

**TAXONOMIC STATUS AND PHYLOGENETIC RELATIONSHIP
OF LITTLE KNOWN HILL STREAM FISH OF THE GENUS
PARAPSIORHYNCHUS (CYPRINIFORMES)***

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INTRODUCTION

The fish fauna of hill streams offer us an unique opportunity for studying some of the most remarkable adaptive designs amongst fishes. *Parapsilorhynchus* is one such fish, found in the fast flowing streams of the western ghats and the Satpuda hill ranges. This genus is remarkable in possessing a combination of characters which in turn form the family diagnostic characters of Cyprinidae, Psilorhynchidae, Homalopteridae and Gyriinocheilidae, besides having its own diagnostic characters. A callous pad present on the ventral side behind the lower lip is a very distinctive feature of this genus.

Annandale (1919) originally described the species *Psilorhynchus tentaculatus* from the hills of the Western ghats. Hora (1920) distinguished this species from other species of *Psilorhynchus* in the presence of a pair of barbels, lower lip bilobed and swim bladder being normal. Later Hora (1921) created a new genus *Parapsilorhynchus* with *Psilorhynchus tentaculatus* as the type species with distinguishing characters such as presence of two blunt cylindrical barbels on the snout, cyprinid type swim bladder and a characteristic upper lip with minute tubercles and with a rudimentary disc behind the lower lip. Later Hora (1925) elevated the genus *Psilorhynchus* into family Psilorhynchidae but the position of the genus *Parapsilorhynchus* was not discussed, obviously retaining it in the subfamily Cyprininae of family Cyprinidae. Yiyu (1981) considered it as a subfamily of Cyprinidae. The genus *Parapsilorhynchus* is known by three species viz., *P. tentaculatus* Annandale, *P. prateri* Hora & Misra and *P. discophorus*. Hora (1925) had considered *P. discophorus* as a synonym of *P. tentaculatus* but a close study of a series of *P. discophorus* specimens obtained from Koyna river (Western ghats) has shown that this species has its own specific characters distinct from *P. tentaculatus* (Yazdani & Rao 1977). The authors have obtained specimens of *P. tentaculatus* from around Pune, of *P. prateri* from Trimbak, Nasik and *P. discophorus* from Koyna river about 20 km. west of Mahabaleshwar. A study of these specimens made the authors realise the necessity to have a critical look into the taxonomic position of this genus vis-a-vis the related genera viz., *Psilorhynchus*, *Garra*, *Crossocheilus* and *Labeo*.

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As taxonomic studies are usually based on external morphological characters which are sometimes not sufficient enough (Regan 1911), osteological work has also been used to supplement the external characters.

MATERIAL AND METHODS

The present investigation is based on the comparative study of the following specimens :

Family CYPRINIDAE

Subfamily CYPRININAE

Labeo dero (Ham), *Parapsilorhynchus tentaculatus* Annandale—2 specimens

Subfamily GARRINAE

Crossocheilus latius (Ham)—2 specimens

Garra mullya (Sykes)—2 specimens

Subfamily PSILORHYNCHINAE

Psilorhynchus balitora (Ham)—1 specimen

Alizarin preparations were made of the above number of specimens for studying the osteological details. The figures were drawn with the help of a camera lucida. The osteological characters of subfamilies Rasborinae, Schizothoracinae and Cultrinae of the family Cyprinidae have not been taken into account as they do not come under the purview of this study.

