

New and poorly known Characiform fishes from French Guiana. 1. Two new Tetras of the genera *Hemigrammus* and *Hyphessobrycon* (Teleostei: Characiformes: Characidae)

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Abstract. Two species of characid fish from French Guiana (Teleostei: Characiformes: Characidae) are described: *Hemigrammus ora* sp. n. and *Hyphessobrycon borealis* sp. n. – *Hemigrammus ora* sp. n. is characterized by the following features: (1) no maxillary teeth, (2) maxilla relatively short (3.91 to 6.59 times in head length), (3) cusps or denticles of each tooth of the inner row of premaxilla arranged in a crescent line, (4) 21 to 24 branched anal fin rays, (5) 32 to 33 lateral scales, (6) 10 to 15 pored scales in the lateral line, (7) body depth 2.94 to 3.44 times in SL, (8) head length 3.42 to 3.96 times in SL, (9) one small, round, not horizontally or vertically prolonged, humeral spot and (10) caudal spot round, not on the whole depth of the caudal peduncle and only a little on the basal parts of the middle caudal fin rays, never reaching the tips. – *Hyphessobrycon borealis* sp. n. is characterized by the following features: (1) largest teeth up to quincuspid, (2) maxilla relatively large (2.68 to 3.60 times in head length), (3) 18 to 22 branched anal fin rays, (4) 29 to 32 lateral scales, (5) about 10 pored scales in the lateral line, (6) body depth 3.09 to 4.03 times in SL, (7) head length 3.37 to 4.00 times in SL, (8) no humeral spot and (9) caudal spot oval, not on the whole depth of the caudal peduncle and only a little on the basal parts of the middle caudal fin rays, never reaching the tips.

Résumé. Deux espèces de poissons characidés (Teleostei: Characiformes: Characidae) sont décrits de Guyane française: *Hemigrammus ora* sp. n. et *Hyphessobrycon borealis* sp. n. – *Hemigrammus ora* sp. n. est défini par les caractères suivants: (1) pas de dents maxillaires, (2) os maxillaire relativement court (3,91–6,59 fois dans la longueur de la tête), (3) cuspides ou denticules de chaque dent de la rangée interne prémaxillaire disposées en forme de croissant, (4) 21–24 rayons ramifiés à la nageoire anale, (5) 32–33 écailles en série longitudinale, (6) 10–15 écailles perforées de la ligne latérale, (7) hauteur du corps 2,94–3,44 fois dans la longueur standard, (8) longueur de la tête 3,42–3,96 fois dans la longueur standard, (9) une tache humérale petite et arrondie, non étendue horizontalement ou verticalement, (10) une tache caudale arrondie n'occupant pas toute la hauteur du pédicule caudal, s'étendant à peine sur la partie basale des rayons caudaux médians et jamais jusqu'à leur extrémité. – *Hyphessobrycon borealis* sp. n. est caractérisé par les traits suivants: (1) dents les plus larges quincuspidées, (2) maxillaire relativement long (2,68–3,60 fois dans la longueur de la tête), (3) 18–22 rayons ramifiés à la nageoire anale, (4) 29–32 écailles en série longitudinale, (5) environ 10 écailles perforées de la ligne latérale, (6) hauteur du corps 3,09–4,03 fois dans la longueur standard, (7) longueur de la tête 3,37–4,00 fois dans la longueur standard, (8) pas de tache humérale, (9) une tache caudale ovale n'occupant pas toute la hauteur du pédicule caudal, s'étendant à peine sur la partie basale des rayons caudaux médians et jamais jusqu'à leur extrémité.

Resumen. Se describen dos nuevas especies de carácidos (Teleostei: Characiformes: Characidae) de Guayana Francesa: *Hemigrammus ora* sp. n. y *Hyphessobrycon borealis* sp. n. – *Hemigrammus ora* sp. n. se caracteriza por (1) un maxilar sin dientes, (2) maxilar además relativamente corto (3,91 a 6,95 veces contenido en la longitud de la cabeza), (3) cúspides de los dientes de la fila interna del premaxilar dispuestas en arco, (4) 21 a 24 radios ramificados en la aleta anal, (5) 32 a 33 escamas en línea longitudinal, (6) línea lateral comprendiendo 10 a 15 escamas perforadas, (7) altura del cuerpo contenida 2,94 a 3,44 veces en la LS, (8) largo de la cabeza 3,42 a 3,96 veces conteniendo en la LS, (9) pequeña mancha humeral no prolongada ni horizontal ni verticalmente y (10) mancha caudal redonda no abarcando la altura total del pedúnculo caudal y solo un poco la parte basal de los radios

caudales centrales pero sin alcanzar las puntas. – *Hyphessobrycon borealis* sp. n. se caracteriza por (1) dientes con hasta cinco puntas, (2) maxilar relativamente largo (2,68 a 3,60 veces contenido en el largo de la cabeza), (3) 18 a 22 radios anales ramificados, (4) 29 a 32 escamas en una línea longitudinal, (5) la línea lateral perfora aproximadamente 10 escamas, (6) altura del cuerpo 3,09 a 4,03 veces en la LS, (7) largo de la cabeza 3,37 a 4,00 veces en SL, (8) sin mancha humeral (9) mancha basal caudal oval no abarcando la altura total del pedúnculo caudal y solo un poco la parte basal de los radios caudales centrales pero sin alcanzar las puntas.

