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Morphological Characterization of Genus *Puntius* from Southern Western Ghats, India

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Abstract: Among the different kinds of freshwater fishes, fishes grouped under the genus *Puntius*, belonging to the order *Cypriniformes*, have been considered an important protein source of the daily diets of human beings in south India, in particular. The inter and intra-genetic relationships of the genus *Puntius* species have not yet been well understood to date and the species are reported to exist in various water bodies of peninsular India. In the present study, a total of 168 individuals of the 17 species of genus *Puntius* have been collected using a cast net, dip net, gill net and drag net from 31 locations of six river systems meandering eastward flowing rivers of Bhavani, Moyar, Chalakudy, Periyar, Cauvery and Kabini of Southern Western Ghats have collected for taxonomy study. The taxonomic status of Genus Puntius has been discussed in this paper based on the Meristic and morphometric characteristics. 35 Morphometric measurements and 23 meristic character counts were made based on the methodology described by Rainboth. All the morphometric characters were divided by the standard length of the fish, to nullify the size effect. The genus *Puntius* has been divided into *Barbodes, Dawkinsia, Eechathalakenda, Haludaria, Pethia, Puntius, Sahyadria, Systomus*. The significance of the study and the taxonomic placement of the species have also been concisely discussed. It is clearly expressed that only a few morphometric and meristic characters show the variation among the species.

Keywords: *Puntius*, Southern Western Ghats, Taxonomic Status, Ambiguity.

INTRODUCTION

The molecular-based taxonomy is a very cost-effective technique and it cannot be applied all the time. One should understand the morphology-based fish taxonomy to know the species. The genes *Puntius* is taxonomically having more ambiguity because the micro and macro habitat (i.e. the geographical location) have influenced the morphological variations within the species. Cypriniformes is the largest clade of freshwater fishes with 3,285 described species, and as many as 2,600 un-described species (most of these species have economic, ornamental and scientific importance). There are 5 families, 10 subfamilies, 70 genera and 413 species of Cypriniformes recorded to date in Indian freshwater bodies.

Barbodes is a name that has been used in the literature for a variety of cyprinid fishes and has long been ignored for Southeast Asian species until revived for a genus of moderately large barbs by Rainboth [29, 30]. The three species originally included in *Barbodes* are now placed in the genus *Puntius* Hamilton, 1822. *Systomus maculatus*

(Valenciennes) is considered a simultaneous junior synonym of *Puntius binotatus* (Valenciennes). *Systomus fasciatus* (Bleeker) is a secondary junior homonym of *Cirrhinus fasciatus* [3] when placed in *Puntius* by Silas and it is now known as *Puntius johorensis* and *Systomys lateristriga* is known as *P. lateristriga* (Valenciennes). Rainboth [30] recently used the name *Puntius* for only a subset of this assemblage and placed some other species in *Systomus* McClelland.

The genus Puntius (Hamilton) is classified under the Cyprinid family, which is represented by a large number of species in the Asian tropics. Amongst different kinds of freshwater fishes, the fishes grouped under the genus *Puntius* (Hamilton) have been considered an important source of protein being used for man's daily diet apart from other sources [31]. The knowledge about the inter and intra-genetic relationship regarding the genus *Puntius* is insufficient which makes the status of this genus unsettled and remains ambiguous till now.

Taxonomic Status of *Genus Puntius*

The genus Puntius is termed as ray-finned fish in the family Cyprinidae of the order Cypriniformes. Fishes of this genus are known as the spotted barbs for the predominant pattern, though many have vertical black bands instead. Historically, many species of Puntius have been classified into several genera, including Barbus. Despite the reclassifications, the specific epithet remains the same in these – except in cases of homonymies – as Barbus and Puntius have the same grammatical gender. The closest living relatives of the spotted barbs are the Cyprinion barbs, the Assamese kingfish (*Semiplotus semiplotus*), and perhaps the *Capoet*a barbs. These and the other "typical" barbs were formerly often separated as subfamily Barbinae, but this group is highly paraphyletic concerning the Cyprininae and better merged at least for the largest part (including Puntius). In particular, the genus Barbonymus, containing the tinfoil barb and its relatives was included in Puntius, which appeared to be a kind of carp that has evolved convergently with barbs.

Puntius has long been recognized as a "catch-all" genus for a variety of small tropical Asian cyprinids whose interrelationships are poorly understood [32–34]. The genus Puntius is widely distributed in Southeast Asia and India, including Sri Lanka. The maximum size for an adult of this genus is less than 25 cm (9.8 in), typically 7–15 cm (2.8–5.9 in), and many species only achieve around 5 cm (2.0 in) adult length. In appearance, they may resemble miniature carp and are often brightly coloured or patterned. The genus comprised 48 valid species in the South Asian region as of 1990 [5], since when some 30 additional species have been described.

The taxonomic status of freshwater fishes has been adopted mostly from Talwar and Jhingran [5]. Many other workers like [7, 9, 10, 17, 18, 26, 27, 32, 35–80] have worked on the distribution of the fish species and their threat status in the Western Ghats.

Despite the revised version of the genus Puntius by Jayaram [81], the taxonomy of the genus continues to be ambiguous, more over fully revised data will have new species included in it. Silas [62] has studied the fishes of various biosphere reserves and sanctuaries. Many have worked on the description of the various species in the genus *Puntius* [17], Talwar and Jhingran [5], Jayaram [81], Hora [9].

Taxonomy of genus *Puntius* has been based mainly on the body parameters related to Standard Length and Head length. Comparative examination of morphological characters was one of the traditional methods of distinguishing fish taxa and stocks. Multivariate methods like principal component analysis of morphometric traits have been proposed as an efficient tool for stock identification in fishery management programs. Meristic and morphometric characters have been commonly used in fisheries biology as powerful tools for measuring discreteness and relationships among various taxonomic categories [5, 6, 50].

There has been considerable inconsistency and confusion in adopting the name Barbus (Cuvier) and/or Puntius (Hamilton). Hamilton placed some species under his division Puntius and a few others under the division Cyprinus. Several workers have treated these names either as a separate genus or a subgenus. The confusion is mainly due to the lack of revision of the entire Barbus group of species on a worldwide basis to know its genetic limits and composition. The genus Barbus comprises about 600 species in its entire range which extend from Africa, Asia and Europe, to Central China, and the East Indies. Gunther subdivided the several sections based on geographical grounds. Day [82] used the name Barbus in a wide sense, although in his key he utilized the Bleeckarian names without any definite indication of their status. Hora [17, 18, 24–27] treated the genus *Puntius* as a sub-genus of *Barbus*. Menon [83] have revived the old Bleekerian names *Barbodes* and *Hypselobarbus* to accommodate some species of *Puntius* and *Gonotoproktopterus*.

The genus *Puntius* was proposed by Hamilton [2] without any definite type designation. Many have believed that *Puntius puntio*[2], a species included by Hamilton-Buchanan, would be the type by the rule of absolute tautonymy. Jayaram [84] suggests that *Puntius* and *puntio* are spelled differently and hence tautonymy cannot be considered. Bleeker in his book *Atlas icthyologique* has designated *Puntius sophore* Hamilton- Buchanan as the type species invariably chosen as a valid species of genus *Puntius*. It is to be noted that *Puntius sophore* is widely distributed in Indian waters. On the other hand, the genus *Barbus* was proposed by Cuvier in 1817 to fit the species such as *Cyprinus barbus* Linnaeus which is distributed in European countries and not in the Asian continent.

Hamilton [2] first described *Pethia ticto* from the South-Eastern parts of Bengal, as a small fish with a spotted dorsal fin and two black spots on the body, one on the lateral line above the pectoral fin and the other near the end of the tail. Subsequently, Day [82] gave a clearer description of *Pethia ticto* and distinguished it from *P. stoliczkanus* and *P. punctatus*, which he had described, by the presence of an incomplete lateral line (vs. a complete lateral line in the other two species). Hora [17, 45] treated *P. stoliczkanus* and *P. punctatus* as synonyms of *Pethia ticto* while Silas [60] considered *P. stoliczkanus* and *P. punctatus* to be subspecies of *Pethia ticto*. Jayaram [81] in his revision of *Puntius*, once again brought *P. stoliczkanus* and *P. punctatus* under the synonymy of *Pethia ticto*. Talwar and Jhingran [5] considered *P. stoliczkanus* and *P. punctatus* as synonyms of *Pethia ticto*.

Because of the above reasons, and also thanks to the research of Rainboth, it is now widely accepted that name Barbus be used to represent the barbells of European continent and Puntius for the Asiatic, especially Indian Fishes. Fishes of the genus Puntius are generalized and exhibit variations within individuals of the same sex. The taxonomic characters commonly used are not helpful in the clear cut diagnosis of the species. The entire gamut of about 70 species of Puntius so far known has been brought down to 53sp. When they are classified as per their affinities as exhibited by their morphometry, they group themselves into several assemblages reflecting their phylogeny. Jayaram [81] has divided the 53 species into 10 groups with 14 complexes and has made comparisons of the groups and their complexes in a better manner.

Earlier Silas [62] has surveyed and reported 25 species in Anamalai hills. Shaji and Easa [55} have recorded *Haludaria melanampyx a tributary of* Kunthipuzha, Silentvalley National Par. *Haludaria fasciatus* (Jerdon) has been assessed as Endangered and *Haludaria melanampyx* (Day) has been assessed as Low Risk least concern in Conservation Assessment and Management Plan Report (1998) [85]. *Puntius mahecola* (Valenciennes), which has been considered a synonym of *D. filamentosus* by many recent authors [5, 81] was shown by Pethiyagoda [86] to be a valid species that has hitherto been confused with *P. amphibius* (Valenciennes).

Even after the consolidated revisal of the genus Puntius by Jayaram [84] many new species have been identified and described by various authors from the Southern Western Ghats. Earlier in 2002 species named *Puntius kannikattiensis* was discovered in Kalakad Mundunthurai Tiger reserve by Arunachalam [77]. The contemporary publication by Rohan Pethiyagoda [87] has stated that the genus Puntius has been split into four new genera like *Systomus, Dawkinsia, Dravidia and Pethia,* which still *makes* the situation more ambiguous and unsettled. Very recently, Pethiyagoda [87] suggested that *S. denisonii* and *P. chalakkudiensis* warrant placement in a separate genus due to the strikingly different coloration and mouth shape compared to all other congeners. From now Raghavan [88] demonstrated that the Redline Torpedo Barbs comprise a distinct genus, named after the Western Ghats – "*Sahyadria*". A perusal of the literatures shows the genus *Puntius* till has ambiguities. Hence the present study was carried out to resolve and reclassify the taxonomic status and ambiguities of *Puntius* species collected from Southern Western Ghats using morphometric and meristic characters.

METHODOLOGY

Specimen Collection and Identification

The fish collection was made from 31 sites (Fig. 1) and sampling sites were selected based on the previous distribution record and the information from the local fisherman. Fish sampling site details are given in table 1. Fishes were collected using a cast net, dip net, gill net and drag net from various streams and rivers of the Southern Western Ghats. A total of 10 specimens from 17 *Puntius* species were collected and the fishes were photographed before being preserved in the formalin so that the fishes can be photographed with their original colour and preserved in 10 percent formalin of smaller samples and for larger samples formalin has been injected into the abdominal cavity so that the internal organs are well preserved for further taxonomic studies. The specimens were tagged and the reference numbers were given for further specimen identification and transported to Lab for further Morphometric and Meristic character analysis. The species were identified based on the key given by Talwar and Jhingran [5], Jayaram [6, 84] and Menon [50]. Holotype and paratypes of Puntius species were examined in the Zoological Survey of India, Southern Regional station, Chennai for confirmation of species. Voucher specimens have been made for each species and deposited at the Dept. of Environmental Sciences, Bharathiar University, Coimbatore. 35 Morphometric measurements like Standard Length (SL), Pre Anal

Length (PAL), Pre Dorsal Length (PDL), Pre Pelvic Length (PPL), Pre Pectoral Length (PPEL), Caudal Peduncle Length (CPL), Dorsal Origin to Pelvic Insertion (DOPvIn), Anal-Fin Length (AFL), Caudel Peduncle Depth (CPD), Caudal-Fin Length (CFL), Dorsal-Fin Length (DFL), Pectoral-Fin Length (PFL), Pelvic-Fin Length (PVL), Occiput to Dorsal-Fin Origin (ODFI), Occiput to Pectoral-Fin Insertion (OPFI), Occiput to Pelvic-Fin Insertion (OPvFI), Dorsal Insertion TO Pelvic Insertion (Dinpin), dorsal origin to pelvic insertion (Dopvin), Dorsal Origin To Anal Origin (DOAO), dorsal-fin base (DFB), anal-fin base (AFB), pectoral insertion to pelvic insertion (PecI-PelI), Total Length (TL), Post-Dorsal Length (PODL), Body Depth (BD), Snout Length (SL), Eye Diamater (ED), Inter Orbital Width (IOW), Inter Nasal Width (INW), Head Width (HW), Gape Width (GW), Head Depth At Occiput (HDO), Maxillary Barbell Length (MBL), Rostral Barbel Length (RBL) and Head Length (HL) and 23 meristic characters counts like Number of Dorsal Fin Spines (NDFS), Number of Anal Fin Spines (NAFS), Number of Pectoral Fin Spines (NPFS), Number of Pelvic Fin Spines (NPVFS), Number of Dorsal Fin Rays (NDFR), Number of Anal Fin Rays (NAFR), Number of Pectoral Fin Rays (NPFR), Number of Pelvic Fin Rays (NPVFR), Total Gill Rackers (TGR), Lateral Line Scale (LLS), Lateral Transverse Scale Upper (LTR U), Lateral Transverse Scale Lower (LTR L), Circumpeduncular Scales (CPS), Circumferential Scale (CFS), PRE DORSAL FIN SCALE (PDFS), Post Dorsal Fin Scale (PODFS), Pre Anal Fin Scale (PAFS), Post Anal Fin Scale (POAFS), Pre Pelvic Fin Scale (PPVFS), Post Pelvic Fin Scale (POPVFS), Post Pectoral Fin Scale (POPFS), Caudal Fin Upper Lobe (CFUL), Caudal Fin Lower Lobe (CFLL) were made based on the methodology described by Rainboth [30] (Fig. 2).

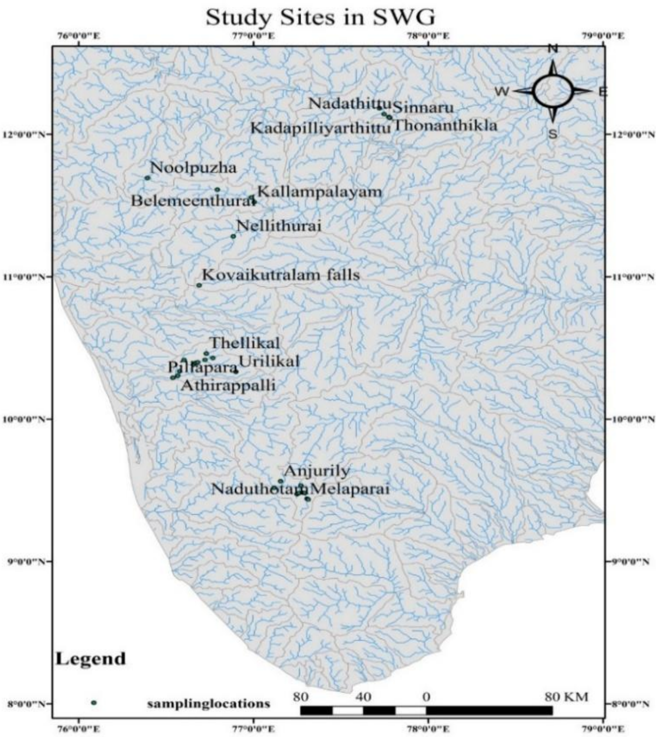

Figure 1: Collection location (The same figure is also used in one of my other publications (Anbu Aravazhi Arunkumar et al., 2017)

The measurements are taken using a digital vernier caliper (in mm) and the data are entered in Microsoft excel for statistical analysis. All the morphometric characters were divided by the standard length of the fish, to nullify the size effect. Morphometric and Meristic character data were analyzed using XLSTAT and SPSS software. Principal component analysis was performed for grouping the species and Cluster analysis was performed to know the similarity between the closely related species.

Table 1: Collection location

S. No	Study site	Latitude and longitude
		Moyar River System
1	Gulithuraipatti	11° 36’ N and 76° 47’ E
2	Kallampalayam	11° 31’ N and 77° 0’ E
3	Belemeenthurai	11° 36’ N and 76° 47’ E
		Chalakudy River System
4	Orukomban range	10° 22’ N and 76° 39’ E
5	Thenmudiparai	10° 24’ N and 76° 36’ E
6	Baghapallam	10° 27’ N and 76° 43’ E
7	Thellikal	10° 27’ N and 76° 44’ E
8	Puliyarkutti 8th bridge	10° 23’ N and 76° 40’ E
9	Puliyarkutti 3rd bridge	10° 23’ N and 76° 41’ E
10	Thunakadavu stream	10° 25’ N and 76° 46’ E
11	Thunakadavu tunnel	10° 20’ N and 76° 34’ E
12	Urilikal	10° 19’ N and 76° 53’ E
13	Athirappalli	10° 18’ E and 76° 34’ N
14	Pillapara	11° 36’ N and 76°47’ E
		Bhavani River System
15	Kovaikutralam falls	10° 56’ N and 76°41’ E
16	Nellithurai	11° 17’ N and 76°53’ E
		Periyar River System
17	Oorpannikaham	09° 28’ N and 77°16’ E
18	Valukuparai	09° 28’ N and 77°17’ E
19	Melaparai	09° 26’ E and 77° 18’ N
20	Naduthotam	09° 26’ N and 77° 19’ E
21	Ummikuppamthodu	09° 28’ N and 77° 14’ E
22	Sorrakottaodai	09° 28’ N and 77° 15’ E
23	Mullaithodu	09° 31’ N and 77° 16’ E
24	Anjurily	11° 36’ N and 76°47’ E

25	Thenkasithodu	11° 36’ N and 76°47’ E
		Cauvery River System
26	Kadapilliyarthittu	12° 07’ N and 77° 46’ E
27	Belikoondu	12° 11’ N and 77° 43’ E
28	Nadathittu	12° 08' E and 77° 44' N
29	Sinnaru	12° 06’ N and 77° 46’ E
30	Thonanthikla	12° 07’ N and 76° 46’ E
		Nugu River System
31	Noolpuzha	11° 41’ N and 76° 23’ E

