Description of a new genus for *Cyrtorhina balabacensis* Serène, 1971, with notes on the Cyrtorhininae (Decapoda, Brachyura, Raninidae)

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Abstract.— The raninid genus *Cyrtorhina* Monod, 1956, is revised and restricted to *Cyrtorhina granulosa* Monod, 1956, from West Africa. A new genus, *Flaberhina*, is established for *C. balabacensis* Serène, 1971 from the Philippines and New Caledonia. Despite their superficial similarities, the two genera can easily be separated by the structures of the carapace, eye, antenna, pterygostome, thoracic sternum, pleon and penis. The taxonomy of the subfamily Cyrtorhininae Guinot & Ng, 2020, which contains both fossil and extant taxa, is also reviewed.

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■ Introduction

The raninid genus *Cyrtorhina* Monod, 1956, was established for one new species, *C. granulosa* Monod, 1956. The holotype was a dry specimen in the Muséum national d'Histoire naturelle (MNHN), Paris, labelled as “*Cyrtorhina granulosa* nov. sp. (A. Milne Edwards *in sched.*)” but the name was never published by A. Milne Edwards. Monod (1956: 49) chose this specimen (33.0 × 29.0 mm) of unknown origin, partially damaged but reconstituted, as the holotype of *Cyrtorhina granulosa*, validating A. Milne Edwards’ name (see also Cleve *et al.*, 2007: 30, fig. 28B; Guinot & Ng, 2020). In addition to this, he had two other male specimens obtained from the Gold Coast in West Africa (Monod, 1956: 49). The only other specimens so far known are a male and a female collected from the Gulf of Guinea by the Calypso Expedition (see Forest & Guinot, 1966). Serène (1971: 904) briefly described *Cyrtorhina balabacensis* from one female obtained from the Balabac Straits in the Philippines, and new material has not been reported

until the present study. Serène & Umali (1972: 49) subsequently redescribed and figured the species and type specimen in greater detail. *Cyrtorhina balabacensis* was known only from the single type female of Serène (1971).

Between 2001 and 2002, however, the authors obtained three specimens of *C. balabacensis* from fishermen in Balicasag Island in the central Philippines, all collected by tangle nets. The study of these specimens was delayed by other projects, only restarting in 2018 when two more specimens collected by tangle nets from the type locality were donated to us by a local collector. We also found one specimen from New Caledonia. Comparisons of these specimens with *Cyrtorhina granulosa* showed major differences that we consider to be of generic level importance. The present paper describes the new genus, *Flaberhina* n. gen. for *Cyrtorhina balabacensis*.

Members of Cyrtorhininae are very rare: in the Recent fauna, only the monotypic genera *Cyrtorhina* and *Flaberhina* n. gen. are known; and in the fossil record, two other genera (with five species in total) have been recorded from

the Palaeocene and Eocene (see Fossil Cyrtorhininae, below).

Material and Methods

The terminology used essentially follows Van Bakel *et al.* (2012) and Davie *et al.* (2015a). Measurements are provided in millimetres and taken at its maximum (including rostrum); and are reported as carapace length to width, respectively. The thoracic somites are numbered from 1 to 8. The thoracic sternal sutures are referred to by the number of the two thoracic sternites involved, and thus are numbered from 1/2 to 7/8. The exposed pleurites at the level of the pereopods are numbered from 4 to 7, corresponding to their respective sternites. The following abbreviations are used: G1 = male first pleopod; G2 = male second pleopod; P1–P5 = pereopods 1–5, respectively. The anteriormost portion of the pterygostome in the genera studied is demarcated by a shallow groove, and Van Bakel *et al.* (2012: 11) named it the ‘subantennary lobe’ or ‘pterygostomial lobe’ (referred to as the ‘avancée ptérygostomienne’ by Guinot, 1976: fig. 7A–D). We use ‘pterygostomial lobe’ in this paper. With regards to the structure of the orbit and surrounding structures, it is difficult to recognise homologous structures, in particular how to name the series of large tubercles and lobes around it. For *Cyrtorhina* and *Flaberhina* n. gen., we recognise two well developed tubercles lateral to the rostrum, along the supraorbital margin (Fig. 6A, C, F, H). Beyond these two tubercles, the lateral edge is rounded and is marked by a large lobe. This extraorbital lobe appears to be divided into two lateral parts by a deep longitudinal fissure; in *Cyrtorhina* it is completely fused at the base but the tip is bifurcated (Fig. 6D, E). In *Flaberhina*, the extraorbital lobe is wider, with a broad median groove, and the tip is sharp (Fig. 6I, J). The suborbital margin is narrow and has a slender long lobe that is tightly appressed to the extra-

orbital lobe in both genera (Fig. 6D, E, I, J).

Specimens examined are deposited in the Muséum national d'Histoire naturelle (MNHN), Paris, France; The Natural History Museum (NHM), London, U.K., Crustacean Collection of the National Museum of the Philippines (NMCR), Manila, Philippines; and the Zoological Reference Collection of the Lee Kong Chian Natural History Museum (ZRC), National University of Singapore.

Taxonomy

Superfamily Raninoidea De Haan, 1839

Family Raninidae De Haan, 1839

Subfamily Cyrtorhininae Guinot & Ng, 2020

Cyrtorhinae Guinot, 1993: 1325, 1330.

Cyrtorhininae Tucker, 1998: 322, 359, figs. 21, 22; Davie, 2002: 485; Ng *et al.*, 2008: 42; Waugh *et al.*, 2009: 35, 38; De Grave *et al.*, 2009: 28; Števcíć, 2005: 25; 2013: 182; Van Bakel *et al.*, 2012: 107; Guinot *et al.*, 2013: 79, 152, 168, 172, table 6; Karasawa *et al.*, 2014: 219, 259; Davie *et al.*, 2015a: 26; 2015b: 939; 2015c: 1065–1068; Schweitzer *et al.*, 2018: 24; Luque *et al.*, 2019 (preprint): 9; Guinot & Ng, 2020: 71.

Remarks

Guinot (1993) revised the classification of the Raninidae and established a new subfamily, Cyrtorhinae [sic] for *Cyrtorhina*. The subfamily name, however, is not available under the current zoological code (ICZN, 1999) (see also ICZN, 2008, 2011) even though it has been used widely, and it was only recently formally validated by Guinot & Ng (2020) (see review in Guinot & Ng, 2020: 73).

The precise structure of the spermatheca of *Cyrtorhina granulosa* was not studied by Guinot & Quenette (2005) in their review of this character in podotreme crabs. We follow Hartnoll (1979) who stated that in raninoids, the spermathecae are lying within endosternite 7/8

and, due to the strong dorsal flexion of the posterior sternites, they open anteriorly on sternite 7 rather than on sternal suture 7/8 as in other podotreme crabs. In *Cyrtorhina*, as in *Flaberrhina* n. gen., the paired apertures are very small, closely appressed, giving the incorrect impression of a single, unpaired median one.

One character worth comment is the presence of a chitinous patch on the inner surface of the P5 coxa (Fig. 10C, F). The ovate chitinous patch is very distinct in both sexes of *Cyrtorhina* and *Flaberrhina*, but different in shape. This character has not been reported or used in podotreme taxonomy previously and is not easy to see as the inner surface of the P5 coxa is normally tightly appressed against P4 and covered by dense setae. Various coloured spots or patches, always with a characteristic texture, have been reported on different parts of the chelae of some homolids and goneplacids and have been called “integumental organs” or “windows” (see Williams, 1976; Guinot, 1989; Ng & Castro, 2020). Coloured spots, dark, brown or violet, variously delineated, deep, shallow and even convex, often sexually dimorphic, are particularly frequent on chelae of bythograeids and are believed to be sensory (Guinot & Segonzac, 2018).

This is the first report in Brachyura, to our knowledge, of a chitinised patch on the last ambulatory leg, present in females as in males. It is possible it is a kind of chordotonal organ that has some kind of sensory function like detecting low-frequency waterborne vibrations (see review in Davie *et al.*, 2015a: 91). We examined a number of other raninoid genera to ascertain if this chitinous patch is present – Raninidae De Haan, 1839: *Ranina* Lamarck, 1801 (Ranininae De Haan, 1839); *Cosmonotus* White, 1848, *Notopus* De Haan, 1841, *Umalia* Guinot, 1993 (Notopodinae Serène & Umali, 1972); *Notopoides* Henderson, 1888, *Notosceles* Bourne, 1922, *Raninoides* H. Milne Edwards, 1837 (Raninoidinae Lörenthey, in Lörenthey & Beurlen, 1929); *Symethis* Weber, 1795 (Syme-

thinae Goeke, 1981); and Lyreididae Guinot, 1993: *Lyreidus* De Haan, 1841, *Lysirude* Goeke, 1985. All, except *Cosmonotus*, possess this chitinous patch but it varies in shape, position and extent. *Cosmonotus* is unusual in that it has no trace of chitinous patches.