Kurzfassung. Es erfolgt die Beschreibung von zwei neuen Salmier-Arten (Teleostei: Characiformes: Characidae) aus Französisch Guayana: *Hemigrammus ora* sp. n. und *Hyphessobrycon borealis* sp. n.. – *Hemigrammus ora* sp. n. ist charakterisiert durch (1) ein zahnloses Maxillare, (2) Maxillare weiterhin relativ kurz (3,91 bis 6,59 mal in der Kopflänge enthalten), (3) Zahnsitzen der Zähne in der inneren Reihe des Praemaxillare bogenförmig angeordnet, (4) 21 bis 24 geteilte Flossenstrahlen der Anale, (5) 32 bis 33 Schuppen in einer Längsreihe, (6) Seitenlinie aus 10 bis 15 durchbohrten Schuppen bestehend, (7) Körperhöhe 2,94 bis 3,44 mal in der SL, (8) Kopflänge 3,42 bis 3,96 mal in der SL, (9) ein kleiner, runder, weder horizontal noch vertikal verlängerter Schulterfleck und (10) Schwanzwurzelfleck rund, nicht die gesamte Höhe des Schwanzstiels einnehmend und höchstens etwas auf die Basis der mittleren Schwanzflossenstrahlen, niemals jedoch bis zu deren Spitzen, reichend. – *Hyphessobrycon borealis* sp. n. ist gekennzeichnet durch (1) Zähne in den Kiefern mit bis zu fünf Spitzen, (2) Maxillare relativ lang (2,68 bis 3,60 mal in der Kopflänge), (3) 18 bis 22 geteilte Afterflossenstrahlen, (4) 29 bis 32 Schuppen in einer Längsreihe, (5) die Seitenlinie durchbohrt etwa 10 Schuppen, (6) Körperhöhe 3,09 bis 4,03 mal in SL, (7) Kopflänge 3,37 bis 4,00 mal in SL, (8) kein Schulterfleck und (9) Schwanzwurzelfleck oval, nicht die gesamte Höhe des Schwanzstiels einnehmend und höchstens etwas auf die Basis der mittleren Schwanzflossenstrahlen, niemals jedoch bis zu deren Spitzen reichend.

Key words. Teleostei, Characiformes, Characidae, *Hemigrammus*, *Hyphessobrycon*, new species, French Guiana, South America, Biogeography.

Introduction

A biogeographic study of the Guianese ichthyofauna is in progress (PLANQUETTE *et al.*, 1996; BOUJARD *et al.*, 1997). It imposes on us to officially name and describe a number of new species, only partly cited in previous publications (cf. GÉRY & PLANQUETTE, 1983a; GÉRY *et al.*, 1991; GÉRY, 1992). Some had been collected long ago. They were not described for diverse reasons: not very characteristic taxa in reputedly “difficult” and often crowded groups, lack of sufficiently abundant biological material, lack of comparative material from the neighboring river basins, imprecise taxonomic level, or simply lack of time owing to some priority studies due to the sudden death of the director of the Laboratoire d’Hydrobiologie de Kourou of the Institut National de la Recherche Agronomique (I.N.R.A.), PAUL PLANQUETTE. These difficulties have been partly overcome; they will nevertheless be recalled and emphasized within the differential diagnoses which follow. The inventory of the ichthyofauna started with modern methods (as described in the papers cited above) in 1957 with the collecting by one of us (J.G.) in the Maroni, the Mana and the Orapu-Comté basins. This was possible with the aid of the Institut Français d’Amérique Tropicale (O.R.S.T.O.M. then I.R.D.), and its director, BORIS CHOUBERT, a precursor in several domains of the Geology, who had made of I.F.A.T. a remarkable research instrument. Publications on Characiform fish appeared in the time from 1959 to 1972. Much later on, the Institut National de la Recherche Agronomique (I.N.R.A.) took up the torch in French Guiana. PLANQUETTE and LE BAIL, sometimes together with GÉRY, continued the inventory on a much larger scale, thanks to the study of numerous collecting stations from the upper and middle Maroni, the Sinnamary, the Kourou, the Approuague and Oyapock (GÉRY *et al.*, 1991) and, more recently, the Mana, the Iracoubo, the Maroni again, in collaboration with the Museum d’Histoire Naturelle de Paris and the I.R.D..

The Sinnamary was the object of a parallel study made by the joint efforts of I.R.D., to study the impact of a dam on the fauna and the flora at the same time (DE MERONA, 2005). A team of researchers worked also on the Arataye, a tributary of the Approuague, where important biological material was collected (BOUJARD *et al.*, 1997).

Despite some secondary waterways, the Guianese ichthyofauna is thus relatively well known. The number of recognized Characiform species, particularly, which were among the most studied fish, increased from 40 or 45, in 1949, to some 150 at present (PLANQUETTE *et al.*, 1996). This knowledge permits inference about the geographic distribution of the ichthyofauna in South America, especially in context with the debated refuges theory. The Guianas (Guyana, Surinam and French Guiana) were never covered by a Tertiary or Quaternary lake, whereas the central Amazonian basin probably was partly covered by a lake. Thus in the Guianas diversification and dispersal of fish species were not influenced by this process.

In this and following papers, we confine ourselves to the description of new or poorly known forms, an essential step preceding any general consideration. The distribution of the described fish will only be mentioned in the discussion of their taxonomic affinities. As far as their phylogeny is concerned, we think that it is premature to undertake a study in a complex group such as the Tetras (Characidae) to which the species described belong.

Materials and methods

Measurements were taken on the left side of each specimen with digital calipers under a binocular microscope and recorded to 0.1 mm. All counts and measurements were recorded following GÉRY (1972). The number of supraneurals, vertebrae and pterygiophores were counted by x-ray investigation (Faxitron 43855C). The count of vertebrae includes all vertebrae, considering the urostyle as the last one. Precaudal and caudal vertebrae are distinguished by the presence or absence of haemal spines. The four vertebrae of the Weberian apparatus, the precaudal and caudal vertebrae are separated by a plus sign.

The type-specimens of the described species are deposited in the Galerie d'Ichtyologie du Museum national d'Histoire naturelle, Paris, France (MNHN); some paratypes are deposited in the following collections: **MTD F** = Staatliche Naturhistorische Sammlungen Dresden, Museum für Tierkunde, Fischsammlung, **IRSNB** = Institut royal des Sciences naturelles de Belgique.

The following abbreviations were used: SD = standard deviation, SL = standard length.

1. *Hemigrammus ora* sp. n. (Fig. 1 to 4, Table 1 and 2)

Material

Holotype. MNHN 2006-0785, 37.8 mm SL, French Guiana, Pripri Yiyi, LE BAIL, DURANTON *leg.*, 1.10.1995.

Paratypes. MNHN 2006-0786, 14 ex. 20.0–38.4 mm SL, same data as holotype. MTD F 28837–28842, 6 ex. 23.9–35.6 mm SL, same data as holotype. Priv. Coll. Géry, 4 ex. 22.7–30.2 mm SL, same data as holotype.

