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ON SEXUAL DIMORPHISM IN *BARILIUS BARNA* HAMILTON (PISCES : CYPRINIDAE)

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INTRODUCTION

Tilak and Jaffer (1982), reported secondary sexual differences in the pectoral girdle and fin of *B. bendelisis* Hamilton but no other species of the genus *Barilius* had so far been known to show such characteristics. Recently, sexually dimorphic characters were observed in the male and the female of *B. barna* in the pelvic region. Apart from this, other differences in the external morphology of the male and the female of this species also show differences. The well-developed pelvic fin should need strong pelvic muscles and hence, the pelvic bones should also show a similar development. Therefore, the external morphology and the pelvic girdle of the male and the female have been thoroughly examined here in a long series of specimens and the sexually dimorphic characters have been described and figured in this communication.

MATERIAL AND METHODS

The material for the present study has been collected form hill-streams along the base of Himalaya or shivalik ranges in Uttar Pradesh. The material under study was collected from a large number of localities. Altogether 120 male and 98 female specimens of different size range were examined, and of these 10 examples of male and 6 of female were dissected for study of osteology of the pelvic region. The pelvic fin alongwith the girdle was removed from the abdominal region with the help of a pair of scissors and treated with 4% Potassium hydroxide solution and stained in alizarin 'S' red in a usual manner.The muscles were carefully removed and the stained girdle and the fins were studied under a low power stereomicroscope. The extent of variation in the morphology of the girdle in different specimens was found to be insignificant. The morphological characters of the bony parts were normal and uniformally similar in the material studied here. The drawings of the bony parts have been prepared with the help of a camera lucida fitted over a low power stereomicroscope.

OBSERVATIONS

External morphology

The scales of the body of the male are tuberculated, there are four or more rows of tubercles on each scale. These tubercles are absent in the female. The snout is also tuberculated both in the male and the female but these tubercles are more prominent in the former.

The body of the male is deeper (being 3.96-4.45 times in total length) against 4.45-4.75 times in the total length of the female.

The shape and configuration of the pelvic fin of the male is significantly different from that of the female. Of the seven branched rays of pelvic fin of the male, the last two (sixth and seventh) are extremely thickened and tend to fuse along their basal part, making the inner end of the fin formidably strong. The other rays of this fin are also thickened. The whole fin has a wider expanse and opens out in the shape of a fin. The rays of the pelvic fin of female are of normal type. The pelvic fin is longer in the male, reaching the origin of the anal fin; its length is contained 1.26-1.33 times in head length, 5.93-6.45 times in total length and 1.00-1.06 times in the distance between the origin of the ventral and anal fins. In the female, the pelvic fin is weaker and smaller. The length of the pelvic fin in female is contained 1.40-1.56 times in head length, 7.37-7.60 in total length and 1.26-1.40 times in the distance between the origins of the ventral and anal fins. This clearly distinguishes the male and the female.

