cent of standard length; its least height 22.22–33.33 (M=27.77) per cent of its length.

Colour: Dark brown with darker blotches; caudal banded.

Size: Largest specimen examined 90.5 mm SL.

Affinities: This species is a highly specialised member of the subfamily and is closely related to the other species of the genus occurring in the Western Ghats of the Indian Peninsula. It is readily separated by means of characters in the key.

Range: India: Eastern Himalayas; Khasi hills, Meghalaya through Darjeeling to Gandak drainage, Nepal.

Bangladesh: Chittagong Hills. *Burma:* Mytkyina to Meekalan. *Thailand:* Thaungyin River, border between Thailand and Burma.

Material examined: India: Meghala: 3 specimens, ZSI F 11092/1, Nong-piang stream, Cherrapungi, Khasi Hills., 3 specimens, ZSI F 9857–59/1, Tong-Siam stream, Cherrapungi.

85. **Balitora mysorensis** Hora

1941. *Balitora brucei var. mysorensis* Hora, *Rec. Indian Mus.*, **43**: 232, pl. 8, fig. 4. (Type locality: Sivasamudram, Mysore State, now Karnataka).

1952. *Balitora brucei var. mysorensis*, Silas, *Rec. Indian Mus.*, **50**: 206.

1977. *Balitora mysorensis*, Menon, *Matsya*, **3**: 31.

Diagnosis: A more slender species than *B. brucei* (depth of body 12.25 *versus* 10.96) with longer head (24.02 *versus* 12.01) larger body scales (64.65 *versus* 62.70) and vent placed far in front of anal fin (vent to anal fin distance 4 *versus* 5 times in the distance between the origins of pelvic and anal fins.)

Description: Based on 2 specimen, 50.5–51.5 mm SL., from Thungabhadra River, below Thungabhadra Reservoir, Karnataka.

D. 2–3/8–9; P. 8–9/10–11; A. 2/5; V 2/9; C. 17; L.l. 64–65; Ltr. $7\frac{1}{2}$–$8\frac{1}{2}/5\frac{1}{2}$.

A more slender species; depth of body 12.25 (11.88–12.63) per cent of standard length, head depressed, broader than high at occiput; its length 23.30–24.75 (M=24.02) per cent of standard length; width of head 75.0–80.0 (M=77.50); height 32.0–41.66 (M=36.83) per cent of length of head. Eye small, situated in the posterior half of head; its diameter 16.0–16.66 (M=16.33) per cent of head. Inter-orbital region flat. Snout semicircular, trenchant, slightly tuberculated; its length 54.16–56.0 (M=55.08) per cent of length of head. Mouth crescentic, with thick, tubercular lips, upper uninterrupted, lower interrupted in the middle. Barbels well developed, 4 rostral, one at each angle of mouth; integument of the spaces between barbels thickened; barbels shorter than diameter of eye.

Scales: Small, absent on chest and belly. Lateral line complete with 64–65 scales along it.

Fins: Dorsal small; pectoral and pelvic fins greatly expanded with thick cushion-like pads of muscles on ventral aspect of simple rays. Pectoral with 20 rays, 8 or 9 simple; the simple rays greatly expanded and horizontally striated. Pelvic with 11 rays, first 2 simple. Pectoral longer than head, extending to pelvic or separated by a very short distance. Pelvic shorter than pectoral not extending to anal opening. Anal fin not reaching base of caudal. Caudal fin slightly shorter than head, emarginate.

Pre-dorsal distance 45.63–47.0 (M=46.31) per cent of standard length. Vent a short distance from anal fin; distance from vent to anal fin 22.85–26.66 (M=25.75) per cent in that between anterior origin of pelvic and anal fins.

Caudal peduncle short and stout; its least height 38.88 per cent of its own length.

Colour: Uniformly grey with a diffuse grey band along lateral line in preserved specimens.

Affinities: This species is closely related to *B. brucei;* it can be readily separated by its slender body and other characters listed in the key. The spread of *Balitora* from north-east to Western Ghats occurred during glacial periods of Pleistocene along the Satpura trend of mountains (Menon, 1973).

Range: India: Western Ghats; Cauvery and Thungabhadra River systems in Karnataka State.

Material examined: India: Karnataka: 1 specimen ZSI 13512/1, (holotype of *B. mysorensis*) Sivasamudram.

Genus 5. *Bhavania* Hora

1937. *Bhavania* Hora, *Rec. Indian Mus.*, **39:** 11. (Type species: *Platycara australis* Jerdon (=*Bhavania annandalei* Hora).

Diagnosis: Head and anterior part of body greatly depressed, tail compressed side to side. Ventral surface up to anal flattened. Snout broadly pointed with trenchant margins. Eyes dorso-lateral. Mouth small, inferior; lips fleshy, continuous at angles of mouth; lower lip divided into one central and two lateral portions; middle part followed by two prominent papillae. A narrow groove in front of mouth overhung by rostral fold. Front margin of rostral fold forms indentations, between them arise four rostral barbels. Two lappets of the rostral fold curve inwards between rostral and maxillary barbels. Rostral groove is continuous with grooves at the angles of the mouth. Jaws sharp, covered with horny substance.

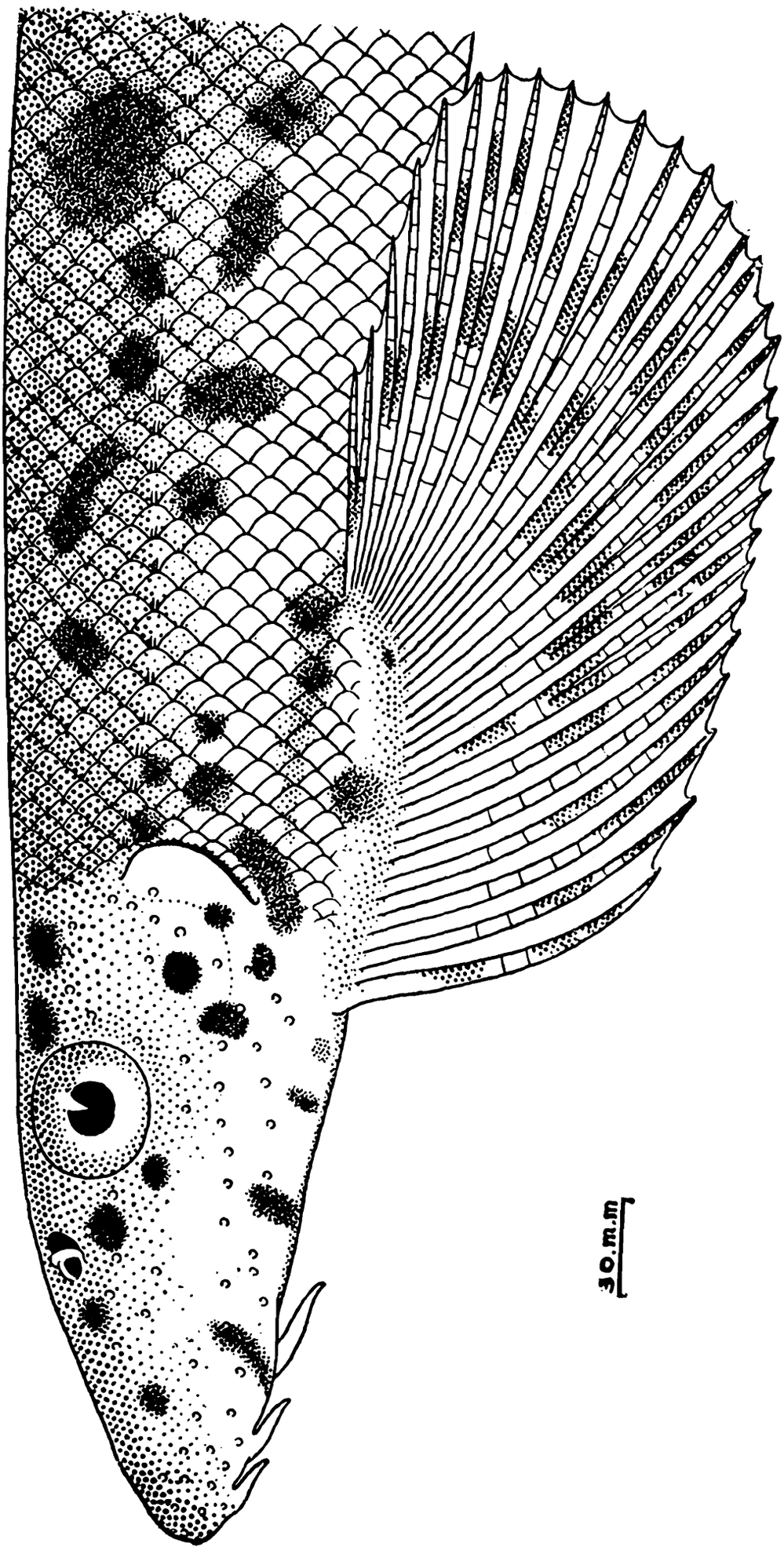


FIG. 5. Lateral views of *Bhavania australis*, showing the modifications in the pectoral fin and the gill opening. Note the small gill-opening restricted to the dorsal surface above base of pectoral.

Gill openings small, restricted to dorsal surface above base of pectoral fins. Body covered with small scales, absent on ventral surface. Paired fins horizontal and extensive.

Relationships: Among Homalopterinae, *Bhavania* is the only genus with gill-openings restricted to the dorsal surface of head. In this respect its development is somewhat parallel to such genera as *Protomyzon*, *Paraprotomyzon*, *Pseudogastromyzon*, *Sewellia*, *Beaufortia*, *Neogastromyzon* and *Gastromyzon* now confined to China, Hainan, Taiwan, S. Vietnam and Borneo. The preponderance of the endemic genera and species in the different geographical areas is a remarkable feature of Homalopterinae indicating the rapid evolutionary radiation after isolation.

86. **Bhavania australis** (Jerdon)

(Fig. 5 & 6, Pl. 9)

1848. *Platycara australis* Jerdon, *Madras J. Litt. Sci.* **25:** 333 (Type locality: Walliar, Nilgiris).

1867. *Homaloptera brucei*, Day (nec Gray) *Proc. Zool. Soc., Lond.* p. 348 (Wyanad).

1868. *Homaloptera brucei*, Günther (nec Gray), *Cat. Fish. Brit. Mus.*, **5:** 340 (Wyanad from Day's collection).

1868. *Homaloptera brucei*, Day (nec Gray), *J. Asiat. Soc. Beng;* **41:** 28, (Wyanad).

1877. *Homaloptera maculata*, Day (nec Gray), *Fish India*, p. 256, pl. 122 fig. 2 (Wyanad specimen figured).

1889. *Homaloptera maculata*, Day (nec Gray), *Faun. Brit. Ind. Fish.*, **1:** 243 (Wyanad).

1909. *Homaloptera maculata*, Jenkins (nec Gray), *Rec. Indian Mus.*, **3:** 28 (Tenmalai, Western Ghats).

1920. *Bhavania annandalei* Hora, *Rec. Indian Mus.*, **19:** 20, pl. 10, figs. 1 to 3, pl. 11, figs. 5 to 7. (Travancore, Nilgiris and Malabar).

1920. *Bhavania australis*, Hora, *Rec. Indian Mus.*, **19:** 205, pl. 10, figs.4 to 6, pl. 11, fig. 8.

1929. *Homaloptera maculata*, Pillai (nec. Gray) *J. Bombay nat. Hist. Soc.*, **33:** 356.

1936. *Homaloptera maculata*, John (nec Gray), *J. Bombay nat. Hist. Soc.* **38:** 110.

1937. *Bhavania annandalei* Hora, *J. Bombay nat. Hist. Soc.* **39:** 11, fig. 4, (Western Ghats: Mysore).

1941. *Bhavania australis*, Hora, *Rec. Indian Mus.*, **43:** 225 pl. 8, figs. 1 to 3.

1941. *Bhavania australis*, Hora and Law, *Rec. Indian Mus.*, **43:** 248.

1948. *Bhavania australis*, Ramaswami, *Proc. Zool. Soc. Lond.*, **118**: 515.

1950. *Bhavania australis*, Law, *Rec. Indian Mus.*, **48**: 76, pl. 3. fig. 4.

1951. *Bhavania australis*, Silas, *J. Bombay nat. Hist. Soc.*, **50**(2): 330.

1952. *Bhavania australis*, Silas, *Rec. Indian Mus.*, **50**: 184. (Mysore, Nilgiris and Travancore).