Diagnosis. A relatively large species (largest known specimen 38.4 mm SL) of the genus *Hemigrammus* GILL, 1858 (type-species: *Poecilurichthys* [*Hemigrammus*] *unilineatus* GILL, 1858). The new species is a member of the *Hemigrammus-ocellifer*-group sensu GÉRY (1978): one or sometimes two humeral spots and one caudal spot. The new species is characterized by the following features: (1) no maxillary teeth, (2) maxilla relatively short (3.91 to 6.59 times in head length), (3) cusps or denticles of each tooth of the inner row of premaxilla arranged in a crescent line, (4) 21 to 24 branched anal fin rays, (5) 32 to 33 lateral scales, (6) 10 to 15 pored scales in the lateral line, (7) body depth 2.94 to 3.44 times in standard length, (8) head length 3.42 to 3.96 times in standard length, (9) one small, round, not horizontally or vertically prolonged humeral spot and (10) caudal spot round, not on the whole depth of the caudal peduncle and only a little bit on the basal parts of the middle fin rays of caudal fin, never reaching the tips.



Fig. 1. *Hemigrammus ora* sp. n., lateral view, 38.4 mm SL, paratype.

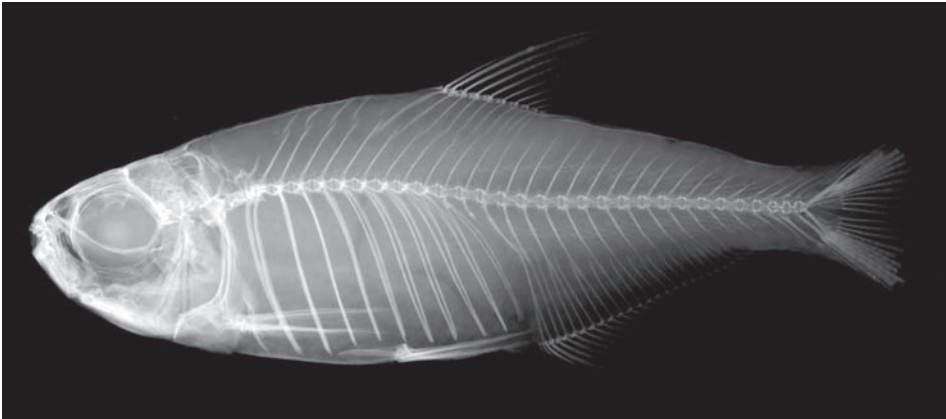


Fig. 2. *Hemigrammus ora* sp. n., radiograph, lateral view, 37.8 mm SL, paratype.

Description ($n = 25$; 24.0–38.4 mm SL; first figure = holotype; second figure = mean; figures between the brackets = variability). The morphometric features, expressed in percent of standard length, see Table 1.

Body elongated and slender, appearing somewhat stout, laterally compressed, broadest behind the head. The dorsal outline rises in a regular curve up to the anterior root of the dorsal fin and is less curved than the ventral outline. Preventral area flat, especially anterior to the beginning of ventral fin. Greatest body depth approximately anterior to the beginning of dorsal fin, 3.24; 3.15 (2.94 to 3.44) times in standard length (SL). The males are somewhat more slender than the females. The head is relatively small. The head length is 3.81; 3.65 (3.42 to 3.96) times in SL. Eye relatively large. The eye diameter is 2.29; 2.37 (2.05 to 2.66) times in head length. Interorbital width slightly arched, 3.00; 2.79 (2.33 to 3.13) times in head length. Mouth terminal, sometimes directed slightly upwards, not pointed, nearly rounded, relatively short, 5.03; 3.93 (3.29 to 5.03) times in head length. Mandibular not or only slightly prominent. Maxilla relatively short and narrow, up to the rim of the eye, 5.30; 4.74 (3.91 to 6.59) times in head length. Third suborbital is complete, but with a narrow naked zone below. The formation of the fourth and fifth suborbitals corresponds to most other species of the genus. Fontanels are relatively large and long, cranial up to the eyes. Caudal peduncle longer than high. The height of caudal peduncle is 1.15; 1.33 (1.06 to 1.55) times in its length.

Table 1. Morphometric features of *Hemigrammus ora* sp. n. expressed as percent of standard length (n=20).

	Holotypus	\bar{x} (x_{\min} – x_{\max})	S.D.
Standard length [mm]	37.8	24.0–38.4	
Depth	30.87	31.78 (29.04–33.97)	1.361
Head length	26.22	27.44 (25.19–30.44)	1.408
Eye diameter	11.44	11.64 (10.09–13.77)	0.831
Snout length	5.21	5.86 (3.88–7.01)	0.653
Maxilla	4.94	5.86 (3.88–7.01)	0.687
Interorbital width	8.72	9.88 (8.24–11.71)	0.922
Predorsal distance	52.97	53.04 (50.70–56.31)	1.432
Postdorsal distance	50.57	50.30 (45.52–52.88)	1.623
Preventral distance	48.35	48.95 (47.19–50.71)	1.040
Preanal distance	60.77	63.19 (59.73–66.64)	2.195
Dorsal fin base	11.78	12.81 (10.14–17.75)	1.935
Longest dorsal fin ray	24.98	25.40 (21.47–28.66)	1.789
Anal fin base	27.17	29.11 (26.10–31.78)	1.771
Longest anal fin ray	16.41	17.76 (14.25–22.16)	2.018
Pectoral fin length	16.63	20.83 (16.62–26.01)	2.376
Ventral fin length	13.77	15.85 (13.13–19.55)	1.831
Depth of caudal peduncle	11.05	10.20 (8.89–12.12)	0.717
Length of caudal peduncle	12.69	13.56 (10.91–15.90)	1.789

Premaxillary teeth arranged in two rows. Three to four (mostly four) tricuspid teeth are situated in the outer row and five quincuspid teeth in the inner row. The teeth are broad at their bases, not compressed. The lateral cusps begin relatively low. The cusps of the teeth of the inner row are arranged in a semicircle. No maxillary teeth. Dentary with four large, quincuspid teeth followed by eight to about ten abruptly smaller conical teeth.

The dorsal fin originates distinctly posterior to the middle of the body. The predorsal area is 1.89; 1.89 (1.83 to 2.13) times in SL. The basis of dorsal fin is 2.43; 2.18 (1.89 to 2.95) times in head length. The first branched dorsal ray is the longest. It is about equal head and 1.05; 1.08 (0.98 to 1.31) times in head length. Fin rays: ii 8 to 9; 9.90 (9 to 10) pterygiophores of the dorsal fin (n=11, counted in x-ray investigation). The dorsal fin starts with first pterygiophore between the fifth and sixth precaudal vertebrae.

