A new species of Parapsilorhynchus Hora, 1921 (Teleostei, Cyprinidae) from Mahanadi River basin of Odisha, India

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ABSTRACT
A new cyprinid fish, Parapsilorhynchus swaini sp. nov., is described based on specimens collected from a stream near Harisankar, Mahanadi River basin of Odisha, India. It differs from other species of the genus in having combination of characters: elongated and slender body (depth at dorsal fin origin 16.9-18.7% SL); narrow and slender head (width 60.0-68.7% HL, height at occiput 40.0-50.0% HL); narrow inter orbital space (46.6-50.0% HL); 33-34 lateral line scales; 3 simple pectoral fin rays, poorly developed callous pad behind lower lip which is not delimited posteriorly, pectoral fin longer than head length, presence of tubercles on snout and a black bar on the anal fin. With the description of this new species, distributional range of the genus Parapsilorhynchus is extended further north in the Eastern Ghats to the Mahanadi River drainage of Odisha.

Keywords: Cyprinidae, Mahanadi River basin, New species, Odisha, Parapsilorhynchus swaini

Introduction
The members of the genus Parapsilorhynchus Hora, 1921 (family Cyprinidae) are small-sized rheophilic fishes, which are distributed in hill streams of the Western and Eastern Ghats and the Satpura mountain ranges of India. Currently, the genus consists of five valid species viz., Parapsilorhynchus tentaculatus (Annandale, 1919), P. discophorus Hora, 1921; P. prateri Hora & Misra, 1938; P. elongatus Singh, 1994 and P. odishaensis Baliarsingh, Kosygin & Swain, 2017. They are characterised by having two blunt rostral barbels on the snout, 2 to 3 simple pectoral fin rays, upper lip concealed by a fringed rostral cap, which is covered with numerous papillae, prominent lower lip with a rudimentary disc or callous pad behind it, gill openings extending to the ventral surface and cyprinid type swim bladder. A recent ichthyological survey of the Mahanadi River basin in Odisha yielded five specimens of an undescribed species of Parapsilorhynchus. These specimens are herein described as Parapsilorhynchus swaini sp. nov.

Materials and methods
Measurements were made on the left side of the specimens with digital calipers to the nearest 0.1 mm following Jayaram (1999). Fin rays and numbers of scales were counted under a stereozoom microscope. Morphometric data are expressed in percentages of standard length (SL) or head length (HL) or caudal peduncle length. Fin rays counts of dorsal, pectoral, pelvic and anal fins include simple and branched rays. The type specimens were deposited in the Zoological Survey of India (ZSI), Kolkata.

Results
Taxonomy
Parapsilorhynchus swaini sp. nov. Baliarsingh & Kosygin
Common name: Mahanadi minnow
Holotype: ZSI FF5057, 42 mm SL (Fig. 1, Table 1. 2), caught off a stream near Harisankar, Mahanadi River basin in Odisha, India, 20°51'18.08"N; 82°51'37.75"E, Coll. B. K. Baliarsingh, 17 August, 2013.
Paratypes: ZSI FF 5058, 32-42 mm SL, 4 specimens, same data as holotype.
Diagnosis
Parapsilorhynchus swaini sp. nov. can be distinguished from other species of the genus by the following combination of characters: elongated and slender body (depth at dorsal fin origin 16.9-18.7% SL); narrow and slender head (width 60.0-68.7% HL, height at occiput 40.0-50.0% HL); narrow inter orbital space (46.6-50.0% HL); 33-34 lateral line scales; 3 simple pectoral fin rays, poorly developed callous pad behind lower lip which is not delimited posteriorly, pectoral fin...
Parapsilorhynchus swaini sp. nov., ZSI FF5057, holotype, 42.0 mm SL; (a) Dorsal, (b) lateral and (c) ventral views

Fig. 1. Parapsilorhynchus swaini sp. nov., ZSI FF5057, holotype, 42.0 mm SL; (a) Dorsal, (b) lateral and (c) ventral views

longer than head length, presence of tubercles on snout and a black bar on the anal fin.

**Description**

Morphometric data of holotype and 4 paratypes are listed in Table 1 and 2. Body elongate, slender (Fig. 1), greatest depth at dorsal fin origin, ventral surface flattened. Head depressed with a prominent snout. Snout slightly rounded with a few poorly developed horny tubercles. Mouth small, inferior, crescent-shaped. Upper lip concealed by a prominent rostral fold, which is fringed and papillated. A groove present around the corners of the mouth, which is continuous anteriorly round the outer margin of the rostral fold. Lower lip bilobed, finely papillated, with a poorly developed callous pad behind it, which is not delimited posteriorly (Fig. 2). Eyes large, visible from ventral surface, its diameter smaller than interorbital space. One rostral pair of barbels, shorter than eye diameter.