Table 2: List is species studied and species collection location

S. No	*Name of the species*	Collection location
1	*Puntius amphibious*	Gulithuraipatti, Kallampalayam, Sinnaru
2	*Puntius bimaculatus*	Noolpuzha, Thenkasithodu, Urilikal
3	*Barbodes carnaticus*	Baghapallam, Belemeenthurai, Gulithuraipatti, Kadapilliyarthittu, Kallampalayam, Nadathittu, Orukomban range, Puliyarkutti river 3rd bridge, Puliyarkutti river 8th bridge, Sinnaru, Thellikal, Thenmudiparai, Thonanthikla, Thunakadavu stream
4	*Sahyadria chalakkudiensis*	Athirappalli, Pillapara
5	*Puntius chola*	Kallampalayam
6	*Pethia conchonius*	Kadapilliyarthittu, Nadathittu, Sinnaru
7	*Sahyadria denisonii*	Athirappalli, Pillapara
8	*Puntius dorsalis*	Kallampalayam, Gulithuraipatti
9	*Haludaria fasciata*	Baghapallam, Kovaikutralam falls, Orukomban range, Puliyarkutti river 3rd bridge, Puliyarkutti river 8th bridge, Thellikal, Thenmudiparai, Thunakadavu stream, Urilikal, Anjurily, Melaparai, Mullaithodu, Naduthotam, Noolpuzha, Oorpannikaham, Sorrakottaodai, Ummikuppamthodu, Valukuparai
10	*Dawkinsia filamentosa*	Gulithuraipatti, Nadathittu, Sinnaru, Thonanthikla
11	*Puntius mahecola*	Athirappalli, Nellithurai, Orukomban range, Pillapara, Thunakadavu tunnel, Baghapallam, Kadapilliyarthittu, Nadathittu, Puliyarkutti river 3rd bridge, Puliyarkutti river 8th bridge, Thellikal, Thenmudiparai, Thunakadavu stream
12	*Haludaria melanampyx*	Anjurily, Athirappalli, Melaparai, Mullaithodu, Noolpuzha, Oorpannikaham, Pillapara, Sorrakottaodai, Urilikal, Valukuparai, Baghapallam, Kovaikutralam falls, Orukomban range, Puliyarkutti river 3rd bridge, Puliyarkutti river 8th bridge, Thellikal, Thenmudiparai, Thunakadavu stream

13	*Eechathalakenda ophicephalus*	Naduthotam, Ummikuppamthodu
14	*Systomus sarana*	Gulithuraipatti, Kallampalayam, Nellithurai, Noolpuzha, Sinnaru
15	*Systomus spilurus*	Noolpuzha, Nellithurai
16	*Puntius sophore*	Urilikal
17	*Pethia ticto*	Kallampalayam

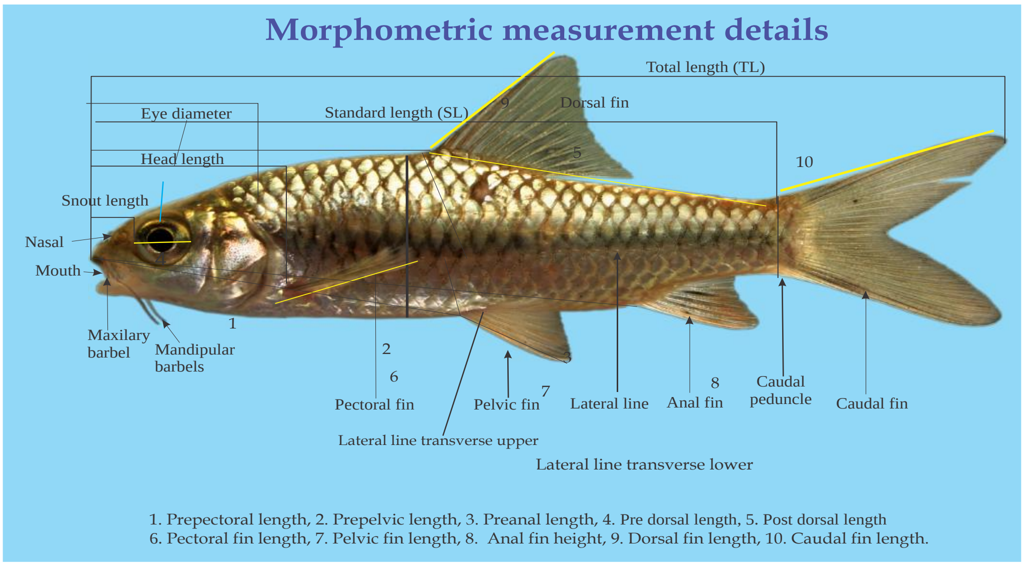

Figure 2: Schematic representation of *Puntius* indicating the positions of the superficial points used to measure the morphometric variables.

Comparative Materials

The type specimens from Zoological Survey of India, Chennai and Kolkata were examined for confirmation of species collected during the present study.

1. *Barbus cauveriensis*: ZSI, F 12179/1, Cauvery River, Coorg state, collected by Prof. C.R. Narayanan Rao.
2. *Puntius arulius*: ZSI *F* 735/2, a stream off the town of Kalladaikurichi on the road to Srigarmpatty range, Tamiraparani water shed.
3. *Barbus (Puntius) ophicephalus* (Raj) F 13514/1, Kallar, near periyar lake, Travancore, collected by Dr. B. Sundrara Raj.
4. *Puntius muzaffarpurensis*: ZSI FF1101, River Baghmati, Saidpur (bihar), 1975.
5. *Barbus parrah*: ZSI 27/8, Rurrisduroor.
6. *Barbus arenatus*: ZSI 2737, Madras, original of cxlii, fig.7.
7. *Barbus melanampyx*: ZSI 2719, Cochin.
8. *Puntius melanampyx*: ZSI F 6164/2, a stream at Molem, Goa, collected by K.S. Pradhan and party, 1967.

9. *Puntius sarana :* ZSI, River krishna, Karnataka, 1987.
10. *Puntius dorsalis:* ZSI, R. Nagulew a tributary of krishna, Andrapradesh, 1989.
11. *Puntius melanampyx:* ZSI F 776, Kodaikanal Lake, collected by Dr. Koshy mathew and party, 1986.
12. *Puntius sarana subnastus:* ZSI F 4572, 155.0 -156.0 mm SL, Tirunelveli, collected by Dr.M.B. Ragunathan and party, 1995.
13. *Puntius sophore:* ZSI, River Tungabadra, Andra Pradesh, 1987.
14. *Puntius fasciatus:* ZSI F 8188, 37.0 mm SL, Uppukala River, collected by Dr. R. Aengelas and Party.
15. *Puntius conchonius:* ZSI F 6098, 13.0 - 62.0mm SL, Harangi dam, collected by Dr. G. Thirumalai, 1999.
16. *Puntius ticto:* ZSI F 7016, 30.0 - 32.00 mm SL, Sringeri, collected by Dr. M.B. Ragunathan, 2002.
17. *Puntius filamentosus:* ZSI, 51.0 - 101.0mm SL, River Cauvery, Collected by KCJ, 1977.

RESULTS AND DISCUSSION

Interrelationship among the Species

The morphometric characters (in proportion to standard length) (Table 3) and meristic characters of *Puntius* species were analyzed (Table 4). The interrelationship among the 17 species has been observed in all based on the morphometric and meristic characteristics discussed.

Table 3: Comparative Range of Morphometrics characters of *Puntius* species.

17 Character	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
Tl	0.77 - 1.29	1.23 - 1.27	0.73 - 0.81	0.81-0.82	0.74 - 0.75	0.77 - 0.82	0.75 - 0.85	0.78 - 0.82	0.77-0.82
Ed	16.02 - 24.95	16.49 - 17.66	13.88 - 16.48	19.61 - 21.47	20.87 - 24.56	12.58 - 16.94	13.77 - 21.60	16.32 - 19.02	11.25 - 16.27
Bd	3.35 - 4.73	4.11 - 5.04	3.16 - 3.46	4.03 - 4.24	2.93 - 3.04	2.34 - 2.88	4.25 - 5.63	3.44 - 3.63	2.81 - 3.23
Hd	5.08 - 6.89	5.17 - 6.79	4.48 - 5.32	6.24 - 6.67	4.03 - 5.20	3.92 - 5.06	7.04 - 8.80	4.24 - 5.06	3.22 - 5.28
Cpd	8.69 - 12.30	8.47 - 9.48	7.68 - 7.68	7.93 - 9.99	7.54 - 8.19	6.19 - 7.64	10.97 - 15.51	8.44 - 10.06	3.57 - 7.14
HL	3.50 - 5.05	4.46 - 5.66	3.68 - 4.18	4.89 - 4.93	3.70 - 4.17	3.64 - 4.12	4.11- 4.52	3.10 - 3.68	3.29 - 6.47
HW	6.82 - 14.06	7.80 - 8.84	5.96 - 6.22	7.58 - 7.88	6.53 - 7.16	5.92 - 7.51	8.40 - 13.52	6.75 - 6.84	3.10 - 6.45
GM	13.08 - 28.13	17.60 - 23.15	12.84 - 15.07	25.95 - 28.42	19.63 - 23.63	15.13 - 22.53	21.9 - 78.52	22.38 - 23.31	11.02 - 14.81
Sl	7.66 - 12.64	9.71 - 12.18	9.03 - 9.53	8.84 - 9.41	9.38 - 11.66	6.74 - 8.94	9.11 - 13.94	8.31 - 9.36	7.79 - 11.34
Pal	1.29 - 1.74	1.73 - 1.81	1.31 - 1.35	1.37 - 1.42	1.35 - 1.38	1.33 - 1.44	1.30 - 1.51	1.37 - 1.46	1.34 - 1.43
Poal	3.68 - 10.47	9.22 - 12.07	6.36 - 8.55	2.29 - 2.51	6.51 - 8.57	6.20 - 9.14	2.40 - 6.60	1.70 - 2.85	5.41 - 7.72
Pdl	1.93 - 2.74	2.32 - 2.57	2.02 - 2.02	2.24 - 22.69	1.87 - 2.00	1.77 - 1.99	2.12 - 2.27	1.86 - 1.95	1.92 - 2.07
Podl	2.49 - 3.97	3.44 - 4.20	2.76 - 3.01	1.57 - 1.72	3.30 - 3.51	3.06 - 4.02	1.65 - 3.20	1.32 - 1.41	3.02 - 3.20
Ppl	3.40 - 5.29	4.27 - 5.01	3.78 - 4.05	4.23 - 4.63	3.74 - 3.87	3.19 - 4.13	3.74 - 4.60	3.34 - 4.05	3.43 - 3.89
Popl	1.25 - 1.97	1.59 - 1.87	1.27 - 1.34	0.98 - 1.07	1.28 - 1.37	1.25 - 1.55	0.90 - 1.40	1.02 - 1.16	1.38 - 1.54
Dfl	3.99 - 5.47	4.96 - 5.73	4.06 - 5.03	4.22 - 4.62	3.88 - 4.55	3.91 - 6.76	3.81 - 7.20	4.22 - 4.88	3.95 - 4.97
Afl	5.43 - 8.56	7.28 - 8.83	4.90 - 4.99	6.63 - 7.26	4.92 - 5.49	6.53 - 9.58	5.71 - 14.90	5.94 - 8.04	4.91 - 7.49
Pfl	4.69 - 8.01	6.50 - 7.11	4.55 - 4.65	6.23 - 6.83	5.15 - 5.29	4.52 - 7.58	5.85 - 12.80	4.79 - 5.50	4.00 - 6.01

Pvl	4.01 - 8.66	6.70 - 8.40	4.61 - 5.04	5.88 - 6.44	4.87 - 5.87	4.89 - 5.95	4.44 - 8.32	6.10 - 7.32	4.98 - 6.77
ODFl	3.21 - 5.60	3.44 - 4.20	3.24 - 3.26	3.73 - 4.08	3.07 - 3.41	2.63 - 3.57	3.80 - 4.67	3.66 - 4.29	1.77 - 2.92
OPFl	2.72 - 6.57	5.74 - 6.46	4.80 - 4.86	6.65 - 7.28	4.46 - 5.05	2.68 - 4.58	6.99 - 8.53	4.95 - 5.06	4.04 - 4.76
OPvFl	2.51 - 3.70	2.90 - 3.16	2.27 - 2.41	2.58 - 2.82	2.39 - 2.49	2.05 - 2.67	2.61 - 3.23	2.58 - 2.72	2.20 - 2.90
Mabl	12.64 - 95.11	23.69 - 86.38	12.57 - 14.92	19.02 - 20.82	38.24 - 41.06	0	7.17 - 23.01	28.49 - 175.00	6.58 - 16.72
Rbl	0	0	19.66 - 22.55	0	0	0	0	0	9.43 - 16.59
Mdbl	0	0	0	0	0	0	0	0	0
Dinpin	2.33 - 5.59	2.98 - 3.20	2.21 - 2.38	2.51 - 2.75	2.15 - 4.27	1.90 - 2.22	2.50 - 3.99	2.50 - 3.05	2.82 - 3.06
Dopvin	2.52 - 4.73	4.13 - 4.82	3.24 - 3.34	4.19 - 4.58	3.05 - 3.15	2.32 - 2.71	3.69 - 5.55	3.33 - 4.19	2.84 - 3.45
Dfb	5.52 - 10.30	7.63 - 10.51	5.40 - 5.71	7.03 - 7.70	4.95 -6.22	4.75 - 6.33	6.54 - 13.86	6.77 - 7.67	4.59 - 5.58
Afb	11.71 - 23.73	11.03 - 17.15	12.10 - 12.84	13.23 - 14.49	8.84 - 12.42	6.98 - 11.26	13.73 - 50.06	13.32 - 17.56	8.72 - 11.75
DOAO	2.57 - 3.62	3.29 - 3.77	2.47 - 2.50	2.78 - 3.04	2.52 - 2.74	2.18 - 2.52	2.80 - 3.78	2.80 - 3.25	2.39 - 2.71
Pin-Pvin	3.39 - 6.49	4.51 - 5.61	3.52 - 4.13	3.61- 3.95	4.32 - 5.09	3.82 - 4.59	3.50 - 5.12	3.78 - 4.80	3.97 - 4.40
l o w	11.53 - 18.69	10.98 - 12.27	9.02 - 9.52	11.47 - 12.56	9.16 - 10.63	9.18 - 14.02	12.85 - 23.01	11.19 - 32.41	5.90 - 7.49
l n w	15.40 - 38.22	23.74 - 31.52	19.65 - 22.75	22.32 - 24.44	18.42 - 33.41	15.07 - 27.79	22.90 - 156.82	25.18 - 41.67	8.38 - 10.35
Cfl	3.40 - 5.60	4.11 - 4.54	3.00 - 3.17	3.64 - 3.99	2.84 - 3.16	3.30 - 3.87	3.27 - 6.75	3.22 - 5.67	3.16 - 5.52

17 Character	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*
Tl	0.72-0.78	0.72 - 0.80	0.77-0.81	1.21 - 1.32	0.74-0.79	1.19 - 1.35	0.76 - 0.81	0.76 - 0.78
Ed	10.77-13.25	13.29 - 18.78	14.01 - 18.33	16.23 - 20.96	10.82 - 15.38	13.70 - 16.92	11.03 - 13.18	12.03 - 15.43
Bd	2.92-3.49	2.92 - 3.43	2.96 - 3.50	5.00 - 5.96	2.99 - 2.99	3.25 - 4.01	2.58 - 3.14	2.49 - 2.76
Hd	4.75-5.74	4.58 - 5.80	3.91 - 5.70	6.09 - 6.76	4.24 - 4.68	4.61 - 5.33	3.69 - 4.10	3.61 - 4.20
Cpd	7.35-9.09	7.24 - 12.06	5.79 - 8.31	11.16 - 14.31	7.18 - 7.72	8.55 - 10.46	6.98 - 7.89	5.80 - 6.77
HL	3.43-3.95	3.26 - 23.40	3.31 - 3.77	4.13 - 4.80	3.67 - 4.08	4.11 - 4.56	3.20 - 3.37	3.29 - 4.03
HW	4.04-8.27	6.74 - 18.78	3.63 - 5.75	7.36 - 9.56	5.81 - 6.49	6.59 - 7.36	5.67 - 6.45	4.90 - 6.88
GM	13.16-20.16	8.67 - 28.18	9.85 - 14.93	12.13 - 20.84	13.55 - 14.74	15.02 - 20.35	13.33 - 20.28	20.72 - 23.37
Sl	6.88-9.33	1.33 - 11.39	7.19 - 9.84	8.93 - 11.99	7.83 - 9.44	9.16 - 11.27	6.67 - 8.22	6.62 - 8.26
Pal	1.29-1.40	1.29 - 5.25	1.33 - 1.40	1.56 - 1.81	1.33 - 1.43	1.65 - 1.92	1.33 - 1.43	1.36 - 1.38
Poal	5.78-7.29	1.60 - 7.61	6.39 - 8.30	6.94 - 9.75	6.49 - 9.30	8.25 - 15.62	7.99 - 9.87	8.52 - 9.48
Pdl	1.78-2.10	1.81 - 3.20	1.92 - 2.02	2.38 - 2.77	1.91 - 1.95	2.13 - 2.49	1.84 - 1.89	1.87 - 1.95
Podl	2.74-3.16	1.16 - 3.69	2.83 - 3.38	3.06 - 3.73	2.83 - 3.16	3.97 - 4.69	3.04 - 3.41	3.24 - 3.60
Ppl	3.32-4.28	1.34 - 4.36	3.40 - 3.81	4.21 - 5.05	3.36 - 3.83	4.05 - 4.58	3.06 - 3.52	3.29 - 3.60
Popl	1.42-1.51	0.95 - 3.76	1.43 - 4.08	1.65 - 1.94	1.34 - 1.38	1.27 - 2.05	1.37 - 1.46	1.33 - 1.53
Dfl	2.61-3.84	3.32 - 6.95	3.79 - 5.56	4.34 - 8.41	4.01 - 4.06	4.36 - 6.72	4.25 - 5.32	4.36 - 5.43
Afl	5.27-6.13	5.80 - 8.41	4.78 - 5.78	5.95 - 7.55	5.25 - 6.12	7.20 - 9.26	5.26 - 8.01	5.72 - 6.97
Pfl	3.91-5.23	4.71 - 8.04	4.58 - 5.42	5.83 - 7.16	4.10 - 5.72	6.09 - 7.85	4.33 - 5.53	4.59 -4.99
Pvl	4.05-5.11	4.54 - 6.26	5.20 - 5.58	6.96 - 9.05	4.96 - 5.69	6.93 - 9.24	5.18 - 6.30	5.51 - 5.94
ODFl	2.63-5.16	1.79 - 4.14	1.98 - 4.29	4.26 - 5.39	3.08 - 3.85	3.64 - 4.50	2.75 - 3.18	2.59 - 3.43
OPFl	4.32-4.81	4.26 - 5.74	4.13 - 4.56	6.21 - 7.63	4.34 - 4.42	4.82 - 5.73	3.93 - 4.65	3.91 - 4.86
OPvFl	2.22-2.62	2.23 - 2.79	2.38 - 2.72	3.04 - 3.67	2.21 - 2.34	2.43 - 3.31	2.46 - 2.82	2.15 - 2.32
Mabl	11.95-29.29	26.05 - 122.29	6.11 - 7.78	11.03 - 22.25	13.38 - 15.12	16.61 - 22.34	0	0
Rbl	0	0	8.99 - 16.56	13.15 - 20.11	18.42 - 18.70	23.08 - 42.10	0	0
Mdbl	0	0	0	0	0	0	0	0
Dinpin	2.67-3.13	2.01 - 2.50	2.82-3.11	3.19 - 3.69	2.26 - 2.26	2.65 - 3.18	2.23 - 2.52	1.97 - 2.25
Dopvin	2.79-4.02	2.88 - 3.74	3.11-3.60	5.22 - 5.83	2.96 - 3.04	3.07 - 3.98	2.72 - 3.16	2.48 - 2.85
Dfb	5.05-6.24	5.11 - 7.98	4.99-5.81	8.00 - 10.24	5.25 - 5.72	6.85 - 8.35	5.55 - 6.20	4.32 - 5.40
Afb	9.37-10.50	8.97 - 20.38	9.21-12.57	11.30 - 17.55	9.52 - 12.81	11.95 - 15.92	7.82 - 13.09	7.36 - 11.77
DOAO	2.27-2.68	2.43 - 3.01	2.54-2.76	3.71 -4.01	2.46 - 2.63	2.76 - 3.73	2.43 - 2.80	2.24 - 2.33
Pin-Pvin	3.49-4.39	3.22 - 4.69	3.72-4.48	4.56 - 5.87	4.15 - 4.26	3.88 - 5.48	4.25 - 4.98	3.68 - 4.00
l o w	5.98-8.44	11.23 - 18.78	5.66-6.23	12.28 - 15.43	9.27 - 9.85	10.44 - 15.32	9.26 - 10.97	10.03 - 13.56
l n w	8.10-10.66	8.28 - 38.16	8.79-10.36	17.94 - 37.34	16.56 - 16.80	19.51 - 29.30	15.85 - 23.73	25.64 - 28.88
Cfl	2.59-3.37	2.95 - 3.87	3.20-3.91	4.34 - 5.31	3.12 - 3.92	3.95 - 6.28	2.84 - 3.50	3.36 - 3.75

1. P. amphibius, 2. P. bimaculatus, 3. B. carnaticus, 4. S. chalakkudiensis, 5. P. chola, 6. Pethia conchonius, 7. S. denisonii, 8. P. dorsalis, 9. H. fasciata, 10. D. filamentosa, 11. P. mahecola, 12. H. melanampyx, 13. E. ophicephalus, 14. S. sarana, 15. S. spilurus, 16. P. sophore, 17. Pethia ticto.