The close relationship between Cyrtorhininae and Symethinae, both markedly different from other gymnopleures, was first suggested by Serène & Umali (1972) and is supported by recent studies, including paleontology (Guinot, 1993; Van Bakel *et al.*, 2012; Guinot *et al.*, 2013; Karasawa *et al.*, 2014; Martínez-Díaz *et al.*, 2017).

According to genetic analysis of Ahyong *et al.* (2007: fig. 3), the position of *Symethis* (based on *S. corallina* Davie, 1989) in Bayesian topology “is ambiguous, probably being an artefact of the incomplete 18S sequence for that terminal”. These authors concluded that “until comprehensive phylogenetic analyses of Raninidae sensu lato become available, we follow Davie (2002) in recognising Symethinae rather than Symethidae”. With regards to the Symethinae, the members include (from oldest to youngest) the following genera: † *Carinatus* Nyborg, Phillips, Van Bakel & Vega, 2017 (the first Cretaceous symethine crab, from upper Maastrichtian of Mississippi); † *Eosymethis* Van Bakel, Guinot, Artal, Fraaije & Jagt, 2012 (Ypresian of Spain); and the extant *Symethis* Weber, 1795 (three species) from the western Atlantic and western Pacific.

† *Symethoides* Van Bakel, Guinot, Artal, Fraaije & Jagt, 2012 (Danian of New Jersey and upper Maastrichtian of Mississippi) was included in the Symethinae by Van Bakel *et al.* (2012: 103, 105, 215) and reassigned without comment by Schweitzer *et al.* (2018: 20) to Lyreididae (in the Lyreidinae). Van Bakel *et al.* (2012: 107) had already noted the “superficial resemblance” to Lyreididae but preferred to keep it in the Cyrtorhininae. In adding a new species to *Symethoides*, *S. danieli* Schweitzer, Feldmann, Phillips & Armstrong, 2019, Sch-

weitzer *et al.* (2019: 165) provided several arguments for this reassignment, but, as the pereopods are not preserved in either of the two known species, namely the typical sickle shape of the P5 and P5 dactyli, we cannot be really sure if the genus is a lyreidid. It is provisionally left in the Lyreididae for the time being.

***Cyrtorhina* Monod, 1956**

Type species

Cyrtorhina granulosa Monod, 1956, by monotypy; gender feminine.

Diagnosis

Carapace rostrum with prominent sharp longitudinal keel on ventral surface (Fig. 6B); supraorbital margin with 2 prominent tubercles, smaller one adjacent to rostrum, slightly larger one weakly falciform, next to extraorbital lobe, 2 short fissures (1 low one between rostrum and first supraorbital tubercle, another between 2 supraorbital tubercles) (Fig. 6A, C); extraorbital lobe divided into 2 lateral parts by deep longitudinal fissure, tip bifurcated but completely fused basally (Fig. 6A, C–E); margin between extraorbital tooth and first anterolateral spine with 2 sharp teeth or spines (Fig. 6A, C); ocular peduncle short, third element dorsally exposed, elongate, strongly arched, gently narrowing, with fungiform granules on dorsal surface; cornea subovate, distal, with tip of peduncle rounded, unarmed (Figs. 6C, D, 8A, B); antenna massive, articles 1, 2 fused, barely mobile to fused with cephalothorax; nephridiopore (urinary opening) on tip of raised projection on inner mesial side; visible in frontal view, not hidden by edge of pterygostomial lobe; article 2 rectangular, large; article 3 mobile, expanded, outer part with large lobe that reaches just beyond distal part of article 4, ventral lobe curved, pointed; article 5 short, cylindrical; flagellum elongate, articles short, similarly shaped, not flattened

(Figs. 2A, 7A–C, 8A, B, 9A); pterygostomial lobe subovate, with tip weakly bifurcated (Fig. 7C); exposed pleurite 4 relatively broad (Figs. 10A, 12C); thoracic sternite 3 exposed as small, V-shaped, horizontally extended strip, laterally wide with distinctly angular lateral margins, median part gently concave, not forming ‘crown’ with sternites 1 and 2 (Figs. 2C, 11A, 12A); thoracic sternite 5 tripartite, not expanded, except for relatively wider lateral extensions between P1 and P2, median part triangular (Fig. 12B, C); thoracic sternites 6, 7 conspicuously reduced, narrow, linear: sternite 6 with proximal margin deeply concave, sternite 7 strongly compressed laterally (Fig. 13B); P5 merus relatively short, stout (Fig. 10B), inner surface of coxa with longitudinally ovate subdistal chitinous patch (Fig. 10C); penis as almost straight tapering calcified tube from edge of P5 coxa, positioned at about right angles to coxo-sternal condyle (Fig. 14A); male and female elson slightly sunken into distal margin of somite 6 (Fig. 2F; Monod, 1956: fig. 19).

Remarks

For differences with *Flaberhina* n. gen., see remarks for that genus.

***Cyrtorhina granulosa* Monod, 1956**

(Figs. 1, 2, 6A–E, 7A–C, 8A, B, 9A, 10A–C, 11A, 12A–C, 13A, B, 14A–C)

Cyrtorhina granulosa Monod, 1956: 49, figs. 19–31; Forest, 1959: pl. 2 fig. 1; Forest & Guinot, 1966: 42; Serène & Umali, 1972: 49; Manning & Holthuis, 1981: 9; Goeke, 1986: 227, in key; Guinot & Quenette 2005: 312, 327; Števíć, 2005: 25; 2013: 182; Cleva *et al.*, 2007: 257, fig. 28B; Ng *et al.*, 2008: 42; Van Bakel *et al.*, 2012: fig. 48E, F; Guinot *et al.*, 2013: 294, fig. 13C; Karasawa *et al.*, 2014: 219, 259; Schweitzer *et al.*, 2018: 26, fig. 12.2; Luque *et al.*, 2019 (preprint): 9, fig. 8G–I; Guinot & Ng, 2020: 71, 73.

Fig. 1. *Cyrtorhina granulosa*, overall dorsal view. A, holotype dry male (33.0 × 29.0 mm) (MNHN-IU-2000-215 = MNHN-B215), no location; B, female (47.0 × 41.0 mm) (MNHN-IU-2016-2020 = MNHN-B16181), Gulf of Guinea.

Material examined

Holotype: dried male (33.0 × 29.0 mm) (MNHN-IU-2000-215 = MNHN-B215), provenance not known. Other material: 1 male (38.0 × 33.0 mm), station 83, 1°39'35"N 7°26'53"E, 12 m, dredge, 25 June 1956; 1 female (47.0 × 41.0 mm), station P11, in front of Praia Pequena, 5–6 m, 28 June 1956 (both MNHN-IU-2016-2020 = MNHN-B16181), both coll. Calypso Expedition.

Diagnosis

As for genus.

Description

Carapace ovate, longer than wide, convex in both directions (Figs. 1A, B, 2A). Dorsal surface ornamented in anterior half, with numerous rounded, low granules; cervical and branchiocardiac grooves obsolete (Figs. 1A, B, 2A, 6A). Lateral margins rimmed; anterolateral margin rounded, with 2 distinct teeth; margin from extraorbital lobe to first anterolateral spine with 2 sharp tubercles and small gran-

ules; posterolateral margin straight, distinctly converging towards posterolateral margin; posterolateral margin almost straight (Fig. 1A, B). Front short; rostrum widely triangular, laterally weakly rimmed, with prominent sharp longitudinal keel on ventral surface (Figs. 1A, B, 6A). Supraorbital margin with 2 prominent tubercles, smaller one adjacent to rostrum, slightly larger one weakly falciform, next to extraorbital lobe, 2 short fissures (1 low one between rostrum and first supraorbital tubercle, another between 2 supraorbital tubercles) (Fig. 6A, C); extraorbital lobe divided into 2 lateral parts by deep longitudinal fissure, tip bifurcated but completely fused basally (Fig. 6A, C–E); margin between extraorbital tooth and first anterolateral spine with 2 sharp teeth or spines (Fig. 6A, C); suborbital lobe narrow, elongate, appressed against extraorbital lobe, separated by open fissure (Figs. 6E, 8A, B). Orbits small; ocular peduncle short, with 3 elements: proximal element reduced, only ventrally visible; second element triangular, elongated; third element dorsally exposed, elongate, strongly

Fig. 2. *Cyrtorhina granulosa*, female (47.0 × 41.0 mm) (MNHN-IU-2016-2020 = MNHN-B16181), Gulf of Guinea. A, frontal view of cephalothorax; B, frontal view showing eyes, cephalic appendages, third maxillipeds; C, buccal cavity, third maxillipeds and pterygostomial regions; D, outer view of left cheliped; E, pleonal somites 1–5; F, pleonal somites 3–6 and telson; G, right P2 propodus and dactylus; H, right P3 propodus and dactylus; I, right P4 propodus and dactylus; J, right P5 propodus and dactylus.