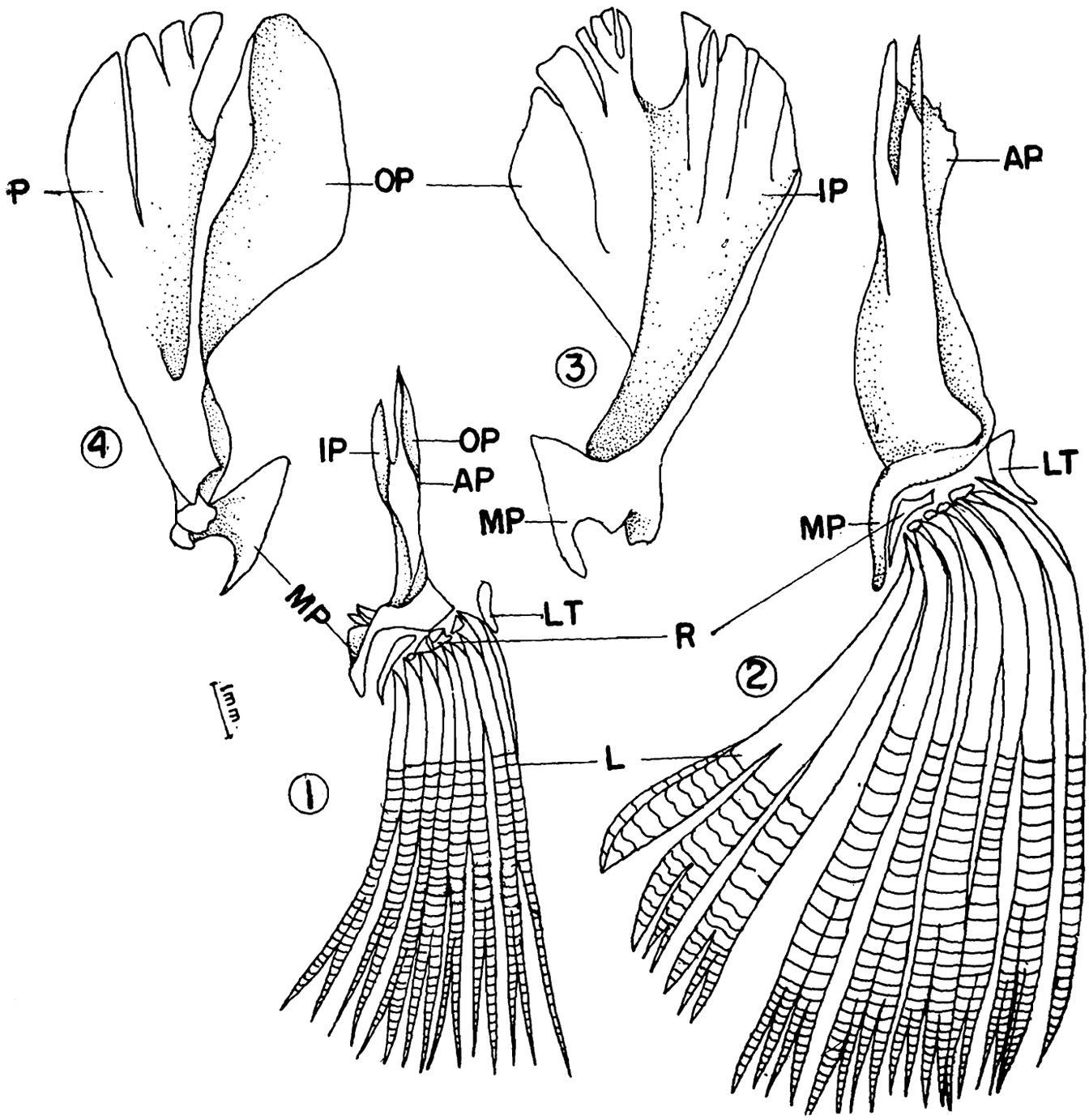
Pelvic girdle :

The pelvic girdle of *B. barna* is basically of a cyprinid type (Howes, 1978, 1980) but is highly modified in the case of male.

In female (fig. 1), the basipterygium is thin and weak with the anterior end (AP, fig.1) bifurcated into outer (OP, fig.1) and inner processes (IP, fig.1). The outer process (OP,fig.1) is slightly longer than the inner (IP,fig.1) and also bears a vertical ridge for attachment of pelvic muscles. The inner process (IP, fig.1) is twisted at the tip. The medial process (MP,fig.1)is prominent and helps in the union of basipterygium of the other side. The anterior process of the basipterygia of the two sides do not meet each other. Attached to the bifid ends of the lepidotrichia (L,fig.1) of the pelvic fin on the one side and the body of the basipterygium of the other, There are six radials (R, fig.1). Five of the radials are small nodular bodies while the sixth and the inner-most radial is bent rod-shaped bone which lies outer to the medial process, probably to afford additional strength to the pelvic symphysis. The laterotrichium (LT, fig. 1) is a small rod-shaped bone attached to the outer side of the base of the first unbranched ray to which is attached another reduced ray of much smaller length.