Dorsal fin with ii, 6 (1), ii, 6, i (3), or ii, 7(1) rays, inserted slightly in advance of pelvic fin, its origin almost equidistant between snout tip and caudal fin base. Pectoral fin with iii, 10, i (4) or iii, 11, i (1) rays, longer than head, not reaching pelvic fin origin. Base of the pectoral fin forms adhesive pads ventrally, with a few anterior branched rays and simple rays (Fig. 3). Pelvic fin with i, 5, i (5) ray, shorter than pectoral, not reaching anal opening. Anal fin base short, with i, 5 (5) rays, not reaching base of caudal fin. Lateral line complete with 33 or 34 scales. Scales in lateral transverse row above lateral line 4 or 4½ and below lateral line from pelvic fin origin 3½ or 4. Predorsal scales 18-22, scales arranged irregularly. Chest and belly scaled. Caudal fin forked with i, 17, i (4) or i,18, i (1) principal rays.
Table 1. Morphometric data of *Parapsilorhynchus swaini* sp. nov.

| Morphometric parameters | Holotype (ZSI FF 5057) | Paratypes | Mean±SD |
|-------------------------|------------------------|-----------|---------|
| Standard length (mm)    | 42                     | 32, 42    | 36.7±4.17 |
| % Standard length       |                        |           |         |
| Head length             | 22.8                   | 22.5, 23.5| 22.9±0.48 |
| Body depth              | 18.3                   | 16.9, 18.7| 17.7±0.76 |
| Caudal peduncle length  | 14.2                   | 12.5, 14.7| 13.8±0.82 |
| Caudal peduncle height  | 11.9                   | 10.2, 12.5| 11.5±0.65 |
| Predorsal length        | 50                     | 50, 53.5  | 51.3±1.43 |
| Prepectoral length      | 14.2                   | 13.7, 18.7| 16.2±2.17 |
| Prepelvic length        | 50                     | 50, 53.1  | 51.3±1.34 |
| Preanal length          | 73.8                   | 73.8, 81.2| 77.7±3.11 |
| Preanus length          | 71.4                   | 70, 75    | 71.8±1.97 |
| Dorsal fin height       | 16.6                   | 16.6, 18.7| 17.5±0.80 |
| Pectoral fin length     | 24                     | 24, 26.5  | 25.2±0.89 |
| Pelvic fin length       | 19                     | 17.5, 20.3| 18.8±1.03 |
| Anal fin height         | 19                     | 14, 19    | 16.2±2.05 |
| Caudal fin length       | 25                     | 22.5, 25  | 23.6±0.89 |
| Distance from anus to caudal fin base | 25 | 21.2, 25 | 23.4±1.64 |

% Head length

| Counts | Holotype (ZSI FF 5057) | Paratypes |          |
|--------|------------------------|-----------|----------|
| Dorsal fin rays | ii,6,i                  | ii,6 or ii,6,i or ii,7 |          |
| Pectoral fin rays | iii,10,i              | iii,10,i or iii,11,i |          |
| Ventral fin rays  | i,5,i                  | i,7,i     |          |
| Anal fin rays     | i,5                    | i,5       |          |
| Caudal fin rays   | i,17,i                 | i,17,i or i,18,i |          |
| Predorsal scales  | 19                     | 18-22     |          |
| Lateral line scales | 34                   | 33 or 34  |          |
| Lateral transverse scales | 4/1/4                | 4 or 4½/1/3½ or 4 | |

% Caudal peduncle length

| Counts | Holotype (ZSI FF 5057) | Paratypes |          |
|--------|------------------------|-----------|----------|
| Caudal peduncle height | 83.3             | 76, 91 | 83.7±5.91 |

Min. = Minimum, Max. = Maximum; SD = Standard deviation

Table 2. Meristic data of *Parapsilorhynchus swaini* sp. nov.

| Counts         | Holotype (ZSI FF 5057) | Paratypes |          |
|----------------|------------------------|-----------|----------|
| Dorsal fin rays | ii,6,i                  | ii,6 or ii,6,i or ii,7 |          |
| Pectoral fin rays | iii,10,i              | iii,10,i or iii,11,i |          |
| Ventral fin rays  | i,5,i                  | i,7,i     |          |
| Anal fin rays     | i,5                    | i,5       |          |
| Caudal fin rays   | i,17,i                 | i,17,i or i,18,i |          |
| Predorsal scales  | 19                     | 18-22     |          |
| Lateral line scales | 34                   | 33 or 34  |          |
| Lateral transverse scales | 4/1/4                | 4 or 4½/1/3½ or 4 | |

**Colour**

Body dark grey with white ventral surface. A black horizontal bar or vertically elongated spot on the caudal peduncle. Dorsal and anal fins with a distinct black bar at the middle. All the fins dusky. Caudal fin with black longitudinal mark on median rays.