Table 4: Comparative meristic characters of *Puntius* species.

	Species																
Characters	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*
Ndfs	2	3	4	4	3	3	2	3	2	3	2	2	3	3	3	3	3
Nafs	2	3	2	3	2	3	2	2	2	2	2	1	3	3	2	2	3
Npfs	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Npvfs	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ndfr	8	8	8	8	8	8	8	8	8	8	9	9	7	8	8	8	8
Nafr	8	5	5	5	5	5	5	5	6	6	8	6	5	5	5	5	5
Npfr	11	10	15	12	15	12	12	12	13	12	16	12	15	15	15	13	14
Npvfr	5	8	8	8	8	8	5	8	9	9	13	9	7	8	7	8	8
Tgr	4	4	3	5	4	4	4	4	5	5	5	4	4	3	4	4	3
LLs	25	24	28	27	28	21	29	26	21	24	21	24	42	30	28	22	25
Ltr U	5.5	4.5	5.5	5.5	5.5	5.5	5.5	4.5	4.5	5.5	4.5	4.5	7.5	5.5	5.5	4.5	5.5
Ltr L	3.5	3.5	3.5	3.5	5	4.5	3.5	2.5	3.5	3.5	4.5	3.5	3.5	4.5	3.5	3.5	4.5
Cps	12	10	10	14	12	10	11	12	14	12	11	14	16	8	11	11	11
Cfs	19	13	22	22	21	23	20	18	18	18	18	18	23	18	17	15	22
Pdfs	8	9	12	9	9	8	8	8	7	8	8	7	15	10	9	8	10
Po-dfs	12	10	11	15	11	10	12	12	10	9	10	11	20	11	11	11	11
Pafs	16	14	20	21	18	18	19	20	17	18	6	17	20	16	15	15	14
Po-afs	6	5	5	7	6	7	8	6	6	5	6	7	5	5	6	4	5
Ppvfs	9	7	7	14	10	10	11	12	11	12	12	11	10	11	8	7	10
Po-pvfs	12	9	11	13	16	13	20	14	13	15	9	15	15	11	11	9	9
Po-pfs	18	14	18	20	22	22	28	23	21	23	22	24	25	21	21	14	19
Cful	12	12	11	16	15	13	15	13	13	15	12	13	13	10	17	17	10
Cfll	11	12	8	15	15	13	15	12	13	15	12	13	13	19	19	19	9

1. P. amphibius, 2. P. bimaculatus, 3. B. carnaticus, 4. S. chalakkudiensis, 5. P. chola, 6. Pethia conchonius, 7. S. denisonii, 8. P. dorsalis, 9. H. fasciata, 10. D. filamentosa, 11. P. mahecola, 12. H. melanampyx, 13. E. ophicephalus, 14. S. sarana, 15. S. spilurus, 16. P. sophore, 17. Pethia ticto.

Morphometric Characters

Total Length

The total length of *P. amphibius* 1.20 - 1.30 (1.26); *P. bimaculatus* 1.23 - 1.27 (1.26); *B. carnaticus* 1.24 - 1.37 (1.31); *S. chalakkudiensis* 1.23 - 1.23 (1.23); *P. chola* 1.33 - 1.34 (1.34); *Pethia conchonius* 1.23 - 1.29 (1.26); *S. denisonii* 1.17 - 1.33 (1.27); *P. dorsalis* 1.22 - 1.28 (1.25); *H. fasciata* 1.22 - 1.30 (1.26); *D. filamentosus*1.29 - 1.40 (1.35); *P. mahecola* 1.25 - 1.39 (1.31); *H. melanampyx* 1.24 - 1.30 (1.27); *E. ophicephalus*1.21 - 1.32 (1.27); *S. sarana* 1.27 - 1.35 (1.31); *S. spilurus* 1.19 - 1.35 (1.29); *P. sophore* 1.24 - 1.32 (1.28); *Pethia ticto* 1.27 - 1.32 (1.30) in percentage of standard length. In comparing with all the species

P. bimaculatus, S. spilurus and *E. ophicephalus*has elongated body compare to all other species (Table 3).

Eye Diameter

Eye diameter of *P. amphibius* 0.04 - 0.07 (0.05); *P. bimaculatus* 0.07 - 0.08 (0.07); *B. carnaticus* 0.06 - 0.07 (0.07); *S. chalakkudiensis* 0.06 - 0.07 (0.07); *P. chola* 0.04 - 0.05 (0.04); *Pethia conchonius* 0.06 - 0.08 (0.07); *S. denisonii* 0.05 - 0.07 (0.06); *P. dorsalis* 0.05 - 0.06 (0.06); *H. fasciata* 0.06 - 0.09 (0.07); *D. filamentosus*0.08 - 0.09 (0.08); *P. mahecola* 0.05 - 0.08 (0.06); *H. melanampyx* 0.05 - 0.07 (0.07); *E. ophicephalus*0.06 - 0.08 (0.07); *S. sarana* 0.07 - 0.09 (0.08); *S. spilurus* 0.07 - 0.10 (0.09); *P. sophore* 0.08 - 0.09 (0.08); *Pethia ticto* 0.06 - 0.08 (0.07) in percentage of standard length. In comparing all the species *P. chola, S. chalakkudiensis* and *P. amphibius* have larger eye diameter than all other species (Table 3).

Body Depth

Body depth of *P. amphibius* 0.23 - 0.30 (0.27); *P. bimaculatus* 0.25 - 0.30 (0.27); *B. carnaticus* 0.29 - 0.32 (0.30); *S. chalakkudiensis* 0.29 - .32 (0.30); *P. chola* 0.33 - 0.34 (0.33); *Pethia conchonius* 0.35 - 0.43 (0.40); *S. denisonii* 0.18 - 0.24 (0.21); *P. dorsalis* 0.28 - 0.29 (0.28); *H. fasciata* 0.31 - 0.36 (0.32); *D. filamentosus*0.29 - 0.34 (0.31); *P. mahecola* 0.29 - 0.34 (0.31); *H. melanampyx* 0.29 - 0.34 (0.31); *E. ophicephalus*0.21 - 0.25 (0.23); *S. sarana* 0.33 - 0.33 (0.33); *S. spilurus* 0.33 - 0.37 (0.34); *P. sophore* 0.32 - 0.39 (0.34); *Pethia ticto* 0.36 - 0.40 (0.38) in percentage of standard length. In comparing all the species *E. ophicephalus, S. denisonii* and *P. bimaculatus* have deep body compared to all the species (Table 3).

Head Depth

Head depth of *P. amphibius* 0.15 - 0.22 (0.18); *P. bimaculatus* 0.19 - 0.24 (0.20); *B. carnaticus* 0.19 - 0.22 (0.21); *S. chalakkudiensis* 0.15 - 0.16 (0.16); *P. chola* 0.19 - 0.25 (0.22); *Pethia conchonius* 0.20 - 0.25 (0.23); *S. denisonii* 0.11 - 0.14 (0.13); *P. dorsalis* 0.20 - 0.24 (0.21); *H. fasciata* 0.19 - 0.31 (0.23); *D. filamentosus*0.17 - 0.21 (0.19); *P. mahecola* 0.17 - 0.22 (0.20); *H. melanampyx* 0.18 - 0.26 (0.21); *E. ophicephalus*0.18 - 0.21 (0.20); *S. sarana* 0.21 - 0.24 (0.22); *S. spilurus* 0.25 - 0.26 (0.26); *P. sophore* 0.24 - 0.27 (0.25); *Pethia ticto* 0.24 - 0.28 (0.26) in percentage of standard length. In comparing all the species *S. denisonii, S. chalakkudiensis* and *E. ophicephalus*has have greater head depth than all other species (Table 3).

Caudal Peduncle Depth

Caudal peduncle depth of *P. amphibius* 0.08 - 0.12 (0.10); *P. bimaculatus* 0.13 - 0.15 (0.14); *B. carnaticus* 0.13 - 0.13 (0.13); *S. chalakkudiensis* 0.10 - 0.13 (0.11); *P. chola* 0.12 - 0.13 (0.13); *Pethia conchonius* 0.13 - 0.16 (0.15); *S. denisonii* 0.06 - 0.09 (0.08); *P. dorsalis* 0.10 - 0.12 (0.11); *H. fasciata* 0.14 - 0.28 (0.16); *D. filamentosus*0.11 - 0.14 (0.12); *P. mahecola* 0.08 - 0.14 (0.10); *H. melanampyx* 0.12 - 0.17 (0.14); *E. ophicephalus*0.09 - 0.11 (0.10); *S.*

sarana 0.13 - 0.14 (0.13); *S. spilurus* 0.12 - 0.15 (0.13); *P. sophore* 0.13 - 0.14 (0.14); *Pethia ticto* 0.15 - 0.17 (0.16) in percentage of standard length. In comparing all the species *E. ophicephalus, S. denisonii* and *P. mahecola* have greater caudal peduncle depth than all other species (Table 3).

Head Length

Head length of *P. amphibius* 0.23 - 0.31 (0.26); *P. bimaculatus* 0.22 - 0.28 (0.25); *B. carnaticus* 0.24 - 0.27 (0.26); *S. chalakkudiensis* 0.20 - 0.20 (0.20); *P. chola* 0.24 - 0.27 (0.25); *Pethia conchonius* 0.24 - 0.27 (0.27); *S. denisonii* 0.22 - 0.24 (0.23); *P. dorsalis* 0.27 - 0.32 (0.29); *H. fasciata* 0.15 - 0.30 (0.27); *D. filamentosus*0.25 - 0.29 (0.27); *P. mahecola* 0.04 - 0.31 (0.25); *H. melanampyx* 0.27 - 0.30 (0.28); *E. ophicephalus*0.26 - 0.30 (0.28); *S. sarana* 0.24 - 0.27 (0.26); *S. spilurus* 0.28 - 0.32 (0.30); *P. sophore* 0.30 - 0.31 (0.29); *Pethia ticto* 0.25 - 0.30 (0.29) in percentage of standard length. In comparing all the species *P. mahecola, P. bimaculatus* and *S. chalakkudiensis* have longer head length than all other species (Table 3).

Head Width

Head width of *P. amphibius* 0.07 - 0.15 (0.12); *P. bimaculatus* 0.14 - 0.16 (0.15); *B. carnaticus* 0.16 - 0.17 (0.16); *S. chalakkudiensis* 0.13 - 0.13 (0.13); *P. chola* 0.14 - 0.15 (0.15); *Pethia conchonius* 0.13 - 0.17 (0.16); *S. denisonii* 0.07 - 0.12 (0.10); *P. dorsalis* 0.15 - 0.15 (0.15); *H. fasciata* 0.16 - 0.32 (0.23); *D. filamentosus*0.12 - 0.25 (0.17); *P. mahecola* 0.05 - 0.15 (0.07); *H. melanampyx* 0.17 - 0.28 (0.23); *E. ophicephalus*0.13 - 0.17 (0.15); *S. sarana* 0.15 - 0.17 (0.16); *S. spilurus* 0.17 - 0.19 (0.18); *P. sophore* 0.15 - 0.18 (0.16); *Pethia ticto* 0.15 - 0.20 (0.18) in percentage of standard length. In comparing all the species *P. mahecola, S. denisonii* and *P. bimaculatus* has larger head width than all other species (Table 3).

Gape of Mouth

Gape of Mouth of *P. amphibius* 0.04 - 0.08 (0.06); *P. bimaculatus* 0.05 - 0.07 (0.06); *B. carnaticus* 0.07 - 0.08 (0.07); *S. chalakkudiensis* 0.04 - 0.04 (0.04); *P. chola* 0.04 - 0.05 (0.05); *Pethia conchonius* 0.04 - 0.07 (0.05); *S. denisonii* 0.01 - 0.05 (0.03); *P. dorsalis* 0.04 - 0.04 (0.04); *H. fasciata* 0.07 - 0.09 (0.08); *D. filamentosus*0.05 - 0.08 (0.06); *P. mahecola* 0.04 - 0.12 (0.06); *H. melanampyx* 0.07 - 0.10 (0.08); *E. ophicephalus*0.06 - 0.10 (0.08); *S. sarana* 0.07 - 0.07 (0.07); *S. spilurus* 0.06 - 0.09 (0.08); *P. sophore* 0.05 - 0.08 (0.06); *Pethia ticto* 0.04 - 0.05 (0.05) in percentage of standard length. In comparing all the species *S. denisonii, S. chalakkudiensis* and *P. dorsalis* has a larger mouth than all other species (Table 3).

Snout Length

Snout length of *P. amphibius* 0.08 - 0.13 (0.10); *P. bimaculatus* 0.10 - 0.13 (0.12); *B. carnaticus* 0.10 - 0.11 (0.11); *S. chalakkudiensis* 0.11 - 0.11 (0.11); *P. chola* 0.09 - 0.11(0.10); *Pethia conchonius* 0.11 -0.15 (0.13); *S. denisonii* 0.07 - 0.11 (0.09); *P. dorsalis*

0.11 - 0.12 (0.12); *H. fasciata* 0.09 - 0.13 (0.12); *D. filamentosus*0.11 - 0.15 (0.12); *P. mahecola* 0.09 - 0.75 (0.14); *H. melanampyx* 0.10 - 0.14 (0.12); *E. ophicephalus*0.11 - 0.14 (0.12); *S. sarana* 0.11 - 0.13 (0.12); *S. spilurus* 0.11 - 0.14 (0.13); *P. sophore* 0.12 - 0.15 (0.13); *Pethia ticto* 0.12 - 0.15 (0.14) in percentage of standard length. In comparing all the species *S. denisonii, P. chola* and *Pethia ticto* have longer snout length than all other species (Table 3).

Pre Anal Length

Pre anal length of *P. amphibius* 0.70 - 0.77 (0.74); *P. bimaculatus* 0.69 - 0.72 (0.72) *B. carnaticus* 0.74 - 0.77 (0.75); *S. chalakkudiensis* 0.70 - 0.73 (0.72); *P. chola* 0.72 - 0.74 (0.73); *Pethia conchonius* 0.69 - 0.75 (0.71); *S. denisonii* 0.66 - 0.77 (0.73); *P. dorsalis* 0.68 - 0.73 (0.70); *H. fasciata* 0.70 - 0.75 (0.72); *D. filamentosus*0.71 - 0.77 (0.74); *P. mahecola* 0.19 - 0.77 (0.71); *H. melanampyx* 0.71 - 0.75 (0.73); *E. ophicephalus*0.71 - 0.79 (0.73); *S. sarana* 0.70 - 0.75 (0.73); *S. spilurus* 0.70 - 0.73 (0.72); *P. sophore* 0.70 - 0.75 (0.72); *Pethia ticto* 0.72 - 0.73 (0.73) in percentage of standard length. In comparing all the species *S. spilurus, P. bimaculatus* and *E. ophicephalus*has longer pre-anal length than all other species (Table 3).

Post Anal Length

Post anal length of *P. amphibius* 0.10 - 0.27 (0.18); *P. bimaculatus* 0.11 - 0.13 (0.11); *B. carnaticus* 0.12 - 0.16 (0.14); *S. chalakkudiensis* 0.40 - 0.44 (0.42); *P. chola* 0.12 - 0.15 (0.13); *Pethia conchonius* 0.11 - 0.16 (0.14); *S. denisonii* 0.15 - 0.42 (0.19); *P. dorsalis* 0.35 - 0.59 (0.51); *H. fasciata* 0.13 - 0.18 (0.16); *D. filamentosus*0.14 - 0.17 (0.16); *P. mahecola* 0.13 - 0.62 (0.21); *H. melanampyx* 0.12 - 0.16 (0.14); *E. ophicephalus*0.12 - 0.18 (0.15); *S. sarana* 0.11 - 0.15 (0.13); *S. spilurus* 0.09 - 0.16 (0.12); *P. sophore* 0.10 - 0.13 (0.12); *Pethia ticto* 0.11 - 0.12 (0.11) in percentage of standard length. In comparing all the species *S. spilurus, P. bimaculatus* and *Pethia ticto* have longer Post anal length than all other species (Table 3).

Pre Dorsal Length

Pre dorsal length of *P. amphibius* 0.44 - 0.52 (0.48); *P. bimaculatus* 0.49 - 0.55 (0.51); *B. carnaticus* 0.49 - 0.50 (0.50); *S. chalakkudiensis* 0.04 - 0.45 (0.25); *P. chola* 0.50 - 0.53 (0.51); *Pethia conchonius* 0.50 - 0.57 (0.53); *S. denisonii* 0.44 - 0.47 (0.46); *P. dorsalis* 0.51 - 0.54 (0.53); *H. fasciata* 0.48 - 0.52 (0.50); *D. filamentosus*0.48 - 0.56 (0.51); *P. mahecola* 0.31 - 0.55 (0.48); *H. melanampyx* 0.50 - 0.52 (0.51); *E. ophicephalus*0.46 - 0.53 (0.48); *S. sarana* 0.51 - 0.52 (0.52); *S. spilurus* 0.53 - 0.58 (0.56); *P. sophore* 0.53 - 0.54 (0.52); *Pethia ticto* 0.51 - 0.53 (0.52) in percentage of standard length. In comparing all the species *S. spilurus, P. bimaculatus* and *Pethia ticto* have longer pre-dorsal length than all other species (Table 3).