Fig. 3. *Flaberhina balabacensis*, Philippines. A–D, holotype female (42.0 × 39.0 mm) (NMCR 1346); E, male (44.3 × 37.4 mm) (ZRC 2017.1023); F, male (40.7 × 34.6 mm) (ZRC 2017.1022). A, E, F, overall dorsal view; B, ventral view of cephalothorax; C, frontal view of cephalothorax; D, pleonal somites 1–6 and telson. A–D by Marivene Manuel-Santos.

Fig. 4. *Flaberhina balabacensis*, Philippines. A–I, male (44.3 × 37.4 mm) (ZRC 2017.1023); J, male (40.7 × 34.6 mm) (ZRC 2017.1022). A, frontal view of cephalothorax; B, frontal view showing eyes, cephalic appendages, third maxillipeds; C, buccal cavity, third maxillipeds and pterygostomial regions; D, anterior thoracic sternum; E, outer view of right cheliped; F, right P2 propodus and dactylus; G, right P3 propodus and dactylus; H, right P4-propodus and dactylus; I, right P5 propodus and dactylus; J, pleonal somites 1–6 and telson.

arched, gently narrowing, with fungiform granules on dorsal surface; cornea subovate, distal, with tip of peduncle rounded, unarmed (Figs. 2A,

6C, D).

Antennule deeply inserted, completely hidden by antenna; antennary fossae situated pos-

Fig. 5. *Flaberhina balabacensis*, female (52.4 × 47.3 mm) (ZRC 2017.1024), Philippines. A, overall dorsal view; B, frontal view of cephalothorax; C, outer view of left cheliped; D, left P3 propodus and dactylus; E, left P4 propodus and dactylus; F, left P5 propodus and dactylus; G, pleonal somites 1–6 and telson.

terior to antennulary fossae. Proepistome low but distinct. Antenna massive, meeting medially; articles 1, 2 fused, barely mobile to fused with cephalothorax; nephridiopore (urinary

opening) on tip of raised projection on inner mesial side; visible in frontal view, not hidden by edge of pterygostomial lobe; article 2 rectangular, large; article 3 mobile, expanded, out-

Fig. 6. A–E, *Cyrtorhina granulosa*, female (47.0 × 41.0 mm) (MNHN-IU-2016-2020 = MNHN-B16181), Gulf of Guinea; D–F, *Flaberhina balabacensis*, female (52.4 × 47.3 mm) (ZRC 2017.1024), Philippines. A, F, dorsofrontal view of carapace; B, G, ventral view of rostrum; C, H, dorsal view of orbital teeth and eye; D, I, lateral view of left orbital teeth and eye; E, J, ventral view of right infraorbital margin. Abbreviations: ex = extraorbital lobe; ey = eye; ro = rostrum; s1, s2 = first and second supraorbital tubercles, respectively; so = suborbital lobe.

er part with large lobe that reaches just beyond distal part of article 4, ventral lobe curved, pointed; article 5 short, cylindrical; flagellum

elongate, articles short, similarly shaped, not flattened (Figs. 2A, 7A–C, 8A, B, 9A).

Epistome with high longitudinal triangular

Fig. 7. A–C, *Cyrtorhina granulosa*, female (47.0 × 41.0 mm) (MNHN-IU-2016-2020 = MNHN-B16181), Gulf of Guinea; D–F, *Flaberhina balabacensis*, female (52.4 × 47.3 mm) (ZRC 2017.1024), Philippines. A, D, right antennal flagellum; B, E, left antenna; C, F, left pterygostome and antenna. Abbreviations: a1–4 = antennal articles 1–4, respectively; n = nephridiopore; pt = pterygostomial lobe.

Fig. 8. Left antenna. A, B, *Cyrtorhina granulosa*, female (47.0 × 41.0 mm) (MNHN-IU-2016-2020 = MNHN-B16181), Gulf of Guinea; C, *Flaberrhina balabacensis*, female (52.4 × 47.3 mm) (ZRC 2017.1024), Philippines. A, B, viewed at slightly different angles. Abbreviations: a1–4 = antennal articles 1–4, respectively; ex = extraorbital lobe; n = nephridiopore; pt = pterygostomial lobe; so = suborbital lobe.

Fig. 9. Left antenna. A, *Cyrtorhina granulosa*, female (47.0 × 41.0 mm) (MNHN-IU-2016-2020 = MNHN-B16181), Gulf of Guinea; B, *Flaberrhina balabacensis*, female (52.4 × 47.3 mm) (ZRC 2017.1024), Philippines. Abbreviations: a1–4 = antennal articles 1–4, respectively; n = nephridiopore; pt = pterygostomial lobe. Scales = 1.0 mm.

lamelliform ridge. Pterygostome surface granular, with rows of setae and densely setiferous posteriorly (Figs. 2A, B, 10A); pterygostomial lobe subovate, with tip weakly bifurcated (Fig. 7C). Third maxillipeds operculiform; endopod long, merus shorter than ischium; palp short, concealed; exopod short, wider than endopod, anteriorly pointed (Figs. 2B, C, 11A). Exposed pleurites 4–7 forming large, unexcavated plate; pleurite 4 relatively broad (Figs.

10A, 12C). Branchiostegite developed, high, overhanging exposed pleurites, restricted by P5 apposed along branchiostegal margin (Figs. 10A, 12C). Large posterior branchial orifices present. Thoracic sternum/pterygostome junction very narrow, recessed (Figs. 11A, 12A); Milne-Edwards openings absent; thoracic sternum/exposed pleurite connections widest between P1 and P2, narrower between P2 and P3 (Figs. 12A, B, 13A). Thoracic sternum narrow

Fig. 10. A–C, *Cyrtorhina granulosa*, female (47.0 × 41.0 mm) (MNHN-IU-2016-2020 = MNHN-B16181), Gulf of Guinea; D–F, *Flaberhina balabacensis*, female (52.4 × 47.3 mm) (ZRC 2017.1024), Philippines. A, D, right lateral branchiostegite and exposed pleurites; B, E, outer view of right P5; C, F, inner view of coxa of right P5. Abbreviation: br = branchiostegite; cx5 = coxa of P5; pl4–pl7 = exposed pleurites 4–7; w = chitinous patch.

throughout length, with P1–P5 coxae almost adjacent to each other (Figs. 11A, 12A, B, 13A, B); strong deflection at level of sternite 8; thoracic sternites 1 and 2 at lower level, concealed (Fig. 12A); sternite 3 exposed as small, V-shaped, horizontally extended strip, laterally wide with distinctly angular lateral margins, median part gently concave, not forming ‘crown’ with sternites 1 and 2 (Figs. 2C, 11A, 12A); sternite 4 narrow, not laterally expanded except for slender episternite 4, joining slender sternum/pterygostome junction to exposed pleurite 4 (Fig. 12B); sternite 5 tripartite, not expanded, except for relatively wider lateral extensions between P1

and P2, median part triangular (Fig. 12B, C); sternites 6, 7 conspicuously reduced, narrow, linear: sternite 6 with proximal margin deeply concave, sternite 7 strongly compressed laterally (Fig. 13B); sternite 8 perpendicular to sternite 7; median line present along sternites 5–8 (Figs. 12B, C, 13A, B). Spermathecal apertures small, contiguous, recessed in deep depressions.