Diagnosis: Bhavania australia, a *Balitora*-like fish, with the head and the anterior part of the body greatly depressed. Gill openings restricted above base of pectoral fins. Mouth small, lips thick and fleshy, continuous at angles of mouth; the medium part of lower lip separated from the lateral parts. A deep groove between the upper lip and rostral fold. Pectoral with 19 rays, 6–8 simple; ventral 9, 2 simple.

Description: Based on 6 specimens 40.0–90.0 mm SL from Sayivala, New Amarambalam, Kerala.

D. 2/7–9; P. 6–8/9–11; V 2/7–8; A. 1/5–6; C. 17–18; L. l. 70–75.

A *Balitora*-like fish with the anterior part of body up to anal opening greatly depressed, ventral surface horizontal and flat. Tail broad; compressed. Dorsal profile greatly arched; depth of body in front of dorsal fin 10.98–13.33 (M=12.09); head broad, rounded and trenchant, covered with series of short, hard, spine-like growth. The length of head 19.51–25.56 (M=21.62) per cent of standard length, its width 78.26–88.46 (M=84.18), height 43.48–57.69 (M=46.87) per cent of head. Snout of moderate length; its length 10.98–14.44 (M=12.2) per cent of standard length; 53.85–59.09 (M=56.40) per cent of head. Eye moderate in size, approximated dorsally, situated in the posterior half of head, not visible from the ventral surface; its diameter 16.67–38.46 (M=24.05) per cent of head length, 30.0–46.14 (M=38.05) per cent of length of snout, 50.0–75.0 (M=61.07) per cent of inter-orbital width. The nostrils are situated close to each other, the anterior in a flap. Mouth small, inferior, semicircular. Lips well developed, both lips continuous at angles of mouth; the medium part of posterior lips separated from lateral parts, followed by two prominent barbel-like papillae. Jaws hard and covered by a horny substance. A deep groove between the anterior lip and rostral fold, bifurcated near the origin of the maxillary barbel, the inner branch continued round the angle of mouth, the outer directed outwards and backwards. Barbels short and stumpy. In between the rostral barbels, a rostral fold is produced into lobes; at sides lappets are formed covering the rostral groove. Gill openings are small, spout-like apertures, restricted above base of pectoral fin.

Scales: Small, absent on head and ventral surface upto anal opening. Lateral line complete with 70–75 scales along it. 30 pre-dorsal scales, 12–15 above lateral line, 9–10 below lateral line to base of ventral.

Fins: Dorsal small, higher than body, commences slightly behind the pelvics; origin of dorsal nearer tip of snout than base of caudal fin. Paired fins are broad, and horizontal. Pectorals commence just behind the eyes, longer than the head, extends almost to base of pelvics. Pelvics similar to pectoral, may or may not extend to anal opening but separated from anal fin by considerable distance. Caudal fin as long as or slightly shorter than head, 85.71–127.27 (M=101.58) per cent of head length, forked with lower lobe longer.

Pre-dorsal distance 44.44–51.09 (M=46.58) per cent of standard length; vent a short distance from anal fin; distance from vent to anal fin 19.23–25.00 (M=22.71) per cent in that between anterior origins of pelvic and anal fins. Pectoral 23.89–31.52 (M=27.94), pelvic 21.74–26.09 (M=23.50) per cent of standard length; height of dorsal 16.11–21.74 (M=18.01) per cent; of anal 12.60–17.39 (M=13.85) per cent. Caudal 17.39–30.43 (M=22.61) per cent of standard length.

Caudal peduncle short and stout; its length 13.04–15.75 (M=14.70) per cent of standard length; its least height 50.0–66.67 (M=55.23) per cent of its length.

Colour: Body and fins covered with black spots, irregularly distributed on body but form regular rows on fins.

Size: Largest size examined 90.0 mm SL.

Affinities: This species is the only known member of its genus with no close relative.

Range: India: Western Ghats: Karnataka, Nilgiris (Tamil Nadu) and Kerala.

Material examined: India: Kerala: 1 specimen, SRS/ZSI F 498, Poochapara, New Amarambalam, Coll. K. R. Rao and Party, 7.iii. 1979. 25 specimens, SRS/ZSI F 497, Sayivala, New Amarambalam, Coll. K. R. Rao, 19.iii.1979.

Genus 6. *Travancoria* Hora

1941. *Travancoria* Hora, *Rec. Indian Mus.*, **43:** 228 (Type species: *Travancoria jonesi* Hora).

Diagnosis: Head and anterior part of body greatly depressed, ventrally flattened. Snout narrowly rounded in front and resembling

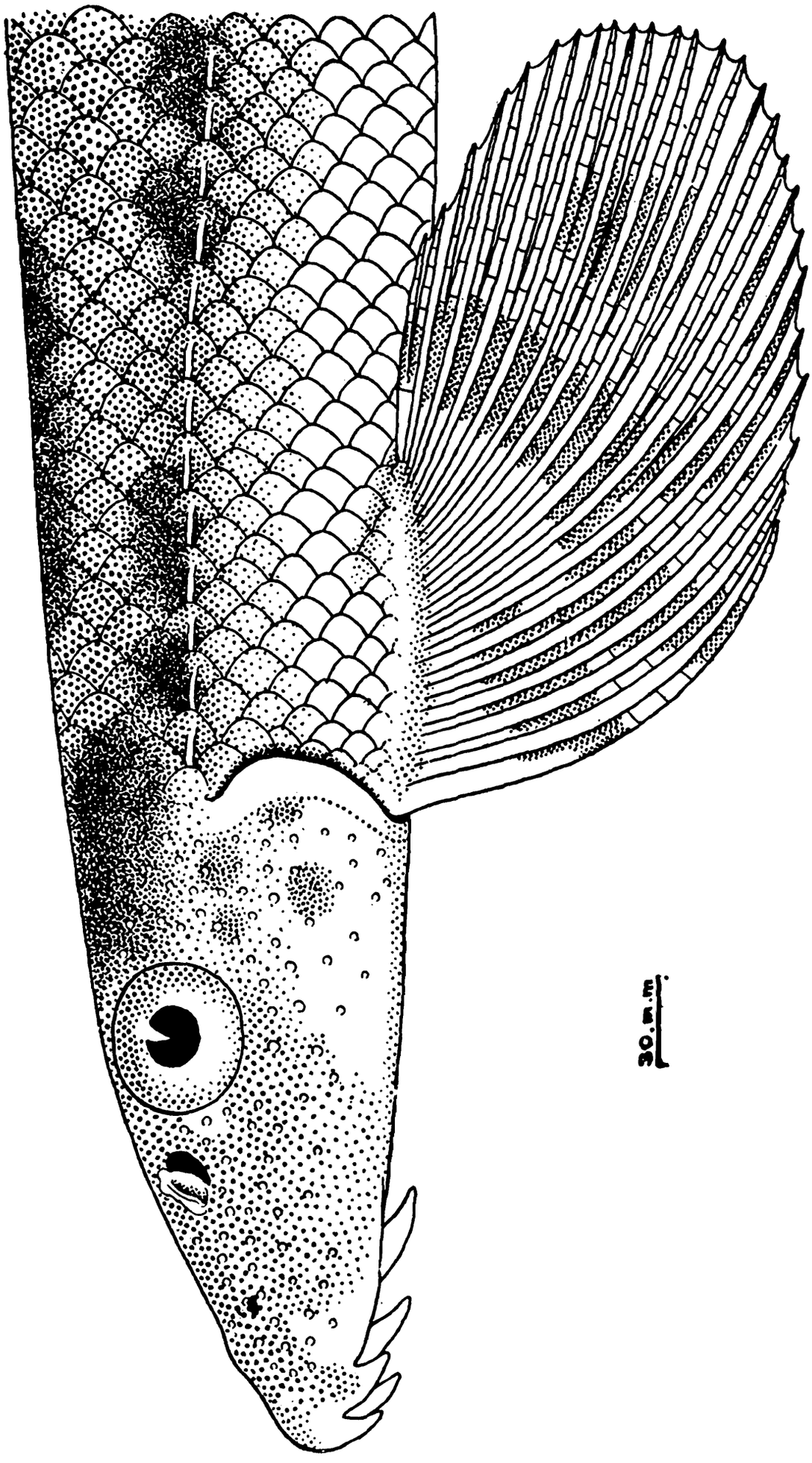


FIG. 6. Lateral view of *Travancoria jonesi*, showing its close similarity to *Bhavania* except the extent of the gill opening. Note the gill opening extending in front of pectoral fin to the ventral surface for a short distance.

narrow-headed form of *Balitora brucei*. Mouth small, inferior, transverse and greatly arched. Lips plain, continuous round corner of mouth; the middle part separated from two lateral parts followed by two well developed papillae. A deep groove in front of mouth bordered by rostral fold; it is continued backwards round the angles of mouth. 4 short rostral barbels, in between them the rostral fold is produced into 3 barbel-like projections. A pair of maxillary barbels at angles of mouth. Gill opening oblique and extends to ventral surface for a short distance. Scales all over body, absent on head and ventral surface in front of anal fin. Paired fins are broad and horizontal. The pectoral fin pedunculate and commences considerably behind the eyes; reaching the pelvic. Pelvics extends considerably beyond anal opening. Pectoral with 15–16 rays, 6 anterior simple; pelvic with 8–9 rays, 2 anterior simple. Caudal forked with lower lobe longer.

Relationships: The structure of lips, the form of the rostral groove, lepidosis and the presence of two papillae behind lower lip are suggestive of its close relationship with *Bhavania* Hora. The nature of the gill opening distinguishes the two genera (gill openings restricted above base of pectoral fin in *Bhavania;* extend to the ventral surface in *Travancoria*).

87. **Travancoria jonesi** Hora

(Figs. 7 & 8, Pl. 9)

1941. *Travancoria jonesi* Hora, *Rec. Indian Mus.*, **43:** 230, pl. 8, figs. 5 to 9, (Type locality: Streams within a radius of 5 miles from Pampadampara, Peerumedu, Kerala).

1941. *Travancoria jonesi*, Hora and Law, *Rec. Indian Mus.*, **43:** 249.

1942. *Travancoria jonesi*, Hora and Law, *J. Asiat. Soc., Beng.*, **8:** 39.

1952. *Travancoria jonesi*, Silas, *Rec. Indian Mus.*, **50:** 204 (High Ranges, N. Travancore, Anamalai Hills).

Diagnosis: A well-built loach of moderate size with head and body depressed, tail compressed side to side. Gill openings small extending to ventral surface for a short distance. Mouth small, inferior, semicircular. Lips continuous at the angles of the mouth, a medium part of posterior lip separated from lateral parts, followed by two prominent papillae. A deep groove between upper and rostral fold. Pectoral with 16 rays, 6 anterior rays simple. Pelvic with 8–9 rays, 2 anterior rays simple.

Description: Based on 8 specimens 58.0–83.5 mm SL from Pampadampara, Travancore, Kerala.

D. 2/7–8; P. 6/9–10; V 2/6–7; A. 1/4–5; C. 17; L. l 75–77

A well-built loach of moderate size with head and body depressed; tail compressed side to side. Ventral profile is greatly flattened up to commencement of anal fin. The dorsal profile greatly arched; the depth of body 12.57–14.66(M=13.62). Head broadly pointed anteriorly and covered with hard spine-like growth. Its length 18.97–19.16 (M=19.07) per cent of standard length; its width 71.81–95.45 (M=83.67), height 53.13–56.09 (M=56.11) per cent of head. Snout of moderate length, its length 11.21–11.38 (M=11.30) per cent of standard length, 59.09–59.38 (M=59.24) per cent of head. Eye of moderate size, approximated dorsally, situated in the posterior half of head, not visible from ventral surface; its diameter 22.73–25.00 (M=23.87) per cent of head length, 33.46–42.11 (M=40.29) per cent of length of snout, 50.0–72.73 (M=61.37) per cent of inter orbital width. Nostrils close to each other, situated closer to eye than tip of snout, anterior nostril in a flap. Mouth is small, inferior, semicricular and horizontal. Lips well developed and free from jaws; the anterior lip covers the jaw, the posterior leaves a considerable part of jaw bare. Lips continuous at angles of the mouth but the median part of posterior lips is separated followed by two prominent papillae. Jaws hard, covered with horny substance. A rostral groove between anterior lip and rostral fold, bifurcated near the base of the maxillary barbel; the inner branch continued round the corner of mouth, outer extends to the side of head. Barbels, 4 rostral and 2 maxillary, between the bases of the rostral barbels the rostral fold is produced into three barbel-like processes. On the side of maxillary barbel the rostral fold forms a lappet, covering the rostral groove. Gill openings small, extending to ventral surface.