Post Dorsal Length

Post dorsal length of *P. amphibius* 0.28 - 0.40 (0.36); *P. bimaculatus* 0.29 - 0.36 (0.33); *B. carnaticus* 0.33 - 0.36 (0.35); *S. chalakkudiensis* 0.58 - 0.64 (0.61); *P. chola* 0.28 - 0.30

(0.29); *Pethia conchonius* 0.25 - 0.33 (0.30); *S. denisonii* 0.31 - 0.61 (0.37); *P. dorsalis* 0.71 - 0.76 (0.73); *H. fasciata* 0.31 - 0.33 (0.32); *D. filamentosus*0.32 - 0.36 (0.34); *P. mahecola* 0.27 - 0.86 (0.37); *H. melanampyx* 0.30 - 0.35 (0.32); *E. ophicephalus*0.33 - 0.42 (0.38); *S. sarana* 0.32 - 0.35 (0.33); *S. spilurus* 0.27 - 0.33 (0.30); *P. sophore* 0.29 - 0.33 (0.32); *Pethia ticto* 0.28 - 0.31 (0.29) in percentage of standard length. In comparing all the species *P. bimaculatus, S. denisonii* and *P. mahecola* has longer post dorsal length than all other species (Table 3).

Dorsal Fin Length

Dorsal fin length of *P. amphibius* 0.19 - 0.28 (0.23); *P. bimaculatus* 0.22 - 0.26 (0.23); *B. carnaticus* 0.20 - 0.25 (0.22); *S. chalakkudiensis* 0.22 - 0.24 (0.23); *P. chola* 0.22 - 0.26 (0.24); *Pethia conchonius* 0.15 - 0.26 (0.20); *S. denisonii* 0.14 - 0.26 (0.21); *P. dorsalis* 0.20 - 0.24 (0.22); *H. fasciata* 0.20 - 0.25 (0.23); *D. filamentosus*0.26 - 0.38 (0.30); *P. mahecola* 0.14 - 0.30 (0.26); *H. melanampyx* 0.18 - 0.26 (0.23); *E. ophicephalus*0.15 - 0.30 (0.22); *S. sarana* 0.25 - 0.25 (0.25); *S. spilurus* 0.20 - 0.29 (0.24); *P. sophore* 0.19 - 0.24 (0.22); *Pethia ticto* 0.18 - 0.23 (0.21) in percentage of standard length. In comparing all the species *E. ophicephalus, P. bimaculatus* and *Pethia conchonius* have longer Dorsal fin length than all other species (Table 3).

Anal Fin Length

Anal fin length of *P. amphibius* 0.12 - 0.18 (0.15); *P. bimaculatus* 0.14 - 0.17 (0.16); *B. carnaticus* 0.20 - 0.20 (0.20); *S. chalakkudiensis* 0.14 - 0.15 (0.14); *P. chola* 0.18 - 0.20 (0.19); *Pethia conchonius* 0.10 - 0.15 (0.14); *S. denisonii* 0.07 - 0.18 (0.13); *P. dorsalis* 0.12 - 0.17 (0.14); *H. fasciata* 0.13 - 0.20 (0.18); *D. filamentosus*0.16 - 0.19 (0.18); *P. mahecola* 0.12 - 0.17 (0.14); *H. melanampyx* 0.17 - 0.21 (0.20); *E. ophicephalus*0.17 - 0.20 (0.19); *S. sarana* 0.16 - 0.19 (0.18); *S. spilurus* 0.14 - 0.18 (0.16); *P. sophore* 0.12 - 0.19 (0.16); *Pethia ticto* 0.14 - 0.17 (0.17) in percentage of standard length.

In comparing all the species *P. bimaculatus, Pethia conchonius* and *P. mahecola* has longer Anal fin length than all other species (Table 3).

Pectoral Fin Length

Pectoral fin length of *P. amphibius* 0.15 - 0.21 (0.18); *P. bimaculatus* 0.17 - 0.19 (0.19); *B. carnaticus* 0.22 - 0.22 (0.22); *S. chalakkudiensis* 6.23 - 6.83 (6.53) 0.15 - 0.16 (0.15); *P. chola* 0.19 - 0.19 (0.19); *Pethia conchonius* 0.13 - 0.22 (0.18); *S. denisonii* 0.08 - 0.17 (0.14); *P. dorsalis* 0.18 - 0.21 (0.20); *H. fasciata* 0.17 - 0.25 (0.20); *D. filamentosus*0.19 - 0.26 (0.22); *P. mahecola* 0.12 - 0.21 (0.17); *H. melanampyx* 0.18 - 0.22 (0.20); *E. ophicephalus*0.17 - 0.22 (0.19); *S. sarana* 0.17 - 0.24 (0.21); *S. spilurus* 0.16 - 0.22 (0.18); *P. sophore* 0.18 - 0.23 (0.19); *Pethia ticto* 0.20 - 0.22 (0.21) in percentage of standard length.

In comparing all the species *S. denisonii, S. spilurus* and *P. bimaculatus* has longer Pectoral fin length than all other species (Table 3).

Pelvic Fin Length

Pelvic fin length *P. amphibius* 0.14 - 0.25 (0.17); *P. bimaculatus* 0.15 - 0.18 (0.16); *B. carnaticus* 0.20 - 0.22 (0.21); *S. chalakkudiensis* 0.16 - 0.17 (0.16); *P. chola* 0.17 - 0.21 (0.19); *Pethia conchonius* 0.17 -0.20 (0.18); *S. denisonii* 0.12 - 0.23 (0.18); *P. dorsalis* 0.14 - 0.16 (0.15); *H. fasciata* 0.15 - 0.20 (0.18); *D. filamentosus*0.20 - 0.25 (0.22); *P. mahecola* 0.16 - 0.22 (0.19); *H. melanampyx* 0.18 - 0.19 (0.19); *E. ophicephalus*0.14 - 0.18 (0.17); *S. sarana* 0.18 - 0.20 (0.19); *S. spilurus* 0.15 - 0.17 (0.16); *P. sophore* 0.16 - 0.19 (0.17); *Pethia ticto* 0.17 - 0.18 (0.17) in percentage of standard length. In comparing all the species *S. spilurus, P. bimaculatus* and *P. dorsalis* has longer pelvic fin length than all other species (Table 3).

Dorsal Fin Base

Dorsal fin base of *P. amphibius* 0.11 - 0.18 (0.15); *P. bimaculatus* 0.12 - 0.16 (0.13); *B. carnaticus* 0.18 - 0.19 (0.18); *S. chalakkudiensis* 0.13 - 0.14 (0.14); *P. chola* 0.16 - 0.20 (0.19); *Pethia conchonius* 0.16 - 0.21 (0.19); *S. denisonii* 0.16 - 0.21 (0.19); *P. dorsalis* 0.13 - 0.15 (0.14); *H. fasciata* 0.18 - 0.22 (0.20); *D. filamentosus*0.16 - 0.20 (0.19); *P. mahecola* 0.13 - 0.20 (0.15); *H. melanampyx* 0.17 - 0.20 (0.18); *E. ophicephalus*0.12 - 0.16 (0.14); *S. sarana* 0.17 - 0.19 (0.18); *S. spilurus* 0.15 - 0.19 (0.17); *P. sophore* 0.16 - 0.18 (0.17); *Pethia ticto* 0.19 - 0.23 (0.21) in percentage of standard length. In comparing all the species *P. bimaculatus, S. denisonii* and *E. ophicephalus*has longer Dorsal fin base than all other species (Table 3).

Anal Fin Base

Anal fin base of *P. amphibius* 0.04 - 0.10 (0.06); *P. bimaculatus* 0.07 - 0.11 (0.09); *B. carnaticus* 0.08 - 0.08 (0.08); *S. chalakkudiensis* 0.07 - 0.08 (0.07); *P. chola* 0.08 - 0.11 (0.10); *Pethia conchonius* 0.09 - 0.14 (0.12); *S. denisonii* 0.02 - 0.07 (0.05); *P. dorsalis* 0.06 - 0.08 (0.06); *H. fasciata* 0.09 - 0.11 (0.11); *D. filamentosus*0.10 - 0.11 (0.10); *P. mahecola* 0.05 - 0.11 (0.08); *H. melanampyx* 0.08 - 0.11 (0.10); *E. ophicephalus*0.07 - 0.11 (0.09); *S. sarana* 0.08 - 0.11 (0.09); *S. spilurus* 0.08 - 0.10 (0.09); *P. sophore* 0.08 - 0.13 (0.10); *Pethia ticto* 0.08 - 0.14 (0.11) in percentage of standard length. In comparing all the species *S. denisonii, P. dorsalis* and *P. amphibius* have longer anal fin base than all other species (Table 3).

Inter Orbital Width

Inter orbital width of *P. amphibius* 0.05 - 0.11 (0.07); *P. bimaculatus* 0.10 - 0.11 (0.11); *B. carnaticus* 0.11 - 0.11 (0.11); *S. chalakkudiensis* 0.08 - 0.09 (0.08); *P. chola* 0.09 - 0.11 (0.10); *Pethia conchonius* 0.07 - 0.11 (0.10); *S. denisonii* 0.04 - 0.08 (0.06); *P. dorsalis* 0.03 - 0.09 (0.08); *H. fasciata* 0.13 - 0.17 (0.16); *D. filamentosus*0.12 - 0.17 (0.15); *P. mahecola* 0.05 - 0.09 (0.07); *H. melanampyx* 0.16 - 0.18 (0.17); *E. ophicephalus*0.08 - 0.10 (0.09); *S. sarana* 9.27 - 9.85 (9.56) 0.10 - 0.11 (0.10); *S. spilurus* 0.08 - 0.11 (0.11); *P. sophore* 0.09 - 0.11 (0.10); *Pethia ticto* 0.07 - 0.10 (0.09) in percentage of standard length. In comparing all the species *S. denisonii*, *P. mahecola* and *P. dorsalis* have greater Inter orbital width than all other species (Table 3).

Inter Nasal Width

Considering Inter nasal width of *P. amphibius* 0.03 - 0.06 (0.05); *P. bimaculatus* 0.04 - 0.05 (0.05); *B. carnaticus* 0.04 - 0.05 (0.05); *S. chalakkudiensis* 0.04 - 0.04 (0.04); *P. chola* 0.03 - 0.05 (0.04); *Pethia conchonius* 0.04 - 0.07 (0.05); *S. denisonii* 0.01 - 0.04 (0.03); *P. dorsalis* 0.02 - 0.04 (0.04); *H. fasciata* 0.10 - 0.12 (0.11); *D. filamentosus*0.09 - 0.12 (0.11); *P. mahecola* 0.03 - 0.12 (0.07); *H. melanampyx* 0.10 - 0.11 (0.11); *E. ophicephalus*0.03 - 0.07 (0.06); *S. sarana* 0.06 - 0.06 (0.06); *S. spilurus* 0.05 - 0.07 (0.05); *P. sophore* 0.04 - 0.06 (0.05); *Pethia ticto* 0.03 - 0.04 (0.04) in percentage of standard length. In comparing all the species *S. denisonii, P. dorsalis* and *Pethia ticto* have greater Inter nasal width than all other species (Table 3).

Caudal Fin Length

Caudal fin length of *P. amphibius* 0.20 - 0.29 (0.24); *P. bimaculatus* 0.27 - 0.31 (0.29); *B. carnaticus* 0.32 - 0.33 (0.32); *S. chalakkudiensis* 0.25 - 0.27 (0.26); *P. chola* 0.32 - 0.35 (0.33); *Pethia conchonius* 0.26 - 0.30 (0.29); *S. denisonii* 0.15-0.31 (0.25); *P. dorsalis* 0.18 - 0.31 (0.28); *H. fasciata* 0.18 - 0.32 (0.26); *D. filamentosus*0.30 - 0.39 (0.36); *P. mahecola* 0.26 - 0.34 (0.29); *H. melanampyx* 0.26 - 0.31 (0.28); *E. ophicephalus*0.23 - 0.30 (0.28); *S. sarana* 0.25 - 0.32 (0.29); *S. spilurus* 0.19 - 0.33 (0.28); *P. sophore* 0.29 - 0.35 (0.28); *Pethia ticto* 0.27 - 0.30 (0.28) in percentage of standard length. In comparing all the species *S. spilurus, E. ophicephalus*and *P. amphibius* have greater caudal fin lengths than all other species (Table 3).

Meristic Characters

No. of. Dorsal fin spines B. carnaticus and S. chalakkudiensis has (4); D. filamentosa, S.sarana, S. spilurus, E. ophicephalus, P. dorsalis, P. bimaculatus; Pethia conchonius; P. chola; Pethia ticto and P. sophore has (3); and further H. melanampyx, P. fasciatus, P. amphibius, P. mahecola and P.denisonii has (2). No. of. Anal fin spines D. filamentosa, H. melanampyx, P. fasciatus, S. spilurus, P. amphibius, P. dorsalis, P. mahecola, S. denisonii, P. chola, B. carnaticus and P. sophore has (2); and further S. sarana , E. ophicephalus, S. chalakkudiensis, P. bimaculatus, Pethia conchonius and P. ticto has (3). No. of. Pelvic fin spines and Pectoral fin spines are all the seventeen species that have (1). No. of. Dorsal fin rays E. ophicephalus (7), P. mahecola (9) and the rest of the other species have (8). No. of. Anal fin rays P. amphibius and P. mahecola have (8); D. filamentosa, H. melanampyx and H. fasciata have (6), and the rest of the species have (5). No. of. Pectoral fin rays P. mahecola has (16); S. sarana , S. spilurus, E. ophicephalus, P. chola and B. carnaticus have (15); and P. bimaculatus have the least count (10). No. of. Pelvic fin rays P. mahecola have (13); whereas P. amphibius and S. denisonii have the least count of (5). Circumpeduncular scales of all the species E. ophicephalus has the highest count of (16); and lest count of (8) was noted in S. sarana. Circumferential scales of all the species E. ophicephalus and Pethia conchonius have the highest count of (23); and lest count of (15) was noted in P. sophore. Pre-dorsal scales of all the species S. sarana and Pethia ticto has the highest count of (10); and lest count of (7) was noted in H. melanampyx and P. fasciatus. Post dorsal scales of all the species E. ophicephalus has the highest count of (20); and lest count of (9) was noted in D. filamentosa. Pre-anal scales of all the species E. ophicephalus and P. dorsalis has the highest count of (20); and lest count of (6) was noted in P. mahecola. Post anal scales of all the species S. denisonii has the highest count of (8); and lest count of (4) was noted in P. sophore. Pre pelvic scales of all the species S. chalakkudiensis has the highest count of (14); and lest count of (7) was noted in P. bimaculatus, B. carnaticus and P. sophore. Post pelvic fin scales of all the species S. denisonii has the highest count of (20); and lest count of (9) was noted in P. bimaculatus, Pethia ticto and P. sophore. Post pectoral fin scales of all the species S. denisonii has the highest count of (28); and lest count of (14) was noted in P. sophore. Caudal fin upper lobe of all the species S. chalakkudiensis has the highest count of (16); and lest count of (10) was noted in S. sarana and Pethia ticto. caudal fin lower lobe of all the species S. Sarana, S. spilurus and P. sophore has the highest count of (19); and lest count of (8) was noted in B. carnaticus (Table 4).

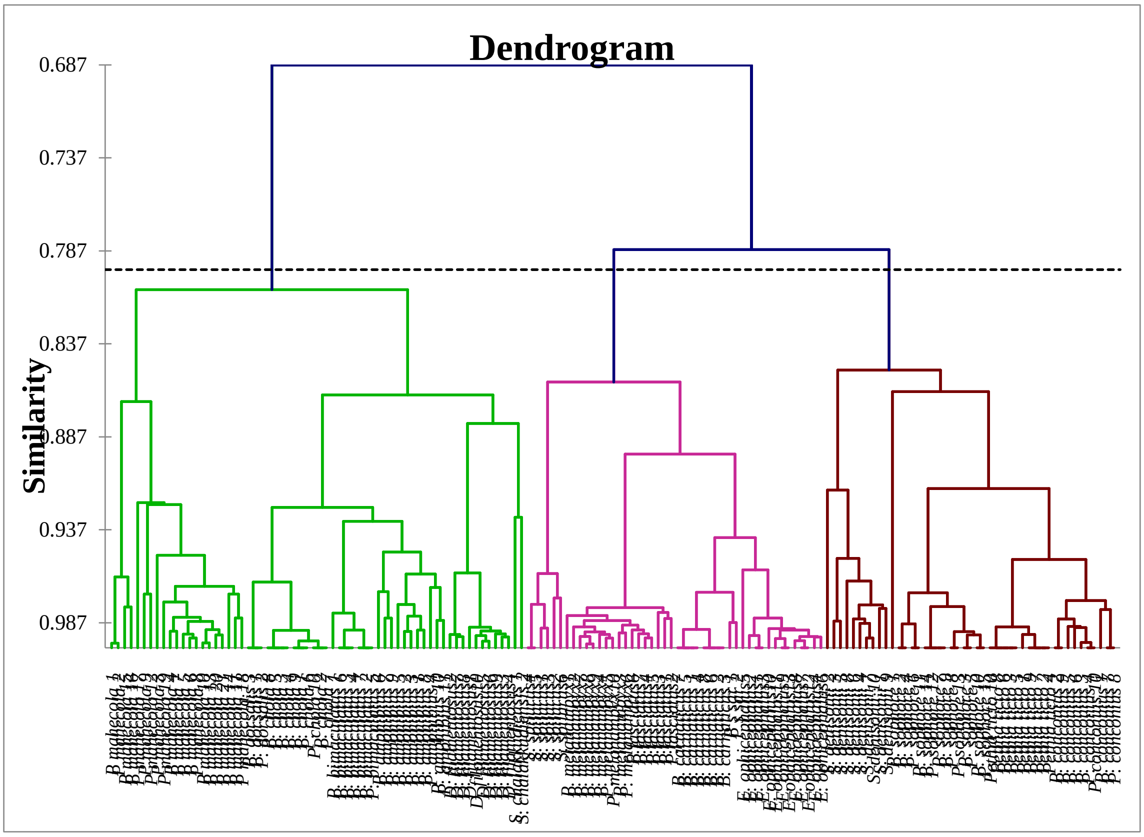

Figure 3: Similarity between the species.

The results of multivariate analysis using morphometric and meristic variables of Puntius species were grouped into three groups. The dendrogram (Fig 3) expresses that the first class has 7 species; Puntius amphibius, Puntius mahecola, Puntius chola, Puntius bimaculatus, Puntius dorsalis, Puntius filamentous, Sahyadria chalakkudiensis. The second class has 6 species; Haludaria melanampyx, Systomus spilurus, Haludaria fasciata, Eechathalakenda ophicephalus, Barbodes carnaticus, Systomus sarana . The third class has 4 species; Pethia ticto, Sahyadria denisonii, Puntius sophore, Pethia conchonius. Regarding all the 17 species from southern Western Ghats it is clear that the variation within the species is 58.35% and between the species is 41.65% and it is observed that there is no overlapping of morphometric and meristic characters between the species (Fig 4 and 5).