Chelipeds homochelous, homodontous in both sexes (Figs. 1A, B, 11A); basis-ischium short, immoveably fused with large merus (Fig. 12B); chela relatively slender, propodus narrow, upper, lower margins smooth; fingers

Fig. 11. Ventral view of cephalothorax. A, *Cyrtorhina granulosa*, female (47.0 × 41.0 mm) (MNHN-IU-2016-2020 = MNHN-B16181), Gulf of Guinea; B, *Flaberrhina balabacensis*, female (52.4 × 47.3 mm) (ZRC 2017.1024), Philippines.

long, acicular, acute tips crossing when closed; dactylus curved, with long acute basal spine, cutting margin unarmed; palm with long acute spine just behind base of dactylus; fixed finger bent at angle from palm, cutting edge with 3 acute spines on proximal half, increasing in size distad (Figs. 1A, B, 2D, 11A).

P2–P4 moderately stout, carpus short, modified (Figs. 1A, B, 11A). P2 dactylus spatulate; P3, P4 dactylus sickle-shaped (Fig. 2G–I); P5 dorsal, moderately reduced, lying along posterolateral carapace margin, adapted to branchiostegal edge, merus relatively short, stout (Figs. 2J, 10B), inner surface of coxa with longitudinally ovate subdistal chitinous patch (Fig. 10B, C); dactylus spatulate (Figs. 2J, 10B). Pleon incompletely folded, proportionally small, 6 freely articulated somites and telson, first 3 somites dorsal; somite 1 as wide as posterior carapace margin; telson slightly sunken into distal margin of somite 6, distolateral margin slightly projecting (Fig. 2F; Monod, 1956: fig. 19); pleura distinct in both sexes (Fig. 2E, F).

Male pleon narrow (Fig. 1A). Female pleon slightly wider (Fig. 2E, F); somite 2 longitudinally narrow (Fig. 2E, F); pleura well-developed. Pleonal-locking mechanism, uropods, sockets absent. Penis as almost straight tapering calcified tube from edge of P5 coxa, positioned at about right angles to coxo-sternal condyle (Fig. 14A). G1 gently curved, distal part distinctly hooked towards mesial surface (Fig. 14B); G2 subequal in length to G1, with flagelliform distal part (Fig. 14C). (modified from Van Bakel *et al.*, 2012: 107–108; Guinot & Ng, 2020: 73).

Sexual Dimorphism

The carapaces and surface ornamentation of male and female specimens do not appear to differ in proportions (Fig. 1A, B), at least for the few specimens we have been able to examine.

Remarks

The species is well described by Monod (1956), with additional characters documented

Fig. 12. Female thoracic sternites. A–C, *Cyrtorhina granulosa*, female (47.0×41.0 mm) (MNHN-IU-2016-2020 = MNHN-B16181), Gulf of Guinea; D–F, *Flaberhina balabacensis*, female (52.4×47.3 mm) (ZRC 2017.1024), Philippines. Abbreviations: br = branchiostegite; cx1, 2 = coxa of P1, P2, respectively; e4 = episternite 4; j = junction between st4 and pl4; st3–st5 = sternites 3–5, respectively; og4, og5 = outgrowth of exposed pleurites 4, 5, respectively; pl4, pl 5, exposed pleurites 4, 5, respectively.

by Guinot (1993), Van Bakel *et al.* (2012) and Guinot *et al.* (2013). For detailed comparisons with *Flaberhina* n. gen., see Table 1 and remarks for the latter.

In addition to the holotype male (MNHN-IU-2000-215 = MNHN-B215), Monod (1956: 49) listed two paratypes: a male (40.0×34.0 mm) collected from a net 16 km off Accra

in Gold Coast (now in NHM, not examined), as well as a second male (36.0×32.0 mm) from an unspecified location (but presumably also from the Gold Coast) in the University College of the Gold Coast (not examined).

Biology

Cyrtorhina granulosa is not a deep-water

Fig. 13. Female thoracic sternites. A, B, *Cyrtorhina granulosa*, female (47.0 × 41.0 mm) (MNHN-IU-2016-2020 = MNHN-B16181), Gulf of Guinea; C, D, *Flaberhina balabacensis*, female (52.4 × 47.3 mm) (ZRC 2017.1024), Philippines. Abbreviations: cx2–4 = coxa of P2–P4, respectively; g = female gonopore on P3 coxa; sp = spermatheca; st6, 7 = sternites 6 and 7, respectively.

species, with all the known specimens originating from shallow waters. Monod (1956: 49) noted the biology of the species was 'N1' which indicates it is a neritic species. The two specimens collected by the Calypso Expedition were collected both obtained by dredges from less than 12 m depth in sand and mud substrates.

Flaberhina n. gen.

LSID urn:lsid:zoobank.org:act:E880555B-8C8F-4363-939F-9A3D00F8B33B

Type species

Cyrtorhina balabacensis Serène, 1971 by present designation.

Diagnosis

Carapace rostrum with low longitudinal keel

on ventral surface (Fig. 6G); supraorbital margin with 2 prominent tubercles, small one adjacent to rostrum, much larger falciform one next to extraorbital lobe, 2 short fissures (1 between rostrum and first supraorbital tubercle, another between 2 supraorbital tubercles) (Fig. 6F, H); extraorbital lobe broad, subovate, with broad deep longitudinal groove, tip sharp (Fig. 6F, H–J); margin between extraorbital tooth and first anterolateral spine unarmed (Fig. 6F, H); ocular peduncle short, third element dorsally exposed, elongate, strongly arched, strongly narrowing at tip, with fungiform granules on dorsal surface; cornea very small, subdistal, with distinct granule at tip of peduncle (Figs. 4A, 5B, 6H, I); antenna massive, articles 1, 2 fused, barely mobile to fused with cephalothorax; nephridiopore (urinary opening) flat on inner me-

Fig. 14. Penis and gonopods. A–C, *Cyrtorhina granulosa*, male (38.0 × 33.0 mm) (MNHN-IU-2016-2020 = MNHN-B16181), Principe, Gulf of Guinea; B, C, *Cyrtorhina granulosa*, paratype male (40.0 × 34.0 mm) (NHM), Gold Coast; D–J, *Flaberhina balabacensis*, male (40.7 × 34.6 mm) (ZRC 2017.1022), Philippines. A, D, left P5 coxa and penis; E, lateral view of left penis; B, left G1; C, left G2; F–I, left G1, various views; J, left G2. Scales: A, B = 2.0 mm; D–F, J = 1.0 mm; G–I = 0.5 mm. Abbreviations: co = coxo-sternal condyle of P5 coxa; p = penis. A after Guinot *et al.* (2013: fig. 13C); B, C after Monod (1956: figs. 30, 31).

dial margin, not visible in frontal view, hidden by extended edge of pterygostomial lobe; article 2 subquadrate, small; article 3 mobile, expanded, outer part forming very large spatulate lobe that prominently overreaches distal part of article 4, ventral lobe pointed; article 5 short, subovate; flagellum short, articles 6 and 7 subovate, articles 8 and 9 expanded, auriculi-form, dorsoventrally flattened, remaining articles short, subovate (Figs. 4A, 5B, 7D–F, 8C, 9B); pterygostomial lobe acutely triangular with rounded tip (Fig. 7E, F); exposed pleurite 4 narrow, median part appears constricted (Figs. 10D, 12F); thoracic sternite 3 exposed as small, V-shaped, with rounded lateral margins, median part concave, not forming ‘crown’ with

sternites 1 and 2 (Figs. 4D, 11B, 12D); thoracic sternite 5 tripartite, not expanded, except for slender lateral extensions between P1 and P2, median part ovate (Fig. 12E, F); thoracic sternites 6, 7 conspicuously reduced, narrow, linear: sternite 6 with proximal margin deeply concave, sternite 7 compressed laterally (Fig. 13D); P5 merus relatively slender (Figs. 3A, E, F, 5A, 10E); inner surface of coxa with ovate subdistal chitinous patch (Fig. 10F); penis as curved calcified tube emerging from short process of expanded P5 coxa, positioned at about right angles to coxo-sternal condyle (Fig. 14D, E); male and female telson prominently sunken into distal margin of somite 6 (Figs. 3D, 4J, 5G).

Table 1. Main differences between *Cyrtorhina* Monod, 1956 and *Flaberhina* n. gen.