**Distribution**

Presently known from a stream near Harisankar, Mahanadi River basin in Odisha, India (Fig. 4).

**Etymology**

Named after Dr. S. K. Swain of ICAR-Central Institute of Freshwater Aquaculture (ICAR-CIFA), Bhubaneshwar for his encouragement and support in the present study.

**Discussion**

*Parapsilorhynchus swaini* sp. nov. is similar to *P. elongatus* in having an elongated body and 3 unbranched pectoral fin rays. However, the new species can be distinguished from *P. elongatus* in having lesser lateral line scales (33-34 vs 36), shorter predorsal length (50.0-53.5% SL vs 56.2), pectoral fin longer (vs shorter) than head length, narrower interorbital space (46.6-50.0% HL vs 60.2-66.6) and presence (vs absence) of black bar.
on the anal fin (Table 3). *P. swaini* sp. nov. differs from *P. discophorus* in having a poorly (vs prominently) developed callous pad behind the lower lip, which is not delimited posteriorly, a more slender body (depth at dorsal fin origin 16.9-17.6% SL vs 18.3-24.2), more simple pectoral fin rays (3 vs 2), pectoral fin longer (vs shorter) than head and presence (vs absence) of a black bar on the anal fin.

*P. swaini* sp. nov. differs from *P. tentaculatus* in having lesser lateral line scales (33-34 vs 36-39), a more depressed head (height at occiput 40-50% HL vs 61.1), eyes visible (vs not visible) from ventral side of head, presence (vs absence) of tubercles on the snout, presence of a vertical black bar (vs oval spot) on the caudal fin and presence (vs absence) of a black bar on the anal fin. The new species differs from *P. prateri* in having fewer lateral line scales (33-34 vs 43-47), a more depressed head (height at occiput 40-50% HL vs 57.2-60.0), larger eyes (25.0-31.2% HL vs 20.0-22.7) and poorly developed (vs well developed) callous pad behind the lower lip.

Recently, Baliarsingh *et al.* (2017) described *Parapsilorhynchus odishaensis* from the Mahendra Tanaya and Rushikulya Rivers in the southern part of Odisha. The new species is similar to *P. odishaensis* in having poorly developed callus pad, tubercles on the snout and 3 simple pectoral fin rays. However, *P. swaini* differs from *P. odishaensis* in having a more slender body (depth at dorsal fin origin 16.9-18.7% SL vs 19.6-25.0),
slender and narrower head (depth at occiput 40-50% HL vs 57.2-75.0; 60.0-68.7% HL vs 71.4-94.1), smaller interorbital space (46.6-50.0% HL vs 53.3-64.3), poorly (vs prominently) developed tubercles on snout, presence (vs absence) of adhesive pads at the base and ventral surface of simple rays of pectoral fin, a bilobed (vs rounded) lower lip and a distinct black bar on anal fin.

Yazdani and Singh (1991) pointed out that fishes of the genus *Parapsilorhynchus* possess peculiar combination of characters, which they share with other cyprinid subfamilies. However, based on the osteological studies they remarked that *Parapsilorhynchus* has its own distinctive characters not found in the related subfamilies. They also remarked that *Parapsilorhynchus* appears to have common origin with the related genus *Psilorhynchus*, which occurs in the Himalayan region as they have similarities in general morphology and habitats. Fishes of the genus *Parapsilorhynchus* were considered endemic in the Western Ghats and the Satpura mountain ranges of India (Singh, 1994) except *P. tentaculatus* which was also reported from Eastern Ghats in Andhra Pradesh (Rama Devi and Menon, 1995; Rema Devi and Indra, 2003). However, *P. odishaensis*, was described recently from the Eastern Ghats of India (Baliarsingh et al., 2017). With the description of this new species, distribution of the genus is further extended to north in the Eastern Ghats to the Mahanadi River drainage of Odisha.