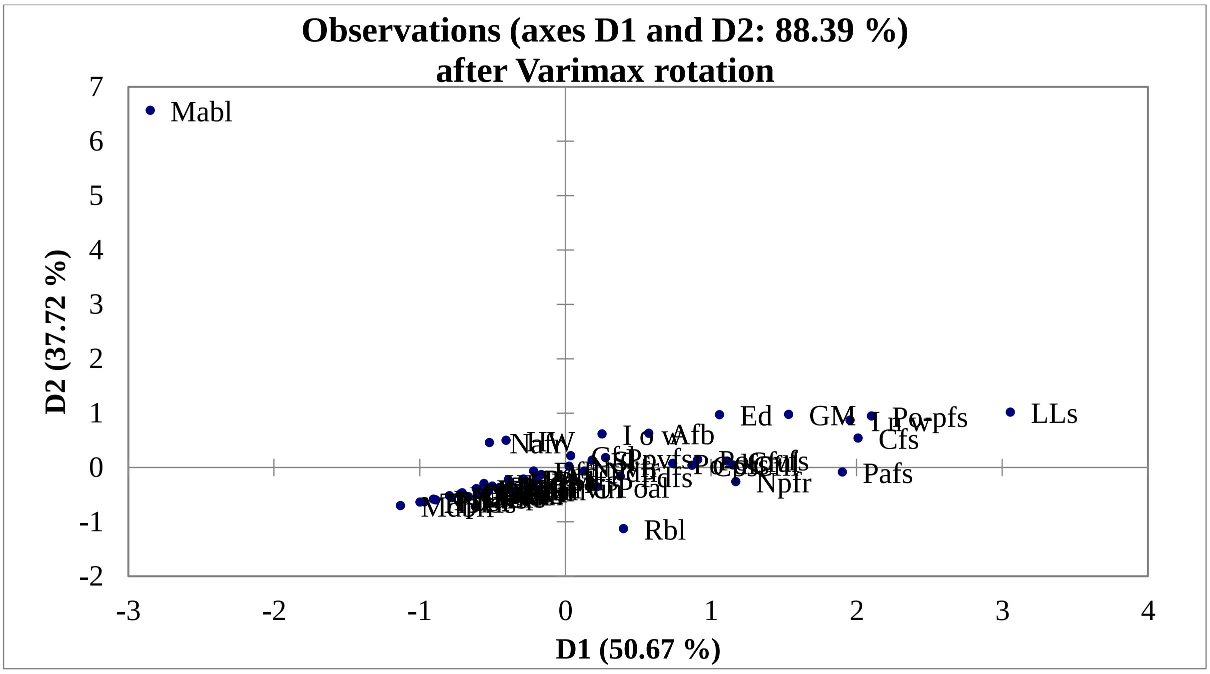

Figure 4: PCA plot for Morphometrics characters.

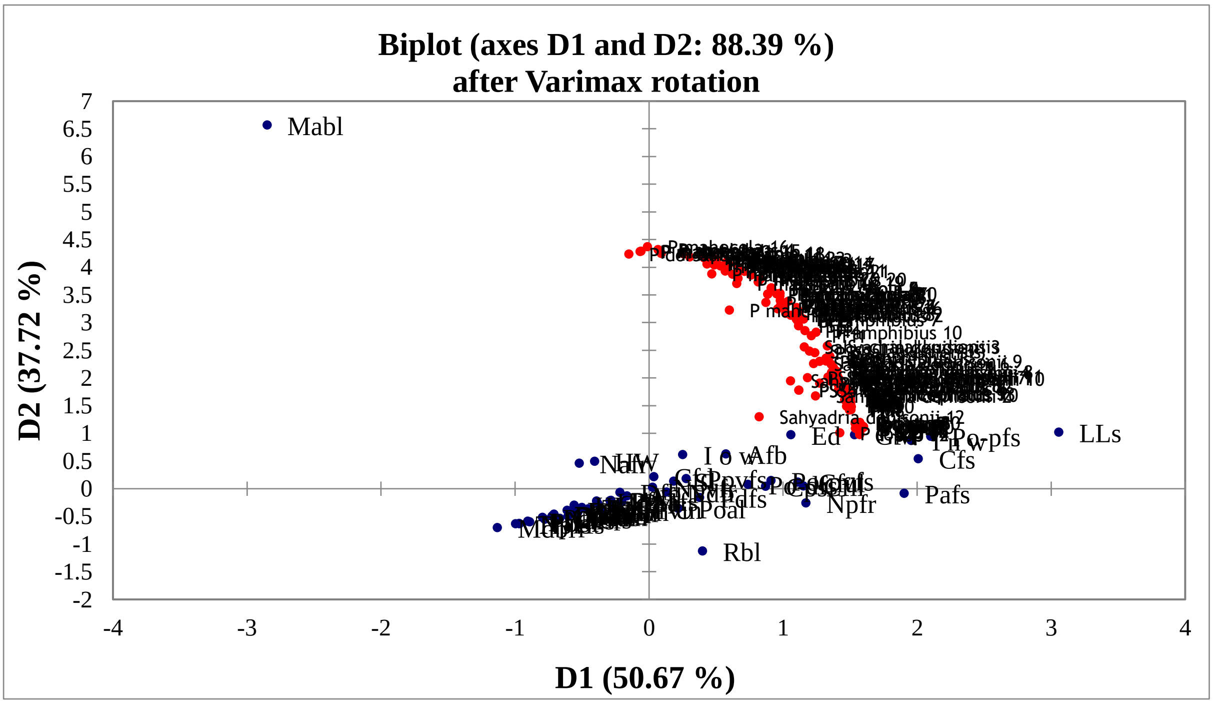

Figure 5: PCA plot for *Punitus* species.

The principle Component analysis shows that phenotypically all the species show minimal variations between the species. The species mainly vary with the contribution of the observation (%) to factor I in Maxillary barbell length (31.188), Inter nasal width (23.892), Circumferential scales (22.00), No. of pre-anal fin scales (16.439), Lateral line scales (34.881), Gape of mouth (20.901), Eye diameter (16.609), No. of post pelvic fin scale

(25.783), Caudal fin upper lobe (10.831) and Caudal fin lower lobe (10.673). All other characters did not show much variation between the species. It is clearly expressed that only a few morphometric and meristic characters show the variation among the species. It shows that all species have a common ancestral pattern and mostly share all common characters morphometric and meristic variations.

Taxonomy of the genus *Puntius* has been mainly based on the morphology character with proportion to Standard Length and Head length [5, 6, 50]. Morphologically compared with *Puntius filamentosus*, *Haludaria melanampyx* and *Haludaria fasciatus* are deep-bodied species. In that *Dawkinsia filamentosus*has one pair of barbel (maxillary), the *Haludaria melanampyx* and *Haludaria fasciatus*has two pairs of barbels (maxillary and rostral). Body depth in % to SL *Dawkinsia filamentosus*2.92 to 11.90 (4.08) and *Haludaria fasciatus*2.96 to 3.50 (3.21) is greater than *Haludaria melanampyx* 2.81 to 3.23 (3.10). Head short in all three species. Head length in % to SL *Haludaria melanampyx* 3.29 to 6.47 (3.81) and *Dawkinsia filamentosus*3.43 to 3.95 (3.66) is greater than *Haludaria fasciatus*3.31 to 3.77(3.53). Head depth at occiput in % to SL *Dawkinsia filamentosus*4.75 to 5.74 (5.17) and *Haludaria melanampyx* 3.91 to 5.70 (4.72) is higher than *Haludaria fasciatus*3.22 to 5.28 (4.50). Snout conical and shows more similarity in *Haludaria fasciatus* and *Haludaria melanampyx*. Snout length in % to SL *Haludaria fasciatus* 7.79 to 11.34 (8.73) and *Haludaria melanampyx* 7.19 to 11.77 (8.46) is higher than *Dawkinsia filamentosus*6.88 to 9.33 (8.15). Variation in Eye diameter in % to HL of *Haludaria melanampyx* 4.01 to 5.23 (4.37) and *Dawkinsia filamentosus*3.33to 3.53 (3.28) is greater than *Haludaria fasciatus*0.73 to 1.55 (1.22). Inter orbital width in % to HL of *Haludaria melanampyx* 2.33 to 2.92 (2.68) and *Haludaria fasciatus*1.36 to 2.96 (2.54) is greater than *Dawkinsia filamentosus*2.57 to 3.11 (2.43). Gap of mouth in % to HL of *Dawkinsia filamentosus*4.63 to 5.43 (4.60) and *Haludaria fasciatus*2.12 to 4.59 (3.83) is greater than *Haludaria melanampyx* 2.82 to 4.51 (3.51).

In regards to colouration the *Haludaria melanampyx* has a reddish colour on the body with one black vertical band and *Haludaria fasciatus*has 2 or 3 vertical black bands but no colouration on the body. Misra has observed that *Haludaria fasciatus* females have three black bands whereas males with only two bands. The first band is very broad extending from the 9^{th} to 14^{th} scale of the lateral line, covering about seven scales on the dorsal and three on the ventral sides. The Males have tubercles on the snout and in females absent. Hitherto the reason for the colouration is unknown but it is characterized that the habitat characters play a role in it. It is noted that in *Haludaria fasciata, Haludaria melanampyx and Dawkinsia filamentosus* the dorsal fin base is greater than the least depth of caudal peduncle. Based on meristic analysis it shows similarity in counts of dorsal fin, anal fin, pectoral fin, and pelvic fin, band only Lateral line scale and caudal fin of *Dawkinsia filamentosa*(19 -20; 24), *Haludaria melanampyx* (14- 15; 22) and *Haludaria fasciatus*(15- 16; 21) shows variations. More *Dawkinsia filamentosus*is related to the *sarana* group, and differs from the *sarana* group in the number of barbels, lateral line scale count and the dorsal spine being smooth. *Haludaria fasciatus* besides colorations the barbels count and the scale count differs and link to be related to *Puntius arulius*. Similarly, with *Puntius dorsalis*, *Puntius mahecola* and *Puntius amphibius* are deep-bodied. Head length in % to SL of *Puntius dorsalis* 3.10 to 3.68 (3.42) and *Puntius amphibius* 3.50 to 5.05 (4.15) is lesser than *Puntius mahecola 3.26 to 23.40* (5.14). Body depth in % to SL *Puntius dorsalis* 3.44 to 3.63 (3.51) and *Puntius mahecola* 2.92 to 3.43 (3.18) are smaller than *Puntius amphibius* 3.35 to 4.73 (3.94). According to % of head length the orbit width of *Puntius amphibius* 1.23 to 1.79 (1.41) is greater than

Puntius dorsalis 1.37 to 1.38 (1.37) and *Puntius mahecola* 0.22 to 1.78 (1.27). Inter-orbital width in % of HL *Puntius amphibius* 3.78 to 10.28 (5.82), *Puntius mahecola* 0.50 to 11.23 (4.13) is lesser than *Puntius dorsalis* 6.93 to 13.44 (8.47). Gape of mouth in of HL percentage, *Puntius amphibius* 2.08 to 2.92 (2.45), *Puntius mahecola* 0.06 to 3.06 (2.26) is lesser than *Puntius dorsalis* 2.42 to 2.86 (2.53).

Puntius dorsalis, P. mahecola and *P. amphibius* has one pair of barbels (maxillary) whereas rostral and mandibular barbels are absent in them. Puntius amphibious is considered to be widely distributed throughout peninsular India [5]. *Puntius amphibius* is closely related to *Puntius dorsalis* which is differentiated by its weak dorsal spine, absence of spots on dorsal and anal fins which *dorsalis* has. Further *Puntius dorsalis* has iv, 8 dorsal rays whereas *Puntius amphibius* has iii, 7 -9 in the count. *Puntius dorsalis* has 25 – 26 lateral line scales but *Puntius amphibius* has 24 – 25 in common. Jayaram [48] has already stated that *Puntius dorsalis* is closely allied to *Puntius cauveriensis* which is differentiated by the presence of 3½ rows of scales below the lateral line and the pelvic fin base 2½ in *Puntius dorsalis*. *Puntius dorsalis* is also in close relation with *Puntius bimaculatus* distributed in south India differs chiefly in coloration and the articulated, non-osseous dorsal ray. Evidently, it's said that *Puntius bimaculatus* has evolved from *dorsalis* ancestor. Gunther has related *Puntius bimaculatus* to *Barbodes carnaticus* however both varying in scale counts and its color pattern. *Puntius mahecola* is distinguished from all other *Puntius* recorded from southern India by the following combination of characters - last simple dorsal ray smooth; a horizontally- elongate black blotch about 1½ times as wide as it is high across 3½ scales of the lateral line immediately behind anal-fin base. Furthermore, it differs from *D. filamentosus*by not having the dorsal-fin branched rays elongated into filament-like extensions; and by having the caudal blotch entirely posterior to the anal-fin origin. Hora [17,24] considered *P. mahecola* to represent female specimens of *D. filamentosa*, and was followed in this synonymy by most subsequent authors. Hora [24] examined specimens of *D. filamentosus*from different parts of Kerala, but paid attention mainly to the barbels and did not mention other characters. *Puntius mahecola* recorded by Raj in 1916 is actually *P. filamentous*. *Dawkinsia filamentosaand Puntius mahecola* have frequently been confused and occasionally treated as synonyms8. *P. mahecola* is now known to be a species very similar to *P. amphibius* and the taxonomic status of *P. amphibius* is questionable86. *P. melonostigma* recorded previously is being considered as *P. mahecola* [86].

Likewise compared with *Systomus sarana* , *Systomus spilurus*, and *Eechathalakenda ophicephalus*are deep bodied, which has two pair of barbels (maxillary and rostral) both species. Body depth in % to SL of *Systomus sarana* 2.99 to 2.99 (2.99) and *Systomus spilurus* 3.25 to 4.01 (3.75) is lesser than *Eechathalakenda ophicephalus*5.00 to 5.96 (5.50). Head length in % to SL of *Systomus sarana* 3.67 to 4.08 (3.88) and *Systomus spilurus* 4.11 to 4.56 (4.31) is lesser than *Eechathalakenda ophicephalus*4.13 to 4.80 (4.80). Head depth at occiput in % to SL *Systomus sarana* 4.24 to 4.68 (4.46) and *Systomus spilurus* 4.61 to 5.33 (5.02) is lesser than *Eechathalakenda ophicephalus*6.09 to 6.76 (6.45). The *Eechathalakenda ophicephalus* snout length in % to HL 2.38 to 5.39(3.37) is lesser than *Systomus spilurus* 3.70 to 5.43 (4.65). Eye diameter in % to HL of *Systomus sarana* 1.04 to 1.28 (1.16) and *Systomus spilurus* 1.12 to 1.22 (1.17) is lesser than *Eechathalakenda ophicephalus*1.27 to 1.56 (1.43). Based on Meristics analysis it shows similarity in counts of a dorsal fin, pectoral fin, and pelvic fin, and only Lateral line scale, anal fin and caudal fin of *Systomus spilurus* (26 -28; 3; 34), and *Eechathalakenda ophicephalus*(40- 42; 4; 35) shows variations.

Systomus sarana is considered a unique species of apparently independent sock whose affinities lie with some other Cyprininae genus. It shows the similarity between *Dawkinsia filamentosus*in coloration, but differs markedly from it. Menon made a statistical analysis of *sarana* based on the lateral line count and has divided it into four subspecies viz… (*Systomus sarana , Systomus spilurus, Puntius sarana orphoides and Puntius sarana subnastus)*. In regard to *Eechathalakenda ophicephalus*it is distributed in the southern part of India, differing in lips which do not have a cartilaginous covering and also having greater no in the Lateral Line count and coloration from *Puntius lithopidos*.

In regard to *Sahyadria denisonii*, *Sahyadria chalakkudiensis* and *Puntius bimaculatus* are deep bodied. All three species (Sahyadria denisonii, *Sahyadria chalakkudiensis* and *P. bimaculatus)* have one pair of barbels (maxillary) whereas Rostral and mandibular barbels are absent in all three species. Body depth in % to SL of *Sahyadria chalakkudiensis* 4.03 to 4.24 (4.13) and *Puntius bimaculatus* 4.25 to 5.63(0.06) is lesser than *Sahyadria denisonii* 4.25 to 5.63 (4.80). Head length in % to SL of *Puntius bimaculatus* 4.46 to 5.66 (5.04) is greater than *Sahyadria denisonii* 4.11 to 4.52 (4.36) and *Sahyadria chalakkudiensis* 4.89 to 4.93 (4.91). Head depth at occiput in % to HL *Puntius bimaculatus* 1.53 to 1.79(1.66) and *Sahyadria chalakkudiensis* 1.54 to 1.61 (1.58) is smaller than *Sahyadria denisonii* 1.91 to 3.12 (2.40). Snout length in % to HL *Puntius bimaculatus* 4.49 to 18.25(7.29) is greater than *Sahyadria denisonii* 1.63 to 5.15 (3.06) and *Sahyadria chalakkudiensis* 3.89 to 4.23 (4.06).

Sahyadria denisonii is related to *Puntius dorsalis* distantly, differing from it in having a longitudinal color band and the dorsal fin being weak whereas in *Puntius dorsalis* the body is plain and the dorsal spine is strong and smooth. *Sahyadria denisonii* has a black band and a scarlet stripe from the snout to mid-caudal and also an oblique black caudal fin band (Jayaram 1981). *P. chalakkudiensis* is distinguishable from all other *Puntius* species by its inferior mouth (terminal or sub-terminal in all other species) and from *S. denisonii* by the distinctive black blotch on its dorsal fin. Body silvery with a black band from the snout to the base of caudal fin; a pale scarlet stripe above this; caudal fin with an oblique dark band crossing the posterior third of each lobe; dorsal with a dark mark in the middle of the outer surface extending up to the second branched ray Menon *et al.*, (1999).

Similarly, with *Pethia conchonius*, *Puntius chola* and *Pethia ticto* are deep bodied. Head length in % to SL of *Pethia conchonius* 3.64 to 4.12 (3.76) and *Pethia ticto* 3.29 to 4.03 (3.47) is lesser than *Puntius chola* 3.70 to 4.17 (3.94). Body depth in % to SL *Pethia conchonius* 2.34 to 2.88 (2.52) and *Pethia ticto* 2.49 to 2.76 (2.66) is lesser than *Puntius chola* 2.93 to 3.04 (3.01). According to % of head length the orbit width of *Puntius chola* 1.1 to 1.2 (1.1) and *Pethia ticto* 1.03 to 1.21 (1.10) is lesser than *Pethia conchonius* 0.95 to 1.38 (1.17). Inter-orbital width in % of HL *Pethia conchonius* 3.83 to 7.60 (5.57) and *Puntius chola* 5.0 to 8.0 (5.9) is lesser than *Pethia ticto* 7.17 to 8.77 (7.88).