OBSERVATIONS

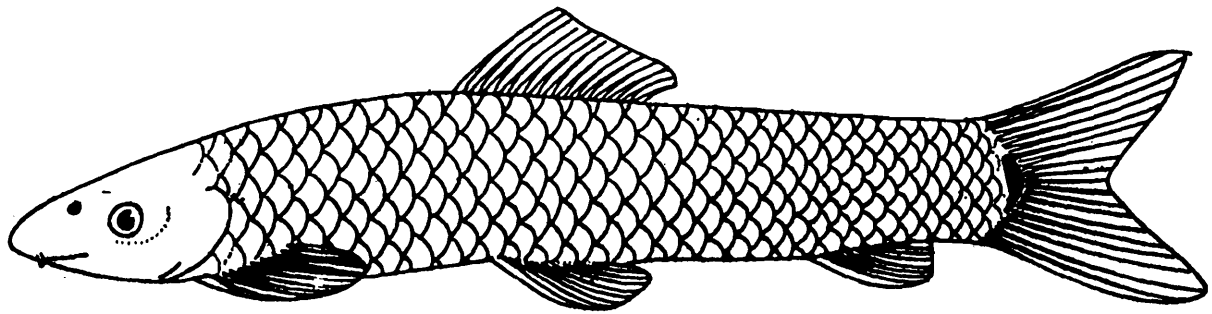
In *Parapsilorhynchus* the head is depressed, bearing a pair of rostral barbels. The snout is prominent. The mouth is small, ventral and horizontal (fig. 1). The upper lip is covered by a prominent rostral fold which is fringed. The lower lip is finely papillated. A groove is present round the corners of the mouth which is continued anteriorly round the outer margin of the rostral fold. Behind the lower lip is a callous area of skin. The ventral surface is flattened especially the anterior half of the body. Paired fins are horizontally placed, flattened and fan shaped. Four anterior rays of the pectoral are simple. The body is covered with small cycloid scales, except on the head and ventral surface. The gill openings are restricted to the sides. The gill rakers are absent. Only two pairs of pharyngeal teeth are present.

In all cyprinids the swim bladder lies immediately beneath the vertebral column and is an elongated structure consisting of anterior and posterior chambers (fig. 2). The two chambers are separated by a constriction in between them. In *Parapsilorhynchus* the swim bladder is reduced while in *Crossocheilus*, *Garra* and *Labeo* it is well developed. In *Psilorhynchus* it is generally very much reduced and the anterior chamber is partly or wholly covered with a thick fibrous coat.

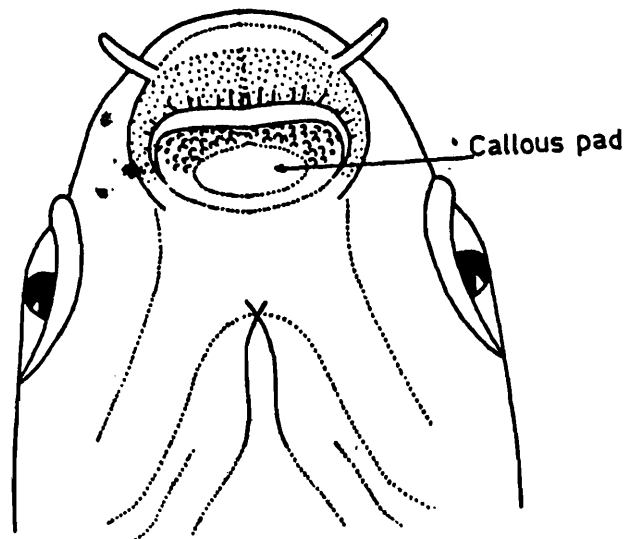
Some of the important osteological characters of *Parapsilorhynchus* are compared with those of related genera (Table 1, fig. 3 & 4).

Table 1

Osteological characters	Parapsilorhynchus	Subfamily : Garrinae <i>Crossocheilus Garra</i>		Subfamily : Psilorhynchinae <i>Psilorhynchus</i>	Subfamily : Cyprininae <i>Labeo</i>
Skull	Dorsoventrally flattened	Dorsoventrally flattened	Dorsoventrally flattened	Dorsoventrally flattened	not flattened
Supraethmoid notch	absent	absent	absent	absent	present
Ethmoid	Depressed	depressed	depressed	depressed	not depressed
Lateral process of ethmoid	Bifid	bifid	bifid	bifid	not distinctly bifid
Location of Preethmoid Prevomer	In anterior part	anterior part	anterior part	anterior part	posteriolateral part
Frontals	Broad with short posterior process	with blunt process	long process	long process	blunt process
Infraorbitals	long & narrow	long & narrow	long & narrow	long & narrow	not long & narrow
Parasphenoid	four	five	six	five	five
	Anterior broad posterior not forked	anterior slender posterior forked	anterior broad posterior not forked	anterior slender posterior forked	anterior slender posterior not forked
Interorbital septum					
Basioccipital	absent	present	absent	absent	present
	with very long post. process	very long post. process	very long post. process	short process	long with bifid tip
Urohyal					
Coracocleithral fenestra of Pectoral girdle	vertical wing extended much reduced	not extended much reduced	extended much reduced	not extended much reduced	extended not reduced
lateral fenestra of Pelvic girdle	short	long	short	short	long



A



B

Fig. 1. A. Lateral view of *P. tentaculatus* Hora
B. Anterior part of ventral surface of head.