Scales: Small, absent on head and on ventral side as far as anal opening. Lateral line complete with 75–77 scales along it, 9 rows above it, 9 rows below to base of pelvic fin.

Fins: Dorsal fin short, commences opposite or slightly behind pelvics, the origin of dorsal fin considerably nearer to tip of snout than to base of caudal fin. Paired fins are broad, wing-like and horizontal. Pectorals commence behind the eyes and are longer than head; not extending to pelvic base. Pelvics are similar to pectorals, almost as long as head, extending considerably beyond anal opening. Anal fin not reaching caudal base. Caudal fin almost as long as head, forked, both lobes bluntly pointed.

Pre-anal distance 42.51–44.83 (M=43.67) per cent of standard length. Vent a short distance from anal fin; distance from vent to anal fin 29.73–38.60 (M=34.17) per cent in that between anterior origins of pelvic and anal fins. Pectoral 21.55–22.16 (M=21.86), pelvic 17.24–19.76 (M=18.50) per cent of standard length; height of dorsal 17.37–18.10 (M=17.74) per cent; of anal 9.48–13.17

(M=11.33) per cent; caudal 6.59–7.76 (M=7.18) percent of standard length. Caudal peduncle short and stout; its height 29.73–38.60 (M=34.17) per cent of its length.

Colour: Body dark above, pale below in the flattened part. A series of 8–10 broad, saddle-shaped spots on the back; head and sides of body mottled with black spots of different sizes and pattern, some forming a black band along lateral line. Fins with series of spots.

Size: Largest specimens examined 83.5 mm SL.

Affinities: This species is the only known member of its genus with no close relatives.

Range: India: Western Ghats: Kerala; High ranges and Anamalai Hills.

Material examined: India: Kerala: Travancore: 1 specimen, ZSI F 13507/1, (holotype) Pampadampara, Coll. S. Jones, 9 specimens, ZSI F 13507/1 (paratypes) taken along with holotype.

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INDEX OF SCIENTIFIC NAMES

New taxonomic names are marked with an asterisk(*).

PLATE I

FIG. 1. *Noemacheilus* (*Schistura*) *pakistanicus* Mirza & Banarescu
FIG. 2. *Noemacheilus* (*Schistura*) *punjabensis* Hora
FIG. 3. *Noemacheilus* (*Schistura*) *multifasciatus* Day
FIG. 4. Ventral aspect of head *of N. multifasciatus*
FIG. 5. *Noemacheilus* (*Schistura*) *carletoni* Fowler
FIG. 6. *Noemacheilus* (*Schistura*) *doonensis* Tilak
FIG. 7. *Noemacheilus* (*Schistura*) *devdevi* Hora

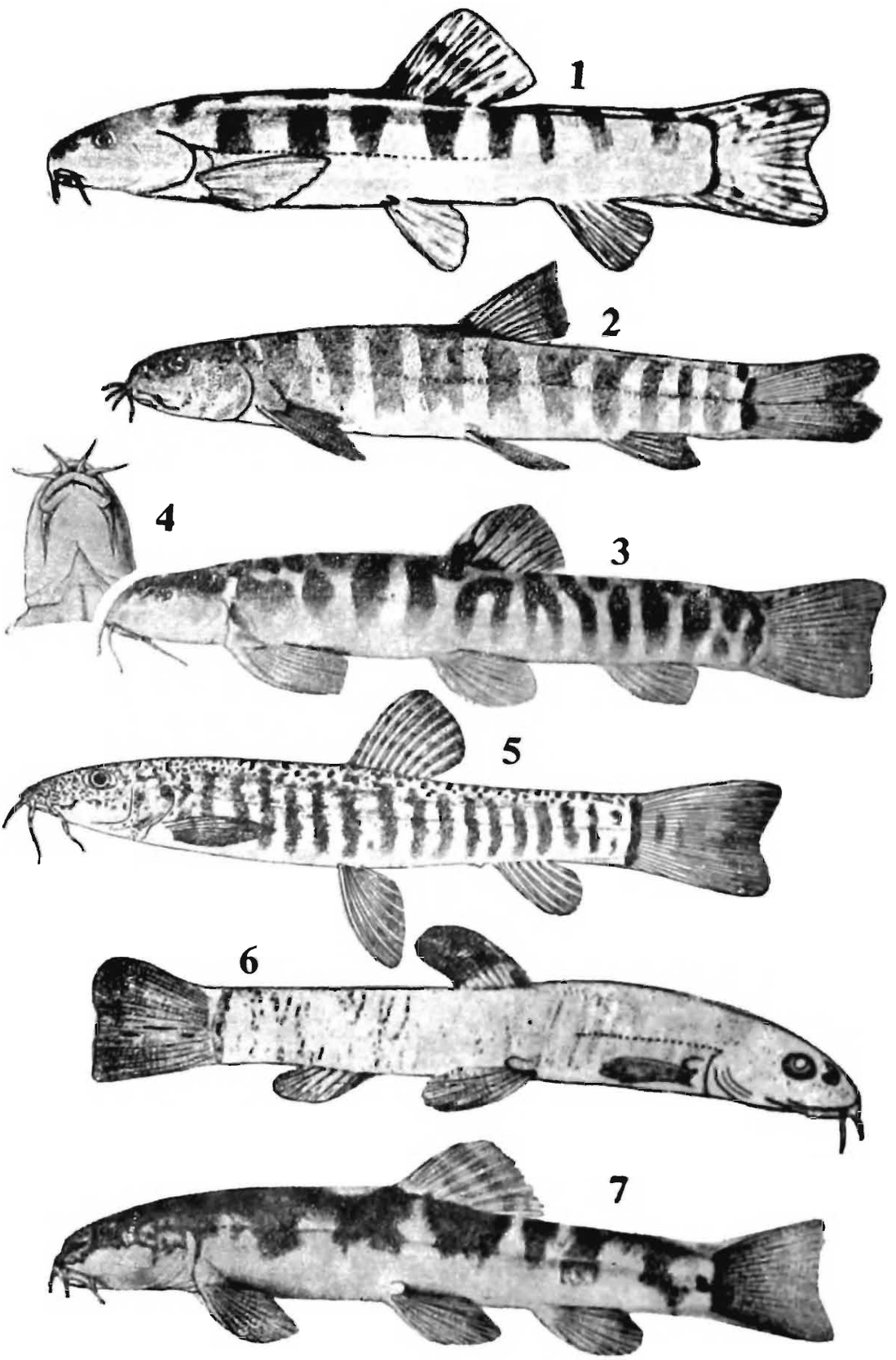
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Plate II

Fig. 1. *Noemacheilus* (*Schistura*) *kessleri* Günther

Fig. 2. *Noemacheilus* (*Schistura*) *prashari* Hora

Fig. 3. Ventral aspect of head of *N. prashari*

Fig. 4. *Noemacheilus* (*Schistura*) *baluchiorum* Zugmayer

Fig. 5. Ventral aspect of head of *N.* (*Schistura*) *baluchiorum* Zugmayer

Fig. 6. *Noemacheilus* (*Schistura*) *arafi* (Mirza & Banarescu)

Fig. 7. *Noemacheilus* (*Schistura*) *kohatensis* (Mirza & Banarescu)

Fig. 8. *Noemacheilus* (*Schistura*) *fascimaculatus* (Mirza & Nalbant)

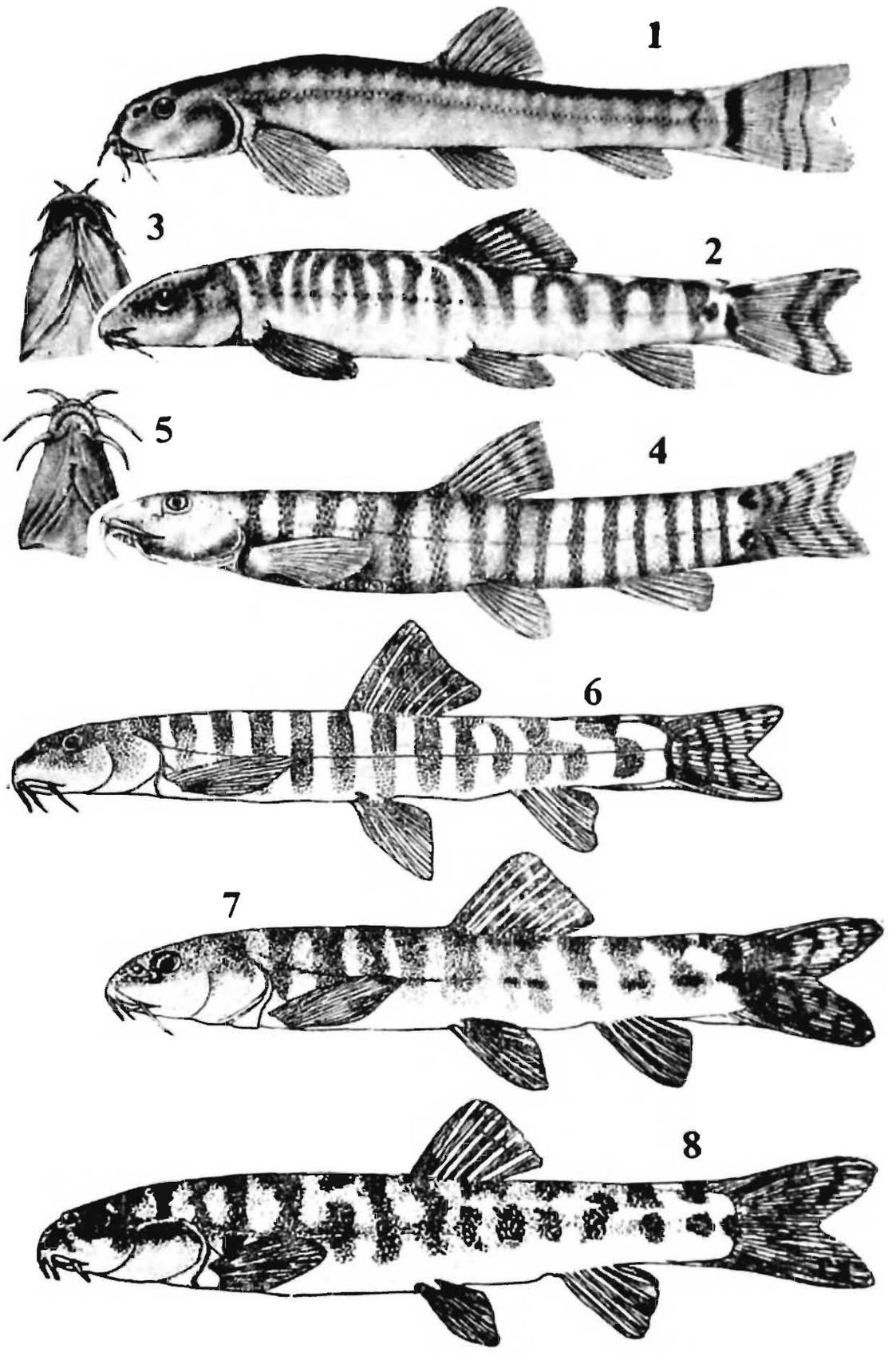
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Plate III

Fig. 1. *Noemacheilus* (*Schistura*) *horai* Menon

Fig. 2. *Noemacheilus* (*Schistura*) *scaturigina* (McClelland)

Fig. 3. Ventral aspect of head of *N. scaturigina* (McClelland)

