



## A new species of *Cyonomus* A. Milne-Edwards, 1880, from the deep waters of the Gulf of Mexico (Crustacea: Brachyura: Cyonomidae)

DARRYL L. FELDER<sup>1,2\*</sup> & MARCOS TAVARES<sup>3</sup>

<sup>1</sup>Department of Biology, University of Louisiana, Lafayette, Louisiana 70504-2451, U.S.A.

<sup>2</sup>Department of Invertebrate Zoology, National Museum of Natural History, Smithsonian Institution, Washington, DC 20560, U.S.A

<sup>3</sup>Museu de Zoologia, Universidade de São Paulo, Ipiranga 04263-000, São Paulo, SP, Brazil.

✉ [mdst@usp.br](mailto:mdst@usp.br); <https://orcid.org/0000-0002-7186-5787>

\*Corresponding author: ✉ [dlf4517@louisiana.edu](mailto:dlf4517@louisiana.edu); <https://orcid.org/0000-0001-7679-7712>

### Abstract

A new western Atlantic member of the cyonomid crab genus, *Cyonomus* A. Milne-Edwards, 1880, is described from the continental slope in the northern Gulf of Mexico. While the only two available specimens are poorly preserved and lack appendages, they are clearly distinct from other known members of the genus on the basis of the subangular anterolateral margin of the carapace paired with nearly straight, untapered eyestalks that terminate in a slightly bulbous, well-defined cornea, and antennal peduncles that reach beyond the second article of the antennular peduncle. Despite extensive collecting efforts in adjacent waters, the specimens remain known from only the type locality at 850 m depth.

**Key words:** *Cyonomus*, Cyonomidae, new species, continental slope, Gulf of Mexico

### Introduction

Relatively few specimens of cyonomid brachyuran crabs are presently available from the Gulf of Mexico and immediately adjacent waters. This likely reflects their small size and bathymetric distributions limited to benthic habitats of the deep outer continental shelf and slope. Dredges, trawls, and box core samplers that can capture small intact cyonomid crabs have not been utilized extensively in those waters over the course of recent regional surveys, so most existing specimens from the Gulf of Mexico and adjacent waters date from collecting efforts of previous decades, in some cases to major expeditions of the late 19th century (A. Milne-Edwards & Bouvier 1902). However, worldwide the described species of the group are often known from relatively few specimens, and those are sometimes damaged or incomplete (Tavares 1994; Campos 1997; Ahyong 2019).

For many years following the work of Chace (1940), little attention was accorded to the therein treated western Atlantic representatives of species now regarded as cyonomids. Progress was, however, made in studies that included species descriptions, the erection of new genera, and family reassignments (Tavares 1991, 1993a, b; 1994; Campos 1997; Lemaître & Bermúdez 2000). Records for members of this family from the Gulf of Mexico region remain limited, and potential for morphological variability among even those few taxa leaves a number of the identifications in question. Ontogenetic and post-maturational changes in carapacial shape and armature, as well as rostral variations (perhaps due to naturally occurring breakage), are unlikely to be fully understood within regional species until fresh materials representing variants are obtained for molecular genetic analyses. Also, several species described from off Brazil by Tavares (1991) and Campos Junior (1997) may be expected to range more widely than presently appreciated, especially given present records that suggest a broad western Atlantic distribution for several species in this family.

Two specimens taken in 1983 during environmental trawl sampling in the northwestern Gulf of Mexico were some years thereafter forwarded to one of us (DLF) for examination. While damaged, poorly preserved, and missing all pereopods, the materials appeared to be clearly assignable to the genus *Cyonomus* A. Milne-Edwards, 1880, though not to a known species. In hopes that additional specimens would be obtained over the course of our future

sampling or in study of other museum holdings, formal description and naming of the obviously new species was deferred until now.

No additional materials have to date been obtained, ruling out further insights into comparative morphology. However, there are several precedents for description of rarely collected cymonomids on the basis of very limited type materials, even when on the basis of a single incomplete specimen, if their characters are considered distinct enough to warrant recognition (Tavares 1994; Campos 1997; Ahyong 2019). In the present case, there are at least two specimens that share essential diagnostic characters. Shared morphology of the carapace, pleon, antennae, and eyestalks shows them to be conspecific and to represent a unique taxon from all other currently known species. The present work undertakes their formal description, establishing *Cymonomus windsorae* n. sp.