	<i>Cyrtorhina</i>	<i>Flaberhina</i> n. gen.
Rostrum	Ventral keel sharp (Fig. 6B)	Ventral keel low (Fig. 6G)
Eye	Ocular peduncle short, stout, tip smooth, unarmed; cornea large, distal (Figs. 6C, D, 8A, B)	Ocular peduncle slender, elongate, narrowing, tip with small distinct granule; cornea small, subdistal (Figs. 6H, I, 8C)
Antennal article 1 and position of nephridiopore	On tip of raised projection on inner mesial side; visible in frontal view, not hidden by edge of pterygostomial lobe (Figs. 7B, 8A, 9A)	Flat on inner medial margin; not visible in frontal view, hidden by extended edge of pterygostomial lobe (Figs. 7E, 8C, 9B)
Antennal articles 2–4	Article 2 rectangular, large; outer part of article 3 with large lobe that reaches just beyond distal part of article 4 (Figs. 7A–C, 8A, B, 9A)	Article 2 subquadrate, small; outer part of article 3 forming very large spatulate lobe that prominently overreaches distal part of article 4 (Figs. 7D–F, 8C, 9B)
Antennal article 5 and flagellum	Article 5 cylindrical; flagellum elongate, with articles short, not flattened, similarly shaped (Figs. 7A, 9A)	Article 5 subovate; flagellum short, articles 6 and 7 subovate, articles 8 and 9 prominently expanded, dorsoventrally flattened, remaining articles subovate (Figs. 7D, 9B)
Margin between extraorbital tooth and first anterolateral spine	With 2 distinct sharp teeth or spines (Fig. 6A, C)	Unarmed, only with granules (Fig. 6F, H)
Pterygostomial lobe	Subovate with tip weakly bifurcated (Fig. 7C)	Acutely triangular with rounded tip (Fig. 7F)
Thoracic sternite 3	Laterally wide with angular margins; median part gently concave (Fig. 12A)	Laterally less wide, with more rounded margins; median part concave (Fig. 12D)
Thoracic sternite 5	Median part subtriangular; lateral parts wide (Fig. 12B, C)	Median part ovate; lateral parts slender (Fig. 12E, F)
Thoracic pleurite 4	Relatively broad (Fig. 12C)	Narrower, median part appears constricted (Fig. 12F)
Thoracic sternite 6	Proximal margin almost straight (Fig. 13A)	Proximal margin deeply concave (Fig. 13C)
Thoracic sternite 7	Distinctly laterally compressed (Fig. 13B)	Relatively less compressed laterally (Fig. 13D)
P5	Merus relatively short, stout (Fig. 10B); inner surface of coxa with longitudinally ovate subdistal chitinous patch (Fig. 10C)	Merus relatively more slender (Fig. 10E); inner surface of coxa with ovate subdistal chitinous patch (Fig. 10F)
Penis	Forming almost straight tapering calcified tube from edge of P5 coxa (Fig. 14A)	Forming distinctly curved calcified tube from edge of P5 coxa (Fig. 14D, E)
Female pleonal somite 2	Longitudinally narrow (Fig. 2E, F)	Longitudinally wider (Figs. 3D, 5G)
Female pleonal pleura	Relatively developed (Fig. 2E, F)	Relatively less developed (Figs. 3D, 5G)
Male and female pleonal somite 6 and telson	Telson slightly sunken into distal margin of somite 6, distolateral margin slightly projecting (Fig. 2F; Monod, 1956: fig. 19)	Telson prominently sunken into distal margin of somite 6, distolateral margin distinctly projecting (Figs. 3D, 4J, 5G)

Etymology

From the Latin “flabellum” for fan, in arbitrary combination with “-rhina”; alluding to the flattened antennal flagellum. The gender is feminine.

Remarks

Despite their superficial similarity, there are major differences between *Cyrtorhina* s. str. and *Flaberhina* n. gen. in structures of rostrum, carapace, frontal, orbital and anterolateral armature, eye, antennal articles (notably in the position of the nephridiopore and flagellum),

pterygostomial lobe, thoracic sternites, exposed pleurites, ambulatory legs and penis.

***Flaberhina balabacensis* (Serène, 1971) n. comb.**
(Figs. 3–5, 6F–J, 7D–F, 8C, 9B, 10D–F, 11B, 12D–F, 13C, D, 14D–J)

Cyrtorhina balabacensis Serène, 1971: 904, pl. 1A; Serène & Umali, 1971: 49, figs. 35–42, pl. 4 figs. 1–3; Ng *et al.*, 2008: 42; Karasawa *et al.*, 2014: 219, 259.

Material examined

Holotype: female (42.0 × 39.0 mm) (NMCR 1346) (photographs examined), station D 1–12, off Cape Melville, Balabac Island, Philippines, 24–77 m, coll. Pele-Sulu Sea Expedition, 8 March 1964. Others: 1 male (40.7 × 34.6 mm) (ZRC 2017.1022), Balabac Islands, Palawan, Philippines, ca. 20 m, coll. Tangle nets, Octopus fishermen, October 2017; 1 male (44.3 × 37.4 mm) (ZRC 2017.1023), Balabac Islands, Palawan, Philippines, ca. 20 m, coll. Tangle nets, Octopus fishermen, October 2017; 1 male (35.2 × 30.4 mm) (ZRC 2001.0646), deep reefs, Balicasag Island, Panglao, Bohol, Visayas, Philippines, in tangle nets, by fishermen, coll. P. K. L. Ng, 28 November 2001; 1 male (36.3 × 30.7 mm) (ZRC 2008.0053), deep reefs, Balicasag Island, Panglao, Bohol, Visayas, Philippines, in tangle nets, by fishermen, coll. P. K. L. Ng, June 2002; 1 female (52.4 × 47.3 mm) (ZRC 2017.1024), deep reefs, Balicasag Island, Panglao, Bohol, Visayas, Philippines, in tangle nets, by fishermen, coll. P. K. L. Ng, June 2002; 1 male (40.0 × 37.0 mm) (MNHN-IU-2014-23854) (photographs examined), substrate of rocks and coral rubble, station DC612, Yaté Sector, New Caledonia, 22°08.9'S 167°00.5'E, 46–48 m, coll. B. Richer de Forges, LAGON Cruise, RV "Vauban", 5 August 1986.

Diagnosis

As for genus.

Description

Carapace ovate, longer than wide, convex in both directions (Figs. 3A, C, E, F, 4A, 5A). Dorsal surface prominently ornamented in anterior half, with numerous low, closely packed granules; cervical and branchiocardiac grooves obsolete (Figs. 3A, E, F, 4A, 5A, B, 6F). Lateral margins rimmed; anterolateral margin rounded, with 2 distinct teeth; tubercle adjacent to extraorbital lobe, otherwise margin to first anterolateral spine unarmed, lined only with

granules; posterolateral margin straight, distinctly converging towards posterolateral margin; posterolateral margin straight (Figs. 3A, E, F, 5A). Front short; rostrum triangular, laterally rimmed, with low longitudinal keel on ventral surface (Figs. 3A, E, F, 5A, 6F, G). Supraorbital margin with 2 prominent tubercles, small one adjacent to rostrum, much larger falciform one next to extraorbital lobe, 2 short fissures (1 between rostrum and first supraorbital tubercle, another between 2 supraorbital tubercles) (Fig. 6F, H); extraorbital lobe broad, subovate, with broad deep longitudinal groove, tip sharp (Fig. 6F, H–J); margin between extraorbital tooth and first anterolateral spine unarmed, lined only with granules (Fig. 6F, H); suborbital lobe triangular, elongate, tightly appressed against extraorbital lobe (Figs. 6J, 8C). Orbits small; eyestalk short, with 3 elements: proximal element reduced, only ventrally visible; second element triangular, elongated; third element dorsally exposed, elongate, strongly arched, strongly narrowing at tip, with funiform granules on dorsal surface; cornea very small, subdistal, with distinct granule at tip of peduncle (Figs. 4A, 5B, 6H, I). Antennule deeply inserted, completely hidden by antenna; antennary fossae situated posterior to antennular fossae. Proepistome low but distinct. Antenna massive, meeting medially; articles 1, 2 fused, barely mobile to fused with cephalothorax; nephridiopore (urinary opening) flat on inner medial margin, not visible in frontal view, hidden by extended edge of pterygostomial lobe; article 2 subquadrate, small; article 3 mobile, expanded, outer part forming very large spatulate lobe that prominently overreaches distal part of article 4, ventral lobe pointed; article 5 short, subovate; flagellum short, articles 6 and 7 subovate, articles 8 and 9 expanded, auriculiform, dorsoventrally flattened, remaining articles short, subovate (Figs. 3C, 4A, 5B, 7D–F, 8C, 9B). Epistome with high longitudinal triangular lamelliform ridge (Fig. 8C). Pterygostome surface with prominent large gran-