Anal fin relatively long, somewhat larger than the head, beginning below the last fin rays of the dorsal fin. The first fin rays are a little longer than the rest. There is a weakly concave lappet at the beginning of the fin. The preanal area is 1.65; 1.58 (1.50 to 1.67) times in SL. The anal fin base is 0.96; 0.96 (0.80 to 1.13) times in head length. Anal fin with a basal sheath of a single series of scales which reach up to about the sixth branched fin ray. The fourth or fifth fin ray is the largest and the first branched one, 1.59; 1.56 (1.31 to 1.81) times in head length. Fin rays: iii to iv 21 to 24 (i) (n=25), mean 22.64. Anal fin with 24.27 (23 to 25) pterygiophores (n=11, counted in x-ray investigation). The anal fin starts with one to four pterygiophores between the third and fourth caudal vertebrae. No hooklets on the first rays of anal fin.

The ventral fins are situated anterior to the dorsal fin. The preventral area is 2.07; 2.04 (1.96 to 2.12) times in SL. The length of ventral fin is 1.90; 1.82 (1.40 to 2.09) times in head length, extending up to the beginning of the anal fin or a little bit beyond. Fin rays: ii 8. Pectoral fin relatively long, 1.58; 1.37 (1.11 to 1.72) times in head length, reaching further than to the



Fig. 3. *Hemigrammus ora* sp. n., lateral view, Pripri Yiyi, male, not preserved.



Fig. 4. *Hemigrammus ora* sp. n., lateral view, Pripri Yiyi, female, not preserved.

beginning of the ventral fin. Fin rays: i 13. Caudal fin deeply forked, lobes about equally long, principal caudal fin ray count 1/9–8/1.

Scales in a longitudinal row 32; 32.24 (31 to 33, n=25), 11 (6/1/4) transverse scales anterior to dorsal fin. Lateral line relatively long with 12; 12.28 (10 to 15) pored scales. 11; 10.48 (10 to 11) predorsal scales in a regularly row. 12 scales around caudal peduncle.

17.56 (16 to 19) relatively short gill-rakers on the first arch of the left side, seven to eight on the upper and nine to eleven on the lower branch.

Four supraneuralia. 32.72 [32 to 34 (4+9–10+19–20)] vertebrae (n=11, counted on x-ray investigation).

Coloration (in vivo). Body pale to medium yellow, belly silvery, somewhat darker dorsally. A lateral dark yellow to silvery band extends from the gill cover to the black caudal spot. Shape of humeral spot typical for this species: it is small, round and not vertically or horizontally prolonged. Also the shape of the black caudal spot is typical for this species: it is round, not on the whole depth of the caudal peduncle and only a little on the basal parts of the middle caudal fin rays, never reaching the tips. Iris of the eye silvery to light yellow. Fins hyaline, some yellow only in front of the basis of dorsal fin and on the basal parts of the lobes of caudal fin (see also Figs. 3 and 4).

Table 2. Differences in color pattern between *Hemigrammus ora* sp. n., *H. schmardae* (STEINDACHNER, 1882), *H. guyanensis* GÉRY, 1959, *H. boesemani* GÉRY, 1959 and *H. rodwayi* DURBIN, 1909.

	<i>ora</i> sp.n.	<i>schmardae</i>	<i>guyanensis</i>	<i>boesemani</i>	<i>rodwayi</i>
Humeral spot	small, round, distinct	mostly absent, rarely weakly developed vertically	small, round to nearly quadratic	not developed	not developed
Caudal spot	round, not on the whole height of caudal peduncle	round, mostly on the whole height of caudal peduncle	horizontally elongated, not on whole height of caudal peduncle	horizontally elongated, on whole height of caudal peduncle	horizontally elongated, not on whole height of caudal peduncle
Longitudinal band on the lateral sides	a weakly developed lateral band	a very weakly developed lateral band	a distinct black or silvery lateral band	not developed to a very weakly lateral line	no lateral band
Band on the anal fin base	not developed	not developed	not developed	developed	not developed

Coloration (in alcohol). Body pale to medium brown, belly lighter, somewhat darker dorsally. There is the same pattern as in living specimens: a small round humeral spot and a deep black round caudal spot. A horizontal black line joins both. No markings on the fins (see also Fig. 1).

Distribution. The species was only collected in the coast region of French Guiana (Sinnamary, Pripri Yiyi), see also the distribution map in PLANQUETTE *et al.* (1996), and seems to be endemic of this area. It lives in swamp, near the water surface, sympatric with *H. rodwayi* and *H. boesemani* which have similar color pattern, except the absence of humeral spot.

Derivatio nominis. The species name is derived from the latin *ora* and refers to the distribution of this species in the coast region. *Ora* means the coast as the end of the land and also the whole habitable region on the coast, used as substantive in apposition.

Discussion

Hemigrammus ora sp. n. is described and figured as *Hemigrammus* aff. *schmardae* in PLANQUETTE *et al.* (1996). According to its very small humeral spot and its very large caudal spot this species is phenotypically not similar to any other species of the genus *Hemigrammus* Gill, 1858 from French Guiana (Table 2), see also the key in PLANQUETTE *et al.* (1996).

Among the *Hemigrammus* occurring in the Guianas *Hemigrammus guyanensis* GÉRY, 1959 (loc. typ.: Sable Creek, upper Mana) is perhaps most similar. *H. ora* sp. n. can be differentiated from this species by (1) the number of teeth in the maxilla (no teeth in the maxilla in *H. ora* sp. n. vs. three small conical teeth in *H. guyanensis*), (2) the denticles of the larger teeth of the interior row of premaxilla arranged in a series ranging from a crescent to a U (vs. in a straight line in *H. guyanensis*), (3) the number of branched anal fin rays (21 to 24 in *H. ora* sp. n. vs. 18 to 21 in *H. guyanensis*) and the coloration and pattern. (4) The different form of the caudal spot (round in *H. ora* sp. n. vs. diamond-shaped in *H. guyanensis*) and (5) the iris of the eye unicolor, clear to light golden shining vs. above bright red in *H. guyanensis* (see Fig. 9 in ZARSKÉ & GÉRY, 2002).