## Materials and methods

Line illustrations were prepared with a Wild M5 dissecting microscope equipped with a camera lucida, after staining with Chlorazole Black E when necessary. Postorbital carapace width (pcl) and greatest carapace width (cw) were measured in millimeters (nearest 0.1 mm) with a calibrated ocular micrometer. Specimens are archived in the Smithsonian Institution National Museum of Natural History, Washington, D.C., USA (USNM). They were formerly holdings of the University of Louisiana's Lafayette Zoological collection, Lafayette, Louisiana (ULLZ), transferred permanently to the USNM, where they remain cross-referenced under both catalog systems. Some comparative materials in crustacean collections the Museum of Comparative Zoology, Harvard University, Boston, MA, USA (MCZ CRU), were also included in studies.

Materials of regional congeners compared to the specimens of *Cymonomus windsorae* n. sp. included the following: *Cymonomus caecus* (Chace, 1940), female holotype, Florida Straits off Cuba (MCZ CRU-10705); *C. granulatus* (Norman in Wyville Thompson, 1873), male, Gulf of Lion, France (USNM 173083); *C. quadratus* A. Milne-Edwards, 1880, female syntype, Florida Straits (MCZ CRU-6681); *C. rostratus* (Chace, 1940), female holotype, Florida Straits off Havana, Cuba, MCZ CRU-10706 preserved male allotype (cw 6.2 mm), Cuba, MCZ CRU 10707.

## Taxonomic account

### Family Cymonomidae Bouvier, 1898

### Genus *Cymonomus* A. Milne-Edwards, 1880

#### *Cymonomus windsorae* n. sp.

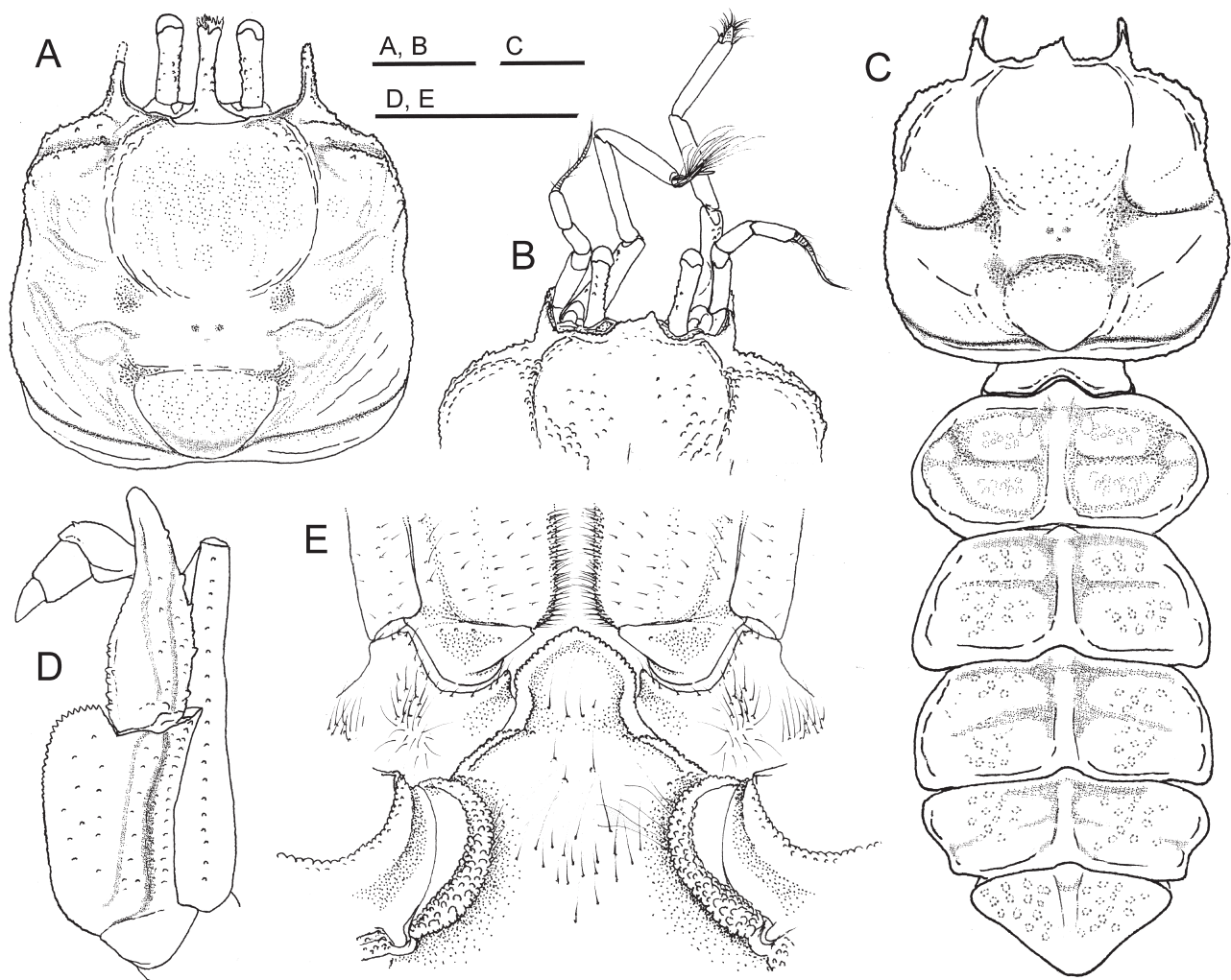
(Figs 1A–E, 2A–D)

