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Assessing the Taxonomic Diversity of Danionid Fishes of Brahmaputra Basin, Assam, North-East India: An Effort towards the Conservation of Small Indigenous Fish

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Authors' contributions

This work was carried out in collaboration among all authors. Author MB did the sample collection, identification and initial drafting. Author SB did the conceptualization, and manuscript preparation. Author BP did the conceptualization, funding acquisition, identification and reviewing the manuscript. Author APK did the supervision and manuscript revision. Author AKJ did the sample identification, reviewing the manuscript. Author AT did the reviewing manuscript. Author RK did the sample collection and identification. All authors read and approved the final manuscript.

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ABSTRACT

The family Danionidae (Order: Cypriniformes) exhibits a wide diversity with 364 species belonging to 39 genera, most of which are small and brightly coloured and are considered as small indigenous fish. Although, they don't contribute significantly to the commercial landing, they possess a huge potential for ornamental use, recreational activity apart from food value. Thus to know this potential, a study was taken up to explore the danionid diversity of Brahmaputra basin of Assam, North east India. Fish samples from four different rivers of Brahmaputra basin was collected during 2023, identified through classical taxonomy and preserved in formalin (10%). A total of 17 species belonging to 11 genera and 4 subfamilies were recorded. The subfamily Chedrinae is comprised highest number of species (9), followed by Danioninae (5), Rasborinae (2) and Esominae (1). The present communication deals with the diagnostic characters and colour pattern of the danionid fishes. Findings of the study will help to identify the danionid fishes and thus, conservation of these resources from Brahmaputra River basin of Assam.

Keywords: Brahmaputra; conservation; classical taxonomy; diagnostic characters; Danionidae.

ABBREVIATIONS

SIF : Small Indigenous Fish
D : Dorsal fin ray
P : Pectoral fin ray
V : Ventral fin ray
A : Anal fin ray
C : Caudal fin ray

1. INTRODUCTION

India is one of the mega diverse nation having 4 out of 36 Global biodiversity hotspot [1]. "The North-eastern India is a part of the Indo-Burma and the Himalayan biodiversity hotspot and supports innumerable diverse freshwater ecosystems and considered to be hotspot of biodiversity by the World Conservation Monitoring Centre" [2]. "A total of 422 freshwater fishes belonging to 133 genera under 38 families have been reported from North-eastern region, and the family Cyprinidae is reported to have maximum number of species, i.e. 154" [3]. Assam, a part of Northeast India is endowed with two major riverine systems, the Brahmaputra and the Barak River [4]. A total of 217 fish species belonging to 104 genera 37 families and 10 orders have been recorded by Bhattacharjya et al. [5] from the wetland and other water bodies of Assam. Later, Goswami et al. [3] reported 311 fish species from Assam state.

The family Danionidae is one of the species rich taxon under order Cypriniformes and ranges from phytoplankton feeder to carnivores [6]. The family level status of Danionidae (previously Danioninae) has been recently upgraded by Tan and Armbruster [7]. Currently, the family Danionidae comprises of 4 subfamilies, namely Chedrinae, Rasborinae, Danioninae and Esominae. These subfamilies include 39 valid genera and 364 valid species [8]. The model organism for many different research purpose, *Danio rerio* and the world's smallest organism *Paedocypris progenetica* belongs to this family which highlights the diversity of this family [9]. Most species belonging to this family are brightly coloured with beautiful pattern of vertical bars and stripes, attracting the aquarium trade. Coad [10] reported that most of the danionid fishes inhabit the mountain streams and few are found in lowland areas. Very fragmented literature are available on the diversity of danionid species from Assam as well as other parts of India that highlights a lacuna in the proper taxonomic study of this family in this particular part of North East India. Moreover, most of the species under genus *Rasbora, Barilius, Opsarius, Devario* are morphologically similar and have some convoluted taxonomy, which needs to be addressed for effective conservation of these native resources. Hence, the present attempt has been taken to describe the taxonomic diversity of danionid species of Brahmaputra river basin, Assam.

2. MATERIALS AND METHODS

For the present study, a total of 4 rivers namely Brahmaputra, Diyung, Manas and Kopili River (Fig. 1) were explored considering their origin and topographical characteristics. The river Brahmaputra is the mighty ocean flowing through the heart of Assam before draining into the Bay of Bengal. River Manas is a north bank tributary of the Brahmaputra. The river Diyung originates in the Dima Hasao district of Assam and joins river Kopili, which then culminates into river

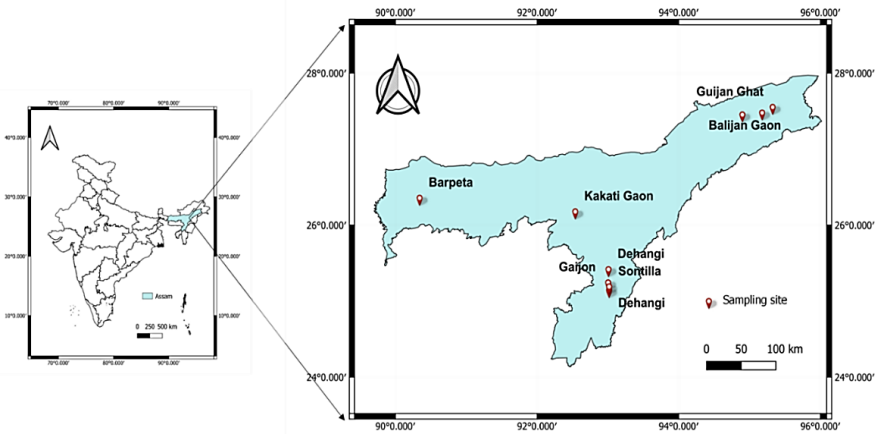

Fig. 1. Map showing the sampling locations of danionid species

Brahmaputra. The fishes were collected by conducting experimental fishing in the rivers using gill net and cast net with the assistance of local fishermen during 2023. The samples were also collected from the markets where the fishes captured from the selected rivers were sold. The fishes were photographed in fresh condition on the site for appropriate morphological observation and colouration. The fishes were transported to the laboratory in an insulated ice box. In the laboratory, fishes were washed and cleaned thoroughly, and identified up to the species level following standard keys described by Talwar and Jhingran [11], Jayaram [12], Nath et al. [13] and Phukan et al. [14]. The mouth structure and fins of the species were observed with the help of a stereozoom microscope (ZEISS STEMI 508) and photographed using Mosaic V2.0 software. Later, the fishes were preserved in 10% formalin and submitted to the indigenous fish museum of College of Fisheries, Raha, Assam.