The ethmoid region

The skull is dorsoventrally depressed in *Parapsilorhynchus*, *Psilorhynchus*, *Garra* and *Crossocheilus* while in *Labeo* it is not so. The premaxilla in all the five genera studied (*Parapsilorhynchus*, *Garra*, *Crossocheilus*, *Labeo* & *Psilorhynchus*), shows the characteristic *cyprinid* rostral process. In *Parapsilorhynchus* and *Psilorhynchus* the lateral limb of the premaxilla is long and bent at almost right angles. It shows an expanded posterior part. The lateral limb is short in *Crossocheilus* and *Labeo* while it is long in *Garra*. In *Parapsilorhynchus*, the supraethmoid part of the ethmoid possess two wing like extensions lying dorsally over the prominent prevomerine projection. In *Psilorhynchus* the supraethmoid is very broad and extends anteriorly in the form of a projection in the middle. In *Garra* and *Labeo* too the supraethmoid is wide with the prevomer extending considerably in front as a projection, while in *Crossocheilus* it is not so broad, leaving a small gap between the two prevomerine projections. The supraethmoid notch is absent in all except in *Labeo*, the preethmoid occupies a somewhat anterior portion of the prevomer while in *Labeo* it lies posterolateral to the prevomer.

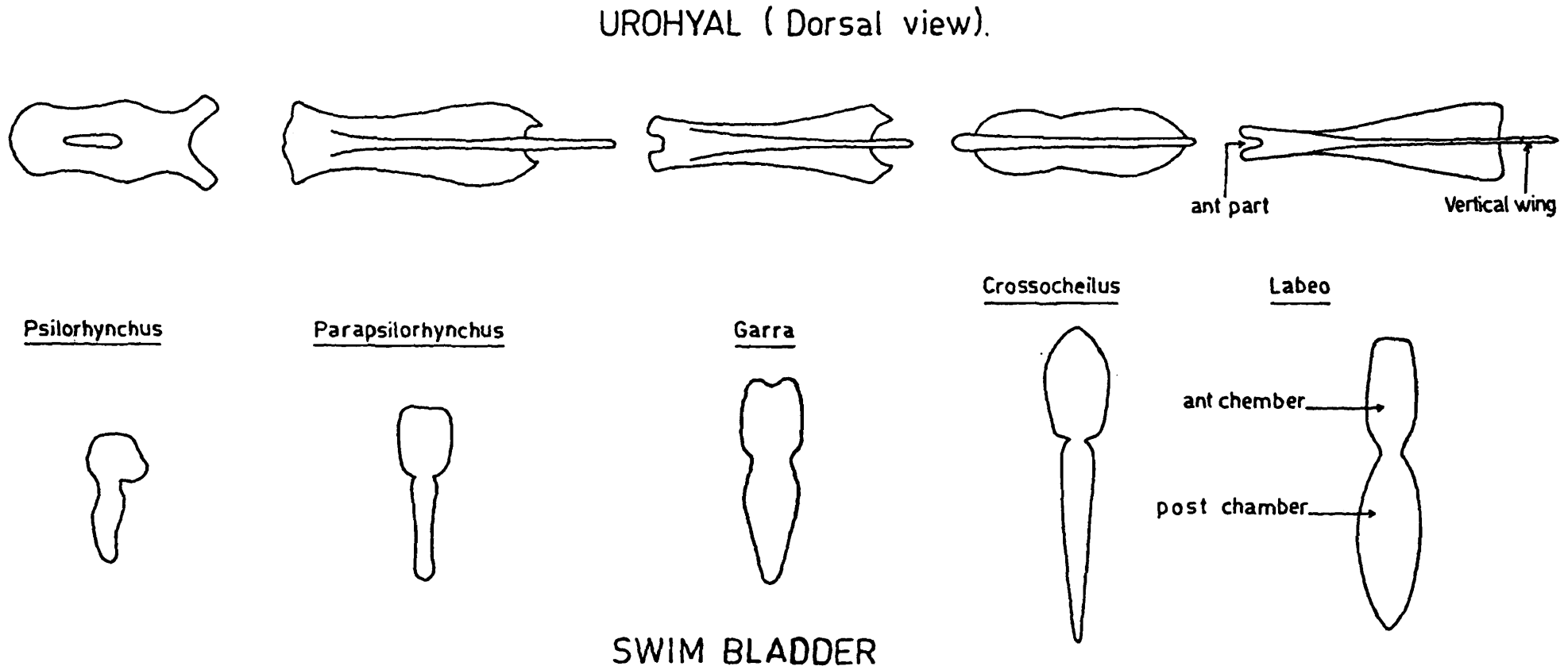


Fig. 2. Swim Bladder of *Parapsilorhynchus*, *Crossocheilus*, *Garra*, *Labeo* and *Psilorhynchus*.