**Material examined.** Holotype: Ovigerous female, cw 3.9 mm, pcl 3.5 mm, USNM 1546450 (= ULLZ 12698A), trawl sample, LGL Stn 3, Cruise I, off Louisiana, northwestern Gulf of Mexico, 27°48'N, 90°03.3'W, 850 m, 27 November 1983. Paratype: Ovigerous female, cw 4.0 mm, pcl 3.7 mm, USNM 1705285 (= ULLZ 12698B), collection data same as for holotype.

**Diagnosis.** Carapace regions well marked, irregularly granulate; broad gastric region delimited laterally by distinct arched furrow. Eyestalks elongate, untapered, subcylindrical with slight dorsoventral flattening proximally, directed anteriorly, nearly straight, freely articulated at base, no evident fusion to one another or frontal margin of carapace. Cornea translucent, unfaceted, no remaining evidence of pigment, distinctly bulbous, separation from adjacent heavily sclerotized eyestalk cuticle distinctly evident.

**Description.** Carapace outline subquadrate, lateral margins sinuous, subparallel, widest posteriorly at lateral margin of slightly inflated branchial region, irregularly granulate anterolateral margin slightly extended mesially above base of outer orbital process (Figs 1A–C, 2A–D). Carapace regions dorsally indicated, shallow cervical groove evident; hepatic region with lateral supramarginal crest bearing irregular coarse granules and small denticles; broad gastric region slightly elevated anteriorly above level hepatic regions, delimited laterally by distinct arched

furrow, frontal and fronto-orbital margins upturned, posteriorly with distinct pair of small gastric pits near median line; pattern of four shallow depressions framing intestinal region, two near posterolateral limits of gastric region, two near anterolateral limits of cardiac region; cardiac region distinctly inflated, elevated above thickened posterior margin of carapace; surfaces overall with well-separated small granules and weak rugae marking regional furrows, cervical groove, branchial grooves, also as irregular patterns on hepatic region, branchial region, and near carapacial margins. Anterolateral spine low, anteriorly directed, slightly enlarged among other acute to subacute marginal granules of anterolateral margin. Fronto-orbital margin reaching anteriorly little if any beyond anterolateral margins; width about half that of anterior carapace; outer orbital process narrowly digitiform, positioned below plane of rostrum, dorsoventrally thickened by raised granulate margins proximally, mesial margin continued from upturned fronto-orbital margin, raised margins obsolete distally. Rostrum (fractured from carapace at base, appearing crushed terminally) narrowly elongate, extending anteriorly at least as far as eyestalk corneas, lacking subrostral tubercle; rostral margins parallel at sides, divergent at base. Carapace ventrally with pterygostomian region swollen, finely granulate, forming elongate boss.