In regards to *Pethia conchonius* a large round black spot on the middle of the side above the posterior portion of the anal fins is noted rather in *Pethia ticto* a black spot on the side of the tail before the base of the caudal fin and immediately behind the anal; a smaller one (frequently absent) at the commencement of the lateral line. *Puntius chola* a dark blotch is usually present on the side of the free portion of the tail from 23rd to the 25th scales of the lateral line, a dark mark along the base of anterior dorsal ray, and a row of dark spots along its center is noted. *Pethia ticto* is distantly related to *Puntius chola* differing from it, having a larger and more anterior caudal spot over the anal fin besides another above pectoral fin and lateral line incomplete. *Pethia conchonius* is in close relation with *Pethia ticto* differing from it by having a deeper body, more no of lateral line scales and absence of an anterior color spot. Regardless of the popularity and conservation significance, the taxonomy and systematics of both S. denisonii and Puntius chalakkudiensis, has been rather uncertain. Sahyadria denisonii has been placed under several genera including Labeo [89], Puntius [48,89], Barbus 90–92 and Hypselobarbus [93]. Very recently, Pethiyagoda 87 suggested that S. denisonii and Puntius chalakkudiensis deserve placement in a separate genus due to the strikingly different coloration and mouth shape compared to all other species.

Regarding colorations the *Puntius bimaculatus* in life dorsally olive green sides and belly – silvery. Dorsal with a black spot on the base of the third to eight rays and a black spot on the end of the lateral line on 23rd and 24th scales. Mature specimens show a crimson lateral band. Scales margin tinged brown. *Sahyadria denisonii has* - silvery, with a black band, above which runs a horizontal scarlet stripe passing from the snout to the center of the base of the caudal fin. Caudal with an oblique black band crossing the posterior third of each lobe. *Sahyadria chalakkudiensis* has its upper half of its body dark blue, becoming pale beneath. A dark spot at base of caudal fin invariably present and chalakudiensis varies from denisonii by a single character i.e. *Sahyadria denisonii* has a scarlet tinge in the dorsal fin, rather *Sahyadria chalakkudiensis* has a black spotted tinge in the dorsal fin spine and rays. Variation in caudal fin lobes (upper and lower) and lateral line counts are noted down in *Puntius bimaculatus* (12-12; 28), *Sahyadria denisonii* (15-15; 30), *Sahyadria chalakkudiensis* (15-16; 27).

Key to the Puntius species

- **1a.** Barbels present **2**
- **1b.** Barbels absent…………………………………………………………….....**17**
- **2a.** One pairs of barbels...….**3**
- **2b.** Two pair of barbels..………………………………………………..…………..…**13**
- **3a.** Lateral Line Complete……………………………………………………………**4**
- **3b.** Lateral Line incomplete..**16**
- **4a.** Lateral line scales less than 35 scales……………………………………....**5**
- **4b.** Lateral line scales 35 and more..……………………………….................**15a**
- **5a**. Last un- branched dorsal spine osseous, strong ………………………………**6**
- **5b.** Last un- branched dorsal spine non –osseous, weak articulated.............**15b**
- **6a.** A finger like mark on the caudal peduncle present…………………………....**7**
- **6b.** No such finger like mark on the caudal peduncle ………………………………**8**
- **7a.** A finger like oval dark blotch on the caudal fin base, on 14th to 16th scale, Anterior four or five branched dorsal rays may be tinted dark and rays elongated……………………………………………………***Dawkinsia filamentosa***

- **7b.** A blotch commences just above or a little behind the base of the last anal fin ray…………………………………………………………………....***Puntius mahecola***
- **8a.** Body with vertical colour bands………..…………………………………….**9**
- **8b.** Body without vertical colour bands …….……………………………….…**10**
- **9a.** Body with one vertical band at the dorsal fin base………..***Haludaria fasciata***
- **9b.** Body with three vertical bands….……………..…….***Haludaria melanampyx***
- **10a.** Lateral line scales 22 to 27………..…………………………………..….**11**
- **10b.** Lateral line scales 27 to 34…………………………………………..……….**12**
- **11a.** Lateral line scales 23 -24. PDS 7 -8. Upper half steel blue fading to white with golden tinge on flanks and abdomen. A black spot at the base of caudal fin ……..……………………………………………..…...***Puntius amphibius***
- **11b.** Lateral line scales 25 – 26. PDS 8 -9. A black blotch on the caudal fin and indistinct black band on lateral line…………………………..….***Puntius dorsalis***
- **12a.** Lateral line scales 28; A black band along lateral line…***Sahyadria chalakkudiensis***
- **12b.** Lateral line scales 23 -28; Body with a black band along the lateral line over which a scarlet stripe along anal and caudal fins………………..…***Sahyadria denisonii***
- **13a.** Lateral line scales 22 to 32; PDS 10 – 12; Pre anal scales 20 -22; ………………………………….……………..…...***Barbodes carnaticus***
- **13b.** Lateral line scales 28 to 34; Two pairs of barbels……………..……..……….**14**
- **14a.** Body plain; back olive, flanks silvery with golden reflection. Barbels reddish brown. Cheeks golden. A dark blotch on lateral line before base of caudal fin; Fins dusky brown to orange. Lateral line scales 30 -34 ………….………..….………….……….…..……….….***Systomus sarana***
- **14b.** Greenish-blue above, dull yellow below, 8 longitudinal rows of prominent black spots on the sides. A black band behind operculum from its upper angle to base of pectoral fin present. A finger like large black blotch is also present at the caudal fin base. Dorsal, pectoral and caudal fins are dusky, the ventral and the anal yellowish-white. Lateral line scales26 to 28; PDS810 ………………..…***Systomus spilurus***
- **15a.** Lateral line scales 40 to 42; complete two pairs of barbels. ***Eechathalakenda ophicephalus***
- **15b.** Lateral line scales 23 to 24; complete one pairs of barbels. ***Puntius bimaculatus***
- **16a.** Lateral line scales 22 – 25. PDS 9. A black blotch above the pectoral fin and another blotch on 16^{th} to 20^{th} scales. Dorsal spine smooth. Gill rackers on lower limb of first gill arch 15 to 17. Pre anal scales 14 – 15. Circumpeduncular scales 9 to 10 ……………………………………………………………...***Pethia ticto***
- **16b.** Lateral line scales 24 – 26; Black blotch of 18^{th} and 19^{th} scale, Dorsal spine serrated, Circumpeduncular scales 10 or 11……………………..…***Pethia conchonius***

- **17a.** PDS 8 - 10 Body with two conspicuous dark blotches generally between 21st and 23rd scales and another near the gill opening. A dark mark at the base of anterior dorsal ray also present…………………………………………………..……..*Puntius chola*
- **17b. Posterior** dark blotch on 22nd to 24th scales. Dorsal spine smooth. Gill rackers on lower limb of first gill arch 15 to 17. Pre – anal scales 14 or 15; Circumpeduncular scales 9 or 10……………………………………………………….……*Puntius sophore*

Taxonomic Chatacterization and Description of Puntius sp..

- ***Puntius sophore (Hamilton)***
- ***Cyprinus sophore*, Hamilton**, 1822, Fish Ganges: 310,389 (type locality, ponds and rivers of Gangetic provinces).
- ***Systomus chrysopterus*, McCelland,** 1839, Asiat. Res., 19: 285,383 (type locality, Bengal and Assam).
- ***Lecciscs stigma*, Valenciennes, 1844,** Hist. Nat. poiss, 17: 93 (type locality, Mysore).
- ***Barbus annandalei*, Fowler, 1924,** Proc. Acad. Nat. Sci. Philad., 76: 90 (type locality, Dehra Dun).
- ***Barbus sophore*, Misra, 1938,** Rec. Indian. Mus., 40: 260 (type locality, Kodur, Padkonda, Nallamalai hills, E. Ghats).
- ***Puntius sophore*, Rajan, 1955,** J. Bombay nat. His. Soc., 53(1):45 (type locality, Bhavani and Moyar Rivers, Nilgiri Hills).
- **Salient Features**: D 12(3/9); P 15; V 9 (1/8); A 7(2/5), LL. 25, L.tr. 3 ½ / 4 ½.
- Vernacular name: Tam – Pungella
- **Diagnosis**: *Puntius sophore* is distinguished from *Pethia ticto* in having fewer predorsal scale rows (8 vs.10), fewer circumferential scale rows (15 vs. 22), and fewer lateral line scales (22 vs. 25), as well as morphometric characters involving longer dorsal fin base length (5.55 - 6.20 vs. 4.32 - 5.40 % SL), longer anal fin base length (7.82 - 13.09 vs. 7.36 - 11.77 % SL), longer pectoral fin length (4.33 - 5.53 vs. 4.59 -4.99 % SL). *Puntius sophore* is distinguished from *Pethia conchonius* in having more pectoral fin rays (13 vs. 12), more post - dorsal scale rows (11vs.10), more Circumpeduncular scale rows (11 vs. 10), and more lateral line scales (22 vs. 21), as well as morphometric characters involving longer dorsal fin base length (5.55 - 6.20 vs. 4.75 - 6.33 % SL), longer anal fin base length (7.82 - 13.09 vs. 6.98 - 11.26 % SL) and longer caudal peduncle depth (6.98 - 7.89 vs. 6.19 - 7.64 % SL).
- **Description**: Dorsal and ventral profiles gently arched. Head small, moderately blunt. Head length 3.20 to 3.37 (3.31); body depth 2.58 to 3.14 (2.96) in the percentage of standard length. Head width 1.58 to 6.99 (4.89), depth head at occiput 1.68 to 3.22 (1.91) in the percentage of head length. Snout moderately pointed, plain. Eyes moderate, 0.60 to 1.28 (1.13), inter orbital width 3.11 to 7.18 (5.47) in the percentage of head length. Mouth antero – superior, its width equal to or less than inter – nostril distance. Both lips equally reflected. No barbels. The dorsal fin

is inserted nearly midway between the tip of the snout and caudal base. The last unbranched dorsal ray ossified into a smooth spine. Dorsal fin base greater than the depth of caudal peduncle. Pectoral fins do not extend to pelvic fins; the latter reaches the anal opening. The anal fin when laid flat not reaching the root of the caudal fin. The lateral Line is complete.

Pethia conchonius (Hamilton)

- ***Cyprinus conchonius*, Hamilton**, 1822, Fish Ganges: 317,389 (type locality, North east Bengal and rivers Kosi and Ami).
- ***Systomus conchonius*, McCelland,** 1839, Asiat. Res., 19: 285,286,384.
- ***Barbus conchonius*, Gunther,** 1868, Cat. Fish. Brit. Mus., 7: 153.
- *Barbus (Puntius) conchonius,* Horaand Law, 1941, Rec. Indian. Mus., 43(2): 237,240
- ***Pethia conchonius*, Jayaram** et al., 1982, Rec. Zool. Surv. India, Occ. Paper No. 36, pp.54, fig 10 (Cauvery river, S India, record form Cauvery).
- *Pethia conchonius,* Pethiyagoda, R., M. Meegaskumbura and K. Maduwage 2012, Ichthyological Exploration of Freshwaters v. 23 (no. 1): 69-95.
- **Salient Features**: D 11(3/8); P 11; V 9(1/8); A 7(2/5), LL. 24 - 26, L.tr. 5 ½ / 6 ½.
- **Vernacular name**: English – Rosy barb
- **Diagnosis**: *Pethia conchonius* is distinguished from *P. sophore* in having less pectoral fin rays (12 vs. 13), less post - dorsal scale rows (10vs.11), fewer Circumpeduncular scale rows (10 vs. 11), and fewer lateral line scales (21 vs. 22), as well as morphometric characters involving shorter dorsal fin base length (4.75 - 6.33 vs. 5.55 - 6.20 % SL), shorter anal fin base length (6.98 - 11.26 vs. 7.82 - 13.09 % SL) and shorter caudal peduncle depth (6.19 - 7.64 vs. 6.98 - 7.89 % SL). *Pethia conchonius* is distinguished from *Pethia ticto* in having more predorsal scale rows (10 vs.8), more circumferential scale rows (23 vs. 22), and fewer lateral line scales (21 vs. 25), as well as morphometric characters involving longer dorsal fin base length (4.75 - 6.33 vs. 4.32 - 5.40 % SL), shorter anal fin base length (6.98 - 11.26 vs. 7.36 - 11.77% SL), longer pectoral fin length (4.52 - 7.58 vs. 4.59 -4.99 % SL).
- **Description**: Dorsal and ventral profiles arched. Head moderately sized, bluntly pointed. Head length 3.64 to 4.12 (3.76); body depth 2.34 to 2.88 (2.52) in the percentage of standard length. Head width 4.09 to 6.19 (5.03), head depth at occiput 1.54 1.91 (1.69) in percentage of head length. Snout bluntly pointed, plain. Eyes large, superior, 0.95 to 1.38 (1.17), inter orbital width 3.83 to 7.60 (5.57) in the percentage of head length. Mouth antero – superior, gape of mouth greater than inter – nostril distance. Lips thick, upper lip reflected a bit forward. No barbels. The dorsal fin is inserted equidistant between tip of the snout and the caudal base. Last unbranched dorsal ray ossified, strong and serrated. Dorsal fin base greater than least depth of caudal peduncle. Pectoral fins do not extend to pelvic fins; the latter nearly reaches the anal opening. Lateral Line incomplete ceasing after 9 to 10 scales.

Pethia ticto (Hamilton)

- ***Cyprinus ticto*, Hamilton**, 1822, Fish Ganges: 314,389; pl.8, fig. 87 (type locality, south – eastern parts of Bengal).
- ***Systomus ticto*, McCelland,** 1839, Asiat. Res., 19: 382.
- ***Barbus ticto*, Hora and law, 1941,** Rec. Indian. Mus., 43(2); 248 (type locality, Achenkovil, Central kerala).
- ***Pethia ticto*, Rajan, 1955,** J. Bombay nat. His. Soc., 53(1):45 (type locality, Bhavani and Moyar Rivers, Nilgiri Hills).
- ***Pethia ticto*, Pethiyagoda, R., M. Meegaskumbura and K. Maduwage** 2012, Ichthyological Exploration of Freshwaters v. 23 (no. 1): 69-95.
- **Salient Features**: D 11(3/8); P 13 to 15; V 9 (1/8); A 7(2/5), LL. 21- 26, L.tr. 5 / 4 ½.
- **Vernacular name:** Tam – Wennattee, Pulli kendai.
- **Diagnosis**: *Pethia ticto* is distinguished from *P. sophore* in having more predorsal scale rows (10 vs.8), more circumferential scale rows (22 vs.15), and more lateral line scales (25 vs. 22), as well as morphometric characters involving longer eye diameter (12.03 - 15.43 vs. 11.03 - 13.18 % SL), longer gape of mouth (20.72 - 23.37 vs. 13.33 - 20.28 % SL), longer inter orbital width (10.03 - 13.56 vs. 9.26 - 10.97 % SL) and longer inter nasal width (25.64 - 28.88 vs. 15.85 - 23.73 % SL). *Pethia ticto* is distinguished from *Pethia conchonius* in having less predorsal scale rows (8 vs.10), less circumferential scale rows (22 vs.23), and more lateral line scales (25 vs. 21), as well as morphometric characters involving longer post anal length (8.52 - 9.48 vs. 6.20 - 9.14 % SL), longer gape of mouth (20.72 - 23.37 vs. 15.13 - 22.53 % SL), longer inter orbital width (10.03 - 13.56 vs. 9.18 - 14.02 % SL) and longer inter nasal width (25.64 - 28.88 vs. 15.07 - 27.79 % SL).
- **Description:** Dorsal profiles steep with a distinct raise from the occiput, and the ventral profile is uniformly arched. Head short, conical. Head length 3.29 to 4.03 (3.47); body depth 2.49 to 2.76 (0.11) in the percentage of standard length. Head width 5.23 to 7.11 (6.32), head depth at occiput 1.49 to 1.71 (1.58) in the percentage of head length. Snout plain, obtuse. Eyes small to moderate, 1.03 to 1.21 (1.10), inter orbital width 7.17 to 8.77 (7.88) in the percentage of head length. Mouth terminal, its width equal to or less than inter–nostril distance. Lips thin, plain. No barbels. The dorsal fin is inserted slightly behind the pelvic origin nearer the caudal base than the tip of the snout. Last unbranched dorsal ray osseous, posterior margin serrated with 12 to 18 strong serrations. Dorsal fin base greater than least depth of caudal peduncle. Pectoral fins do not extend to pelvic fins Lateral Line may be complete or incomplete with 24 to 26 scales.

Barbodes carnaticus (Jerdon)

- ***Barbus carnaticus*, Jerdon,** Mad. Jour. L. S. xv, 1849, p. 311.
- ***Barbus carnaticus*, Day, Fish**. India, p. 563, pl. cxxxvii, fig 3.

- ***Barbodes carnaticus*, Rajan, 1955,** J. Bombay nat. His. Soc., 53(1):45 (type locality, Bhavani and Moyar Rivers, Nilgiri Hills).
- **Salient Features**: D 12(4/8); P 15; V 9 (1/8); A 7(2/5), C. 19; LL. 32, L.tr. 5/6.
- **Vernacular name**: Tam – Poaree candee, Saal candee, Shellee;
- **Diagnosis**: *Barbodes carnaticus* is distinguished from *P. dorsalis* in having more no. of dorsal fin spines (4 vs. 3), more no. of pectoral fin rays (15 vs. 12), more no. of predorsal scale rows (12 vs.8), more circumferential scale rows (22 vs.18), and more lateral line scales (28 vs. 26), as well as morphometric characters involving shorter eye diameter (13.88 - 16.48 vs. 16.32 - 19.02 % SL), shorter gape of mouth (12.84 - 15.07 vs. 22.38 - 23.31 % SL), shorter inter orbital width (9.02 - 9.52 vs. 11.19 - 32.41 % SL) and shorter inter nasal width (19.65 - 22.75 vs. 25.18 - 41.67 % SL). *Barbodes carnaticus* is distinguished from *P. amphibius* in having more predorsal scale rows (12 vs.8), more circumferential scale rows (22 vs.19), and more lateral line scales (28 vs. 25), as well as morphometric characters involving shorter post-anal length (6.36 - 8.55 vs. 3.68 - 10.47 % SL), shorter gape of mouth (12.84 - 15.07 vs. 13.08 - 28.13 % SL), shorter inter orbital width (9.02 - 9.52 vs. 11.53 - 18.69 % SL) and shorter inter nasal width (19.65 - 22.75 vs. 15.40 - 38.22 % SL).
- **Description**: Dorsal and ventral profiles are equally arched. Head short, rounded. Head length 3.68 to 4.18 (3.93); body depth 3.16 to 3.46 (3.31) in the percentage of standard length. Head width 3.07 to 4.10 (3.59), head depth at occiput 1.42 to 1.69 (1.56) in the percentage of head length. Snout obtusely rounded, plain. Eyes moderate, 1.22 to 1.27 (1.24), inter orbital width 4.70 to 6.19 (5.45) in the percentage of head length. Mouth sub-terminal, its width is greater than inter – nostril distance. Lips thick, but not papillated. Two pairs of barbels are present. Dorsal fin inserted midway between tip of the snout and caudal base. Last unbranched dorsal ray osseous, strong, smooth, and occasionally longer than the body depth. Dorsal fin base greater than depth of caudal peduncle. Pectoral fins do not extend to pelvic fins. The anal fin when laid flat not reaching to root of caudal fin. The lateral Line is complete.