Hemigrammus schmardae STEINDACHNER, 1882 (loc. typ.: Brazil, Amazonas, Tabatinga, Fig. 5) is differentiated from *H. ora* sp. n. by (1) the lower number of branched anal-rays (16 to 19 in



Fig. 5. *Hemigrammus schmardae*, lateral view, not preserved.

H. schmardae vs. 21 to 24 in *H. ora* sp. n.), (2) the number of teeth in maxilla (one to three conical to tricuspid teeth in *H. schmardae* vs. no teeth in *H. ora* sp. n.), (3) the direction of cusps of the teeth of the inner row premaxilla (rectilinear in *H. schmardae* vs. the semicircular direction of the cusps of the teeth of the inner premaxillary row with the opening in front in *H. ora* sp. n.), (4) the somewhat elongated body (depth about 3 in *H. schmardae* vs. 3.15 [2.94 to 3.44] times in SL in *H. ora* sp. n.) and (5) the small, always distinct humeral spot (*H. schmardae* has only a very weakly developed humeral spot vs. always distinct in *H. ora* sp. n.) (see Fig. 10 in ZARSKÉ & GÉRY, 2002).

A note on the etymology of the name *H. schmardae*: The name was given in honor to Prof. Ludwig Karl SCHMARDA (1819–1908), at that time teaching at the University of Vienna and also an explorer. The name had been introduced in its latinized form by STEINDACHNER and is to be used in this form according to the ICZN art. 31.1.

Hemigrammus neptunus ZARSKÉ & GÉRY, 2002 (loc. typ.: Bolivia, Pando, río Manuripi between Alimendrillo and Bolima) has (1) four to five teeth in the maxilla (vs. no maxillary teeth in *H. ora* sp. n.), (2) nine (5/1/3) transversal scales before dorsal fin (vs. eleven [6/1/4] in *H. ora* sp. n.), (3) seven to eight scales in lateral line (vs. 10 to 15 in *H. ora* sp. n.), (4) two vertically elongated humeral spots (one very small round humeral spot in *H. ora* sp. n.) and (5) differently shaped caudal spot (trident in *H. neptunus* vs. round in *H. ora* sp. n.).

Hemigrammus barrigonae EIGENMANN & HENN, 1914 (loc. typ.: Colombia, Barrigona, río Meta) has (1) four to five small sixcuspid teeth in the maxilla (vs. maxilla without teeth in *H. ora* sp. n.), (2) a black line above the base of anal fin (vs. not developed in *H. ora* sp. n.), (3) a broad horizontal lateral stripe from the hind margin of the operculum to the base of caudal fin, ending in an ill-defined caudal spot, not expanded on the whole caudal peduncle (vs. no or ill-defined lateral stripe and a big, deep black caudal spot also not expanded on the whole caudal peduncle in *H. ora* sp. n.).

Hemigrammus levis DURBIN, 1908 (loc. typ.: Brazil, Lago do Maximo, Fig. 6) has (1) no humeral spot (vs. humeral spot small and always distinctly visible in *H. ora* sp. n.), (2) the caudal spot is only situated on the middle caudal rays and not on the caudal peduncle (vs. caudal spot only on the caudal peduncle, not exceeding the middle caudal fin rays in *H. ora* sp. n.), (3) 13 to 17 branched anal fin rays [in the whole number 17 to 20] (vs. 21 to 24 branched anal fin rays in *H. ora* sp. n.) and (4) the largest teeth in the inner row of premaxilla are ninecuspid (vs. quincuspid in *H. ora* sp. n.), see also ZARSKÉ (1988).



Fig. 6. *Hemigrammus levis*, lateral view, not preserved.

Hemigrammus vorderwinkleri GÉRY, 1963 (loc. typ.: Brazil, near Tapurucuara, upper rio Negro) has (1) iii 14 to 15 (i) anal rays (vs. iii to iv 21 to 24 (i) in *H. ora* sp. n.), (2) 29 to 30 longitudinal scales (vs. 31 to 33 in *H. ora* sp. n.), (3) 2 or 3 tricuspid maxillary teeth (vs. no maxillary teeth in *H. ora* sp. n.), (4) nine (5/1/3) transversal scales before dorsal fin (vs. eleven [6/1/4] in *H. ora* sp. n.), (5) humeral spot vertically prolonged (vs. round not vertically or horizontally prolonged humeral spot in *H. ora* sp. n.) and others.

2. *Hyphessobrycon borealis* sp. n. (Fig. 7 to 11, Table 3)

Material

Holotype. MNHN 2006–0787, 22.3 mm SL, French Guiana, Mana, Crique St. Anne, LAMARQUE *et al. leg.*, 22.9.1978.

Paratypes. MNHN 2006–0788, 30 ex. largest 25.9 mm SL, same data like holotype. MTD F 28843–28852, 10 ex. largest 24.9 mm SL, same data like holotype. Priv. Coll Géry: 7 ex. largest 26.2 mm SL, same data like holotype. IRSNB 837–866, 30 ex. largest 27.8 mm SL, Brazil, Amapa, Oyapock, Clevelandia, S.M. LEOPOLD III, J.-P. GOSSE *leg.*, 5.12.1962. MTD F 28805–28814, 10 ex. largest 22.7 mm SL, same data like IRSNB 837–866. Priv. Coll Géry: 4 ex. largest 19.6 mm SL, same data like IRSNB 837–866. MNHN 2006–0789, 3 ex. 23.4 mm SL, French Guiana, Kaw, PLANQUETTE *leg.*, 5.1985. IRSNB 20947, 6 ex., French Guiana, Orapu, route, RN2, pk53, crique Boulanger, Billiet-Jadin *rec.*, 22.02.1988 (stat. 8).

Diagnosis. A relatively small species (up to now largest specimen 27.8 mm SL) of the genus *Hyphessobrycon* DURBIN, 1908 (type-species: *Hemigrammus compressus* MEEK, 1904), which belongs in the *Hyphessobrycon-heterorhabdus*-group sensu GÉRY (1978): one intense, relatively narrow lateral band on mid-axis of the body. The new species is characterized by the following features: (1) the largest premaxillary teeth up to quincuspid, (2) maxilla relatively large (2.68 to 3.60 times in head length), (3) 18 to 22 branched anal fin rays, (4) 29 to 32 lateral scales, (5) about 10 pored scales in the lateral line, (6) body depth 3.09 to 4.03 times in SL, (7) head length 3.37 to 4.00 times in SL, (8) no humeral spot and (9) caudal spot oval, not extending on the whole depth of the caudal peduncle, and only a little on the basal parts of the middle rays of caudal fin, never reaching the tips.