Table 3. Comparison of morphometric characters of different species of the genus *Parapsilorhynchus*

| Morphometric characters | *P. discophorus* (ZSI-WRCP/3817; Hora, 1921) | *P. elongatus* (Singh, 1994) | *P. odishaensis* (Baliarsingh et al., 2017) | *P. prateri* (Hora & Misra, 1938) | *P. swaini* sp. nov. (ZSI FF5057 & FF5058) | *P. tentaculatus* (Type ZSI F 9695/1) |
|-------------------------|---------------------------------------------|-----------------------------|---------------------------------------------|---------------------------------|------------------------------------------|--------------------------------------|
| % Standard length       |                                             |                             |                                             |                                 |                                          |                                      |
| Body depth              | 18.3-24.2                                   | 17.2                        | 19.6-25.0                                   | 17.0-18.7                       | 16.9-18.7                               | 22.2                                 |
| Predorsal length        | 49.1-54.7                                   | 56.2                        | 51.5-57.1                                   | -                              | 50.0-53.5                               | 52.8                                 |
| % Head length           |                                             |                             |                                             |                                 |                                          |                                      |
| Head height at occiput  | 40.9-49.1                                   | -                           | 57.2-75.0                                   | 57.2-60.0                       | 40.0-50                                  | 61.1                                 |
| Head width              | 59.1-73.0                                   | -                           | 71.4-94.1                                   | 72.7-73.0                       | 60.0-68.7                                | 72.2                                 |
| Eye diameter            | 23.5-30.8                                   | 22.2-30.3                   | 18.7-28.6                                   | 22.0-22.7                       | 25.0-31.2                                | 27.9                                 |
| Inter orbital space     | 56.2                                        | 60.2-66.6                   | 53.3-64.3                                   | 47.3-50.0                       | 46.6-50                                  | 50.0                                 |
| Mouth width             | 32.6-40.0                                   | -                           | 23.5-28.6                                   | -                              | 26.0-31.2                                | -                                    |
| Lateral line scale      | 33-35                                        | 36                          | 33-35                                       | 43-47                          | 33-34                                    | 36 - 39                              |
| Pectoral fin rays       | 2                                           | 3                           | 3-4                                         | -                              | 3                                        | 3                                    |
| Horn tubercles on snout| Absent/poorly developed                     | Absent                      | Well developed                              | Absent                         | Poorly developed                         | Absent                               |
| Visibility of eye from ventral side of head | Visible | Visible | Visible | Visible | Visible | Not visible |
| Pectoral fin length     | Shorter than head length                    | Shorter than head length    | Equal or longer than head length            | Equal to head length           | Longer than head length                  | Damaged                              |
| Shape of lower lip      | Rounded                                     | Bilobed                     | Rounded                                     | Rounded                        | Bilobed                                  | Bilobed                              |
| Callous pad             | Well developed                              | Poorly developed            | Poorly developed                            | Well developed                 | Poorly developed                        | Poorly developed                     |
| Black bar on anal fin   | Absent                                      | Absent                      | Absent                                      | Absent                         | Present                                  | Absent                               |

Comparative materials

*Parapsilorhynchus discophorus*, 4 ex., 26.4-32.0 mm SL, ZSI-WRCP/3817; India: Vasishti River, Pophli, Ratnagiri District, Maharashtra. Additional data from Hora (1921) and Yazdani and Rao (1977).

*Parapsilorhynchus odishaensis*, holotype, 35.0 mm SL, ZSI FF 4625; India: Mahendra Tanaya River, Tiniamba Village, Rayagada District, Odisha. Additional data from Baliarsingh et al. (2017).

*Parapsilorhynchus prateri*, type, 36 mm SL, ZSI F 12498/1; India: Deolali, Maharashtra. Additional data from Hora and Misra (1938).

*Parapsilorhynchus tentaculatus*, type, 1ex., 36 mm SL, ZSI F 9695/1; India: small hill-streamlets at Khandalla, Poona District, Maharashtra. Additional data from Ammandale (1919).

*Parapsilorhynchus elongatus*: Data from Singh (1994).

Key to species of *Parapsilorhynchus*

1. Lateral line scales less than 43 ............................................ 2
2. Lateral line scales 43-47 ........................................... *P. prateri* 3
2. Callous pad well developed ........................................... *P. elongatus* 4
3. Pectoral fin with 2 simple rays, its length shorter than HL; Lateral line scales 33-35 .........................P. discophorus

Pectoral fin with 3 simple rays, its length longer than HL; Lateral line scales 36 .................................P. elongatus

4. Lateral line scales 36-39; eyes not visible from ventral side of head ..............................................P. tentaculatus

Lateral line scales 33-35; eyes visible from ventral side of head ...................................................... 5

5. Body depth 19.6-25% SL; Anal fin without black bar ..........

..............................P. odishaensis

Body depth 16.9-18.7% SL; Anal fin with a black bar ........

..............................P. swaini sp. nov.

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