**FIGURE 1.** *Cynomus windsorae* n. sp.: A, D, E, USNM 1546450 (= ULLZ 12698A) ovigerous female holotype; B, C, USNM 1705285 (= ULLZ 12698B) ovigerous female paratype. A, carapace and eyestalks, dorsal; B, anterior carapace, eyestalks, antennules, and antennae, dorsal; C, carapace, extended pleon, and pleotelson, dorsal; D, left third maxilliped, external; E, anterior thorax, proximal articles of third maxillipeds, first pereopod coxae, and anterior sternum, ventral. Scale bars = 1.0 mm

Eyestalks narrow, elongate, subcylindrical with slight dorsoventral flattening proximally, directed anteriorly, nearly straight, freely articulated at base, no evident fusion to one another or frontal margin of carapace (Figs 1A, B, 2A, B, D); cornea reaching to just beyond midlength of antennular peduncle first article; dorsal surface of stalk with scattered granules, granules denser, stronger along mesial margin; cornea well defined, translucent, unfaceted, no

remaining evidence of pigment, terminally inflated, separation from adjacent heavily sclerotized cuticle distinctly evident.

Epistome surface produced anteriorly below rostral base, bearing several small, elongate granules, one centered on midline, transverse row of four enlarged granules between bases of antennules; flattened subtriangular lobe mesial to base of antenna.

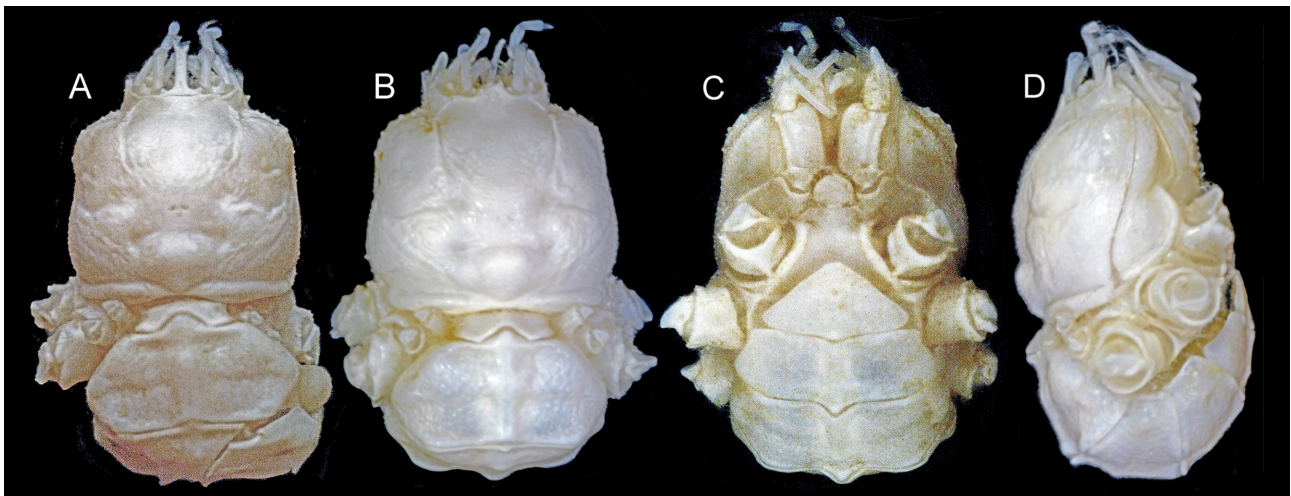
Antennular peduncle length (paratype) about 0.82 carapace width (Fig. 1B); first article granulate dorsally and laterally; second and third articles mostly smooth. Antennal peduncle first to third articles minutely granulate; fourth and fifth articles minutely granulate to smooth.