Systomus sarana (Hamilton)

- ***Cyprinus sarana*, Hamilton**, 1822, Fish Ganges: 307,388. (Type locality, Gangetic System, Bengal).
- ***Barbus sarana*, *Day*,** Fish. India, 560, pl cxxxvi, fig.2.
- ***Puntius sarana orphoides*, Tilak, 1973,** Rec. zool. Surv. India, 67(1-4), p.96, (type locality, Goa, Valus river).
- ***Puntius saberi Datta and karmakar*,** 1981, Bull. Zool. Surv. India. 3, (3) p. 179. (Type locality, Pujaripal Village, Sokma, Bastar dist, Madhya Pradesh).
- **Salient Features**: D 11(3/8); P 15; V 9; A 8(3/5), C. 19; LL. 30-34, L.tr. $5_{1/2}$ - 6 /6.
- **Vernacular name**: Tam – Pungella
- **Diagnosis**: *Systomus sarana is* distinguished from *S. spilurus* in having more no. of anal fin spines (3 vs.2), more no. of pelvic fin rays (8 vs. 7), more circumferential

scale rows (18 vs.17), and more lateral line scales (30 vs. 28), as well as morphometric characters involving shorter eye diameter (110.82 - 15.38 vs. 13.70 - 16.92 % SL), shorter gape of mouth (13.55 - 14.74 vs. 15.02 - 20.35 % SL), shorter inter orbital width (9.27 - 9.85 vs. 10.44 - 15.32 % SL) and shorter inter nasal width (16.56 - 16.80 vs. 19.51 - 29.30 % SL). *Systomus sarana is* distinguished from *E. ophicephalusin* having less predorsal scale rows (10 vs15), less circumferential scale rows (18 vs.23), and less lateral line scales (30 vs. 42), as well as morphometric characters involving longer gape of mouth (13.55 - 14.74 vs. 12.13 - 20.84 % SL), longer maxillary barbel length (13.38 - 15.12 vs. 11.03 - 22.25 % SL), longer rostral barbel length (18.42 - 18.70 vs. 13.15 - 20.11 % SL), shorter inter orbital width (9.27 - 9.85 vs. 12.28 - 15.43 % SL) and shorter inter nasal width (16.56 - 16.80 vs. 17.94 - 37.34 % SL).

- **Description:** Dorsal and ventral profiles slightly arched. Head moderate and bluntly pointed. Head length 3.67 to 4.08 (3.88); body depth 2.99 in percentage of standard length. Width of head at occiput 3.32 to 4.01 (3.67); height of head at occiput 1.42 to 1.77 (1.59); snout 3.28 to 4.12 (3.70); Eyes moderate, superior 1.04 to 1.28 (1.16) in percentage of head length. Snout bluntly pointed, without any pores. Mouth antero – superior, gape of mouth greater than inter – nostril distance. Lips thin, two pairs of barbels. Dorsal fin inserted nearer caudal base than the tip of snout. Last unbranched dorsal ray osseous, strong, posterior margin serrated with 12 to 14 strong serrations. Pectoral fins do not extend to pelvic fins; latter not reaching the anal opening. Anal fin when laid flat not reaching the root of caudal fin. Lateral Line may be complete.

Puntius chola (Hamilton)

- ***Cyprinus chola*, *Hamilton*,** 1822, Fish Ganges: 312,389. (Type locality, Gangetic System, Bengal).
- ***Cyprinus titius*, *Hamilton*,** 1822, Fish Ganges: 315,389. (Type locality, Ponds near Calcutta).
- ***Barbus titius*, Shaw and Shebbeare,** 1937, J. roy. Asiat. Soc. Bengal, 3(1), p.44 (type locality, Terai and Duars).
- ***Cyprinus chola*, McCelland,** 1839, Asiat. Res., 9, pp 286, 384, pl.58, fig.3, (fig from Hamilton's MS drawings).
- ***Leuciscus thermalis*, Valenciennes,** 1843, Hist. Nat, Poiss. 17, p. 94, pl.490 (type locality, Srilanka)
- ***Barbus thermalis*, Gunther,** Cat. Fish. Brit. Mus., 7, p.143, 1868. – Day, Fish. India. P. 580, 1878. – Day, Fauna Brit. India Fish., 1, p. 330. 1889. - Venkateswarlu and Rama and Rao, Occ. Paper. Zool. Surv. India, No. 87, p. 14, 1986 (Synonym of P. chola).
- ***Puntius thermalis*, Jayaram, 1981,** Handbk, FW. Fish. India, p. 103 (distribution), p.110 (key).

- ***Puntius chola*, Rajan, 1955,** J.Bombay nat. Hist. Soc., 53(1); p.45. (Type locality, Bhavani and Moyar Rivers, Nilgiri Hills).
- ***Puntius chola*, Jayaram et al., 1982,** Occ. Paper. Zool. Surv. India, No. 36, p. 54. (Type locality, Cauvery River, S. India).
- **Salient Features**: D 11(3/8); P 15; V 9; A. 7(2/5), C.19; LL. 26 - 28, L.tr. 5 ½ /5.
- **Vernacular name**: Tamil – Pulli kendai, Macha kendai, Vannathi, Poovali kendai, Servali kendai, kooran kendai.
- **Diagnosis**: *Puntius chola* is distinguished from *P. bimaculatus* in having less no. of anal fin spines (2 vs. 3), more circumferential scales (21 vs. 13), and more lateral line scales (28 vs. 24), as well as morphometric characters involving longer eye diameter (20.87 - 24.56 vs. 16.49 - 17.66 % SL), longer gape of mouth (19.63 - 23.63 vs. 17.60 - 23.15 % SL), shorter inter orbital width (9.16 - 10.63 vs. 10.98 - 12.27 % SL) and shorter inter nasal width (18.42 - 33.41 vs. 23.74 - 31.52 % SL).
- **Description:** Dorsal and ventral profiles gently arched. Head moderately small and pointed. Head length 3.70 to 4.17 (3.94); body depth 2.93 to 3.04 (3.01) in percentage of standard length. Head width 5.00 to 6.40 (5.60), head depth at occiput 1.70 to 1.80 (1.70) in percentage of head length. Snout plain, bluntly pointed. Eyes moderate, 1.10 to 1.20 (1.10), inter orbital width 5.0 to 8.0 (5.9) in percentage of head length. Mouth antero – superior, its width equal to or less than inter – nostril distance. Both lips equally reflected. Single pairs of barbels present. Dorsal fin inserted equidistant between tip of snout and caudal base and occasionally nearer to the snout. Last unbranched dorsal ray osseous, strong, smooth, spine. Dorsal fin base greater than depth of caudal peduncle. Pectoral fins do not extend to pelvic fins. Anal fin when laid flat not reaching to root of caudal fin. Lateral Line complete.

Dawkinsia filamentosus(Valenciennes)

- ***Leuciscus filamentosus*, Valenciennes,** 1843, Hist. Nat, Poiss., 17, p. 94, pl.490 (type locality, Srilanka)
- ***Barbus thermalis*, Gunther,** Cat. Fish. Brit. Mus., 7, p.143, 1868. – Day, Fish. India. P. 580, 1878. – Day, Fauna Brit. India Fish., 1, p. 330. 1889. - Venkateswarlu and Rama and Rao, Occ. Paper. Zool. Surv. India, No. 87, p. 14, 1986 (Synonym of P. chola).
- ***Puntius thermalis*, Jayaram, 1981,** Handbk, FW. Fish. India, p. 103 (distribution), p.110 (key).
- ***Puntius chola*, Rajan, 1955,** J.Bombay nat. Hist. Soc., 53(1); p.45. (Type locality, Bhavani and Moyar River, Nilgiri Hills).
- ***Puntius chola*, Jayaram et al., 1982,** Occ. Paper. Zool. Surv. India, No. 36, p. 54. (Type locality, Cauvery River, S. India).
- **Salient Features**: D 11(3/8); P 15; V 9; A. 7(2/5), C.19; LL. 21, L.tr. 4 /4.
- **Vernacular name**:Tamil – Macha kendai, Sevali.

- **Diagnosis**: *Dawkinsia filamentosus*is distinguished from *P. mahecola* in having more no. of dorsal fin spines (3 vs.2), more circumpeduncular scales (12 vs. 11), and more lateral line scales (24 vs. 21), as well as morphometric characters involving shorter eye diameter (10.77 - 13.25 vs. 13.29 - 18.78 % SL), shorter gape of mouth (13.16 - 20.16 vs. 8.67 - 28.18 % SL), shorter inter orbital width (5.98 - 8.44 vs. 11.23 - 18.78 % SL) and shorter inter nasal width (8.10 - 10.66 vs. 8.28 - 38.16 % SL).
- **Description**: Dorsal and ventral profiles arched. Head short, conical. Head length 3.43 to 3.95(3.66), body depth 2.92 to 3.49 (3.22) in percentage of standard length. Height of head at Occiput 1.40 to 1.67, snout 2.20 to 2.63 in percentage of head length. Snout conical, the males often with large tubercles at breeding time. Eyes superior, 3.33 to 3.53, inter-orbital width 2.57 to 3.11 in percent of head length. Mouth sub terminal, its width less than inter-nostril distance. Lips thin, plain, a rudimentary pair of maxillary barbels. Dorsal fin inserted nearer tip of snout than base of caudal fin. Last unbranched dorsal ray articulated, feeble, smooth; the branched rays are prolonged in the adult male. Dorsal fin base more than least depth of caudal peduncle. Pectoral fins do not extend to pelvic fins; latter in turn do not reach anal opening. Anal fin when laid flat not reaching root of caudal fin. Least depth of caudal peduncle 7.35 to 9.09 in percent of its standard length. Caudal fin forked. Scales somewhat dome shaped. Lateral line complete.

Puntius mahecola (Cuv. and Val.)

- *Leuciscus mahecola,* Cuvier and Valenciennes, Hist. Nat, Poiss., 17, p. 305, pl.502.
- Barbus mahecola, Gunther, Day, Fish India, P. 575.
- **Salient Features**: D 11(3/8); P 15; V 9; A. 7(2/5), C.19; LL. 21, L.tr. 5 /4.
- **Vernacular name**: Tamil – Pulli kendai, Macha kendai, Vannathi, Poovali kendai, Servali kendai, kooran kendai.
- **Diagnosis**: *Puntius mahecola* is distinguished from *D. filamentosus*in having less no. of dorsal fin spines (2 vs.3), less circumpeduncular scales (11 vs. 12), and less lateral line scales (21 vs. 24), as well as morphometric characters involving longer eye diameter (13.29 - 18.78 vs. 10.77 - 13.25 % SL), longer gape of mouth (8.67 - 28.18 vs. 13.16 - 20.16 % SL), longer inter orbital width (11.23 - 18.78 vs. 5.98 - 8.44 % SL) and longer inter nasal width (8.28 - 38.16 vs. 8.10 - 10.66 % SL).
- **Description**: Head length 3.26 to 23.40 (5.14); body depth 2.92 to 3.43 (3.18) in percentage of standard length. Head width at occiput 0.39 to 6.99 (4.62); height of head at occiput 0.66 to 5.50 (3.77); snout length 3.56 to 30.04 in percentage of head length. Snout long, pointed, plain. Eyes moderate, 1.26 to 31.51 (14.13) in percent of head length. Mouth sub-terminal, crescentic, its width less than inter- nostril distance. Lips thin, plain, a single pair of maxillary barbels. Color silvery, opercles short with purple and gold. A dark blotch is usually present on the side of the free portion of the tail from 23rd to the 25th scales of the lateral line. A dark mark along the base of anterior dorsal ray, and a row of dark spots along its center.

***Puntius bimaculatus* (Hamilton)**

- ***Ganthopogon bimaculatus* Bleeker,** verb. *Nat. Holl. Maatsch. Haarlem, 2 (20)*: 17, pl 4, fig 1, 1864 (type locality – Ceylon).
- *Puntius puckelli* Day, *Proc. Zool. Soc. Lond.,* p. 197, 1868 (type locality : Banglore).
- ***Barbus puckelli* Day,** *Fish India,* p. 574, pl. 143, fig. 5, 1878 (Banglore).
- **Barbus puckelli Day,** Faun. Brit. Ind. Fish., **1**: 321, 1889 (Banglore).
- ***Barbus puckelli* Bhimachar and Rau,** *J. Mys. Univ.,* **1**: 147, 1941 (River Hemavathi at Kottigehar, Karnataka state).
- Puntius bimaculatus, Talwar and Jhingran, Island fish., 1: 259, 1991 (Srilanka)
- **Puntius bimaculatus, Jayaram,** Rec. Zool. Surv. India Occ. Pap., No. 135 : 70, 1991 (Kalakad, TN and Srilanka)
- ***Puntius puckelli*, Menon, A. G. K. and K. Rema Devi** 1992, a junior synonym of *Puntius bimaculatus* (Pisces: Cyprinidae). Ichthyological Exploration of Freshwaters v. 3 (no. 3): 219-223.
- **Salient Features**: D 11(3/8); P 15; V 9 (1/8); A 8(3/5), LL. 24, L.tr. 3 ½ / 2 ½.
- Vernacular name: Two spot barb
- **Diagnosis**: *Puntius bimaculatus* is distinguished from *P. chola* in having more no. of anal fin spines (3 vs.2), less circumferential scales (13 vs. 21), and less lateral line scales (24 vs. 28), as well as morphometric characters involving shorter eye diameter (16.49 - 17.66 vs. 20.87 - 24.56 % SL), shorter gape of mouth (17.60 - 23.15 vs. 19.63 - 23.63 % SL), longer inter orbital width (10.98 - 12.27 vs. 9.16 - 10.63 % SL) and longer inter nasal width (23.74 - 31.52 vs. 18.42 - 33.41 % SL).
- **Description:** Dorsal profile more convex than ventral profile. Head long, depressed. Head length 4.46 to 5.66 (5.04), body depth 4.11 to 5.04 (4.75) in percent of standard length. Height of head at Occiput 1.53 to 1.79 (1.66), snout 4.49 to 18.25 (7.29) in percent of head length. Snout conical, the males often with large tubercles at breeding time. Eyes superior, 1.09 to 1.52 (1.26), inter-orbital width 4.20 to 6.66 (5.29) in percent of head length. Mouth sub terminal, its width less than inter-nostril distance. Lips thin, plain, a rudimentary pair of maxillary barbels. Dorsal fin inserted midway or slightly nearer tip of snout than base of caudal fin. Last unbranched dorsal ray weak not osseous, articulated, smooth. Dorsal fin base more than least depth of caudal peduncle. Pectoral fins do not extend to pelvic fins; latter in turn do not reach anal opening. Anal fin when laid flat reaching root of caudal fin. Lateral line complete.

***Systomus spilurus* (Gunther)**

- ***Cyprinus sarana*, Hamilton**, 1822, Fish Ganges: 307,388. (type locality, Gangetic System, Bengal).
- **Barbus spilurus, Gunther,** Cat, Fish. Brit. Mus., 7, India, pg. 114,1868.
- **Puntius sarana, Silas,** Bull.Nat. Inst. Sci. India, No. 7, pg. 251, 1952.

- **Systomus spilurus, Menon,** Spolia Zeylanica, 30 (1), pg. 67, 1963.
- *Systomus spilurus,* Jayaram, Handbook FW. Fish. India, p.102, 1981.
- **Systomus spilurus, Menon,** Spolia Zeylanica, 30 (1), pg. 67, 1963.
- ***Puntius timbiri*, Deraniyagala, (Synonym),** 1963, Spolia Zeylanica v. 30 (pt 1): 63-64, Pl. 1.
- **Salient Features**: D 11(3/8); P 15; V 9; A 8(3/5), C. 19; LL. 26-28, L.tr. $3_{1/2}$ / $3_{1/2}$.
- Vernacular name: Olive barb;
- **Diagnosis**: *Systomus spilurus is* distinguished from *S. sarana* in having less no. of anal fin spines (2 vs.3), less no. of pelvic fin rays (7 vs. 8), less circumferential scale rows (17 vs.18), and less lateral line scales (28 vs. 30), as well as morphometric characters involving longer eye diameter (13.70 - 16.92 vs.10.82 - 15.38 % SL), longer gape of mouth (15.02 - 20.35 vs.13.55 - 14.74 % SL), longer inter orbital width (10.44 - 15.32 vs.9.27 - 9.85 % SL) and longer inter nasal width (19.51 - 29.30 vs.16.56 - 16.80% SL). *Systomus spilurus is* distinguished from *E. ophicephalusin* having less predorsal scale rows (9 vs15), less circumferential scale rows (17 vs.23), and less lateral line scales (28 vs. 42), as well as morphometric characters involving longer gape of mouth (15.02 - 20.35 vs. 12.13 - 20.84 % SL), longer maxillary barbel length (16.61 - 22.34 vs. 11.03 - 22.25 % SL), longer rostral barbel length (23.08 - 42.10 vs. 13.15 - 20.11 % SL), shorter inter orbital width (10.44 - 15.32 vs. 12.28 - 15.43 % SL) and longer inter nasal width (19.51 - 29.30 vs. 17.94 - 37.34 % SL).
- **Description**: Head length 4.11 to 4.56 (4.31); body depth 13.7 to 16.9 (15.2) in percent of standard length. Width of head 3.29 to 4.54 (4.00); height of head at occiput 1.60 to 1.71 (1.66); snout 3.70 to 5.43 (4.65); eyes 1.12 to 1.22 (1.17) in percent of head length. Snout bluntly pointed, without any pores. Mouth antero – superior, gape of mouth greater than inter – nostril distance. Lips thin, two pairs of barbels. Dorsal fin inserted nearer caudal base than the tip of snout. Last unbranched dorsal ray osseous, strong, posterior margin serrated with 12 to 14 strong serrations. Pectoral fins do not extend to pelvic fins; latter not reaching the anal opening. Anal fin when laid flat not reaching the root of caudal fin. Lateral Line may be complete. Colour Greenish-blue above, dull yellow below, 8 longitudinal rows of prominent black spots on the sides, each spot being situated at the free portion of the successive scales. A black band behind operculum from its upper angle to base of pectoral fin present a finger like large black blotch is also present at the caudal fin base. Dorsal, pectoral and caudal fins are dusky, the ventral and the anal yellowish-white.