Fig. 4. *Noemacheilus* (*Schistura*) *sikmaiensis* Hora

Fig. 5. Ventral aspect of head of *N. sikmainsis* Hora

Fig. 6. *Noemacheilus* (*Schistura*) *acuticephalus* Hora

Fig. 7. Ventral aspect of head of *N. acuticephalus* Hora

Fig. 8. *Noemacheilus* (*Schistura*) *prashadi* Hora

Fig. 9. Ventral aspect of head of *N. prashadi* Hora

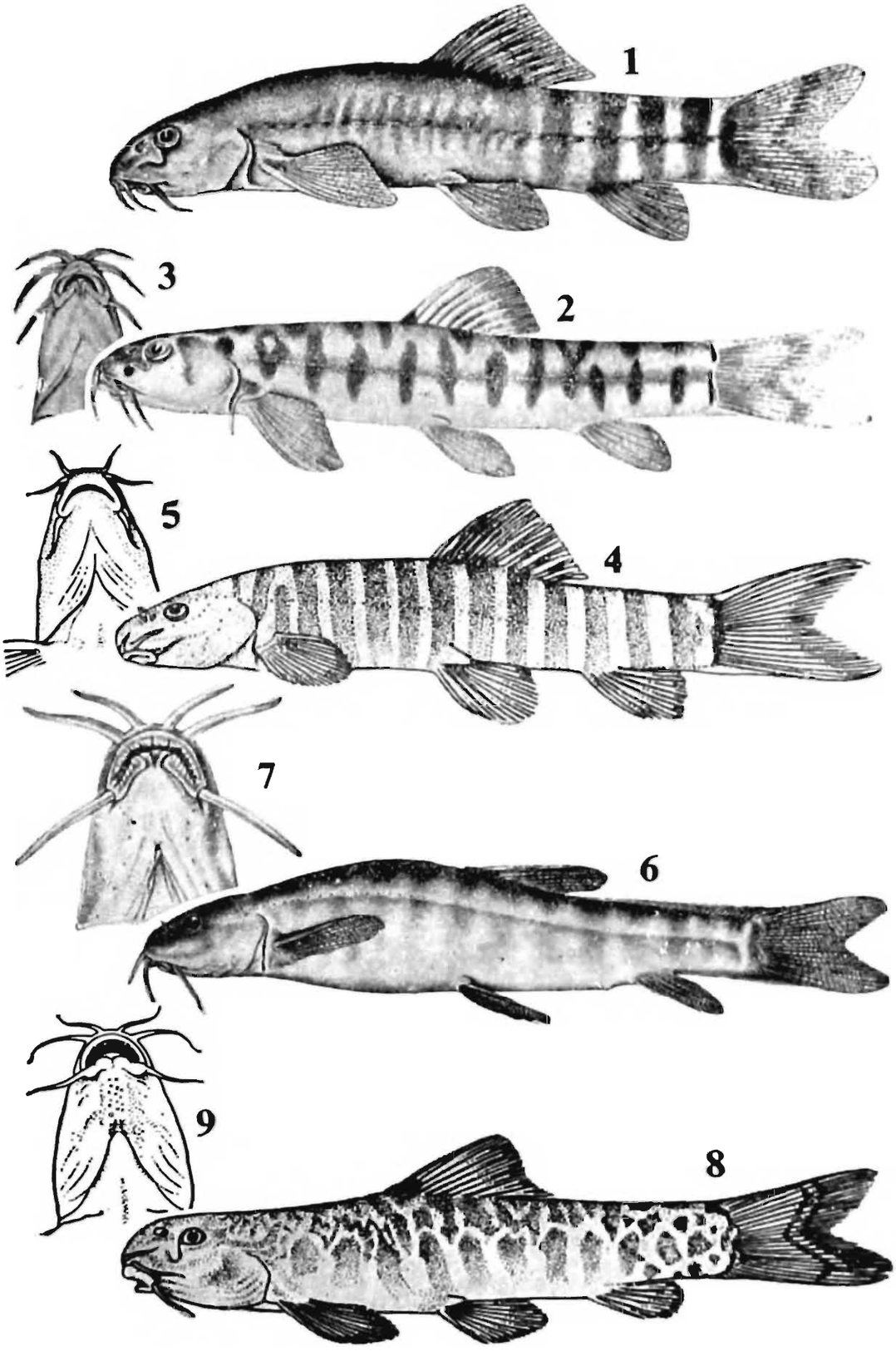
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Plate IV

Fig. 1. *Noemacheilus* (*Schistura*) *rivulicola* Hora

Fig. 2. Ventral aspect of *N. rivulicola* Hora

Fig. 3. *Noemacheilus* (*Schistura*) *vinciguerrae* Hora

Fig. 4. *Noemacheilus* (*Schistura*) *brunneanus* Annandale

Fig. 5. *Noemacheilus* (*Schistura*) *barapaniensis* sp. nov.

Fig. 6. Air bladder of *N.* (*Schistura*) *barapaniensis* sp. nov.

Fig. 7. Ventral aspect of head of *N. barapaniensis*

Fig. 8. *Noemacheilus* (*Schistura*) *notostigma* Bleeker

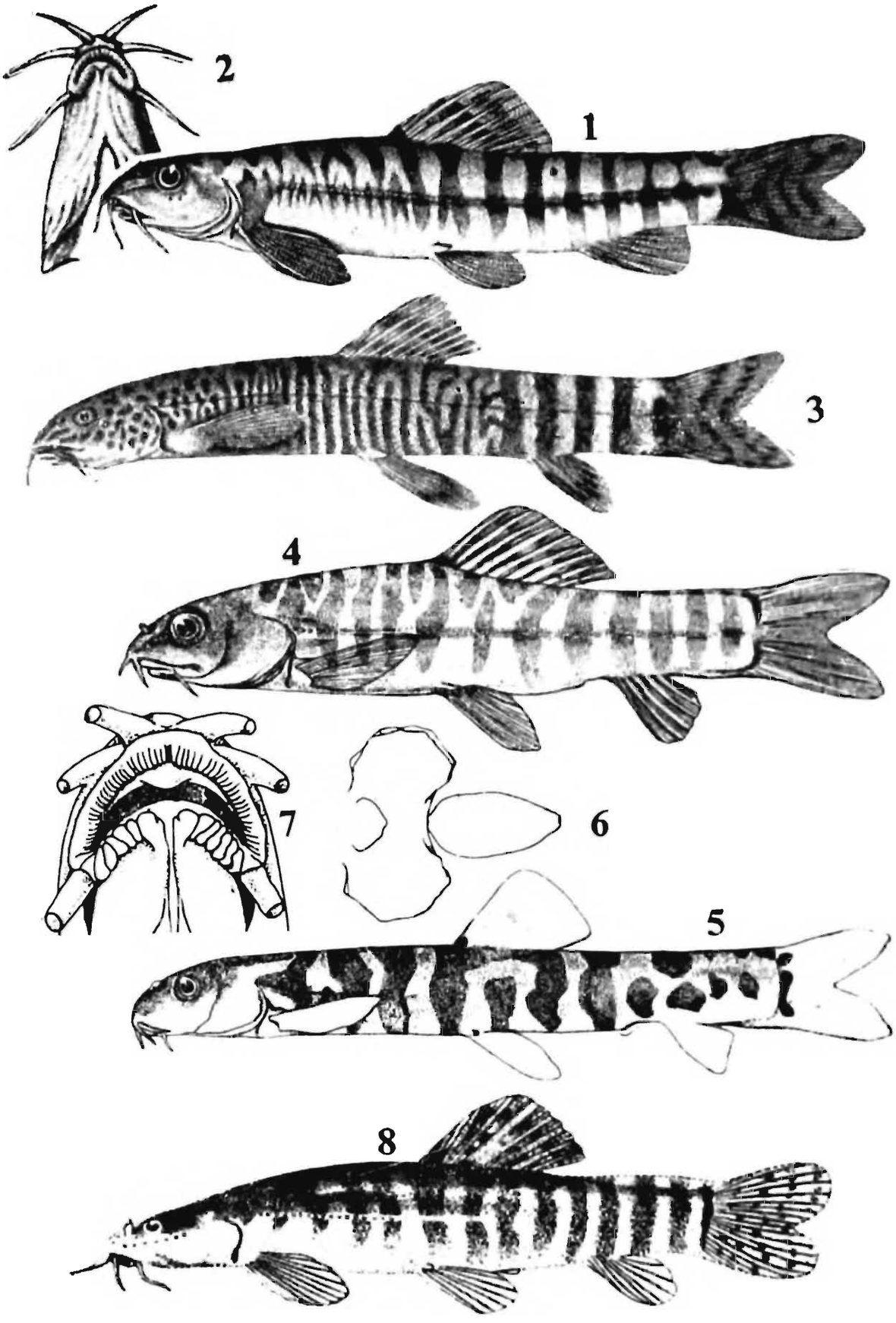
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Plate V

Fig. 1. *Noemacheilus* (*Schistura*) *striatus* Day

Fig. 2. *Noemacheilus* (*Schistura*) *kangjupkhulensis* Hora

Fig. 3. Ventral aspect of head of *N.* (*Schistura*) *kangjupkhulensis* Hora.

Fig. 4. *Noemacheilus* (*Schistura*) *cincticauda* (Blyth)

Fig. 5. *Noemacheilus* (*Acanthocobitis*) *urophthalmus* Günther

Fig. 6. *Noemacheilus* (*Acanthocobitis*) *rubidipinnis* (Blyth)

Fig. 7. Ventral aspect of mouth of *N.* (*Acanthocobitis*) *rubidipinnis*

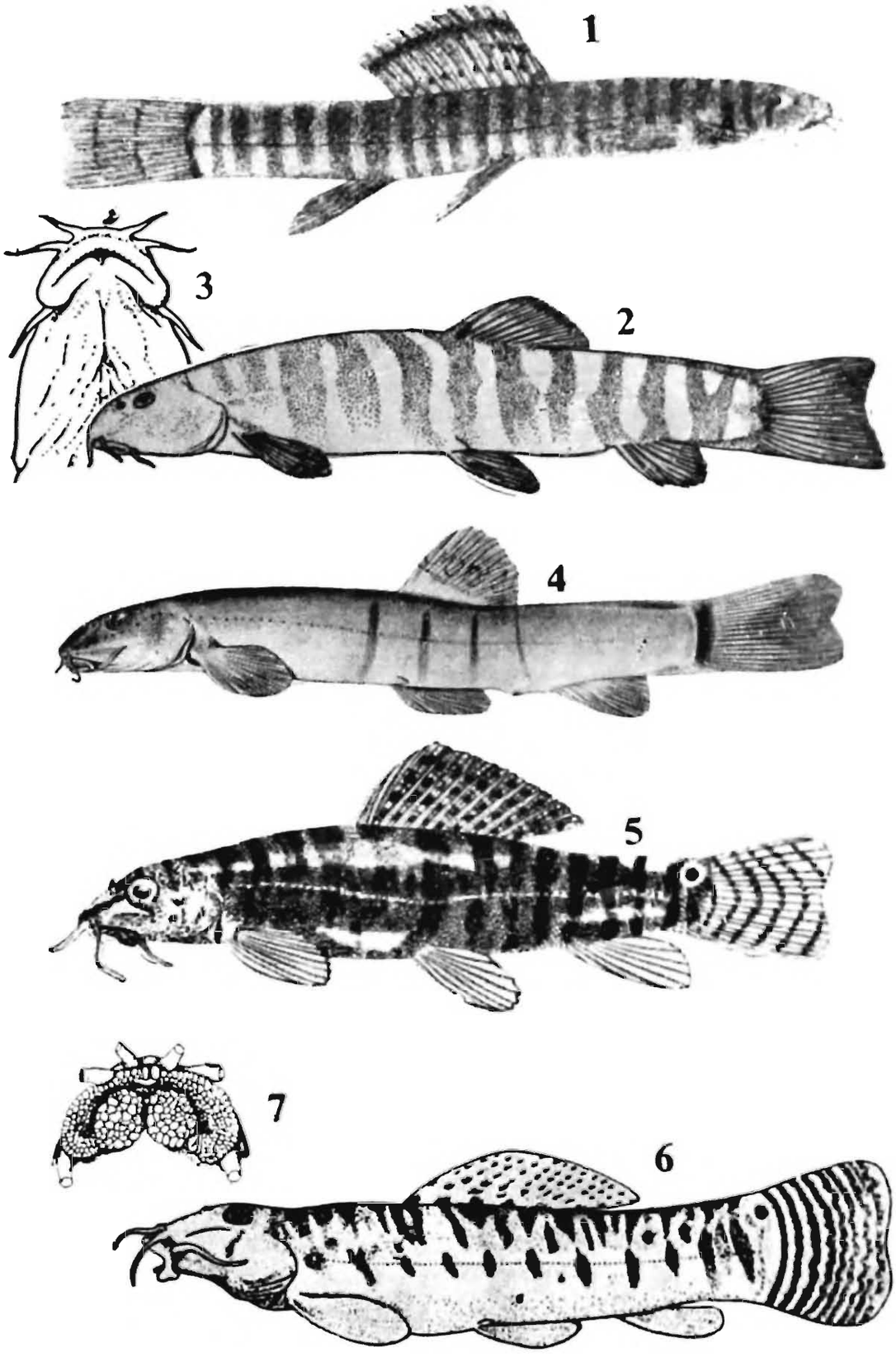
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Plate VI