3. RESULTS

During the present study, a total of 17 species belonging to 11 genera and 4 subfamilies, inhabiting in the different rivers of Assam, were collected and identified (Table 1). The subfamily Chedrinae was represented by 9 species, followed by Danioninae, Rasborinae and Esominae with 5, 2 and 1 species, respectively. The identified species includes *Amblypharyngodon mola* (Hamilton, 1822), *Barilius barila* (Hamilton, 1822), *Cabdio morar* (Hamilton, 1822), *Cabdio jaya* (Hamilton, 1822), *Chela cachius* (Hamilton, 1822), *Danio dangila* (Hamilton, 1822), *Danio rerio* (Hamilton, 1822), *Devario aequipinnatus* (McClelland, 1839), *Devario devario* (Hamilton, 1822), *Esomus danrica* (Hamilton, 1822), *Opsarius barna* (Hamilton, 1822), *Opsarius bendelisis* (Hamilton, 1807), *Opsarius shacra* (Hamilton, 1822), *Opsarius tileo* (Hamilton, 1822), *Raiamas bola* (Hamilton, 1822), *Rasbora daniconius* (Hamilton, 1822) and *Salmostoma bacaila* (Hamilton, 1822). The description of the species are given below:

3.1 *Amblypharyngodon mola* (Hamilton, 1822) (Fig. 2)

Meristic formula: D II/7, P I/13, V I/8, A III/6, C 10+9 (Fig. 3a)

Diagnostic characters: Body elongated, moderately compressed. Mouth small and terminal (Fig. 4). Dorsal profile of the body more convex than the ventral. Barbel absent. Eyes large. Body with small scales. Lateral line incomplete, ceases after 9 to 18 scales; 65 to 91 scales in lateral series. Caudal fin forked. Body colour golden yellow with a silvery band. Dorsal, anal and caudal fins with dark markings. Pectoral and ventral fins clear and transparent.

3.2 *Barilius barila* (Hamilton, 1822) (Fig. 2)

Meristic formula: D II/8, P I/12, V I/8, A II/11, C 10+9 (Fig. 3a)

Diagnostic characters: Body elongated and shallow. Snout pointed. Mouth terminal; slightly directed upwards (Fig. 4). Tubercles on the snout and lower jaw under developed. Barbels 2 pairs (rostral and maxillary pair). Dorsal fin inserted posteriorly, behind the pelvic fin base. Lateral line straight, and complete with 43-46 scales. Pre-dorsal scale 22. Caudal fin forked; lower lobe slightly longer than the upper. Body colour silvery with 14 numbers of blue bands extending from dorsal surface to the lateral line, dark and olivaceous from the dorsal side, fins pinkish.

Table 1. Check list of the danionid spp of Brahmaputra basin, Assam along with distribution & IUCN status

SN	Scientific name	Subfamily	Common name	Sampling location	IUCN status
1.	*Amblypharyngodon mola* (Hamilton, 1822)	Rasborinae	Indian mola Carplet	Kopili River	LC
2.	*Barilius barila* (Hamilton, 1822)	Chedrinae	Barred baril	Brahmaputra River	LC
3.	*Cabdio morar* (Hamilton, 1822)	Chedrinae	Morari	Brahmaputra River, Diyung River	LC
4.	*Cabdio jaya* (Hamilton, 1822)	Chedrinae	Jaya	Brahmaputra River	LC
5.	*Chela cachius* (Hamilton, 1822)	Danioninae	Silver Hatchet Chela	Brahmaputra River, Kopili River	LC
6.	*Danio dangila* (Hamilton, 1822)	Danioninae	Dangila danio	Diyung River	LC
7.	*Danio rerio* (Hamilton, 1822)	Danioninae	Zebra danio	Diyung River	LC
8.	*Devario aequipinnatus* (McClelland, 1839)	Danioninae	Giant danio	Diyung River	LC
9.	*Devario devario* (Hamilton, 1822)	Danioninae	Sind danio	Brahmaputra River	LC
10.	*Esomus danrica* (Hamilton, 1822)	Esominae	Flying barb	Kopili River	LC
11.	*Opsarius barna* (Hamilton, 1822)	Chedrinae	Barna baril	Brahmaputra River, Diyung River, Manas River	LC
12.	*Opsarius bendelisis* (Hamilton, 1807)	Chedrinae	Hamilton's barila	Brahmaputra River, Diyung River, Manas River	LC
13.	*Opsarius shacra* (Hamilton, 1822)	Chedrinae	Shacra baril	Brahmaputra River, Manas River	LC
14.	*Opsarius tileo* (Hamilton, 1822)	Chedrinae	Teileo baril	Diyung River	LC
15.	*Raiamas bola* (Hamilton, 1822)	Chedrinae	Trout barb	Brahmaputra River, Diyung River	LC
16.	*Rasbora daniconius* (Hamilton, 1822)	Rasborinae	Blackline Rasbora	Brahmaputra River	LC
17.	*Salmostoma bacaila* (Hamilton, 1822)	Chedrinae	Large razorbelly minnow	Kopili River	LC

LC – Least concerned

3.3 *Cabdio morar* (Hamilton, 1822) (Fig. 2)

Meristic formula: D II/8, P I/14, V I/7, A II/10, C 10+9 (Fig. 3a)

Diagnostic characters: Body moderately compressed and elongated. Mouth terminal, with short jaws and slightly directing upward (Fig. 4). Barbel absents. Dorsal fin inserted posteriorly, behind the pelvic fin. Lateral line decurved, running lower on the body with 38-42 scales, body with moderate scales. Caudal fin forked. Dorsal surface of the body brownish, the flanks and belly yellowish. Fins dark yellow, dorsal, pectoral and caudal fins are with pinkish tinges.

3.4 *Cabdio jaya* (Hamilton, 1822) (Fig. 2)

Meristic formula: D II/8, P I/13, V I/8, A II/8, C 10 +9 (Fig. 3a)

Diagnostic characters: Body elongated and sub cylindrical. Snout blunt. Mouth sub-terminal with jaws short (Fig. 4). Barbels absent. Dorsal fin inserted opposite to the pelvic fin. Lateral line straight, with 52-60 scales, scales small in size. Body silvery in colour in live condition, fins whitish silvery.