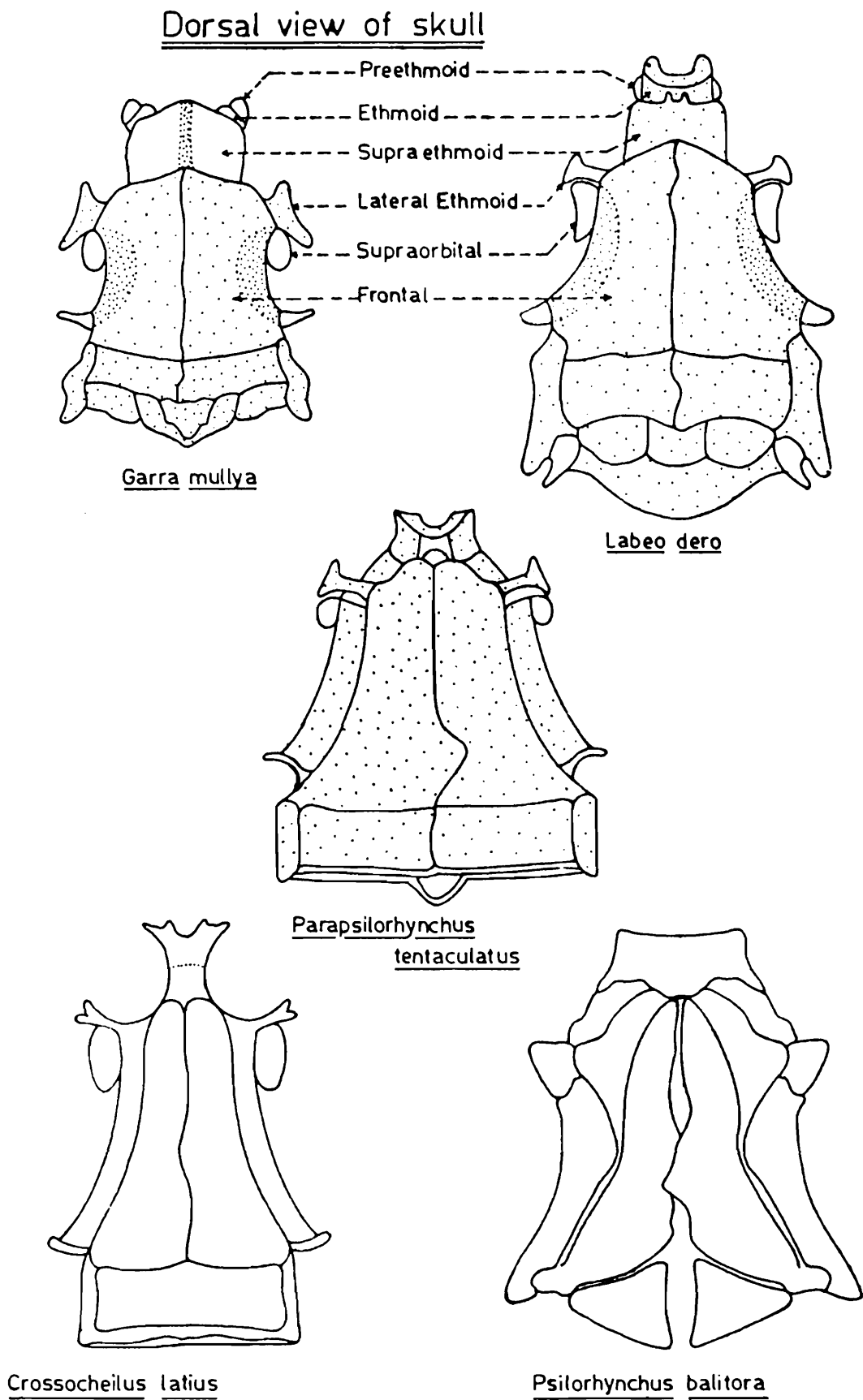


Fig. 3. Dorsal & ventral view of the skull of *Parapsilorhynchus*, *Crossocheilus*, *Garra*, *Labeo* and *Psilorhynchus*.