Third maxilliped ischiobasis subquadrate, with distinct longitudinal sublateral groove, mesial margin coarsely granulate, granules dentiform to spiniform distally (Figs 1D, 2C, D); lateral margin mostly smooth, ending distally in sharp corner; fusion of ischium and basis marked by distinct groove. Merus length near equal that of ischium, elongate, weakly bent toward midline in distal half, terminally rounded; margins bearing a few dentiform granules and short, blunt spines; external surfaces with scattered denticles. Carpus heavy, subtriangular, with sparse marginal dentiform granules, propodus subcylindrical, dactylus subconiform, weakly arched, tapering to subacute tip. Exopod reaching to distal quarter of endopod merus; exopod flagellum well developed, multi-segmented.

Except for coxae (Fig. 2A–D), chelipeds and other pereopods unknown, missing from holotype and paratypes.

Thoracic third sternite subpentagonal, thickened granulate anterolateral margins converging to anterior point at small terminal tubercle; thickened lateral margins slightly concave, weakly divergent posteriorly, posterior width about one and one-half times median length (Figs 1E, 2C). Fourth sternite lateral margin thickened, forming strongly raised coarsely granulate swollen lip along concavity accommodating first pereopod coxa.

Pleon with raised median longitudinal crest on pleonites and pleotelson, otherwise faintly patterned by low anastomosed weakly granular elevations and shallow sulci (Figs 1C, 2A–D); pattern of transverse sulci evident on especially second to fourth pleonites. Pleotelson subtriangular, width slightly less than twice length, sixth pleonite and telson completely fused with no evidence of separating suture along entire width; obtuse angle of terminus rounded.



**FIGURE 2.** *Cymonomus windsorae* n. sp.: A, USNM 1546450 (= ULLZ 12698A) preserved ovigerous female holotype, cw 3.9 mm, northwestern Gulf of Mexico; B–D, USNM 1705285 (= ULLZ 12698B) preserved ovigerous female paratype, cw 4.0 mm, northwestern Gulf of Mexico.

**Etymology.** This species is named for our colleague, Amanda M. Windsor, in recognition of her substantial contributions to phylogenetic and systematic studies of brachyuran crabs.

**Distribution and habitat.** Known at present from only the type locality, northwestern Gulf of Mexico, western Atlantic, at a depth of 850 m.

**Remarks.** Specimens herewith described as *C. windsorae* n. sp. were originally referred to one of us for study (DLF) by Dr. Linda Pequegnat, a consultant to LGL Ecological Research Associates, Bryan, Texas. As both specimens lacked appendages and exhibited varied degrees of damage to the rostrum, description was long deferred in hopes of making additional collections that might include intact and perhaps male specimens, or even DNA



sequence-quality representatives as methods progressed. However, despite repeated collection efforts at similar depths in the northwestern Gulf of Mexico, no additional specimens have been found.

Both specimens are unfortunately now in a very poor state of preservation. Initially fractured, missing appendages, and not well preserved, they were among a few specimens that became dried in the course of the ULLZ collections being shipped to and temporarily stored at (without routine curation during the covid pandemic) the USNM, where they are now curated with other of the former ULLZ holdings. However, most of the line drawings, specimen photographs, and morphological notes were fortunately prepared by DLF prior to the specimens' drying. Having now been rehydrated by standard protocols and returned to alcohol, essential features at very least remain recognizable in the type materials. However, both the holotype and paratype females of *C. windsorae* **n. sp.** initially carried eggs that have now somewhat shriveled and disintegrated. The holotype bore fourteen and the paratype six relatively large eggs, 0.9–1.1 mm in greatest diameter.

Assignment of *C. windsorae* **n. sp.** to the genus *Cymonomus* is based upon a combination of characters, which include ocular peduncles not covered by the long slender rostrum, so that the peduncles are fully exposed in dorsal view; absence of an interantennular septum; third maxilliped merus remarkably elongated distally with the palp articulating at its subdistal inner surface and exopod with well-developed flagellum; and pleon of five pleonites and pleotelson without any trace of suture separating the sixth pleonite from the telson. This is in contrast to members of the closely related genus *Cymonomoides*, in which the rostrum is vestigial or very short and all six pleonites and the telson are freely articulated, thus facilitating ready separation of *Cymonomus windsorae* **n. sp.** from species of *Cymonomoides*, also known to occur in the Gulf of Mexico and adjacent waters (Tavares 1993; Lemaitre & Bermúdez 2000; Felder *et al.* 2009).