3.5 *Chela cachius* (Hamilton, 1822) (Fig. 2)

Meristic formula: D II/7, P I/9, V I/5, A II/23, C 10+9 (Fig. 3a)

Diagnostic characters: Body highly compressed and deep with keeled abdomen only between and behind pelvic fin. Head small with obliquely upward directing mouth (Fig. 4), lower jaw longer. The cleft of mouth not extending to below the anterior edge of eye. Dorsal fin inserted at extreme posterior of the body; near to the caudal fin tip. Unbranched ray of pelvic fin long and filamentous; reaching posterior third of anal fin. Lateral line complete, with 51 to 56 scales; pre-dorsal scales 23 to 29. Caudal fin forked. Body light olive dorsally, translucent and shining silvery, Flanks with slightly greenish blue appearance. Fins yellowish.

3.6 *Danio dangila* (Hamilton, 1822) (Fig. 2)

Meristic formula: D II/10, P I/11, V I/7, A II/15, C 10+9 (Fig. 3a)

Diagnostic characters: Body elongate and laterally compressed. Dorsal profile of the body slightly convex. Mouth small, obliquely directed upwards (Fig. 4). Two pairs of well-developed barbell; rostral barbels slightly shorter than head, the maxillary pair longer, extends up to the pelvic fin base. Dorsal fin inserted posteriorly on the body; nearer to the caudal fin. Caudal fin slightly emarginated. Lateral line complete, with 36 to 40 scales; pre-dorsal scales 12 to 14. Body surface olivaceous dorsally, flanks silvery with several narrow blue lines with beautiful network in the anterior half or two-thirds of body; a dusky spot present at upper angle of gill-opening.

3.7 *Danio rerio* (Hamilton, 1822) (Fig. 2)

Meristic formula: D II/17, P I/12, V I/6, A II-III/10-12, C 10+9 (Fig. 3b)

Diagnostic characters: Body compressed and slim with round abdomen. Head small with large eyes. Mouth small, anterior and obliquely directed upwards (Fig. 4). Lower jaw having symphyseal knob. Two short pairs of barbels (rostral and maxillary), Dorsal fin inserted opposite to mid-space between pelvic and anal fins. Caudal fin forked. Scales on body moderate; lateral line incomplete with 28-30 scales. Dorsal body surface silvery grey while ventral surface yellowish white; flanks shining prussian blue with 4 distinct gold stripes from head to caudal fin and anal fin; dorsal fin yellow olive at base and a white tip; pectoral and pelvic fins hyaline.

3.8 *Devario aequipinnatus* (McClelland, 1839) (Fig. 2)

Meristic formula: D II/11, P I/11, V I/6, A II/14, C 10+9 (Fig. 3b)

Diagnostic characters: Body elongated and compressed. Mouth small and obliquely directed upwards (Fig. 4). Tubercles well developed on the lower jaw. Two short pairs of barbels (rostral and maxillary); the rostral pair longer than the maxillary pair. Dorsal fin inserted near to the caudal fin; opposite to the interspace between the pelvic fin and anal fin. Scales moderate sized. Lateral line complete, with 35 to 37 scales; running lower in the ventral region, pre-dorsal scales 14 or 15. Caudal fin forked. Dorsal surface of body greenish, abdomen silvery; flanks greenish blue with a well-marked bluish lateral band and two thinner golden orange bands both above and below the lateral line; fins bright orange.