Fig. 7. *Hyphessobrycon borealis* n. sp., lateral view, Mana, Crique St. Anne, 22.0 mm SL, paratype.



Fig. 8. *Hyphessobrycon borealis* n. sp. lateral view, Kaw, 24.0 mm SL, paratype.

Description. ($n = 24$; 22.0–27.8 mm SL; first figure = holotype; second figure = mean; figures between the brackets = variability). The morphometric features, expressed in percent of standard length, see Table 3.

The body is elongated and slender, laterally compressed, broadest behind the head. The dorsal outline rises in a regularly curve to the beginning of the dorsal fin, a little more flat than the ventral outline sink. Preventral area flat, especially anterior to the beginning of ventral fin. Greatest body depth just anterior to the beginning of dorsal fin, 3.49; 3.51 (3.09 to 4.03) times in standard length (SL). Head relatively small. Head length 3.37; 3.64 (3.34 to 4.00) times in SL. Eye relatively large. Eye diameter is 2.57; 2.40 (2.18 to 2.80) times in head length. Interorbital width slightly arched, 3.12; 2.71 (2.97 to 3.48) times in head length. Mouth terminal, sometimes directed slightly upwards, snout not pointed, nearly rounded, relatively short, 5.56; 5.40 (2.96 to 5.56) times in head length. Mandible not or only slightly prominent. Maxilla relatively long and narrow, reaching up to the middle of the pupil, 2.93; 3.09 (2.68 to 3.60) times in head length. Third suborbital complete. The formations of the fourth and fifth suborbitale corresponds to that of most other species of the genus. Fontanels relatively large and long, craniad up to the eyes. Caudal peduncle longer than high. The height of caudal peduncle is 1.28; 1.54 (1.10 to 1.65) times in its length.

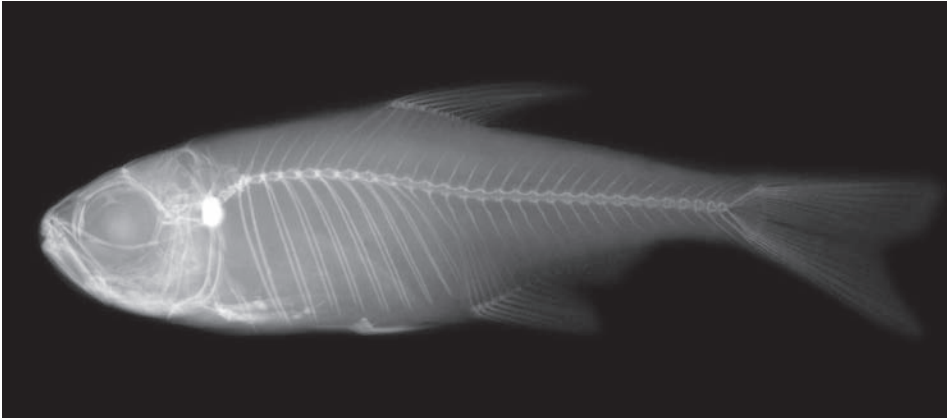


Fig. 9. *Hyphessobrycon borealis* n. sp. lateral view, radiograph, Mana, Crique St. Anne, 25.9 mm SL, paratype.



Fig. 10. *Hyphessobrycon borealis* sp. n., lateral view, not preserved.

Premaxilla with two rows of teeth. The outer row with three tricuspid teeth and the inner row with five tri- to quincuspid teeth. The teeth are large at the base, not compressed. The lateral cusps begin relatively low. The cusps of the teeth of the inner row are arranged in a straight line. Maxilla with one broad tooth. Dentary with four large, tri- to quincuspid teeth, followed by eight to about ten abruptly smaller conical teeth.

The dorsal fin originates in the middle of the standard length or slightly anterior. The predorsal area is 2.02; 1.95 (1.81 to 2.07) times in SL. The predorsal area is 1.02; 1.02 (0.95 to 1.07) times in postdorsal area. The basis of dorsal fin is 2.38; 2.31 (1.98 to 2.44) times in head length. The largest fin ray is the third one, first branched ray. It is usually smaller than the head and 1.30; 1.22 (0.99 to 1.78) times in head length. Fin rays: ii 8–9. 10 pterygiophores of the dorsal fin (counted in x-ray investigation). The dorsal fin starts with one pterygiophore between the fifth and sixth precaudal vertebrae.

Anal fin relatively long, somewhat larger than the head, beginning below the last fin rays of the dorsal fin. First fin rays distinctly longer than the following. There is a markedly concave lappet at the beginning of the fin. Preanal area 1.53; 1.57 (1.49 to 1.70) times in SL. Anal fin base 1.12; 1.00 (0.93 to 1.12) times in head length. Anal fin with a basal sheath of a single series of five to six scales in front about to the fifth branched fin ray. The largest fin ray is the

Table 3. Morphometric features of two populations of *Hyphessobrycon borealis* sp. n. (French Guiana, Mana, n=12 and Brazil, Amapa, n=12) expressed as percent of standard length.