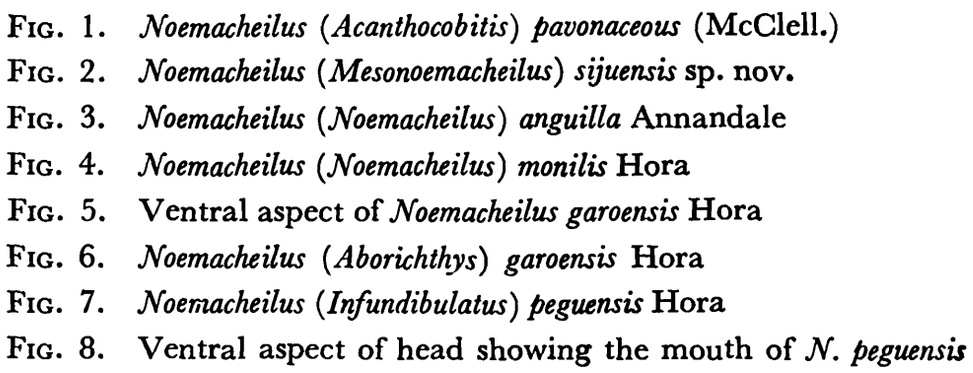

Fig. 1. *Noemacheilus* (*Acanthocobitis*) *pavonaceous* (McClell.)
Fig. 2. *Noemacheilus* (*Mesonoemacheilus*) *sijuensis* sp. nov.
Fig. 3. *Noemacheilus* (*Noemacheilus*) *anguilla* Annandale
Fig. 4. *Noemacheilus* (*Noemacheilus*) *monilis* Hora
Fig. 5. Ventral aspect of *Noemacheilus garoensis* Hora
Fig. 6. *Noemacheilus* (*Aborichthys*) *garoensis* Hora
Fig. 7. *Noemacheilus* (*Infundibulatus*) *peguensis* Hora
Fig. 8. Ventral aspect of head showing the mouth of *N. peguensis*

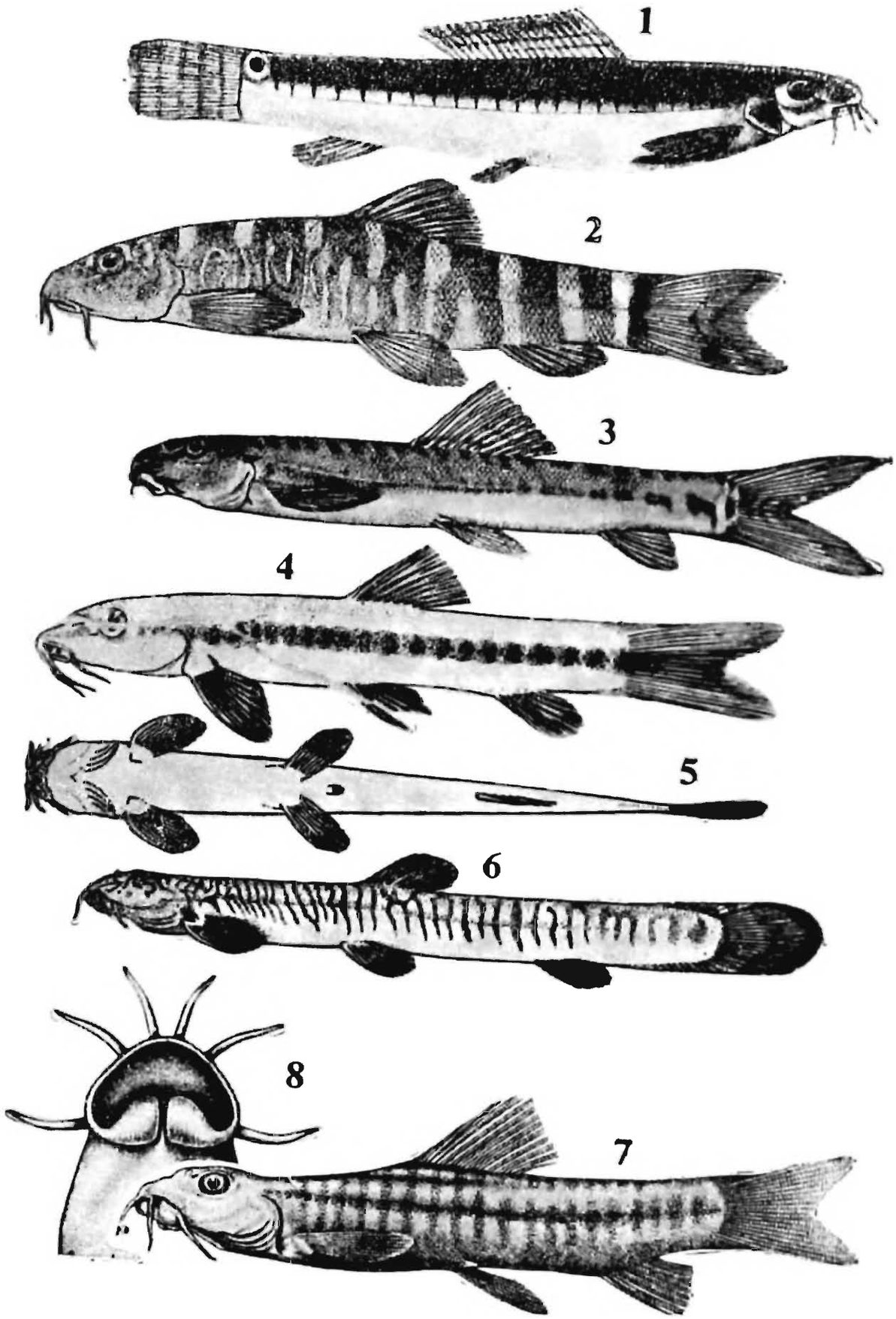
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Plate vii

Fig. 1. *Noemacheilus* (*Indoreonectes*) *evezardi* Day

Fig. 2. Ventral aspect of head of *N.* (*Indoreonectes*) *evezardi* Day

Fig. 3. *Noemacheilus* (*Petruichthys*) *brevis* Boulenger

Fig. 4. Ventral aspect of head of *N.* (*Petruichthys*) *brevis* Boulenger

Fig. 5. *Noemacheilus* (*Aborichthys*) *kempi* (Chaudhuri)

Fig. 6. *Noemacheilus* (*Aborichthys*) *elongatus* (Hora)

Fig. 7. *Triplophysa marmoratus* (Heckel)

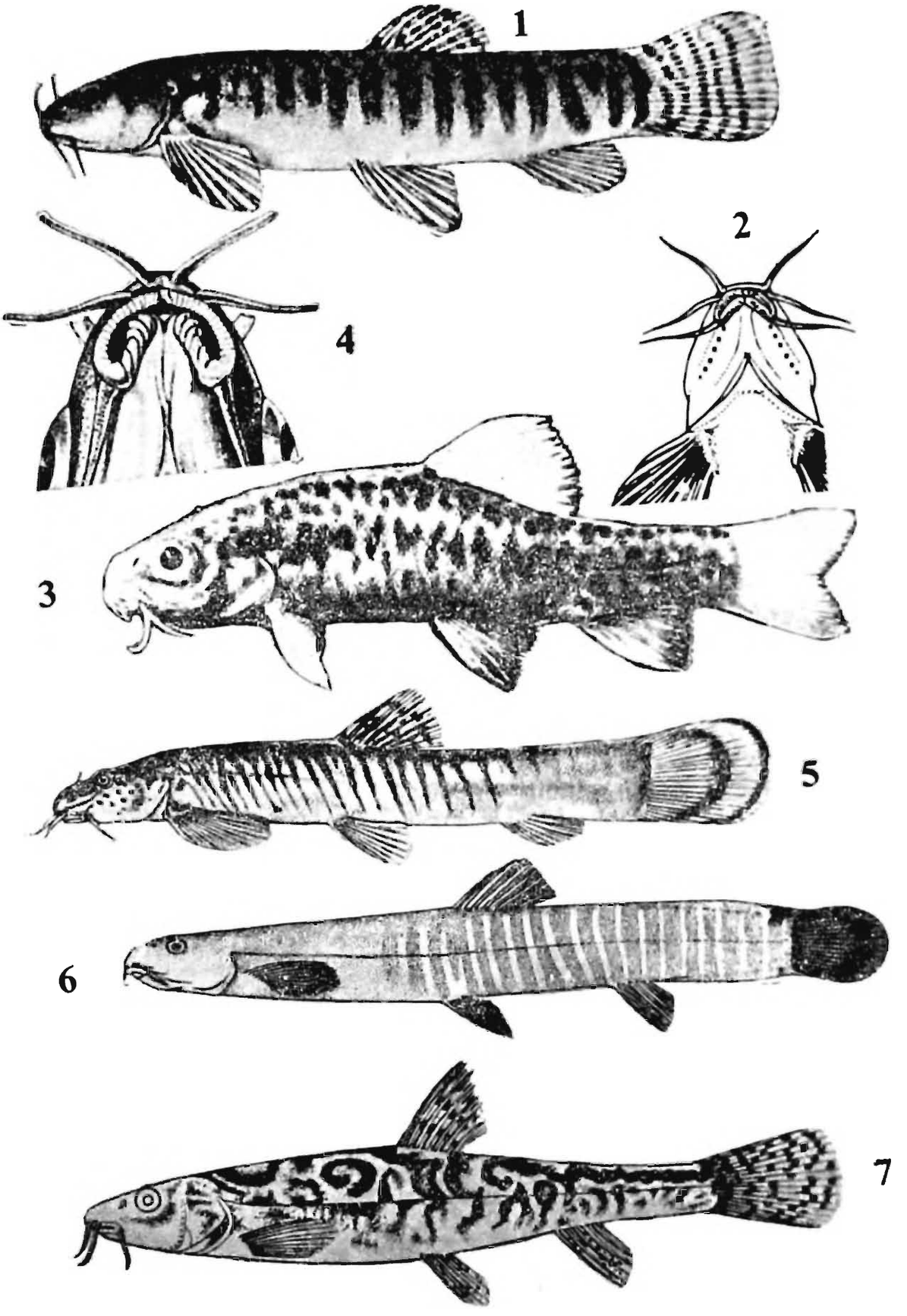
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Plate VIII

Fig. 1. *Triplophysa yasinensis* (Alcock)
Fig. 2. *Triplophysa choprai* (Hora)
Fig. 3. *Triplophysa stoliczkae* (Steind)
Fig. 4. *Triplophysa microps* (Steind)
Fig. 5. *Triplophysa tenuicauda* (Steind)
Fig. 6. *Triplophysa griffithi* (Günther)
Fig. 7. Ventral aspect of head of *T griffithi*
Fig. 8. *Homaloptera bilineata* Blyth

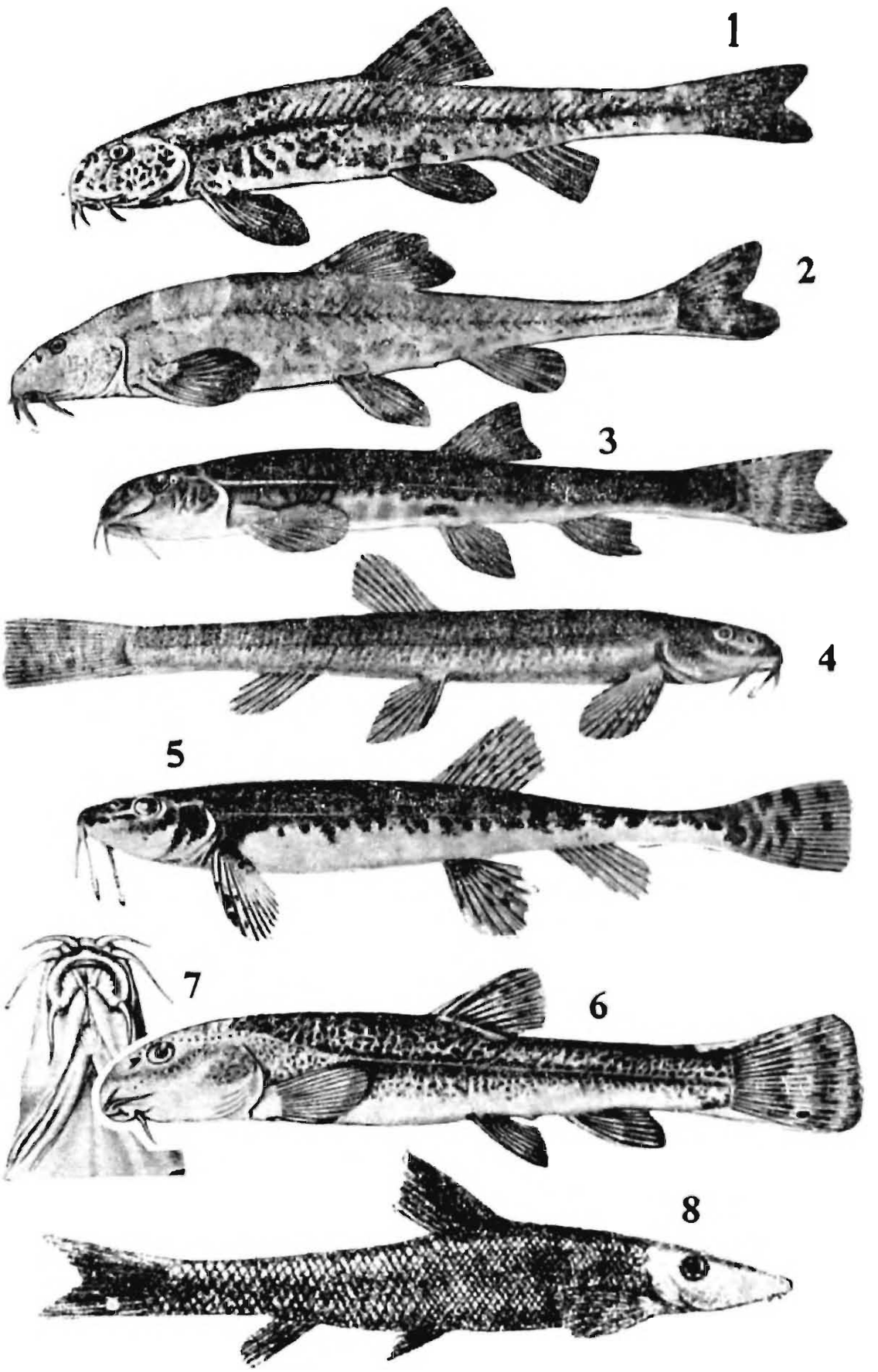
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Plate IX