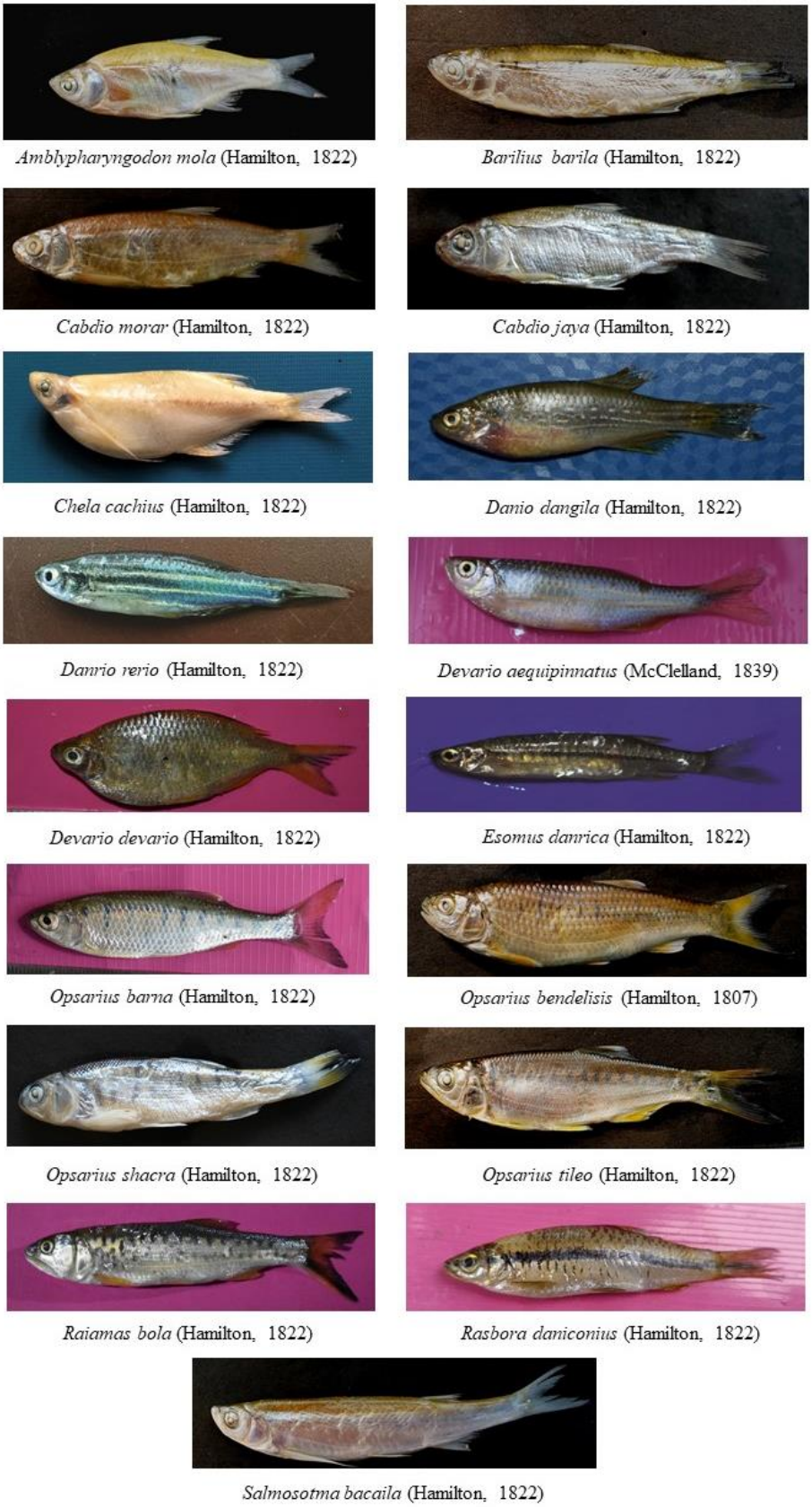

Fig. 2. Photographs of the identified danionid species

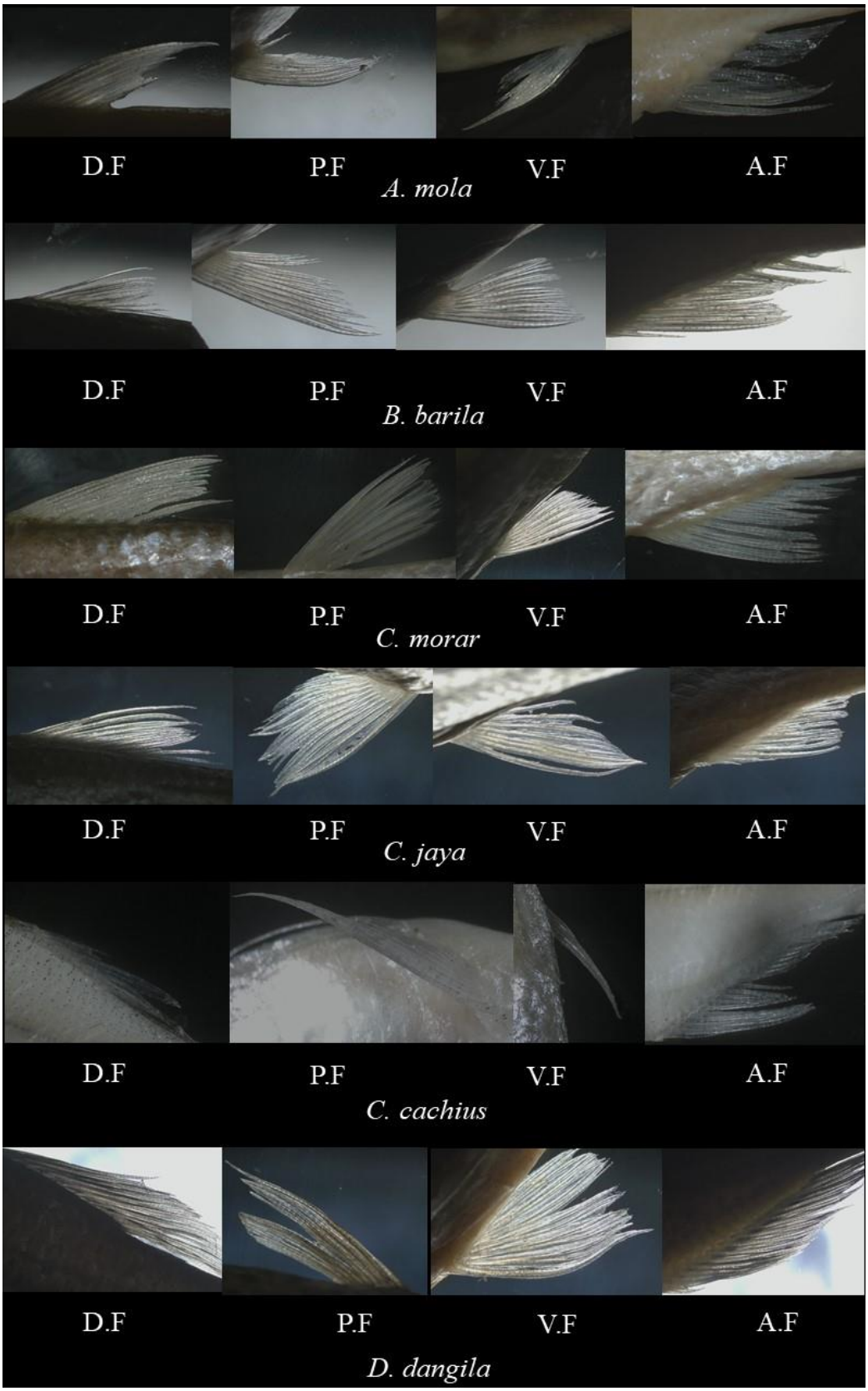

Fig. 3a. Fins of the danionid species

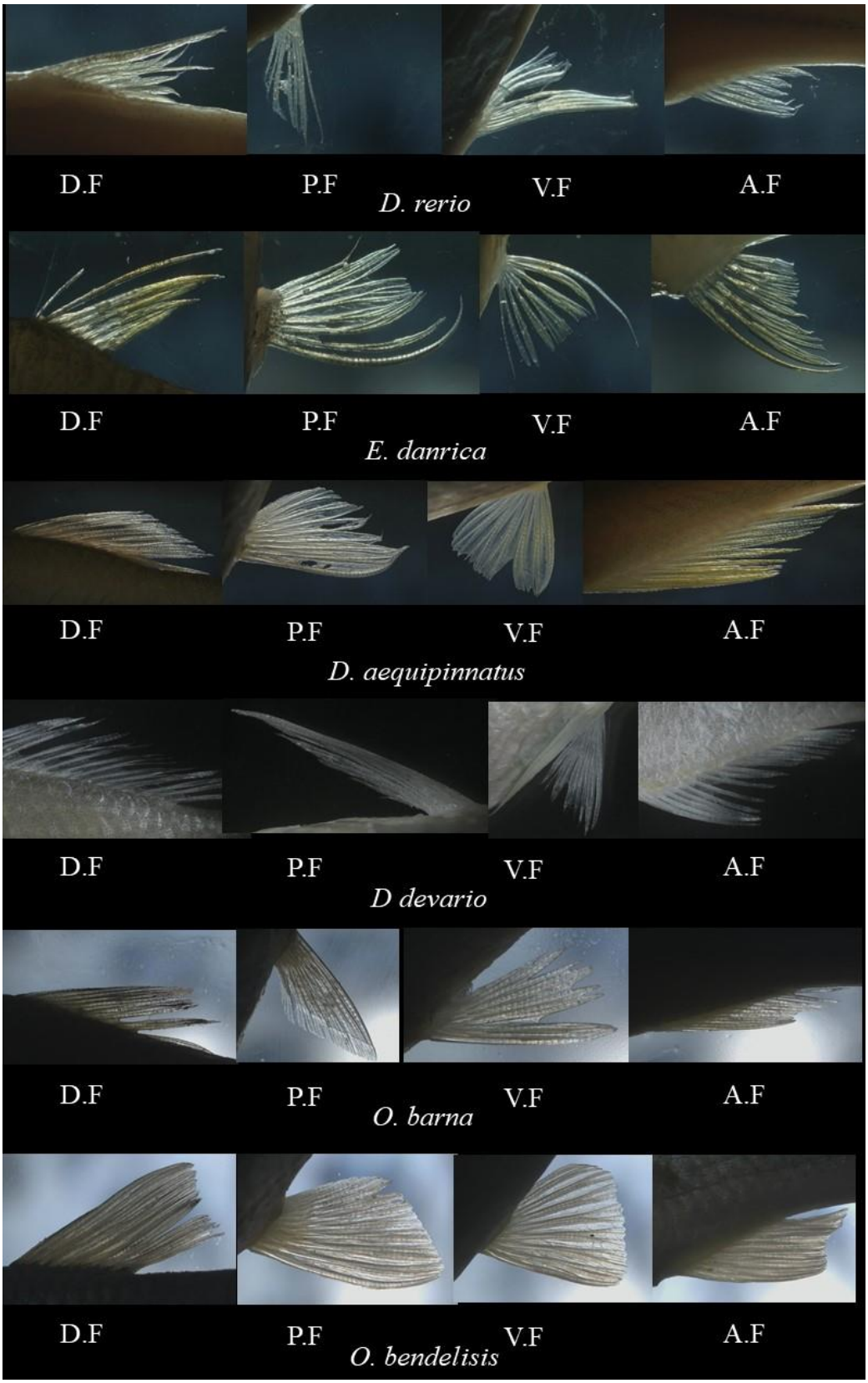

Fig. 3b. Fins of the danionid species

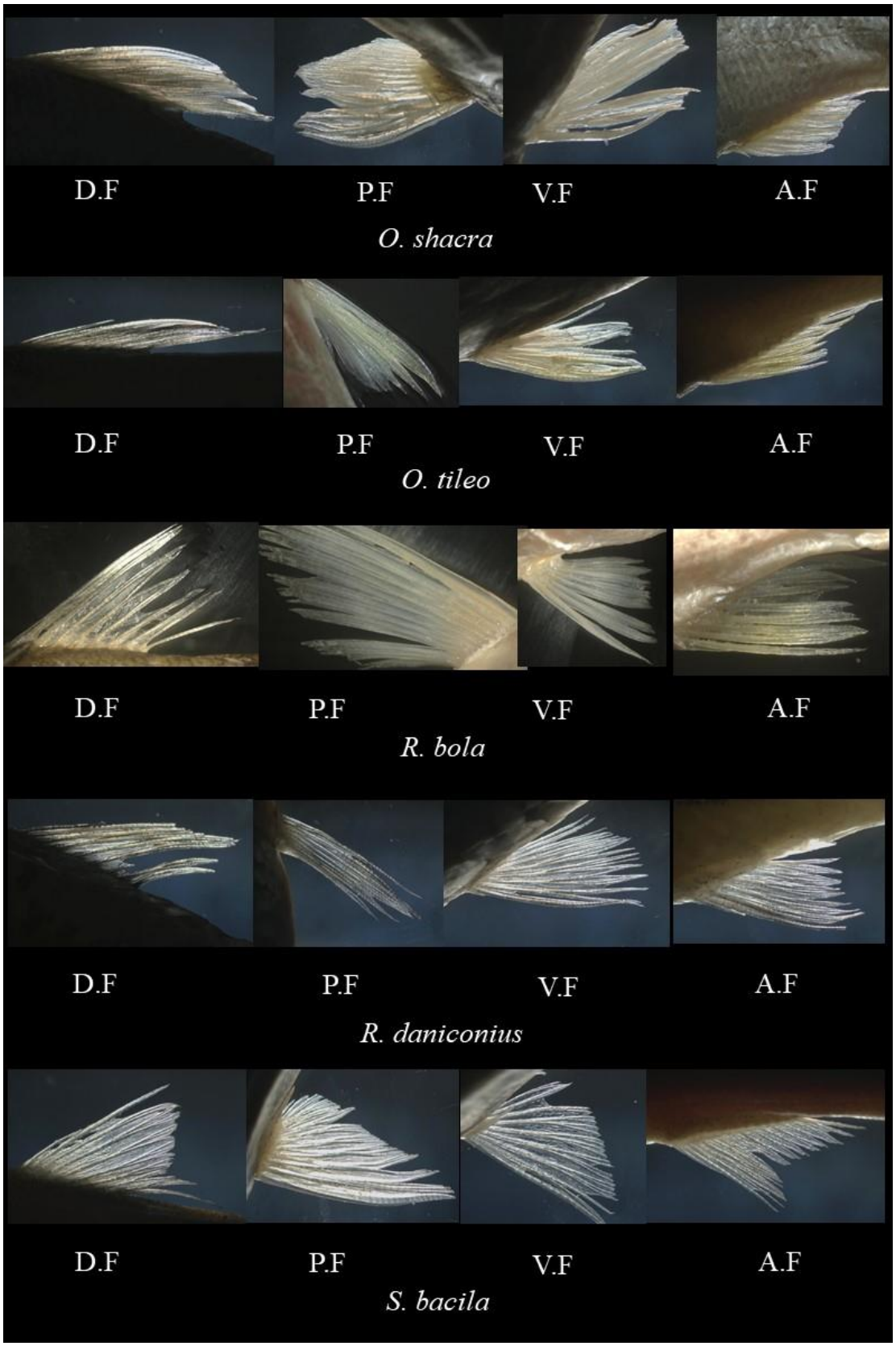

Fig. 3c. Fins of the danionid species

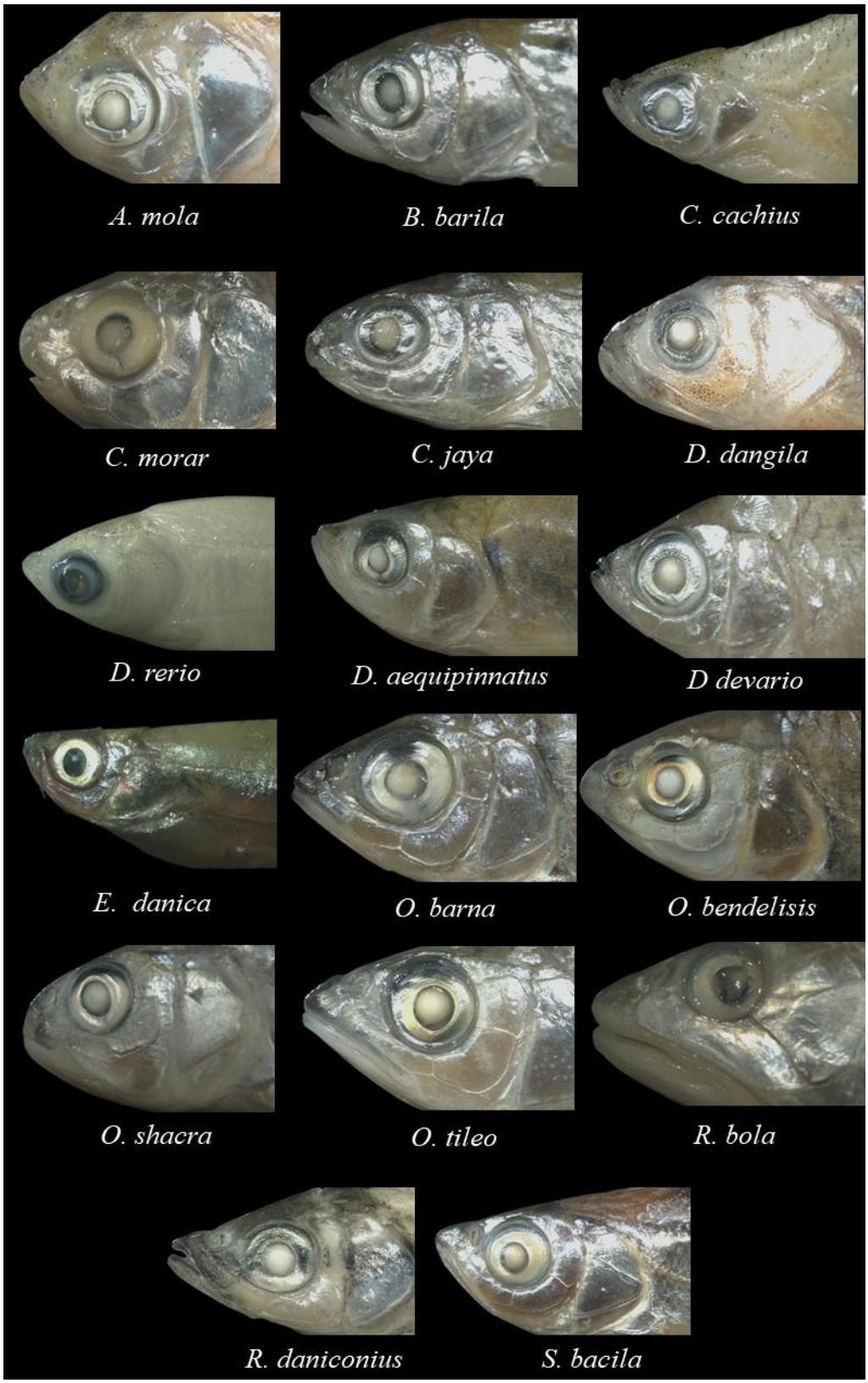

Fig. 4. Mouth structure of the danionid species

3.9 *Devario devario* (Hamilton, 1822) (Fig. 2)

Meristic formula: D II/17, P I/11, V I/7, A II/17, C 10+9 (Fig. 3b)

Diagnostic characters: Body rhomboidal and compressed. Snout pointed; mouth small, obliquely directed upwards (Fig. 4). Barbels absent. Dorsal fin inserted posteriorly, nearer to the caudal fin; opposite to the interspace between the pelvic fin and anal fin. Caudal fin emarginate to lunate. Scales moderate-size; lateral line complete, with 33 to 38 scales; pre-dorsal scales 15 to 17. Dorsal surface of the body greenish; flanks and belly