*Cymonomus windsorae* **n. sp.** can be readily distinguished from all other species in the genus by having an untapered rostrum with rostral margins parallel at the sides and divergent at the base and perhaps distally (though damaged there), and its unique eye morphology with well-developed bulbous terminal corneas of the nearly straight eyestalks, the smooth integumental covering of which is clearly demarcated from that of the eyestalk itself. It superficially resembles the Mediterranean *Cymonomus granulatus* (Norman in Wyville Thompson, 1873) and the Tasmanian *Cymonomus karenae* Ahyong, 2019, in having the transparent cornea similarly demarcated, but in the latter two species the cornea is less bulbous and in *C. karenae*, it is centered on the distoventral terminus of a stout, strongly divergent stalk (Ahyong 2019: 58, fig. 22C, D). Additionally, the two aforementioned species can be easily set apart from *C. windsorae* **n. sp.** by the ornamentation of the dorsal and lateral surfaces of the carapace, which is densely covered with prominent spination or coarse granulation in *C. granulatus* and *C. karenae*, respectively. In *C. windsorae* **n. sp.** it is instead irregularly granulate with surfaces overall bearing well-separated small granules and weak rugae marking regional furrows.

Among the three known species of *Cymonomus* that range into at least eastern extremes of the Gulf of Mexico (Felder *et al.* 2009), the cornea and eyestalks readily separate these species from *C. windsorae* **n. sp.**, as it shares neither the absence of cornea as in *C. rostratus* Chace, 1940, and *C. caecus* Chace, 1940, the distinct lateral curvature of the stalks as in *C. quadratus* A. Milne-Edwards, 1880, nor the strong taper toward the apices as found in *C. caecus*. *Cymonomus windsorae* **n. sp.** can be further separated from *C. rostratus* by the anterolateral shoulder of the carapace that appears more produced or angular in dorsal perspective, often forming a rounded, sometimes spined corner as opposed to a more broadly rounded margin as in *C. rostratus*.

*Cymonomus* is essentially a deep-water group currently consisting of 45 species, of which 33 are Indo-West Pacific and 12 Atlanto-Mediterranean/East Pacific in distribution. It also includes one species from the Late Eocene of Hungary, *C. primitivus* Müller & Collins, 1991. A number of descriptive and distributional accounts over the last two decades have markedly expanded documented diversity of *Cymonomus* in Indo-Pacific waters (Ahyong & Brown 2003; Ahyong 2008, 2014, 2019; Ahyong *et al.* 2020; Ahyong & Ng 2009, 2011, 2017; Takeda *et al.* 2021; Ahyong & Ng 2023). The Atlanto-Mediterranean/East Pacific species of *Cymonomus* are under revision by one of us (MT) so that further additions are anticipated in the course of this effort, as well as range extensions building on previous work (Tavares 1991, 1993a, 1994; Campos Junior 1997). Additional insights into the cymonomid assemblage of the Gulf of Mexico region are, however, constrained by limited appropriate sampling in the region over recent decades, which also limits insight into microhabitats and substrate dependencies of *Cymonomus* and its confamilials.