	French Guiana, Mana, St. Anne			Brazil, Amapa, Oyapoque		
	Holotypus	\bar{x} ($x_{\min.}-x_{\max.}$)	S.D.	\bar{x} ($x_{\min.}-x_{\max.}$)	S.D.	
Standard length [mm]	22.3	21.3–26.0		23.1–27.8		
Depth	28.63	27.43 (24.80–29.19)	1.199	29.50 (28.31–32.29)	1.208	
Head length	29.70	27.66 (24.97–29.70)	1.111	27.01 (25.16–28.87)	1.123	
Eye diameter	11.51	11.71 (10.88–13.08)	0.607	11.18 (10.14–12.31)	0.712	
Snout length	4.53	5.09 (4.59–6.20)	0.492	5.24 (4.10– 8.69)	1.139	
Maxilla	10.13	9.55 (8.39–10.29)	0.555	8.23 (7.52–8.95)	0.455	
Interorbital width	9.50	8.50 (8.04–9.50)	0.381	8.58 (7.52–9.27)	0.434	
Predorsal distance	53.23	51.96 (49.10–54.07)	1.391	52.68 (50.00–55.67)	0.265	
Postdorsal distance	54.35	53.95 (50.98–55.34)	1.573	52.35 (50.11–55.32)	1.309	
Preventral distance	49.51	47.71 (45.21–50.09)	1.201	49.68 (47.60–52.37)	1.283	
Preanal distance	65.32	63.26 (60.60–65.39)	1.521	64.52 (61.20–67.19)	1.850	
Dorsal fin base	12.46	12.28 (10.23–13.76)	0.954	12.58 (11.92–13.40)	0.438	
Longest dorsal fin ray	22.85	21.14 (15.55–25.47)	2.549	23.98 (17.81–29.09)	2.964	
Anal fin base	26.43	27.62 (24.96–29.91)	1.395	27.42 (25.27–29.03)	1.374	
Longest anal fin ray	19.31	17.91 (15.82–19.60)	1.265	18.58 (17.73–20.42)	0.723	
Pectoral fin length	21.01	19.23 (16.74–21.84)	1.508	21.55 (19.59–23.47)	1.129	
Ventral fin length	15.59	15.00 (13.21–16.79)	1.003	15.98 (14.70–17.31)	0.742	
Depth of caudal peduncle	10.17	8.76 (7.31–11.58)	1.145	9.19 (8.07–10.40)	0.567	
Length of caudal peduncle	13.04	12.38 (9.81–14.58)	1.448	12.54 (10.63–14.13)	1.163	

fourth or fifth, first branched ray, 1.53; 1.55 (1.32 to 1.74) times in head length. Fin rays: iii 18 to 22 (i) (n=92), mean 19.69. There are differences between the populations of Mana and Oyapock, see Figs. 7 and 8. The mean of the population of Mana is 19.23 (18 to 21) and the mean of the population of Oyapock is 20.18 (18 to 22) branched anal fin rays. The anal fin starts with three pterygiophores between the second and third caudal vertebrae. Five to seven hooklets on the first four rays of anal fin of males.

The ventral fin begins anterior to the beginning of dorsal fin. Preventral area 2.02; 2.06 (1.95 to 2.20) times in SL. Length of ventral fin 1.90; 1.74 (1.10 to 1.92) times in head length, reaching to the beginning of the anal fin or a little longer. Fin rays: ii 7. Pectoral fin relatively long, 1.41; 1.35 (1.07 to 1.65) times in head length, reaching to the beginning of the ventral fin. Fin rays: i 13. Caudal fin deeply forked, lobes about equally long, principal caudal fin ray count 1/9–8/1. No scales on caudal fin base. Adipose fin small.

Scales coming off very easily, nearly all fish with incomplete scale rows. On fresh material, an analysis of the scales showed the following: 4–5/(10) 29–32/3.

There are 17.56 (16 to 19) relatively short gill-rakers on the first arch of the left side, seven to eight on the upper and eleven to twelve on the lower branch.

33 (4+9+20) vertebrae (counted on x-ray investigation).

Coloration (in vivo). Body light olive-green, belly silvery, somewhat darker dorsally. No humeral spot. A black, sometimes green, shiny band extends on the mid-axis of the body, from the gill cover to the black caudal spot. The caudal spot is oval, not on the whole depth of caudal peduncle, and only a little on the basal parts of middle caudal fin rays, never reaching the tips. Adipose fin colored yellow to light orange. Some yellow on the basis of the lobes of caudal fin above and below the caudal spot, also in front of dorsal and anal fins (see also Fig. 10)

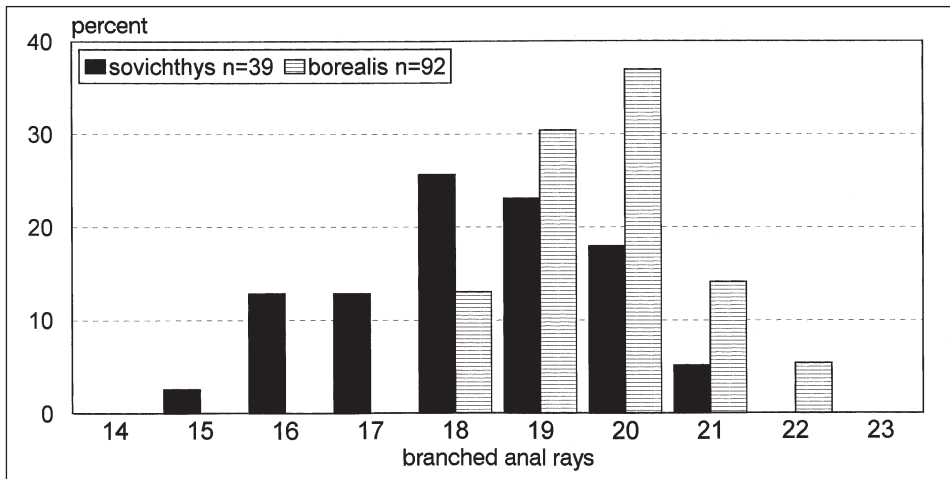


Fig. 11. Distribution of branched rays of anal fin of *Hyphessobrycon sovichthys* (n=39, data according to SCHULTZ, 1944) and *H. borealis* n. sp. (n=92).

Coloration (in alcohol). Pale with an intense, relatively narrow band extending on the mid-axis of the body. The most intense part of this band starts at the level of the first rays of dorsal fin and extends to the middle rays of caudal fin. There is an intense black caudal spot on the caudal peduncle, not on the whole depth of caudal peduncle, and only a little on the middle fin rays of caudal fin, never reaching the tips. Dorsal scales with dark edge (see also Figs. 7 and 8).

Distribution. The species has a relatively wide distribution in French Guiana and occurs frequently. Samples were collected in the following river systems: Oyapock, Approuague, Kaw, Kourou, Sinnamary, Mana and Maroni, see also the distribution map in PLANQUETTE *et al.* (1996). The fishes are gregarious and live near the bank of the river where the water is shallow (10 cm) and the current very low.

Derivatio nominis. The species is named on the basis to its natural distribution in the north of South America. The name *borealis* is derived from the latin *boreas*.