silvery; anterior part of body reticulated at centre by bluish lines divided from each other by narrow vertical yellow bands; three bluish lines, divided by yellow ones, extending backwards to caudal fin, one pair of bluish spots at the base of caudal fin on each side of the body; anal fin golden with pectoral, pelvic and caudal fins yellowish.

3.10 *Esomus danrica* (Hamilton, 1822) (Fig. 2)

Meristic formula: D II/6, P I/13, V I/6, A III/5, C 10+9 (Fig. 3b)

Diagnostic characters: Body slim, compressed and elongated with pointed head. Mouth small, obliquely directed upwards with prominent lower jaw (Fig. 4). Barbels two pairs; rostral pair shorter than maxillary; maxillary pair extremely long and extended up to anal fin. Dorsal fin inserted nearer to caudal fin base than tip of snout, opposite to anal fin. Pectoral fin long and pointed. Caudal fin forked. Lateral line interrupted. Dorsal body surface olive green with pearly iridescence and with fine dots; ventral surface silvery white while flanks silvery violet; one dark lateral band from mouth to the caudal fin base; pelvic fin reddish, dorsal, pectoral and caudal fin brownish orange.

3.11 *Opsarius barna* (Hamilton, 1822) (Fig. 2)

Meristic formula: D II/7, P I/13-14, V I/8, A III/10-11, C 10+9 (Fig. 3b)

Diagnostic characters: Body compressed and deep. Eye large. Snout pointed, mouth terminal, with short jaws (Fig. 4); maxilla extends to anterior-third of orbit; well-developed tubercles on snout and lower jaw. Barbel absent or present, if present, 1 rudimentary pair. Dorsal fin inserted in advance of anal fin, its last fin ray often extends (especially in young) almost to base of caudal fin. Body with moderate scales, with few radii. Lateral line with 39 to 42 scales; pre dorsal scales 15 or 16. Caudal fin forked. Body green-silvery in adults, with 11 vertical bluish black bars extending from dorsal to lateral line; dorsal and caudal fins dark wedged; pectoral, ventral and anal fins yellowish.