ules, some fungiform, with rows of setae and densely setiferous posteriorly (Figs. 4A, B, 5B, 11B); pterygostomial lobe acutely triangular with rounded tip (Fig. 7E, F). Third maxillipeds operculiform; endopod long, merus shorter than ischium; palp short, concealed; exopod short, wider than endopod, anteriorly pointed (Figs. 4B, C, 11B). Exposed pleurites 4–7 forming large, unexcavated plate; pleurite 4 narrower, median part appears constricted (Figs. 10D, 12F). Branchiostegite developed, high, overhanging exposed pleurites, restricted by P5 apposed along branchiostegal margin (Figs. 10D, 12F). Large posterior branchial orifices present. Thoracic sternum/pterygostome junction very narrow, recessed (Figs. 4D, 11B, 12D); Milne-Edwards openings absent; thoracic sternum/exposed pleurite connections widest between P1 and P2, narrower between P2 and P3 (Figs. 4D, 12D, E, 13C). Thoracic sternum narrow throughout length, with P1–P5 coxae almost adjacent to each other (Figs. 11B, 12D, E, 13C, D); strong deflection at level of sternite 8; thoracic sternites 1 and 2 at lower level, concealed (Fig. 12D); sternite 3 exposed as small, V-shaped, with rounded lateral margins, median part depressed, not forming 'crown' with sternites 1 and 2 (Figs. 4D, 11B, 12D); sternite 4 narrow, not laterally expanded except for slender episternite 4, joining slender sternum/pterygostome junction to exposed pleurite 4 (Fig. 12D, E); sternite 5 tripartite, not expanded, except for slender lateral extensions between P1 and P2, median part ovate (Fig. 12E, F); sternites 6, 7 conspicuously reduced, narrow, linear: sternite 6 with proximal margin deeply concave, sternite 7 compressed laterally (Fig. 13D); sternite 8 perpendicular to sternite 7; median line present along sternites 5–8 (Figs. 12D, E, 13C, D). Spermathecal apertures small, contiguous, recessed in deep depression. Chelipeds homochelous, homodontous in both sexes (Figs. 3A, E, F, 5A); basis-ischium short, immovably fused with large merus (Figs. 4D, 11B); chela relatively slender, propodus nar-

row, upper, lower margins smooth; fingers long, acicular, acute tips crossing when closed; dactylus curved, with long acute basal spine, cutting margin unarmed; palm with long acute spine just behind base of dactylus; fixed finger bent at angle from palm, cutting edge with 3 acute spines on proximal half, increasing in size distad (first spine sometimes very low) (Figs. 3A, E, F, 4E, 5C). P2–P4 moderately stout, carpus short, modified (Figs. 3A, E, F, 11B). P2 dactylus spatulate; P3, P4 dactylus sickle-shaped (Figs. 3A, E, F, 4F–H, 5D, E); P5 dorsal, moderately reduced, lying along posterolateral carapace margin, adapted to branchiostegal edge, merus relatively slender (Figs. 3A, E, F, 4I, 5A, F, 10E); inner surface of coxa with ovate subdistal chitinous patch (Fig. 10F); dactylus spatulate (Figs. 4I, 5F, 10E). Pleon incompletely folded, proportionally small but rather wide in male, 6 freely articulated somites and telson, first 3 somites dorsal, somite 1 as wide as posterior carapace margin; telson prominently sunken into distal margin of somite 6, distolateral margin distinctly projecting (Figs. 4J, 5G); pleura distinct in both sexes (Figs. 4J, 5G). Male pleon narrow (Fig. 4J). Female pleon relatively wider (Figs. 3D, 5G); somite 2 longitudinally wide (Figs. 3D, 5G); pleura relatively developed (Fig. 5G). Pleonal-locking mechanism, uropods, sockets absent. Penis as curved calcified tube emerging from a short process of expanded P5 coxa, positioned at about right angles to coxo-sternal condyle (Fig. 14D, E). G1 gently curved, distal part distinctly hooked towards mesial surface (Fig. 14F–I); G2 subequal in length to G1 (Fig. 14J).

Sexual Dimorphism

The carapace of male specimens of *Flaberhina balabacensis* appears slightly less broad (Fig. 3E, F) when compared to that of females (Figs. 3A, 5A; see also Serène, 1971: pl. 1A) but we are not sure if this is a constant character. In another raninid, *Umalia trirufomaculata*

(Davie & Short, 1989), the carapace shape was shown to vary substantially, even within one sex (Ng *et al.*, 2019). In *F. balabacensis* the ornamentation on the anterior half of the carapace is also relatively denser in females (Figs. 3A, C, 5A, B, 6F) compared to males (Figs. 3E, F, 4A). The density and extent of the setae on the pterygostome surface is also somewhat denser in females.

Remarks

Serène (1971: 904) noted that the type female measuring 38.0×33.0 mm was deposited in the Crustacean Section of the National Museum of the Philippines (catalogue number NMCR 1346). Through the kindness of Marivene Manuel-Santos, we were able to examine photographs of the type female (Fig. 3A–D). The present series of specimens agree very well with the descriptions and figures of the species by Serène (1971), Serène & Umali (1972) and the present photographs of the type and we are certain they are conspecific, especially since two of them are from the type locality.

The species was previously only known from the Philippines, the present record from New Caledonia being a substantial extension of its range. The species probably has a wide distribution in the West Pacific.

Biology

The habitat of *Flaberhina balabacensis* appears to be relatively steep and rugged, which cannot be sampled by traditional methods of trawling or dredging. The specimens of *F. balabacensis* from the Philippines were all collected by tangle nets from rocky reef substrates in waters from 20 m to approximately 200–300 m. The holotype female was from depths of 22–26 m (Serène, 1971). This method of fishing has obtained many supposedly rare species over the years (see Ng *et al.*, 2009; Mendoza *et al.*, 2010).

The New Caledonian specimen (MNHN-

IU-2014-23854) was dredged from the south-eastern part of the island, but the barrier reef that used to be there is no longer extant (B. Richer de Forges, pers. comm.). The substrate where it was collected was composed of rocks and coral rubble with red algae.

Fossil Cyrtorhininae

Van Bakel *et al.* (2012: 107) restricted *Cyrtorhina* to the extant species *C. granulosa* and established the new genus *Antonioranina* for three fossil species previously assigned to *Cyrtorhina*. *Cyrtorhina* and *Antonioranina* share a broadly ovate carapace, orbitofrontal construction and dorsal surface ornamentation. The main differences concern the sternal construction, with a more developed thoracic sternum in *Antonioranina*. In *Antonioranina*, sternite 4 is much wider than in *C. granulosa*; episternites 4 are subparallel, almost straight in *A. globosa* (resembling that of *Flaberhina balabacensis*) versus long and arched in *Cyrtorhina granulosa*. In *Antonioranina globosa*, sternite 6 is also more developed than in *C. granulosa* and *F. balabacensis*. A new genus, *Claudioranina* Karasawa, Schweitzer, Feldmann & Luque, 2014 was established (Karasawa *et al.*, 2014) and a list of fossil and extant genera and species of Cyrtorhininae was provided by Martínez-Díaz *et al.* (2017: 74, table 4).

Antonioranina Van Bakel, Guinot, Artal, Fraaije & Jagt, 2012

Antonioranina Van Bakel, Guinot, Artal, Fraaije & Jagt, 2012: 108, figs. 34C, D, 35A, B; Karasawa *et al.*, 2014: 259; Schweitzer *et al.*, 2018: 26, fig. 12.3; Martínez-Díaz *et al.*, 2017: table 4.

Type species

Cyrtorhina globosa Beschin, Busulini, De Angeli & Tessier, 1988 (Beschin *et al.*, 1988: 163, fig. 3, pl. 2 fig. 1a–d; Mikuž, 2010: 166,

pl. 1, table 1; Van Bakel *et al.*, 2012: 108, figs. 34C, D, 35A, B; Karasawa *et al.*, 2014: 259; Schweitzer *et al.*, 2018: 26, fig. 12.3; Martínez-Díaz *et al.*, 2017: table 4. Eocene (Ypresian–Lutetian), Vicenza, Italy and Croatia.