Eechathalakenda ophicephalus(Raj)

- ***Barbus ophicephalus*, Raj,** 1941, *Rec. Indian. Mus., 43, p. 375,* (type locality, Kallar river, Pachakani estate, Periyar lake).
- **Barbus ophicephalus, Menon and Yazdani,** 1968, Rec. Zool. Surv. India, 61, p. 106.
- **Salient Features**: D 10(3/7); P 15; V 9; A 8(3/5), C. 19; LL. 40-42, L.tr. $7_{1/2}$ / 4.
- **Vernacular name**: Tam: Echathalai kendai

- **Diagnosis**: *Eechathalakenda ophicephalusis* distinguished from *S. spilurus in* having more predorsal scale rows (15 vs 9), more circumferential scale rows (23 vs.17), and more lateral line scales (42 vs. 28), as well as morphometric characters involving shorter gape of mouth (12.13 - 20.84 vs. 15.02 - 20.35 % SL), shorter maxillary barbel length (11.03 - 22.25 vs. 16.61 - 22.34 % SL), shorter rostral barbel length (13.15 - 20.11 vs. 23.08 - 42.10 % SL), longer inter orbital width (12.28 - 15.43 vs. 10.44 - 15.32 % SL) and shorter inter nasal width (17.94 - 37.34 vs. 19.51 - 29.30 % SL). *Eechathalakenda ophicephalusis* distinguished from *S. sarana in* having more predorsal scale rows (15 vs10), more circumferential scale rows (23 vs.18), and more lateral line scales (42 vs. 30), as well as morphometric characters involving shorter gape of mouth (12.13 - 20.84 vs.13.55 - 14.74 % SL), shorter maxillary barbel length (11.03 - 22.25 vs.13.38 - 15.12 % SL), shorter rostral barbel length (13.15 - 20.11 vs.18.42 - 18.70 % SL), longer inter orbital width (12.28 - 15.43 vs. 9.27 - 9.85 % SL) and longer inter nasal width (17.94 - 37.34 vs.16.56 - 16.80 % SL).
- **Description**: Dorsal profile slightly more arched then ventral, convex from tip snout to dorsal fin and straight behind the fin, Head length 4.13 to 4.80 (4.54), and body depth 5.00 to 5.96 (5.50) in percent of standard length. Head width 2.94 to 4.54 (3.52), height of head at Occiput 1.74 to 2.11 (1.88), snout 2.38 to 5.39 (3.37) in percent of head length. Snout somewhat prominent, broadly and rounded anteriorly. Eyes large elevated in anterior half of head, just visible from below ventral surface, 1.27 to 1.56 (1.43) in percent of head length. Mouth sub-inferior, horse-shoe shaped width of mouth equal to inter-nostril distance. Lips papillated in some examples, thick. Two pairs of barbels rostral and maxillary. Dorsal fin inserted nearer tip of snout then caudal fin base. Last unbranched dorsal ray stiff, slightly enlarged but very week, smooth, articulated in its upper part. Dorsal fin base greater than least depth of caudal peduncle. Pectoral fins not extend to pelvic fins; lateral not reaching anal opening. Anal fin when laid flat reaching root of caudal fin. Lateral complete.

Puntius dorsalis (Jerdon)

- ***Systomus dorsalis*, Jerdon,** 1849, Mad. Jour. L. Sc. XV, p 314.
- **Barbus dorsalis, Gunther, 1868,** Cat. Fish. Brit. Mus., 7, p.142.
- **Barbus dorsalis, Day, 1878,** Fish. India, p. 573, pl. exiii, fig. 2.
- *Puntius puckelli* Day, *Proc. Zool. Soc. Lond.*, p. 197, 1868 (type locality : Banglore).
- **Barbus dorsalis, Hora,** 1936, Rec. Indian. Mus., 38, p. 2, 3, 4.
- ***Barbus dorsalis*, Misra,** 1938, *Rec. Indian. Mus., 40, p. 258,* (type locality, Nallamalai hills, E.ghats).
- ***Barbus dorsalis*, Silas,** 1951, *J. Bombay nat. His. Soc. 49(4), p. 674,* (type locality, Vannamadi Bridge, Annamalai hills, Ponnanai drainage, kerala).
- ***Puntius dorsalis*, Deraniyagala,** 1930, Spolia Zeylanica 16(1), (p. 12).
- **Salient Features**: D 12(4/8); P 15; V 9; A 8(3/5), C. 19; LL. 22-28, L.tr. $4_{1/2}$ / 4.
- **Vernacular name**: Tam: Saal candee

- **Diagnosis**: *Puntius dorsalis* is distinguished from *B. carnaticus* in having less no. of dorsal fin spines (3 vs. 4), less no. of pectoral fin rays (12 vs. 15), less no. of predorsal scale rows (8 vs.12), less circumferential scale rows (18 vs.22), and less lateral line scales (26 vs. 28), as well as morphometric characters involving longer eye diameter (16.32- 19.02 vs. 13.88 - 16.48 % SL), longer gape of mouth (22.38 - 23.31 vs. 12.84 - 15.07 % SL), longer inter orbital width (11.19 - 32.41 vs. 9.02 - 9.52 % SL) and longer inter nasal width (25.18 – 41.67 vs. 19.65 - 22.75 % SL). *Puntius dorsalis* is distinguished from *P. amphibius* in having more predorsal scale rows (12 vs.8), more circumferential scale rows (22 vs.19), and more lateral line scales (28 vs. 25), as well as morphometric characters involving shorter post anal length (6.36 - 8.55 vs. 3.68 - 10.47 % SL), shorter gape of mouth (12.84 - 15.07 vs. 13.08 - 28.13 % SL), shorter inter orbital width (9.02 - 9.52 vs. 11.53 - 18.69 % SL) and shorter inter nasal width (19.65 - 22.75 vs. 15.40 - 38.22 % SL).
- **Description:** Dorsal profile gently rising, ventral profile nearly straight. Head small, conical. Head length 3.10 to 3.68 (3.42), and body depth 3.44 to 3.63 (3.51) in percent of standard length. Head width 6.33 to 7.24 (6.62), height of at Occiput 1.83 to 2.21 (1.99), snout 7.74 to 56.47 (21.14) in percent of head length. Snout long, pointed, plain. Eyes moderate, 1.37 to 1.38 (1.37) in percent of head length. Mouth sub-terminal, crescentic, its width is less than inter-nostril distance. Lips thin plain. Single pair of maxillary barbels present. Dorsal fin inserted nearer to caudal fin base than the tip of snout. Last unbranched dorsal ray osseous, strong and smooth. Dorsal fin base greater than least depth of caudal peduncle. Pectoral fins not extend to pelvic fins; lateral not reaching anal opening. Anal fin when laid flat reaching root of caudal fin. Lateral line complete.

Puntius amphibius (Cuv. and Val.)

- ***Capoeta amphibius*, Cuvier and Valenciennes,** 1842, Hist. Nat, Poiss. 16, p. 282, pl.578.
- **Systomus amphibius, Jerdon,** Madras J. Lit. and Sci., p.315.
- Barbus mahecola, Gunther, Day, Fish India, P. 574.
- **Salient Features**: D 11(3/8); P 15; V 9; A. 7(2/5), C.19; LL. 21- 28, L.tr. 5 /4.
- **Vernacular name**: Tamil –kulla kendai.
- **Diagnosis**: *Puntius amphibius* is distinguished from *P. dorsalis* in having less no. of dorsal fin spines (2 vs. 3), less no. of pectoral fin rays (11 vs. 12), more circumferential scale rows (19vs.18), and less lateral line scales (25 vs. 26), as well as morphometric characters involving greater eye diameter (16.02 - 24.95 vs. 16.32 - 19.02 % SL), shorter gape of mouth (13.08 - 28.13 vs. 22.38 - 23.31 % SL), shorter inter orbital width (11.53 - 18.69 vs. 11.19 - 32.41 % SL) and shorter inter nasal width (15.40 - 38.22 vs. 25.18 - 41.67 % SL). *Puntius amphibius* is distinguished from *B. carnaticus* in having more predorsal scale rows (8 vs12), more circumferential scale rows (19 vs.22), and more lateral line scales (25 vs. 28), as well as morphometric characters involving longer post anal length (3.68 - 10.47 vs. 6.36 - 8.55 % SL), longer gape of mouth (13.08 - 28.13 vs. 12.84 - 15.07 % SL), longer inter orbital width (11.53

- 18.69 vs. 9.02 - 9.52 % SL) and longer inter nasal width (15.40 - 38.22 vs. 19.65 - 22.75 % SL).

- **Description**: Dorsal profile gently sloping, ventral profile more steep. Head moderate, blunt. Head length 3.50 to 5.05 (4.15); body depth 3.35 to 4.73 (3.94) in percent of standard length. Head width 3.23 to 7.36 (4.74), height of head at occiput 1.58 to 3.19 (2.15), snout 3.28 to 20.90 (9.13) in percent of head length. Snout blunt, plain. Eyes superior, 1.23 to 1.79 (1.41) in percentage to head length. Mouth sub-terminal, its width equal to or less than inter-nostril distance. Lips thin, plain. A pair of maxillary barbels present. Dorsal fin inserted nearer tip of snout then caudal fin base. Last unbranched dorsal ray feebly osseous, mostly seems to the non – osseous, smooth. Dorsal fin base greater than least depth of caudal peduncle. Pectoral fins not extend to pelvic fins; lateral not reaching anal opening. Anal fin when laid flat reaching root of caudal fin. Lateral line complete.

Haludaria melanampyx (Day)

- ***Labeo melanampyx*, *Day*,** 1865, P. Z. S. p. 317 (type locality – Wayanad).
- **Barbus melanampyx, Day,** Fish. India, p. 570, pl. cxxxix, fig. 1.
- **Haludaria melanampyx pradhani, Tilak,** 1972, Rec. Zool. Surv. India, 67 (1-4):97.
- **Puntius afasciatus, Jayaram,** 1988, Bombay, Nat. His. Soc., 87: 107 (Type locality – Nagercoil, Tamil Nadu).
- **Haludaria melanampyx melanampyx, Jayaram et al.,** 1982, Occ. Paper zool. Surv. India No. 36, p. 60, (Cauvery River, S. India).
- **Salient Features**: D 12(4/8); P 15; V8; A. 7(2/5), C.15; LL. 20- 22, L.tr. $3_{1/2}$ /$3_{1/2}$
- **Diagnosis** : *Haludaria melanampyx* is distinguished from *H. fasciata* in having more no. of dorsal fin rays (9 vs. 8), more post anal fin scales (7 vs. 6), and more lateral line scales (24 vs. 21), as well as morphometric characters involving longer eye diameter (14.01 - 18.33 vs. 11.25 - 16.27% SL), longer post anal length (6.39 - 8.30 vs. 5.41 - 7.72 % SL), shorter inter orbital width (5.66 - 6.23 vs. 5.90 - 7.49 % SL) and longer inter nasal width (8.79 - 10.36 vs. 8.38 - 10.35 % SL).
- **Description**: A deep bodied fish with a vertical black band on body, 2 pairs of barbels, lateral line complete with 22. Dorsal profile arched convex, ventral profile slightly arched. Head short. Head length 3.31 to 3.77 (3.53); body depth 2.96 to 3.50 (3.20) in percent of standard length. Head depth 1.02 to 1.74; Orbital width 1.18 to 1.63 (1.35); snout 1.62 to 2.35 (2.00) in percent of Head length. Snout conical with numerous pores. Inter orbital width 2.33 to 2.92 (2.68) in percent of Head Length. Mouth sub terminal, Lips thin and plain. Two pairs of barbels present. Dorsal fin inserted in midway between tip of snout and caudal base. Last unbranched dorsal ray, non-osseous, weak, Dorsal fin base greater than last depth of caudal peduncle. Pectoral fins not extending to pelvics, latter not reaching anal opening. Anal fin when laid flat not reaching root of caudal fin. Caudal fin forked. Scales are somewhat dome shaped. Lateral line complete.

Haludaria fasciata(Jerdon)

- ***Labeo melanampyx*, *Day*,** 1865, P. Z. S. p. 317 (type locality – Wayanad).
- **Barbus melanampyx, Day,** Fish. India, p. 570, pl. cxxxix, fig. 1.
- **Puntius melanampyx pradhani, Tilak,** 1972, Rec. Zool. Surv. India, 67 (1-4):97.
- **Puntius afasciatus, Jayaram,** 1988, Bombay, Nat. His. Soc., 87: 107 (Type locality – Nagercoil, Tamil Nadu).
- **Puntius melanampyx melanampyx, Jayaram et al.,** 1982, Occ. Paper zool. Surv. India No. 36, p. 60,(Cauvery River, S. India).
- Puntius fasciatus, Silas, 1956, Copeia, No.3, p. 194.
- **Salient Features**: D. iv, 8; P. 13-15; A. iii, 5-6; V. I, 8; C. 15-16; LL. 21.
- **Diagnosis**: *Haludaria fasciatus*is distinguished from *H. melanampyx* in having less no. of dorsal fin rays (8 vs. 9), less post anal fin scales (6 vs. 7), and less lateral line scales (21 vs. 24), as well as morphometric characters involving shorter eye diameter (11.25 - 16.27 vs.14.01 - 18.33 % SL), shorter post anal length (5.41 - 7.72 vs. 6.39 - 8.30 % SL), longer inter orbital width (5.90 - 7.49 vs. 5.66 - 6.23 % SL) and shorter inter nasal width (8.38 - 10.35 vs. 8.79 - 10.36 % SL).
- **Description**: A deep bodied fish with 2 or 3 vertical black bands on body, 2 pairs of barbels, lateral line complete with 21. Dorsal profile arched and convex, ventral profile slightly. Head short. Head length 3.29 to 6.47 (3.81); body depth 2.81 to 3.23(3.10) in percent of standard length. Height of head at Occiput 2.12 to 4.25 (3.49); snout 1.29 to 4.90 (2.55) in percent of head length. Snout conical with numerous pores. Eyes Large, 0.73 to 1.55 (1.22); Inter orbital width 1.36 to 2.96 (2.54) in percent of head length. Mouth sub - terminal. Lips thin, plain. Two pairs of barbels present. Dorsal fin inserted midway between tip of snout and caudal base. Last unbranched dorsal ray, non - osseous, weak. Dorsal fin base greater than least depth of caudal peduncle. Pectoral fins not extend to pelvics, latter not reaching anal opening. Anal fin when laid flat not reaching root of caudal fin. Caudal fin forked. Scales somewhat dome shaped. Lateral line complete.

Sahyadria denisonii (Day)

- ***Labeo denisonii*, *Day*,** 1865, P. Z. S. p. 299.
- **Barbus denisonii, Day,** Fish. India, p. 573, pl. cxliii, fig. 2.
- ***Puntius denisonii*, Day,** Fish. Malabar, 1865, p. 212, pl.116, fig.2.
- **Puntius denisonii, Talwar and Jhingran,** Island fish., **1**: 268, 1991 (Travancore hill ranges).
- **Puntius denisonii, Jayaram,** Rec. Zool. Surv. India Occ. Pap., No. 135: 71, 1991 (kerala).
- **Salient Features**: D 11(3/8); P 15; V 9; A. 8(3/5), C.19; LL. 28, L.tr. $4_{1/2}$ /$4_{1/2}$
- **Vernacular name**: Red line torpedo.

- **Diagnosis** : *Sahyadria denisonii* is distinguished from *S. chalakkudiensis* in having less no. of dorsal fin spines (2 vs. 4), less circumferential scale rows (20 vs.22), and more lateral line scales (29 vs. 27), as well as morphometric characters involving lesser eye diameter (13.77 - 21.60 vs. 19.61 - 21.47 % SL), longer gape of mouth (21.9 - 78.52 vs. 25.95 - 28.42 % SL), longer inter orbital width (12.85 - 23.01vs. 11.47 - 12.56 % SL) and longer inter nasal width (22.90 - 156.82 vs. 22.32 - 24.44 % SL).
- **Description**: Dorsal and ventral profiles gentle without much of a rise. Head moderately long. Head length 4.11 to 4.52 (4.36); body depth 4.25 to 5.63(4.80) in percent of standard length. Height of head at Occiput 5.05 to 18.10 (7.61); snout 1.63 to 5.15 (3.06) in percent of head length. Snout plain, obtuse. Eyes Large, 1.58 to 2.00 (1.80); Inter orbital width 5.14 to 36.29 (10.10) in percent of head length. Mouth sub - terminal. Lips thin, plain. One pairs of maxillary barbels present. Dorsal fin inserted nearer tip of snout than caudal base. Last unbranched dorsal ray, weakly osseous, smooth. Dorsal fin base greater than least depth of caudal peduncle. Pectoral fins not extend to pelvics, latter not reaching anal opening. Anal fin when laid flat not reaching root of caudal fin. Caudal fin forked. Lateral line complete.

Sahyadria chalakkudiensis (Menon, Rema Devi and Thobias)

- **Sahyadria chalakkudiensis,** Menon, Rema Devi and Thobias, 1999, Bombay, Nat. His. Soc., (Type locality – Chalakudy river, kerala).
- **Salient Features**: D 11(3/8); P 15; V 9; A. 7(2/5), C.19; LL. 21- 28, L.tr. 5 /4.
- **Vernacular name**: Miss kerala look alike.
- **Diagnosis**: *Sahyadria chalakkudiensis* is distinguished from *S. denisonii* in having more no. of dorsal fin spines (4 vs.2), more circumferential scale rows (22 vs.20), and less lateral line scales (27 vs. 29), as well as morphometric characters involving longer eye diameter (19.61 - 21.47 vs. 13.77 - 21.60 % SL), shorter gape of mouth (25.95 - 28.42 vs. 21.9 - 78.52 % SL), shorter inter orbital width (11.47 - 12.56 vs. 12.85 - 23.01 % SL) and shorter inter nasal width (22.32 - 24.44 vs. 22.90 - 156.82 % SL).
- **Description:** Dorsal and ventral profiles gentle arched. Head moderately long. Head length 4.89 to 4.93 (4.91); body depth 4.03 to 4.24(4.13) in percent of standard length. Head width at occiput 5.31 to 5.77 (5.54); height of head at Occiput 1.54 to 1.61 (1.58); snout 7.74 to 56.47 (21.14) in percent of head length. Snout plain, obtuse. Eyes Large, 1.27 to 1.37 (1.32); Inter orbital width 4.56 to 4.96 (4.76) in percent of head length. Mouth sub - terminal. Lips thin, plain. One pairs of maxillary barbels present. Dorsal fin inserted nearer tip of snout than caudal base. Last unbranched dorsal ray, weakly osseous, smooth. Dorsal fin base greater than least depth of caudal peduncle. Pectoral fins not extend to pelvics, latter not reaching anal opening. Anal fin when laid flat not reaching root of caudal fin. Caudal fin forked. Lateral line complete.

SUMMARY

Puntius species from Southern Western Ghats have a confusing taxonomy and exhibit a clear morphological variation within and between the species. The species collected in different geographical locations did not express variations in body patterns or in colorations. The species like *Haludaria fasciatus* and *Haludaria melanampyx* seems to be the same species temptation ally but it turns out to be separate in individuality in most of the collections sites in Southern Western Ghats. Similarly, the taxonomic identity of the species *Eechathalakenda ophicephalusand Systomus spilurus* are tempted to have variations in characters on the genus *Puntius* and are considered to be as a sister group species by Peithigoda 2012. Similarly, *Puntius dorsalis* was classified near *Puntius mahecola* because they have their body shapes and blotches similar to each other. The multivariate analysis of the morphometric characters in the present study has proved the separate individuality different groups of *Puntius* species in Southern Western Ghats. Further studies have to be performed to define the exact identity of each species and their inter-relationship.

Morphometrics adds more as a quantitative element to descriptions of the individual, allowing more clarified comparisons. It enables to describe complex body shapes in exact and permits numerical comparison between different species and also when combined with multivariate statistical methods (e.g. Principal Component Analysis, Cluster Analysis etc.) they offer a powerful tool for testing and displaying differences between individuals.

Several influential factors have been identified to explain the environmental effects on morphometric characteristics (Swain *et al.,* 2005). Haas *et al.* (2010) found that the physical characteristics of habitats drive changes in the morphological attributes of native fish populations. According to Lindsey (1988) the environmental component in morphologic characters is determined during the early larval stages when variations in temperature, salinity, oxygen and pH, or food availability can modify the trait. Each morphologic character has a genetic basis but the environment may modify the expression of that particular character.

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