3.12 *Opsarius bendelisis* (Hamilton, 1807) (Fig. 2)

Meristic formula: D II/7, P I/14, V I/8, A II/ 8, C 10+9 (Fig. 3b)

Diagnostic characters: Body shallow. Mouth terminal and moderate; jaws long, maxilla extends to below anterior-third of orbit (Fig. 4). Poorly developed tubercles on snout and lower jaw. Barbels two short pairs (rostral and maxillary), the rostral pair reduced or often absent; maxillary pair often longer than the rostral pair. Dorsal fin inserted entirely in advance of anal fin, nearer to base of caudal fin than to snout-tip. Scales moderate-size, with many radii; lateral line complete with 40 to 45 scales; pre-dorsal scales 18 to 20. Caudal fin forked. Dorsal surface of the body greyish; flanks silvery with 8 to 12 dark bands that extends towards the lateral-line, become indistinct in adults; lateral line scales with two black spots at their base; fins yellowish, tinged with orange; edges of dorsal and caudal fins greyish**.**

3.13 *Opsarius shacra* (Hamilton, 1822) (Fig. 2)

Meristic formula: D II/7, P I/14, V I/8, A III/8, C 10+9 (Fig. 3c)

Diagnostic characters: Body elongated and shallow. Mouth moderate; jaws long, maxilla reaches to anterior margin of orbit (Fig. 4). Snout blunt; with poorly developed tubercles. Barbel 2 pairs (rostral and maxillary); the rostral pair slightly longer than the maxillary pair. Dorsal fin inserted opposite to the middle of the pelvic fin. Scales moderate, with many radii; lateral line complete; with 65 to 70 scales; predorsal scales 22 to 25. Caudal fin forked. Dorsal surface of the body olive green with silvery flanks, with 12 bluish vertical bars extending from dorsal surface to the lateral line; dorsal fin having a black band on its upper third, pectoral and caudal fins with yellowish tinge, ventral and anal fins whitish in colour.

3.14 *Opsarius tileo* (Hamilton, 1822) (Fig. 2)

Meristic formula: D II/7, P I/13, V I/8, A III/10, C 10+9 (Fig. 3c)

Diagnostic characters: Body compressed and deep. Mouth terminal; obliquely directed upward and with pointed snout (Fig. 4). Dorsal profile of the body slightly concave. Maxilla reaches the middle of the eye orbit; well-developed tubercles on the snout and lower jaw. Barbels 2 pairs (rostral and maxillary); maxillary pair very minute; rostral pair longer than maxillary. Dorsal fin inserted opposite to the interspace between the pelvic fin and anal fin. Lateral line decurved, with 65-75 scales; scales moderate sized; pre dorsal scale 28-30. Caudal fin forked; lower lobe longer. Dorsal surface of the body bluish brown with silvery flank and belly. One distinct row of vertical blue spots with some other alternative spots and blotches along the sides of the body; dorsal and caudal fins pinkish with dark markings; pectoral, pelvic and anal fins yellowish.

3.15 *Raiamas bola* (Hamilton, 1822) (Fig. 2)

Meristic formula: D I/7, P I/13, V I/8, A II/10, C 10+9 (Fig. 3c)

Diagnostic characters: Body slender and compressed. Head sharply pointed with elongated snout. Mouth very wide and terminal; open horizontally; its cleft extends about one eye-diameter behind orbit (Fig. 4); maxilla extends well beyond posterior margin of the eye orbit. Barbels minute; maxillary pair always present, rostral pair present or absent. Dorsal fin inserted nearer to base of caudal fin. Caudal fin forked and lower lobe longer. Scales moderate, thin and deciduous; lateral line with 44 to 48 scales; pre-dorsal scales 23 to 25. Dorsal surface of the body greenish grey with silvery flanks. Dorsal side separated from silvery side by one longitudinal golden stripe; 2 to 3 rows of alternative greenish blue spots on the body; dorsal and caudal fins brightly orange; dark marking on the lower lobe of caudal fin; pectoral, ventral and anal fins slightly orange.

3.16 *Rasbora daniconius* (Hamilton, 1822) (Fig. 2)

Meristic formula: D II/7, P I/14, V I/8, A II/5, C 10+9 (Fig. 3c)

Diagnostic characters: Body elongated and moderately compressed. Snout pointed, with a terminal mouth (Fig. 4); directed slightly upwards. Barbels absent. Dorsal fin inserted opposite to the pelvic fin; pectoral fin shorter than the head length. Lateral line incomplete; upto the 12th scale. Caudal fin forked. Dorsal surface of the body olive in colour, flanks and ventral parts are silvery; one dark blue black mid lateral stripe runs from eye to base of caudal fin, a dark stipe above anal fin; fins with yellowish orange.

3.17 *Salmostoma bacaila* (Hamilton, 1822) (Fig. 2)

Meristic formula: D II/7, P I/12, V I/8, A II/14, C 10+9 (Fig. 3c)

Diagnostic characters: Body elongated and strongly compressed. Mouth obliquely directed upwards (Fig. 4); lower jaw with a well-developed symphyseal knob. Dorsal fin inserted nearer to the caudal fin, opposite to the anal fin; pectoral fin long, approaching the base of pelvic fin. Scales very small; lateral line slightly decurved, with 86 to 110 scales. Caudal fin forked and unequal; lower lobe slightly elongated. Body grey-greenish dorsally, often silvery; flank with a broad, gleaming white green band; fins hyaline.

4. DISCUSSION

For effective conservation and management of fisheries resources, their accurate taxonomic identification is of utmost importance [15]. Misidentification can result in flaws in planning for management strategies which may result in degradation of overall health of the ecosystem. The traditional tools based on morphometric and meristic traits are excellent mean for identification and classification of fish since centuries but require high taxonomic expertise [16]. Hence, the classical taxonomy can be further enhanced with DNA barcoding especially to resolve the taxonomic ambiguities of cryptic species [17].