Dorsal Aspects of Pelvic girdle

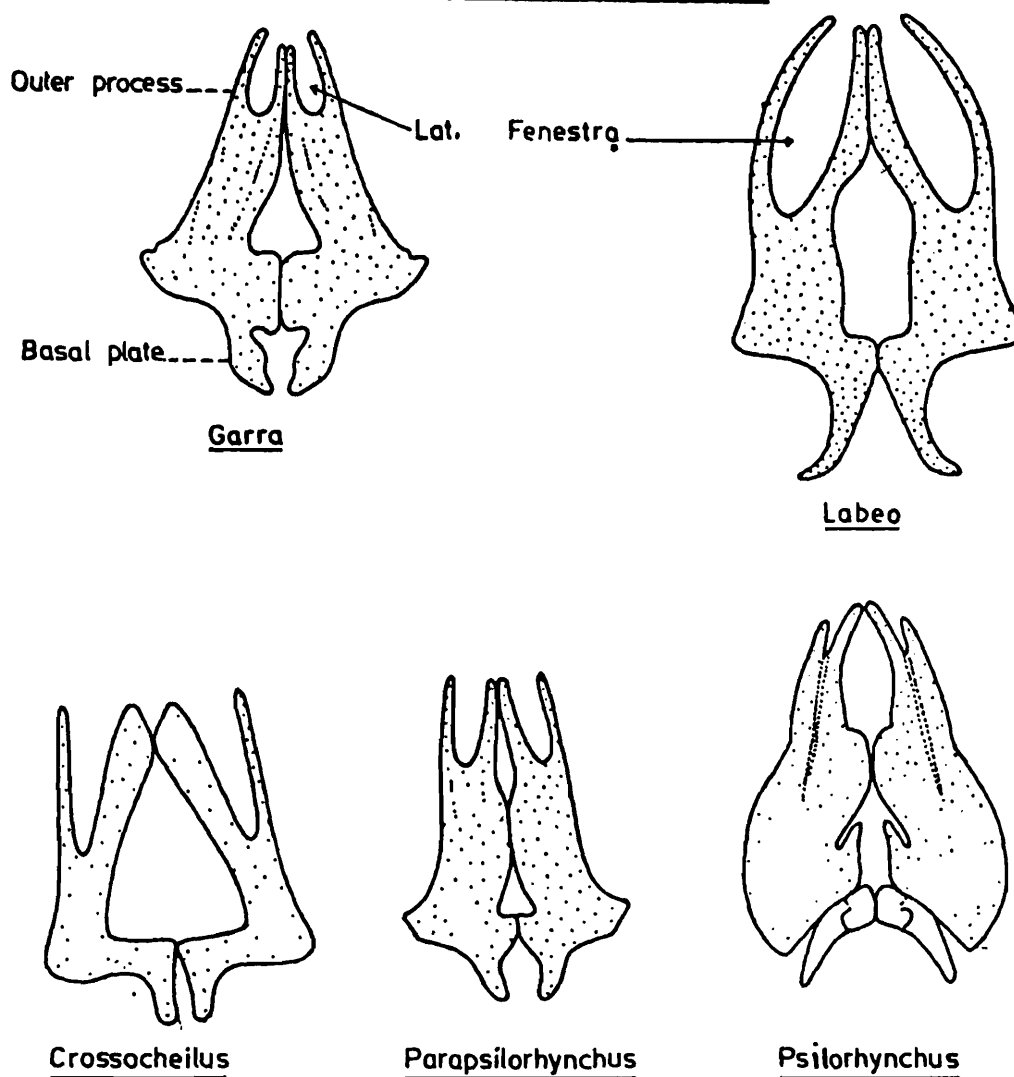


Fig. 4. Urohyal & Pelvic Girdle of *Parapsilorhynchus*, *Crossocheilus*, *Gara*, *Labeo* & *Psilorhynchus*
 pm, premaxilla ; max, maxilla ; mr, median rostral ; et, ethmoid ; pet, preethmoid ; pv, prevomer ; ppv, posterior process of vomer ; se, supraethmoid ; pal, palatine ; sor, supraorbital
 i, first infraorbital ; fr, frontal ; f, fontanel ; na, nasal ; pas, parasphenoid ; pt, pterotic, pro, prootic ; pa, parietal ; epi, epiotic ; eo, exoccipital ; so, supraoccipital ; bo, basioccipital ; So₂-So₆, infraorbitals (2-6) or suborbitals ; pt, post temporal ; php, pharyngeal process ; bp, bony plate.

The prevomer bone is very broad in *Parapsilorhynchus* with a short posterior process. In *Psilorhynchus* it is not as broad but shows a long posterior process. In *Garra* the anterior portion of the prevomer spreads out and there is a long posterior process. In *Crossocheilus* and *Labeo* the anterior portion is not so broad while the posterior portion is blunt.

The Orbital region

In all the genera excepting *Labeo* the frontals are long and narrow. In *Psilorhynchus* alone there is a median fontanel between the two frontals and the posterior edge of the supraethmoid. The orbit is large in *Parapsilorhynchus* and *Psilorhynchus*. Two small supraorbitals are noticed in all the genera studied excepting *Psilorhynchus* where they are completely absent.

In *Parapsilorhynchus*, on either side of the frontals are present 4 infraorbital (suborbitals) bones, while in others it varies from 5 (*Psilorhynchus*, *Crossocheilus*, *Labeo*) to 6 (*Garra*).

The interorbital septum, formed by the orbitosphenoids and the underlying parasphenoid, is present in *Labeo* and *Crossocheilus* while it is absent in the other genera under study. The parasphenoid is prominently forked in *Psilorhynchus* and *Crossocheilus* but it is not so in *Parapsilorhynchus* (and *Labeo* and *Garra*).

The Occipital region