Fig. 1. *Homaloptera montana* Herre

Fig. 2. *Homaloptera rupicola* (Prashad & Mukerji)

Fig. 3. *Balitora brucei* Gray

Fig. 4. Ventral aspect of head of *B. brucei*

Fig. 5. *Bhavania australis* (Jerdon)

F.G. 6. Ventral aspect of head of *B. australis*

Fig. 7. *Travancoria jonesi* Hora

Fig. 8. Ventral aspect of head of *T. jonesi*

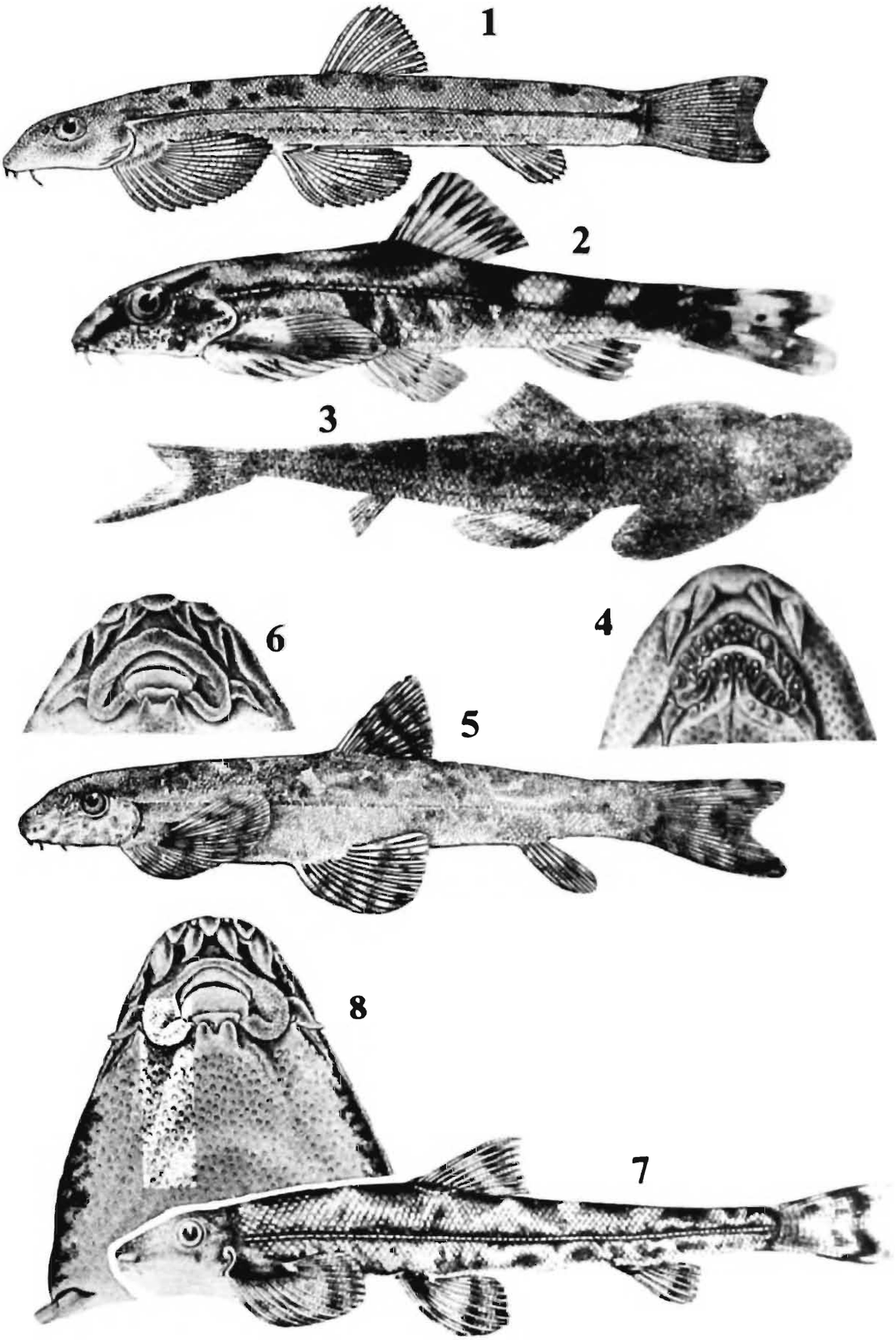
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PLATE X

FIG. 1. *Noemacheilus (Indoreonectes) evezardi* Day from Krishna River, Kurnool.

FIG. 2. *Noemacheilus (Indoreonectes) keralensis* from Pamba River, Kerala.

FIG. 3 & 4. *Noemacheilus denisoni denisoni* Day from Kallar Stream, Mettupalayam, Tamil Nadu.

FIG. 5 & 6. *Noemacheilus denisoni pambaensis* subsp. nov. from Pamba River, Travancore, Kerala.

FIG. 7. *Noemacheilus denisoni mukambbikaensis* subsp., nov. from Kollur River, *Mukambbika,* Karnataka.

FIG. 8. *Noemacheilus nilgiriensis* sp. nov. from Maravakandi Dam (Moyar River basin) Misingudi, Nilgris, Tamil Nadu.

FIG. 9. .*Noemacheilus nilgiriensis* sp. nov. from Pykara Dam outlet, (Moyar River basin) Nilgiris, Tamil Nadu.

PLATE X

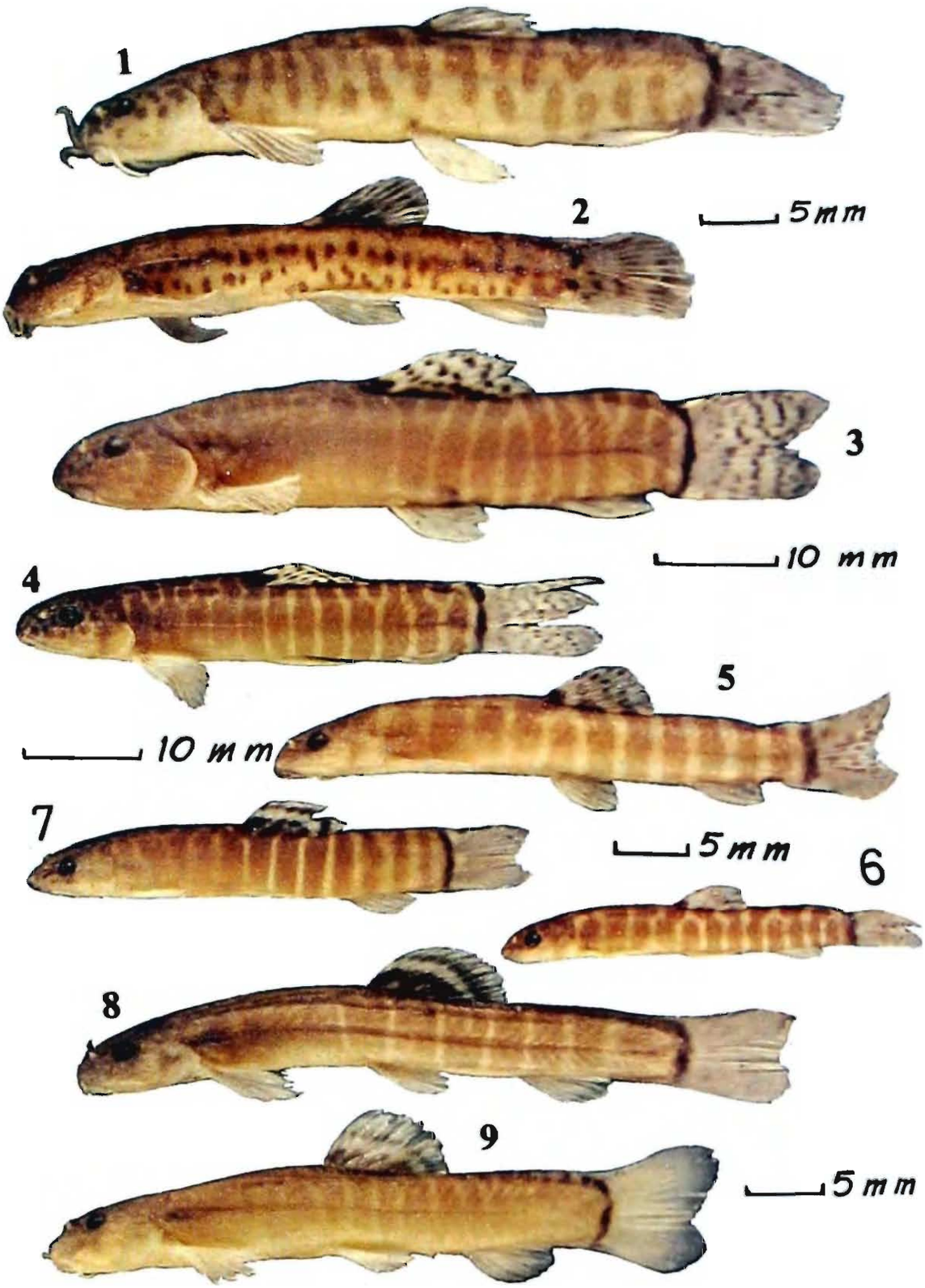

PLATE XI

FIG. 1, 2 & 3. *Noemacheilus semiarmatus* Day from Misinkudi, Nigiris, Tamil Nadu.

FIG. 4 & 5. *Noemacheilus triangularis* Day from Trichur, Kerala.

FIG. 6 & 7. *Noemacheilus montanus* (McClelland) from Giri River, Sadhupur, Himachal Pradesh.

FIG. 8. *Noemacheilus triangularis* from Kunthipuzha River, Silent Valley, Palghat Dt. Kerala.

FIG. 9. *Noemacheilus guentheri* Day from Hati Hola at Mokotlu, 12 km from Mercara, Karnataka.