In the present study, a total of 17 species of the family Danionidae, belonging to 11 genera and 4 subfamilies, were identified with the help of conventional identification tools from Brahmaputra basin. Vishwanath [18] had reported 21 species of the family Danionidae, under 11 genera from the Brahmaputra drainage, where three of them, namely *Barilius barna, Danio rerio,* and *Devario assamensis* are endemic to this river. Kalita [19] reported 14

species of the family Danionidae from the Manas National Park and its adjacent villages in Assam, while Dey and Sarma [20] recorded 16 species belonging to the family Danionidae from the entire stretch of the river Manas. Furthermore, Ahmed et al. [21] reported 11 species belonging to Danionidae from the Diyung river of Assam.

The genus *Amblypharyngodon* is widely distributed throughout the Indian subcontinent and the Southeast Asia, with five valid species [22]. Talwar and Jhingran [11] reported 5 species of *Amblypharyngodon* from India. However, during the present study, only *Amblypharyngodon mola* was collected from the Kopili River of Assam. The genus *Barilius* is characterised by its relatively elongate and compressed body with round belly, vertical bars on the fanks, 9–17 anal-fin rays and sub-laterally placed lateral line [11]. Fricke et al. [23] recorded 24 bariline species from India out of 36 valid species. The genus *Barilius* was erected as a subgenus of *Cyprinus* with *Cyprinus barila* as the type species [24]. Now, the genus *Barilius* is composed of five species characterized by an extremely shallow body. However, during the present study, only *Barilius barila* was recorded from the Brahmaputra River which was also recorded by Jabeen and Barbhiya [25] from Manas River.

In Northeastern region, genus *Aspidoparia* is comprised of 3 species (*A. jaya*, *A. morar*, and *A. ukhrulensis*), of which, *A. ukhrulensis* belongs to Chindwin drainage system. Lalramliana et al. [26] reported another new species *Cabdio crassus* from the Kaladan river basin of Mizoram. During the present study *Cabdio morar* and *Cabdio jaya* were collected from Brahmaputra and Diyung River. Further, species of *Chela,* including 6 species, are widely distributed in Southeast Asia, of which, 4 are reported in India [11]. But, during the present study, only *Chela cachius* was recorded from the Brahmaputra River.

The genus *Danio* is a diverse genus of small, colourful, freshwater fishes commonly found in streams and rice paddies of the native Southern Asia [27] and was erected by Hamilton [28]. Talwar and Jhingran [11] reported 11 species of *Danio* from Indian region; however, many species of this genus has been transferred to the genus *Devario.* During the present study*, Danio dangila* and *D. rerio* was recorded from the Diyung River. The genus *Devario* is diagnosed by presence of short barbels, about half the eye diameter or less; a 'P stripe' along midline of body extending to end of middle caudal fin ray; relatively developed infraorbital and other osteological characters [29]. The genus *Devario* is now being represented by 37 species, of which 11 are found in India [30]. During the present study, 2 species *Devario devario* and *D. aequipinnatus* were reported. The *D. aequipinnatus* is a widely distributed and colourful species in the freshwater region of India, inhabiting hill streams up to an elevation of 300 m.

Fishes of the genus *Esomus* is characterized by long pair of maxillary barbels that extends beyond the pectoral-fin origin, and a single row of pharyngeal teeth on the fifth ceratobranchial [31] and are widely distributed from South to Southeast Asia. The genus currently consists of nine species [7]; however, only *Esomus danrica* was recorded from the Kopili River during the present study.

The genus *Opsarius* was created by Howes [32]. All other Indian and Southeast Asian species, previously classified as *Barilius,* are now placed in the genus *Opsarius* [24]. Arunkumar and Moyon [33] reported 29 valid species under the genus *Opsarius*. The distinguishing characteristics of the genus *Opsarius* from *Barilius* was given by Howes [34]. In the present study, 4 species of *Opsarius* i.e. *Opsarius barna, O. bendelisis, O. shacra* and *O. tileo* were recorded. The genus *Raiamas* was erected by Jordan [35], which consists of 14 species form Africa and 2 species from Asian region. Both the Asian species were reported from India [34]. The genus *Raiamas* had been considered as a junior synonym of the transcontinental genus *Barilius* [36]. However, during the present study, *Raiamas bola* was recorded from Brahmaputra and Diyung River.

The Rasborine fishes are diagnosed by only a few characteristics within the family Danionidae. The genus *Rasbora* are tiny to small elegant fishes inhabiting variety of habitats, from lakes to lower reaches of mountain streams and attains a maximum length of 150 mm standard length [11]. During the present study, *Rasbora daniconius* was recorded from Brahmaputra River. The genus *Salmostoma* is comprised of 14 species, all from Indian region [11]. In the present study, *Salmostoma bacaila* was recorded from the Kopili River. Talwar and Jhingran [11] reported

that *S. bacaila* usually inhabits slow running streams.

The database on indigenous fish species aids in identifying key genetic resources and provides crucial insights for organizing ecosystems and habitats [37]. The emerging anthropogenic pressure over the last two decades has been posing significant threat to the aquatic resources, which needs to be considered for sustaining the diversity and maintaining the ecosystem balance. Baishya et al. [38] reported 52 small indigenous fish (SIF) species from the upper reaches of the Brahmaputra River, of which 2 species have been classified as endangered and 3 as vulnerable. Therefore, establishing baseline information on these species is essential for developing effective conservation and management strategies.

5. CONCLUSION

The present study is a preliminary attempt to report the diversity of danionid species from Brahmaputra basin of Assam. Although the danionids may not hold significant commercial importance within the realm of freshwater species, they do exhibit substantial potential for deployment in aquaculture, the ornamental trade, recreational fishing, and as a food resource. Putative members of this family are brightly coloured with beautiful pattern of bars and stripes, promising to be exceptional resource of ornamental value. For the scientific conservation and management of fishes, their proper identification is of utmost importance. However, as these small indigenous fishes are affected due to various anthropogenic reasons such as habitat shrinkage, pollution, overexploitation with use of small meshed gear etc. they need to be addressed for conservation. Hence, the results of the present study can be used as a baseline information for identification of the particular group and their sustainable management.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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ETHICS APPROVAL

All the fish specimens used in the study were collected using traditional gears. The current study followed the Guidelines of the Committee constituted for the purpose (Ethical Approval Committee, EAC) at College of Fisheries, Assam Agricultural University with vide approval no. AAU/G-9/COF/2021-22/3594 Dated 25/05/2023.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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