In all the genera studied the exoccipitals form the roof of the foramen magnum, supraoccipital being excluded. The basioccipital shows a pharyngeal process which may be short (*Psilorhynchus*) or long (*Parapsilorhynchus*, *Garra*, *Crossocheilus* and *Labeo*). In *Labeo* the long pharyngeal process of the basioccipital tapers into a bifid tip.

The Urohyal

The shape of this bone differs in all the genera studied. The vertical wing of the urohyal extends posteriorly in *Parapsilorhynchus*, *Garra* and *Labeo* while in *Psilorhynchus* and *Crossocheilus* it is very much reduced (fig. 4).

The Pelvic Girdle

It comprises of two basipterygia, each consisting of a bony plate with two anterior processes (an outer & inner) and a horse shoe shaped posterior process. In *Parapsilorhynchus*, *Crossocheilus*, *Garra* and *Labeo* the two anterior processes of basipterygia are long and slender. Their anterior ends are wide apart. In *Psilorhynchus*, unlike others, the basipterygia are completely united with each other and the lateral & median fenestrae are reduced. In *Parapsilorhynchus* the median fenestra is reduced.

DISCUSSION

Fishes of the genus *Parapsilorhynchus* possess a peculiar combination of characters which they share with other Cyprinid subfamilies besides having their own distinctive characters. In order to assess the systematic position of *Parapsilorhynchus* it is, therefore, necessary to first find out the characters it shares with subfamilies Cyprininae, Garrinae & Psilorhynchinae and then its distinctive characters.

Parapsilorhynchus exhibits the following characters which is common to subfamily Cyprininae : premaxilla with a rostral process : median rostral with two dorsolateral processes ; the pre-ethmoid articulates with the palatine ; lateral ethmoid without prominent lateral processes ; supraoccipital does not roof the foramen magnum and exoccipitals cover it dorsally ; basioccipital with prominent pharyngeal process vertical wing of urohyal extended.

