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.

**Key words:** Raninoidea, Cyrtorhina, Flaberhina, new genus, Cyrtorhininae, systematics, review

**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 reconstructed, as the holotype of *Cyrtorhina granulosa*, validating A. Milne Edwards’ name (see also Cleva *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 pereiopods 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 = pereiopods 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 ‘avançée 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 extraorbital 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

*Cyrtorhina* Guinot, 1993: 1325, 1330.

*Cyrtorhinae* 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; Števčič, 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 Flaberhina 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 Flaberhina, 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 Lörenth, in Lörenth & Beurlen, 1929); Symethis Weber, 1795 (Symethylene 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 pereiopods 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-ster nal 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; Števčić, 2005: 25; 2013: 182; Cleva et al., 2007: 257, fig. 2B; 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.
NEW GENUS FOR *CYRTORHINA BALABACENSIS*

**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 male (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 granules; 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. 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.](image_url)
Fig. 2. *Cytorhina 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.
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-
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-
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.
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/pterygostomial 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. 8. Left antenna. A, B, *Cyrtorhina granulosa*, female (47.0 × 41.0 mm) (MNHN-IU-2016-2020 = MNHN-B16181), Gulf of Guinea; C, *Flaberhina 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, *Flaberhina balabacensis*, female (52.4 × 47.3 mm) (ZRC 2017.1024), Philippines. Abbreviations: a1–a4 = antennal articles 1–4, respectively; n = nephridiopore; pt = pterygostomial lobe. Scales = 1.0 mm.
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, immovably fused with large merus (Fig. 12B); chela relatively slender, propodus narrow, 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 (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
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...
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-

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**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.
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, auriculiform, 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).
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, 7C). 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 fungiform 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 antennulary 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 short-
er 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 ori-
fices present. Thoracic sternum/pterygostome
junction very narrow, recessed (Figs. 4D, 11B,
12D); Milne-Edwards openings absent; thorac-
ic 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, con-
cealed (Fig. 12D); sternite 3 exposed as small,
V-shaped, with rounded lateral margins, medi-
anpart depressed, not forming ‘crown’ with
sternites 1 and 2 (Figs. 4D, 11B, 12D); sternite
4 narrow, not laterally expanded except for
slender epistermite 4, joining slender sternum/
pterygostome junction to exposed pleurite 4
(Fig. 12D, E); sternite 5 tripartite, not expanded,
except for slender lateral extensions be-
tween P1 and P2, median part ovate (Fig. 12E,
F); sternites 6, 7 conspicuously reduced, nar-
row, 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,
immoveably 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 articu-
lated somites and telson, first 3 somites dor-
sal, somite 1 as wide as posterior carapace
margin; telson prominently sunken into distal
margin of somite 6, distolateral margin dis-
tinctly projecting (Figs. 4J, 5G); pleura distinct
in both sexes (Figs. 4J, 5G). Male pleon nar-
row (Fig. 4J). Female pleon relatively wider
(Figs. 3D, 5G); somite 2 longitudinally wide
(Figs. 3D, 5G); pleura relatively developed
(Fig. 5G). Pleonal-locking mechanism, uro-
pods, 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 Flaberhi-
na 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 charac-
ter. 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 southeastern 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 (Beschin, 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 Beschin, Busulini, De Angeli & Tessier, 1988 (Beschin 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 (Beschin, 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 heterotrems, which show a broader sternal plate than the more recent and derived representatives (Guinot et al., 2019: 313).

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