PLATE XI

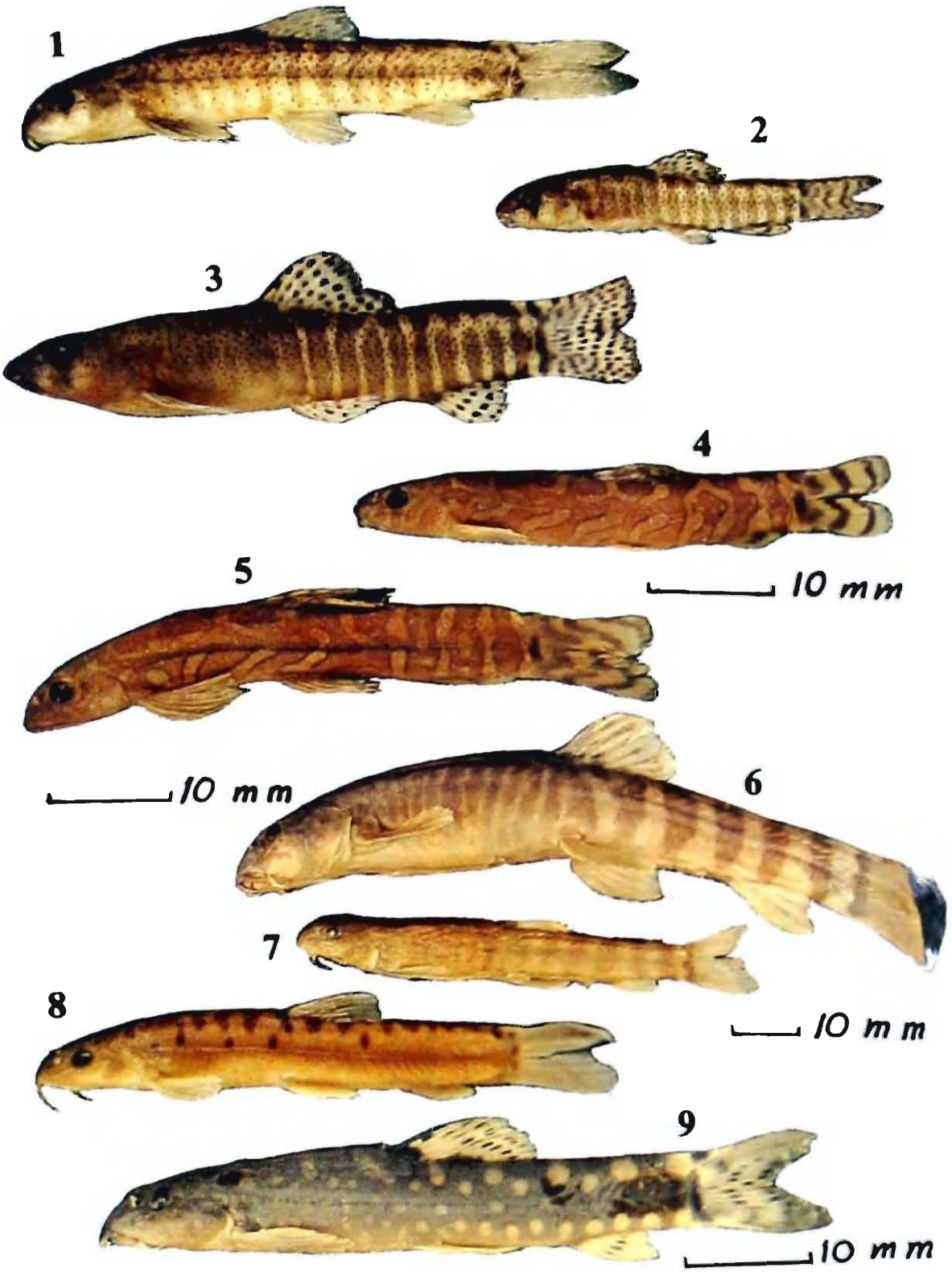

PLATE XII

FIG. 1. *Noemacheilus (Noemacheilichthys) ruppelli* (Sykes) from Simoga, Karnataka.

FIG. 2. *Noemacheilus (Mesonoemacheilus) reticulofasciatus* Singh & Banarescu from Garo Hills, Meghalaya.

FIG. 3. *Noemacheilus (Schistura) corica* (Ham. Buch.) from Tantepur, Uttar Pradesh.

FIG. 4. *Noemacheilus (Schistura) manipurensis* Hora from Kiphir, Nagaland.

FIG. 5. *Noemacheilus (Schistura) barapaniensis* sp. nov.

FIG. 6. *Noemacheilus (Schistura) gangeticus* sp. nov. from Srinagar, Garhwal, Uttar Pradesh.

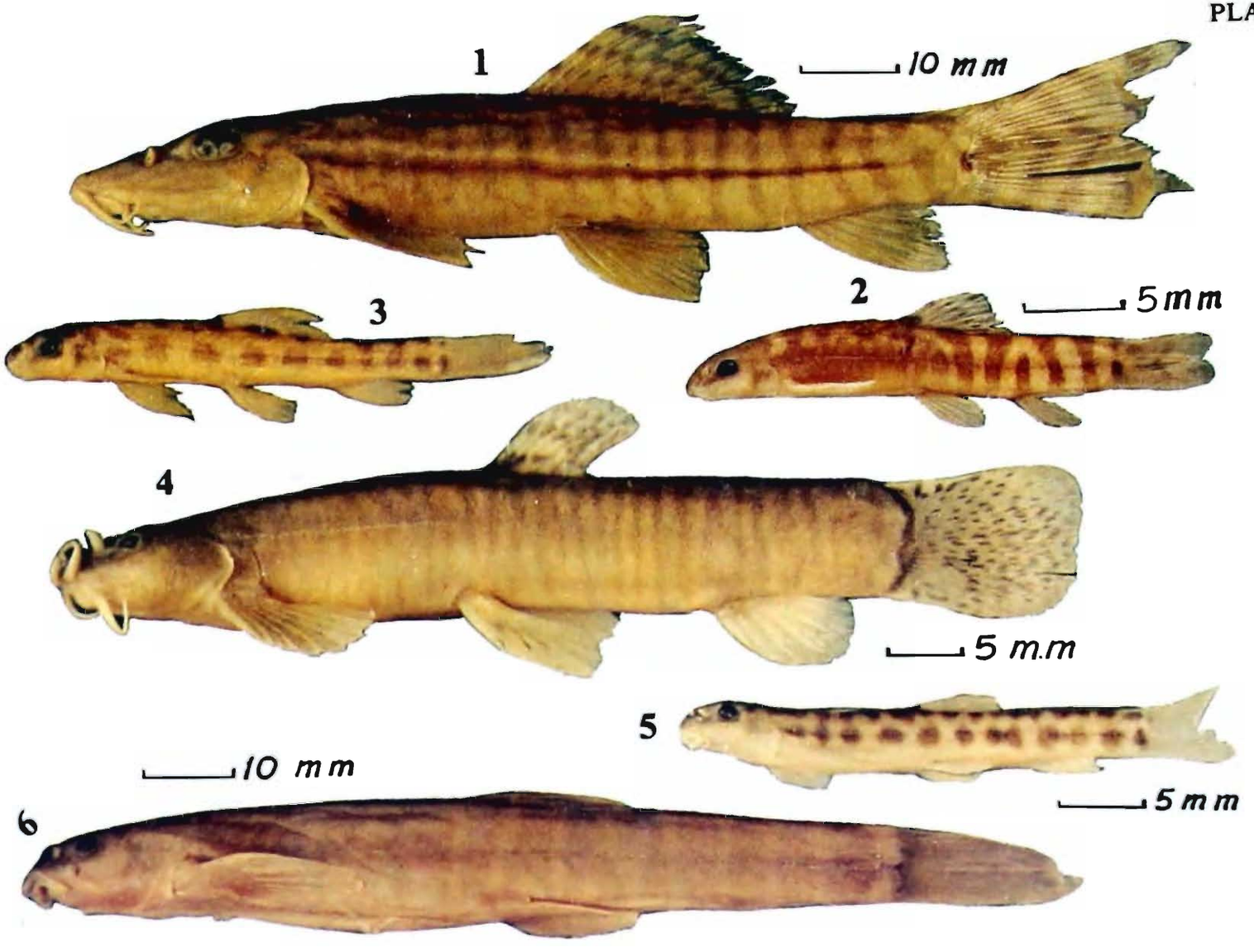
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PLATE XIII

FIG. 1. *Noemacheilus (Acanthocobitis) botia* from Panchkula, Chandigarh, Punjab.

FIG. 2 & 3. *Noemacheilus (Schistura) sikmaiensis* Hora from Meghalaya, Gara Hills.

FIG. 4 & 5. *Noemacheilus (Schistura) beavani* Günther from the Bagmati River, 5 miles down Pashpathinath temple, below Katmandu, Nepal.

FIG. 6 & 7. *Noemacheilus (Schistura) rupecola* (Mc Clell.) from Dehra Dun, U.P.

FIG. 8 & 9. *Noemacheilus (Schistura) scaturugina* from Tista, Darjeeling.

FIG. 10. *Noemacheilus)Schistura) savona* from Dehra Dun.

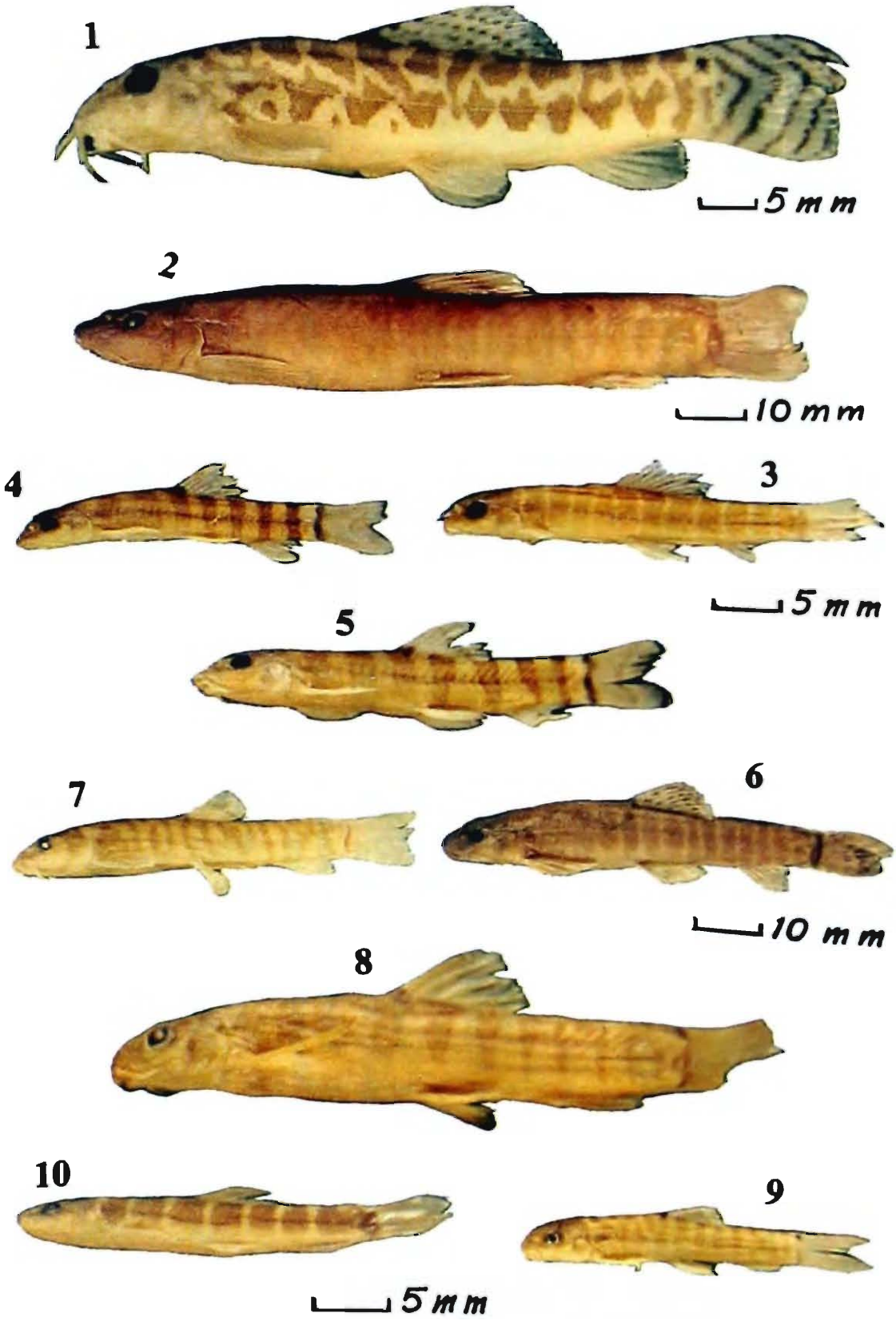
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PLATE XIV

FIG. 1. Lateral view of *Noemacheilus (Schistura) nilgiriensis* sp. nov. from a stream at Nadgani, Nilgiri District, Tamil Nadu.

FIG. 2. Ventral aspect of the above.

FIG. 3. Lateral view of *Noemacheilus (Schistura) semiarmatus* Day from Vaithri River, Wyanad, Calicut District, Kerala.

FIG. 4. Lateral view of *Noemacheilus (Mesonoemacheilus) pulchellus* Day from Bhavani River, Mettupalayam, Tamil Nadu.