Species included

Antonioranina fusseli (Blow & Manning, 1996): middle Eocene, North Carolina, USA (see Tessier *et al.*, 2004); *A. globosa* (Beschlin, Busulini, De Angeli & Tessier, 1988); *A. ripacurtae* (Artal & Castillo, 2005): lower Eocene (middle Ilerdiense), Huelva, southwestern Spain.

Remarks

The thoracic sternum is well preserved in *Antonioranina globosa*, but the ventral parts are still not known in *A. fusseli* and *A. ripacurtae*. Based on the specimens illustrated by Tessier *et al.* (2004, as *Cyrtorhina*), the cuticle of *Antonioranina fusseli* and *A. globosa* shows inclined nodes covering the dorsal carapace (Waugh *et al.*, 2009: 35, as *Cyrtorhina*).

***Claudioranina* Karasawa, Schweitzer, Feldmann & Luque, 2014**

Claudioranina Karasawa, Schweitzer, Feldmann & Luque, 2014: 259, fig. 17; Martínez-Díaz *et al.*, 2017: 74, table 4.

Type species

Cyrtorhina oblonga Beschlin, Busulini, De Angeli & Tessier, 1988 (Beschlin *et al.*, 1988: 166, fig. 4, pl. 3 figs. 1–3; Van Bakel *et al.*, 2012: 108. Transferred to *Claudioranina* by Karasawa *et al.*, 2014: 259, fig. 17; Martínez-Díaz *et al.*, 2017: 74, tables 3, 4.

Species included

Claudioranina latacantha Martínez-Díaz, Aguillón-Martínez, Luque & Vega, 2017: Palaeocene (Selandian) of Coahuila, NE Mexico; *Claudioranina oblonga* (Beschlin, Busulini, De

Angeli & Tessier, 1988) : Vicenza, Italy.

Remarks

Claudioranina Karasawa, Schweitzer, Feldmann & Luque, 2014 (Karasawa *et al.*, 2014: 259, fig. 17) includes the oldest confirmed member of Cyrtorhininae, *C. latacantha* Martínez-Díaz, Aguillón-Martínez, Luque & Vega, 2017, from the Palaeocene (Selandian) of Mexico (Martínez-Díaz *et al.*, 2017: 74, fig. 3L–3S, tables 3, 4). It differs from the other genera in having the carapace narrowing anteriorly and posteriorly, the fronto-orbital region on a lower level than the rest of the carapace, and by the different shapes of sternites 3–6, in particular the rhomboid shape of the sternite 6 (Martínez-Díaz *et al.*, 2017: 74–75). The relatively wider thoracic sternum (but still very narrow compared to most Raninidae) of this earliest cyrtorhinine representative is consistent with what is observed in the oldest and more basal eubrachyuran heterotremes, which show a broader sternal plate than the more recent and derived representatives (Guinot *et al.*, 2019: 313).

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additional information about this specimen. The MNHN specimen was collected during LAGON cruise conducted by MNHN and Institut de Recherche pour le Développement (IRD) as part of the Tropical Deep-Sea Benthos programme (ex MUSORSTOM) (<https://doi.org/10.17600/88010811>). We are most grateful to Peter Davie and Hiroaki Karasawa for their many helpful comments on the manuscript.

■ Literature Cited

- Artal, P., & Castillo, J., 2005. *Cyrtorhina ripacurtae* n. sp. (Crustacea, Decapoda, Raninidae), primera cita del genero en el Eoceno inferior español. *Batalleria*, **12**: 33–38.
- Beschin, C., Busulini, A., De Angeli, A., & Tessier, G., 1988. Raninidae del Terziario bericolessino (Italia settentrionale). *Lavori Società Veneziana di Scienze Naturali*, **13**: 155–215.
- Cleva, R., Guinot, D., & Albenga, L., 2007. Annotated catalogue of brachyuran type specimens (Crustacea, Decapoda, Brachyura) deposited in the Muséum national d'Histoire naturelle, Paris. Part I. Podotremata. *Zoosystema*, **29**(2): 229–279, figs. 1–28.
- Davie, P. J. F., 2002. Crustacea: Malacostraca: Eucarida (Part 2): Decapoda-Anomura, Brachyura. In: Wells, A., & Houston, W. W. K. (eds.), *Zological Catalogue of Australia*, vol. 19.3B. CSIRO Publishing Australia, Melbourne, xiv + 641 pp.
- Davie, P. J. F., Guinot, D., & Ng, P. K. L., 2015a. Anatomy and functional morphology of Brachyura. In: Castro, P., Davie, P. J. F., Guinot, D., Schram, F. R., & von Vaupel Klein, J. C. (eds.), *Treatise on Zoology—Anatomy, Taxonomy, Biology. The Crustacea. Volume 9C-I. Decapoda: Brachyura (Part 1)*, pp. 11–163.
- Davie, P. J. F., Guinot, D., & Ng, P. K. L., 2015b. Phylogeny of Brachyura. In: Castro, P., Davie, P. J. F., Guinot, D., Schram, F. R., & von Vaupel Klein, J. C. (eds.), *Treatise on Zoology—Anatomy, Taxonomy, Biology. The Crustacea. Volume 9C-I. Decapoda: Brachyura (Part 2)*, pp. 921–979.
- Davie, P. J. F., Guinot, D., & Ng, P. K. L., 2015c. Classification and Systematics and classification of Brachyura. In: Castro, P., Davie, P. J. F., Guinot, D., Schram, F. R., & von Vaupel Klein, J. C. (eds.), *Treatise on Zoology—Anatomy, Taxonomy, Biology. The Crustacea. Volume 9C-I. Decapoda: Brachyura (Part 2)*, pp. 1049–1130.
- De Grave, S., Pontcheff, N. D., Ah Yong, S. T., Chan, T.-Y., Crandall, K. A., Dworschak, P. C., Felder, D. L., Feldmann, R. M., Fransen, C. H. J. M., Goulding, L. Y. D., Lemaitre, R., Low, M. E. Y., Martin, J. W., Ng, P. K. L., Schweitzer, C. E., Tan, S. H., Tshudy, D., & Wetzler, R., 2009. A classification of living and fossil genera of decapod crustaceans. *Raffles Bulletin of Zoology*, Supplement **21**: 1–109.
- Forest, J., 1959. Campagne de la *Calypso* dans le golfe de Guinée et aux îles Principe, São Tomé, Annobon (1956). 1. Introduction. Résultats scientifiques des Campagnes de la “*Calypso*”. IV. *Annales de l'Institut Océanographique*, Monaco, **37**: 3–36.
- Forest, J., & Guinot, D., 1966. Campagne de la *Calypso* dans le golfe de Guinée et aux îles Principe, São Tomé, et Annobon (1956). Résultats scientifiques des Campagnes de la “*Calypso*”, Fascicule VII. 16. Crustacés Décapodes: Brachyours. *Annales de l'Institut Océanographique*, Monaco, **44**(1): 23–124.
- Goeke, G. D., 1986. Decapod Crustacea: Raninidae. In: Forest, J. (ed.), Résultats des Campagnes MUSORSTOM. I et II. Philippines (1976–1980), vol. 2. *Mémoires du Muséum national d'Histoire naturelle*, série A, Zoologie, **133**[1985]: 205–228.
- Guinot, D., 1976. Constitution de quelques groupes naturels chez les Crustacés Décapodes Brachyours. I. La superfamille des Belioidea et trois sous-familles de Xanthidae (Polydectinae Dana, Trichiinae de Haan, Actaeinae Alcock). *Mémoires du Muséum national d'Histoire naturelle*, série A, Zoologie, **97**: 1–308.