Parapsilorhynchus is distinguished from cyprininae in possessing more than one undivided pectoral ray ; presence of a callous thickening behind the lower lip ; typical body shape with paired fins horizontally placed ; gill openings restricted to

sides ; skull being dorsoventrally depressed ; supraethmoid notch absent ; pre-ethmoid anterior in position ; prevomer with short posterior process ; parasphenoid broad anteriorly ; interorbital septum absent ; frontals long and narrow ; lower number of infraorbital bones ; pharyngeal process of basioccipital without bifid tip coracocleithral fenestrae of pectoral girdle greatly reduced ; lateral and median fenestrae of the pelvic girdle reduced.

Parapsilorhynchus shows certain characters which are in common with subfamily Garrinae, viz., spatulate body shape ; paired fins horizontally placed pectorals possessing broader base ; skull dorsoventrally flattened ; supraethmoid notch absent ; basioccipital with long posterior process ; vertical wing of urohyal extended parasphenoid not forked.

Parapsilorhynchus differs from subfamily Garrinae in possessing a callous thickening behind the lower lip (regular muscular disc in *Garra*) ; gill openings extending upto pectoral fins ; prevomer with a short process ; parasphenoid not forked ; lower number of infraorbital bones ; absence of interorbital septum.

Parapsilorhynchus exhibits the following characters common in subfamily Psilorhynchinae ; large supraethmoid immovably articulated with the frontals ; pre-ethmoid articulates with the palatines ; premaxilla with a rostral process ; exoccipitals form the roof of foramen magnum ; basioccipital with bony plate and pharyngeal process.

From subfamily Psilorhynchinae it differs in possessing a pair of barbels ; two rows of pharyngeal teeth ; presence of callous thickening behind the lower lip ; under lip with fringed labial fold ; origin of dorsal fin almost opposite to that of the ventral fin ; short posterior process of prevomer ; absence of median ethmoid process ; absence of fontanel ; presence of supraorbital ; wing of urohyal extended ; elongated swim bladder not covered with a fibrous coat and in the number of infraorbital bones.

Parapsilorhynchus has its own distinctive characters not found in the related subfamilies : presence of a characteristic callous thickening on the ventral side, behind the lip ; presence of two blunt barbels on the snout ; gill openings restricted to sides (upto Petoral fin base) ; lesser number (4) of infraorbital bones ; absence of gill rakers.

The features mentioned above are sufficiently distinctive to warrant the separation of *Parapsilorhynchus* from subfamily cyprininae to a rank of a subfamily in itself.

DISTRIBUTION AND EVOLUTION

The genus *Parapsilorhynchus* has a restricted distribution mainly occurring in the Western ghats and the Satpuda hill ranges. It has also been recorded from the Balladila ranges of Bastar (M.P.) by Hora (1938). He also expressed the view that during the earlier geological period the Balladila ranges formed a part of the Satpudas and probably served as a highway for fish migration. The related genus *Psilorhynchus* occurs in the Himalayan region. Both are typical hill stream fishes. From their general similarities in morphology and habit it appears that both have a common origin and most likely as in the case of all earlier fishes, evolved in the South Chinese region and migrated to the eastern Himalayas and Westward to the Western ghats along the Garo hills-Rajmahal-Vindhya-Satpuda ranges during the

Pleistocene glaciation period when the Garo—Rajmahal gap was elevated and migration was possible for hill stream fishes. After migration the forms that reached the western side have specialised and developed their own characters evolving into a different group whereas those remaining back in the eastern himalayas have evolved into the present day Psilorhynchidae.

SUMMARY

Fishes of the genus *Parapsilorhynchus* Hora are found in the fast flowing streams of the Western ghats and Satpuda hill ranges. This genus is remarkable in possessing a combination of characters which in turn form the family diagnostic characters of Cyprinidae, Psilorhynchidae, Homalopteridae and Gyrinocheilidae, besides having its own diagnostic characters. A study was made on the taxonomic status of this genus vis-a-vis the related genera, viz., *Psilorhynchus*, *Garra*, *Crossocheilus* and *Labeo*. In the light of this study it was seen that its present inclusion in subfamily Cyprininae of the family Cyprinidae is not justified.

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