Discussion

Hyphessobrycon borealis sp. n. has been described and figured as *H. sp.* in GÉRY *et al.* (1991) (p. 59, Table XX, Fig. 1) and as *H. aff. sovichthys* in PLANQUETTE *et al.* (1996) (p. 292 Fig. on p. 293). The new species belongs clearly to the *Hyphessobrycon-heterorhabdus*-group (one intense, relatively narrow lateral band on the mid-axis of the body). There is no similar species of the genera *Hyphessobrycon* and *Hemigrammus* in French Guiana, none lacking a humeral spot like *Hyphessobrycon borealis* sp. n.. *Hemigrammus guyanensis* GÉRY, 1959 seems to be the most phenotypically similar species in this area, see the key in PLANQUETTE *et al.* (1996).

Hyphessobrycon sovichthys SCHULTZ, 1944 (loc. typ.: Venezuela, Ciénaga del Guanavana, about 10 km north of Sinamaica, Maracaibo basin) has (1) a higher body (body depth 2.8 to 2.9 vs. 3.09 to 4.03 times in SL in *H. borealis* sp. n.), (2) the teeth in the jaws of *H. sovichthys* only up to tricuspids (vs. up to quincuspids in *H. borealis* sp. n.) and (3) no caudal spot (vs. present in *H. borealis* sp. n.). There are also differences in the number of branched anal fin rays: *H. sovichthys* has 18.28 (15 to 21, n=39) and *H. borealis* sp. n. 19.68 (18 to 22, n=92), see also Fig. 11.

The differences to the other species of the *Hyphessobrycon-heterorhabdus*-group are summarized in Table 2 in ZARSKÉ & GÉRY, 2004 (see also ZARSKÉ & GÉRY, 2006).

Hemigrammus orthus DURBIN, 1909 (loc. typ.: Tukeit, Guyana) has (1) three to five scales of the basal part on each lobe of caudal fin (vs. no scales on caudal fin basis in *Hyphessobrycon borealis* sp. n.), (2) the dorsal fin equidistant from snout and caudal fin (vs. nearer to tip of snout than the base of caudal fin in *H. borealis* sp. n.) and (3) a diffuse, round or somewhat vertically elongated humeral spot (vs. no humeral spot in *H. borealis* sp. n.).

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Literature

- BOUJARD, T.; PASCAL, M.; MEUNIER, J.F. & LE BAIL, P.Y. (1997): Poissons de Guyane. Guide écologique de l'Approuague et de la réserve des Nouragues. – 219 pp.
- DE MERONA, B. (2005): Le fleuve, le barrage et les poissons: Le Sinnamary et le barrage de Petit-Saut en Guyane française. – IRD Editions, Paris, 135 pp.
- EIGENMANN, C. H. (1917–1927): The American Characidae. – Memoirs of the Museum of comparative Zoology at Harvard College, **43**(1–5): 1–428.
- GÉRY, J. (1959): Nouvelles espèces de Guyane française du genre *Hemigrammus* (Tetragonopterinae) avec une liste critique des formes recensées. – Bulletin mensuel de la Société linnéenne de Lyon, **28**(8): 248–260.
- GÉRY, J. (1964): Poissons characoïdes de l'Amazonie péruvienne. – Beiträge zur Neotropischen Fauna, **4**(1): 1–44.
- GÉRY, J. (1965): Characidae et Crenuchidae de l'Igarape Preto (Haute Amazonie). – Senckenbergiana Biologica, **46**(1): 11–45, (3): 195–218.
- GÉRY, J. (1972): Poissons Characoïdes des Guyanes. I. Généralités. II. Famille des Serrasalmidae. – Zoologische Verhandlungen, No. 122: 250 pp.
- GÉRY, J. (1978): Characoids of the World. – tfh-publications, Neptune City inc., 672 pp.
- GÉRY, J. (1992): Description de deux nouvelles espèces proches de *Moenkhausia lepidura* (KNER) (Poissons, Characiformes, Tetragonopterinae), avec une revue du groupe. – Revue française d'Aquariologie, **19**(3): 69–78.
- GÉRY, J. & PLANQUETTE, P. (1983): Additions à la faune characoïde (Poissons Ostariophysaires) de la Guyane. – Revue française d'Aquariologie, **9** (for 1982)(3): 65–76.
- GÉRY, J.; PLANQUETTE, P. & LE BAIL, P.-Y. (1991): Faune characoïde (Poissons Ostariophysaires) de l'Oyapock, l'Approuague et la Rivière de Kaw (Guyane Française). – Cybium **15**(1), Suppl.: 1–69, xx pls.
- PLANQUETTE, P., KEITH, P. & LE BAIL, P.-Y. (1996): Atlas des poissons d'eau douce de Guyane. (1) – Collection du Patrimoine Naturel, vol. 22. IEGB, M.N.H.N., INRA, CSP, Min. Env. Paris, 429 pp.
- Schultz, L.P. (1944): The fishes of the family Characinidae from Venezuela, with descriptions of seventeen new forms. – Proceedings of the United States National Museum, **95**(3181): 235–367, figs. 30–56, tab.1–27.
- ZARSKÉ, A. (1988): Ein hübscher Salmmlerbeifang: *Hemigrammus levis* Durbin, 1908, der Silberstreifentetra. – Aquarien Terrarien, Monatsschrift für Ornithologie und Vivarienkunde, Urania Verlag, Leipzig, Jena, Berlin, **35**(2): 46–49.
- ZARSKÉ, A. & GÉRY, J. (2002): *Hemigrammus neptunus* sp. n. – eine neue Salmmler-Art (Teleostei, Characiformes, Characidae) aus dem Einzugsgebiet des Rio Manuripi in Bolivien (Departamento Pando). – Zool. Abh. (Dresden), **52**: 23–34.
- ZARSKÉ, A. & GÉRY, J. (2004): *Hyphessobrycon nigricinctus* sp. n. – ein neuer Salmmler (Teleostei: Characiformes: Characidae) aus dem Stromgebiet des río Madre de Dios in Peru. – Zool. Abh. (Dresden), **54**: 31–38.
- ZARSKÉ, A. & GÉRY, J. (2006): Beschreibung einer neuen Salmmler-Gattung und zweier neuer Arten (Teleostei: Characiformes: Characidae) aus Peru und Brasilien. – Zool. Abh. (Dresden), **55**: 31–49.