- Guinot D., 1989. Le genre *Carcinoplax* H. Milne Edwards, 1852 (Crustacea, Brachyura: Gonoplacidae). In: Forest, J. (ed.), Résultats des Campagnes MUSORSTOM, vol. 5. *Mémoires du Muséum national d'Histoire naturelle*, section A, **144**: 265–345.
- Guinot, D., 1993. Données nouvelles sur les Raninoidea de Haan, 1841 (Crustacea Decapoda Brachyura Podotremata). *Comptes rendus de l'Académie des Sciences*, Paris, (III)**316**(11): 1324–1331.
- Guinot, D., & Quenette, G., 2005. The spermatheca in podotreme crabs (Crustacea, Decapoda, Brachyura, Podotremata) and its phylogenetic implications. *Zoosystema*, **2**(2): 267–342.
- Guinot, D., & Segonzac, M., 2018. A review of the brachyuran deep-sea vent community of the western Pacific, with two new species of *Austinograea* Hessler & Martin, 1989 (Crustacea, Decapoda, Brachyura, Bythograeidae) from the Lau and North Fiji Back-Arc Basins. *Zoosystema*, **40**(5): 75–107. <https://doi.org/10.5252/zoosystema2018v40a5>.
- Guinot, D., Carbot-Chanona, G., & Vega, F. J., 2019. Archaeochiapasidae n. fam., a new early Cenomanian brachyuran family from Chiapas, Mexico, new insights on Lecythocaridae Schweitzer & Feldmann, 2009, and phylogenetic implications (Crustacea, Decapoda, Brachyura, Eubrachyura). *Geodiversitas*, **41**(7): 285–322. <https://doi.org/10.5252/geodiversitas2019v41a7>
- Guinot, D., & Ng, P. K. L., 2020. On the nomenclature of Cyrtorhininae Guinot, 1993 (Brachyura, Raninoidea). *Crustaceana*, **93**(1): 71–76.
- Guinot, D., Tavares, M., & Castro, P., 2013. Significance of the sexual openings and supplementary structures on the phylogeny of brachyuran crabs (Crustacea, Decapoda, Brachyura), with new nomina for higher-ranked podotreme taxa. *Zootaxa*, **3665**(1): 1–414.
- Hartnoll, R. G., 1979. The phyletic implications of spermathecal structure in the Raninidae (Decapoda: Brachyura). *Journal of Zoology*, London **187**: 75–83.
- ICZN, International Commission on Zoological Nomenclature, 1999. International Code of Zoological Nomenclature. International Commission of Zoological Nomenclature. Fourth Edition. Adopted by the XXI General Assembly of the International Union of Biological Sciences. International Trust for Zoological Nomenclature, in association with the British Museum (Natural History), London, 338 pp.
- ICZN, International Commission on Zoological Nomenclature, 2008. Proposed Amendment of Articles 8, 9, 10, 21 and 78 of the International Code of Zoological Nomenclature to expand and refine methods of publication. *Bulletin of Zoological Nomenclature*, **65**: 265–275.
- ICZN, International Commission on Zoological Nomenclature, 2011. ICZN meeting on electronic publication. *Bulletin of Zoological Nomenclature*, **68**: 246–247.
- Karasawa, H., Schweitzer, C. E., Feldmann, R. M., & Luque, J., 2014. Phylogeny and classification of Raninoidea (Decapoda: Brachyura). *Journal of Crustacean Biology*, **34**(2): 216–272.
- Luque, J., Allison, W. T., Bracken-Grissom, H. D., Jenkins, K. M., Palmer, A. R., Porter, M. L., & Wolfe, J. M., 2019. Evolution of crab eye structures and the utility of ommatidia morphology in resolving phylogeny. Preprint first posted online 7 October 2019; doi: <http://dx.doi.org/10.1101/786087>
- Manning, R. B., & Holthuis, L. B., 1981. West African Brachyuran Crabs (Crustacea: Decapoda). *Smithsonian Contribution of Zoology*, **306**: 1–379.
- Martínez-Díaz, J. L., Aguillón-Martínez, M. C., Luque, J., & Vega, F. J., 2017. Paleocene decapod Crustacea from northeastern Mexico: Additions to biostratigraphy and diversity. *Journal of South American Earth Sciences*, **74**: 67–82.
- Mendoza, J. C. E., Naruse, T., Tan, S.-H., Chan, T.-Y., Richer De Forges, B., & Ng, P. K. L., 2010. Case studies on decapod crustaceans

- from the Philippines reveal deep, steep underwater slopes as prime habitats for 'rare' species. *Biological Conservation*, **19**: 575–586.
- Mikuž, V., 2010. *Cyrtorhina globosa* from middle Eocene beds of Čopi in Istria, Croatia. *Geologija*, **53**(2): 165–168.
- Monod, T., 1956. Hippidea et Brachyura ouest-africains. *Mémoires de l'Institut français d'Afrique Noire*, **45**: 1–674.
- Ng, P. K. L., Bineesh, K. K., Kumar, R. R., & Ravinesh, R., 2019. *Umalia trirufomaculata* (Davie and Short, 1989) in India, with a note on the taxonomy of *U. misakiensis* (Sakai, 1937) (Decapoda: Brachyura: Raninidae). *Nauplius*, **27**: e2019015. Pp. 1–13. DOI 10.1590/2358-2936e2019015.
- Ng, P. K. L., & Castro, P., 2020. A revision of *Carcinoplax abyssicola* (Miers, 1885) and seven related species of *Carcinoplax* H. Milne Edwards, 1852, with the description of two new species and an updated key to the genus (Crustacea, Decapoda, Brachyura, Goneplacidae). *Zoosystema*, **42**(17): 239–284.
- Ng, P. K. L., Guinot, D., & Davie, P. J. F., 2008. Systema Brachyurorum: Part I. An annotated checklist of extant brachyuran crabs of the world. *Raffles Bulletin of Zoology*, Supplement **17**: 1–286.
- Ng, P. K. L., Mendoza, J. C. E., & Manuel-Santos, M., 2009. Tangle net fishing, an indigenous method used in Balicasag Island, central Philippines. *Raffles Bulletin of Zoology*, Supplement **20**: 39–46.
- Schweitzer, C. E., Feldmann, R. M., & Karasawa, H., 2018. Treatise online Number 51 Part R, Revised, Volume 1, Chapter 8S: Systematic descriptions: Infraorder Brachyura, Section Raninoidea. Paleontological Institut, Kansas University, 44 pp.
- Schweitzer, C. E., Feldmann, R. M., Phillips, G. E., & Armstrong, A., 2019. Cretaceous Decapoda (Crustacea) from Mississippi, USA. *Neues Jahrbuch für Geologie und Paläontologie–Abhandlungen*, **293**(2): 145–197.
- Serène, R., 1971. Observations préliminaires sur des Brachyours nouveaux ou mal connus du Sud-Est Asiatique (Crustacea Decapoda). *Bulletin du Muséum National d'Histoire Naturelle*, Paris, Series 2, **42**(5)[1970]: 903–918.
- Serène, R., & Umali, A. F., 1972. The family Raninidae and other new and rare species of brachyuran decapods from the Philippines and adjacent regions. *Philippine Journal of Science*, **99**(1–2): 21–105, pls. 1–9.
- Števcic, Z., 2005. The reclassification of brachyuran crabs (Crustacea: Decapoda: Brachyura). *Natura Croatica (Fauna Croatica)*, **14**, supplement 1: 1–159.
- Števcic, Z., 2013. Addendum to the reclassification of brachyuran crabs (Crustacea: Decapoda: Brachyura). Part II. Classification scheme. *Natura Croatica*, **22**(1): 181–188.
- Tessier, G., Busulini, A., Beschin, C., & De Angeli, A., 2004. Segnalazione di *Cyrtorhina globosa* Beschin, Busulini, De Angeli & Tessier, 1988 (Crustacea, Decapoda, Brachyura) Nell'eocene di Zovo di Bolca (Verona, Italia Settentrionale). Studi e Ricerche Associazione Amici del Museo–Museo Civico “G. Zannato”, Montecchio Maggiore (Vicenza), **11**: 2–12.
- Tucker, A. B., 1998. Systematics of the Raninidae (Crustacea: Decapoda: Brachyura), with accounts of three new genera and two new species. *Proceedings of the Biological Society of Washington*, **111**: 320–371.
- Van Bakel, B. W. M., Guinot, D., Artal, P., Fraaije, R. H. B., & Jagt, J. W. M., 2012. A revision of the Palaeocorystoidea and the phylogeny of raninoidean crabs (Crustacea, Decapoda, Brachyura, Podotremata). *Zootaxa*, **3215**: 1–216.
- Waugh, D. A., Feldmann, R. M., & Schweitzer, C. E., 2009. Systematic evaluation of raninid cuticle microstructure. *Bulletin of the Mizunami Fossil Museum*, **35**: 15–41.
- Williams, A. B., 1976. Integumental organs of unknown function on chelipeds of deep-sea crabs, genus *Hypophrys*. *Journal of Morphology*, **150**(4): 889–899.

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