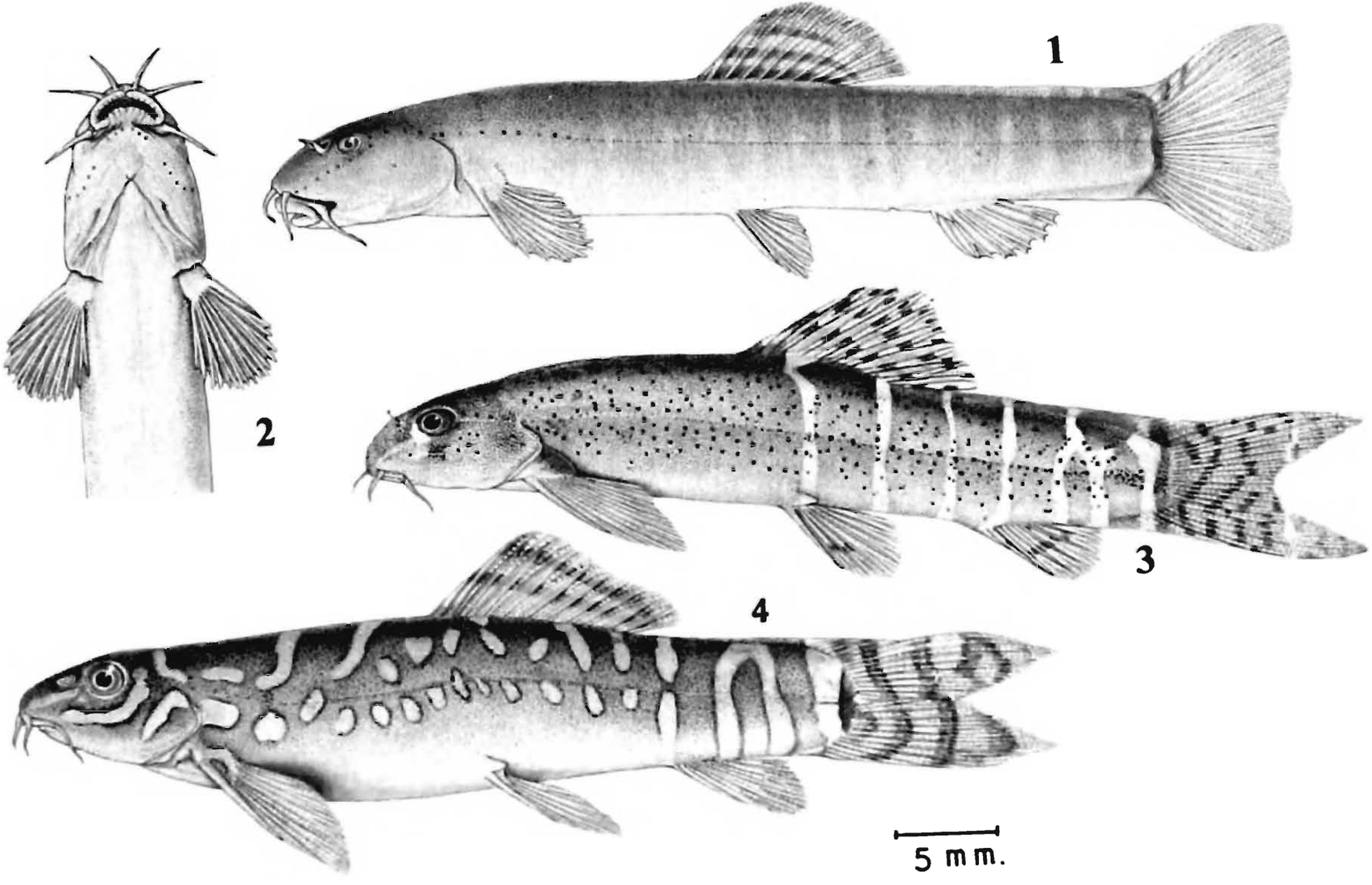
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PLATE XV

FIG. 1. *Noemacheilus (Acanthocobitis) botia* (Ham. Buch.) from Naga Hills, Nagaland.

FIG. 2. *Noemacheilus (Acanthocobitis) botia* (Ham. Buch.) from Kangra Valley, Himachal Pradesh.

FIG. 3. Ventral aspects of the above.

PLATE XV

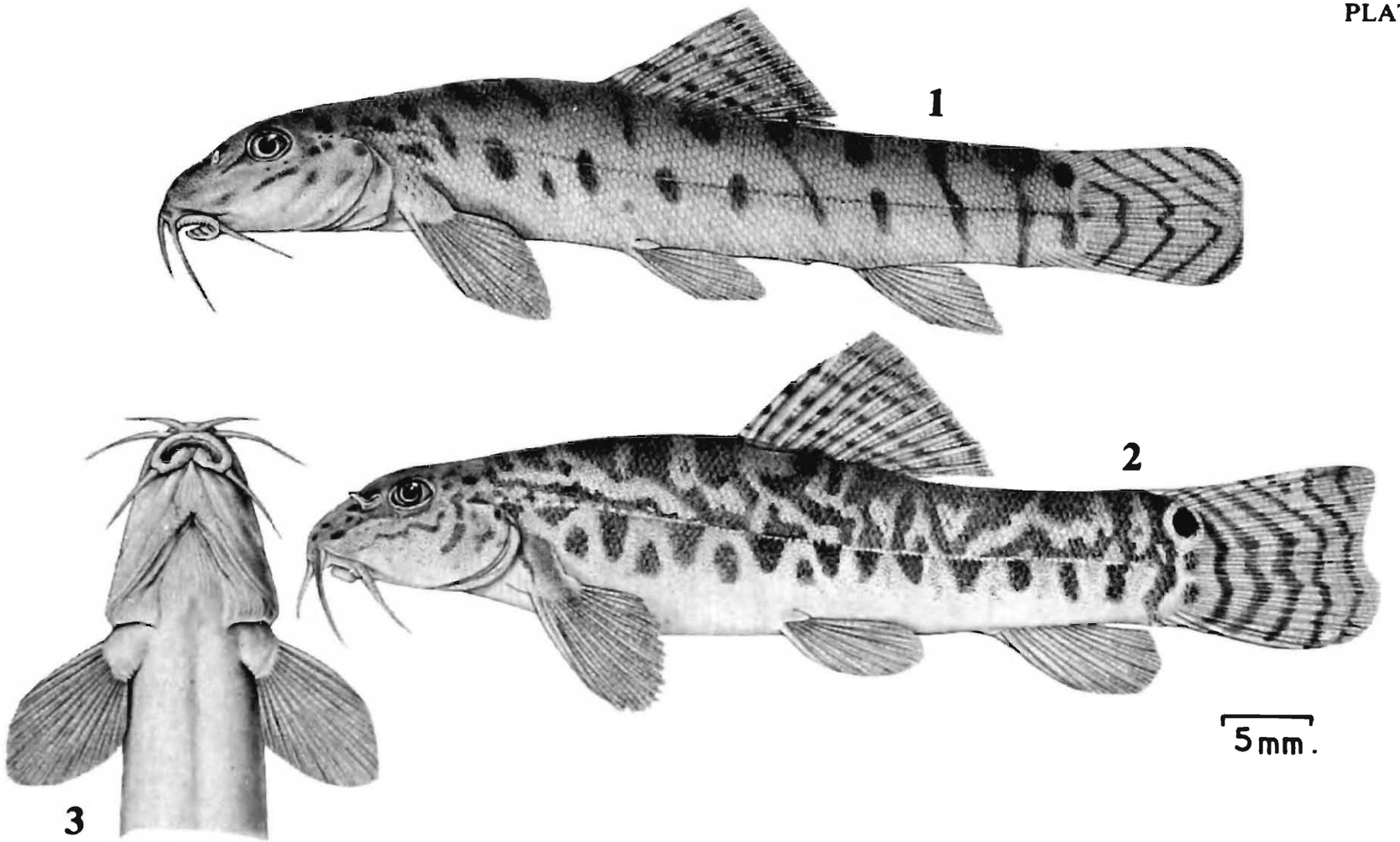


PLATE XVI

FIG. 1. *Noemacheilus singhi* sp. nov. from Kiphire, Nagaland.

FIG. 2. *Noemacheilus hemachalensis* sp. nov. from Kangra Valley.

FIG. 3. *Noemacheilus horai,* Menon from Tani River, Jammu.

FIG. 4. *Noemacheilus punjabensis* Hora from Poonch, J & K.

FIG. 5. *Noemacheilus pulchellus* Day from Bhavani River, Nilgiris.

FIG. 6. *Noemacheilus denisoni dayi* Hora from Hazaribagh, Chota-Nagpur.

FIG. 7. *Noemacheilus vinciguerrae* Hora from Manipur.

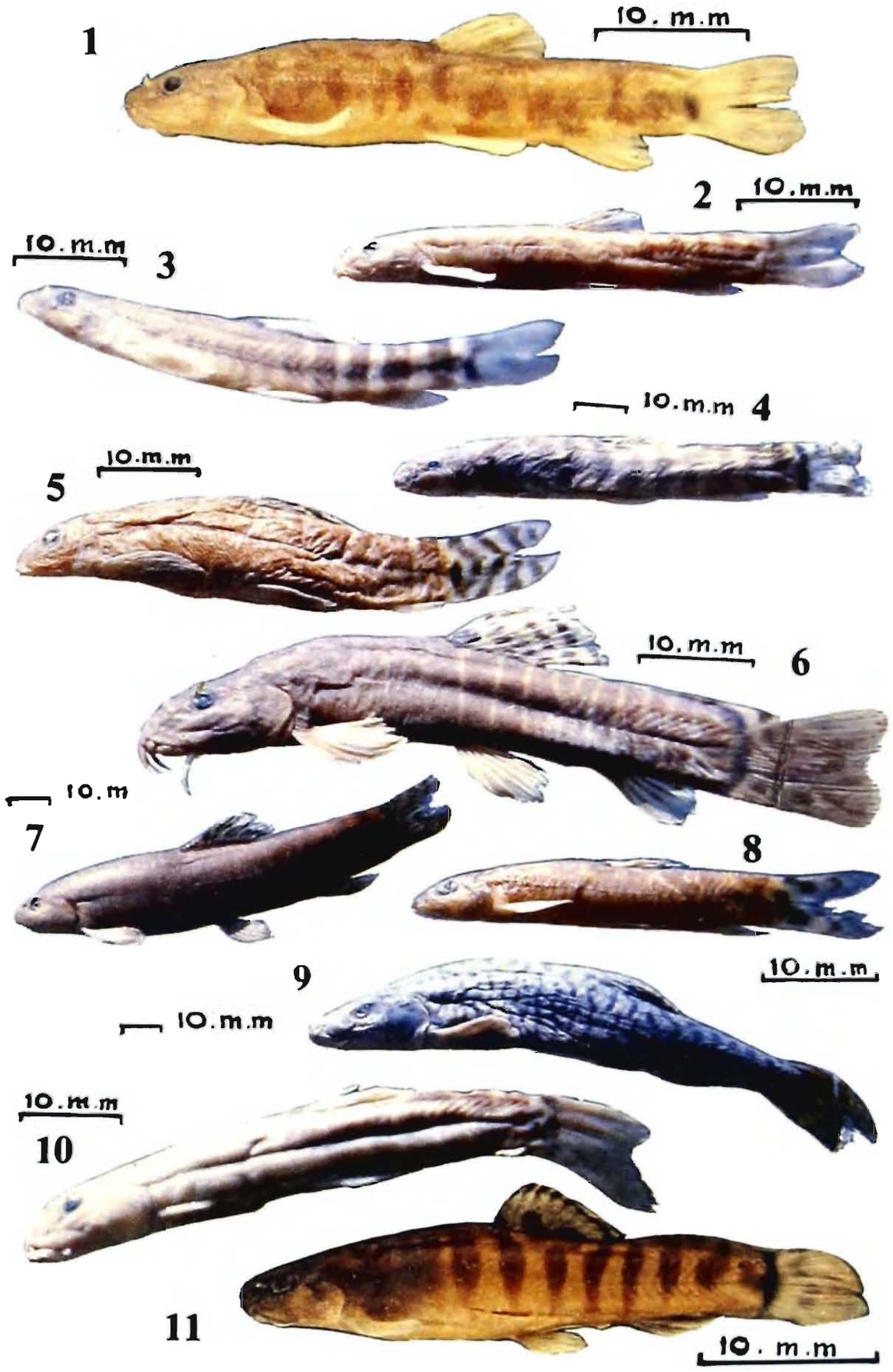
FIG. 8. *Noemacheilus petrubanarescui* Menon from Dharmasthala.

FIG. 9. *Triplophysa shehensis* (Tilak) from Ladakh.

FIG. 10. *Noemacheilus arunachalensis,* sp. nov. from Tirap Dt., Arunachal Pradesh.

FIG. 11. *Noemacheilus kodaguensis,* sp. nov. from Kotu Hola, Mercara.

PLATE XVI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