In the male (fig. 2,3,4), the basipterygium has a formidable growth and the anterior process (AP, fig. 2,3,4) has expanded into a wide plate-like structure. The outer (OP,fig. 2,3,4) and the inner (IP,fig. 2,3,4) processes of the anterior end of the basipterygium are separated by a wide notch.

In life, the anterior end of the basipterygia as well as the medial processes of the two sides remain closely applied to each other. In the dorso-lateral expanded position (fig.3,4), both on the outer as well as the inner surfaces of the basipterygium, there are strong ridges and deep grooves for the accommodation of formidable pelvic muscles. There are only five radials (R, fig. 2) and the laterotrichium (Lt, fig.2) are accordingly enlarged and thickened.



Abbreviations

A P , anterior process; I P, inner process; L, lepidotrichium; L T, laterotrichium; M P, medial process; O P, outer process; R, radial.

Fig. 1. Dorsal view of pelvic girdle of *Barilius barna* (Female). Fig. 2. Dorsal view of pelvic girdle of *Barilius barna* (male). Fig. 3. Medial view of pelvic girdle of *Barilius barna* (male) Fig. 4. Lateral view of pelvic girdle of *Barilius barna* (male).

DISCUSSION

The sexual dimorphism in the genus *Barilius* has earlier been reported in the pectoral girdle of *B. bendelisis* by Tilak and Jaffer (1982) and Tilak and Baloni (in press) and no other species of this genus has been reported to show any kind of sexual dimorphism. The discovery of a trenchant difference in the pelvic fins and the girdles of the male and female of *B. barna* is quite important because it differs from *B. bendelisis* in which a similar difference exists only in the pectoral region. The tubercles on the scales and the snout, the depth of body, the length of pelvic fins and development of the basipterygium and related structure are significantly different in the male and the female of *B.barna*. The formidable expansion of the anterior fan-shaped process of basipterygium of male with prominent ridges and grooves is a development for holding and attachment of strong muscles of the pelvic region. Such strong muscles are required for the movement of heavily built pelvic fin of the male. The thickened pelvic rays, a few of the last rays tending to fuse, forming a strong bony fin is probably used for digging in the sand and mud. It appears that the male digs a burrow during the breeding season for the accommodation of the spawn laid by the female. This heavy development of the pelvic fin is probably because of the special type of parental care assumed by the male. The pelvic fin and the girdle of the females is not so developed because such a demand is not made on this structure of this sex.

The extreme changes in the shape and size of pelvic girdle of the male and the female is brought about due to the secondary sexual characters assumed by the male and they help to distinguish the sexes without any difficulty. Such a change in the body of the male during breeding or near breeding periods of the year is irreversible.

It is a curious fact to record that the exhibition of sexually dimorphic characters is prominently exhibited in the pelvic region of *B.barna* and in the pectoral region of *B. bendelisis*. This shift in the function of the fins of the male of the two species is probably co-related with their mode of living.

Day (1878), while describing *B.barna*, recorded the characters of the young and the adult. The present study indicates that the young of Day (1878) is infact the female and the adult the male. Day (1878) did not record any kind of sexual dimorphism in this species. The taxonomic description of *B. barna* ; therefore, needs a revision through a study of long series of both the male and female of this species. Such a study of this species is nearing completion and an updated description will be published elsewhere.

SUMMARY

There is a marked sexual dimorphism in the male and female of *Barilius barna* Hamilton in the pelvic region which is different from *B. bendelisis* which exhibits such a difference in pectoral region. The sexually dimorphic characters of the male are normally developed during the breeding season and there after the development so acquired becomes irreversible. The well developed pelvic fin with thickened and partly fused rays, the strong and fan shaped pelvic bone, tubercles on the scales of the body and on the snout, and deeper body in the male distinguish it clearly from the female. The pelvic fins and the girdles of both the female and male are described and figured to highlight the sexually dimorphic character.

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