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## References

- Ahyong, S.T. (2008) Deepwater crabs from seamounts and chemosynthetic habitats off eastern New Zealand (Crustacea: Decapoda: Brachyura). *Zootaxa*, 1708 (1), 1–72.  
<https://doi.org/10.11646/zootaxa.1708.1.1>
- Ahyong, S.T. (2014) Cymonomid crabs of the MAINBAZA Expedition (Decapoda: Brachyura). *Zootaxa*, 3821 (3), 384–390.  
<https://doi.org/10.11646/zootaxa.3821.3.7>
- Ahyong, S.T. (2019) The cymonomid crabs of New Zealand and Australia (Crustacea: Brachyura: Cyclodorripoida). *Records of the Australian Museum*, 71 (2), 33–69.  
<https://doi.org/10.3853/j.2201-4349.71.2019.1682>
- Ahyong, S.T. & Brown, D.E. (2003) New species of *Cymonomus* from southeastern Australia (Brachyura, Cymonomidae) with a key to the Indo-West Pacific species. *Crustaceana*, 75, 1363–1374.  
<https://doi.org/10.1163/156854002321629790>
- Ahyong, S.T., Mitra, S. & Ng, P.K.L. (2020). Cymonomid crabs from southwestern Indonesia and redescription of *Cymonomus andamanicus* Alcock, 1905. *Raffles Bulletin of Zoology*, 68, 62–69.
- Ahyong, S.T. & Ng, P.K.L. (2009) The Cymonomidae of the Philippines (Crustacea: Decapoda: Brachyura), with descriptions of four new species. *Raffles Bulletin of Zoology*, Supplement 20, 233–246.
- Ahyong, S.T. & Ng, P.K.L. (2011) Cyclodorippoid crabs from the Philippines collected by the PANGLAO 2004–2005 and AURORA 2007 expeditions. *Zoologischer Anzeiger*, 250, 479–487.  
<https://doi.org/10.1016/j.jcz.2011.06.001>
- Ahyong, S.T. & Ng, P.K.L. (2017) East Asian cymonomid crabs (Crustacea: Brachyura). *Zoological Studies*, 56 (24), 1–20.  
<https://doi.org/10.6620/ZS.2017.56-24>
- Ahyong, S.T. & Ng, P.K.L. (2023) *Cymonomus dwi*, a new species of deep-water cymonomid crab from Indonesia (Crustacea: Brachyura). *Raffles Bulletin of Zoology*, 71, 116–119.  
<https://doi.org/10.26107/RBZ-2023-0010>
- Campos, O. Jr. (1997) Três novas espécies brasileiras do gênero *Cymonomus* A. Milne-Edwards, 1880 (Crustacea, Brachyura, Podotremata). *Trabalhos do Instituto Oceanográfico da Universidade Federal de Pernambuco, Recife*, 25, 127–135.  
<https://doi.org/10.5914/tropocean.v25i1.2734>
- Chace, F.A. Jr. (1940) Reports on the scientific results of the *Atlantis* expeditions to the West Indies, under the joint auspices of the University of Havana and Harvard University. The brachyuran crabs. *Torreia, Havana*, 4, 1–67.
- Felder, D.L., Álvarez, F., Goy, J.W. & Lemaitre, R. (2009) Chapter 59: Decapoda (Crustacea) of the Gulf of Mexico, with comments on the Amphionidaceain. In: Felder, D.L. & Camp, D.K. (Eds.), *Gulf of Mexico Origin, Waters, and Biota. Vol. 1. Biodiversity*. Texas A&M University Press, College Station, Texas, pp. 1019–1104.
- Lemaitre, R. & Bermúdez, A. (2000) A new cyclodorippoid crab of the genus *Cymonomoides* Tavares, 1993 (Crustacea: Decapoda: Brachyura: Cymonomidae) from the Caribbean coast of Colombia. *Proceedings of the Biological Society of Washington*, 113 (4), 974–979.
- Milne-Edwards, A. (1880) Études préliminaires sur les crustacés. In: Reports on the Results of Dredging, under the Supervision of Alexander Agassiz, in the Gulf of Mexico, and in the Caribbean Sea, 1877, '78, '79, by the United States Coast Survey Steamer "Blake," Lieut.-Commander C.D. Sigsbee, U.S.N., and Commander J.R. Bartlett, U.S.N., Commanding, VIII. *Bulletin of the Museum of Comparative Zoology, Harvard*, 8 (1), 1–68.
- Milne-Edwards, A. & Bouvier, E.-L. (1902) Reports on the results of dredging, under the supervision of Alexander Agassiz, in the Gulf of Mexico (1877–78), in the Caribbean Sea (1878–79), and along the Atlantic Coast of the United States (1880), by the U.S. Coast Survey Steamer "Blake". XXXIX. Les Dromiacés et Oxystomes. *Memoirs of the Museum of Comparative Zoölogy at Harvard College*, 27 (1), 1–127.
- Müller, P. & Collins, J.S.H. (1991) Late Eocene coral-associated decapods (Crustacea) from Hungary. *Contributions to Tertiary and Quaternary Geology*, 28 (2–3), 47–92.
- Takeda, M., Ohtsuchi, N. & Komatsu, H. (2021) Crabs (Crustacea, Decapoda) from the Sea off East and Southeast Asia collected by the RV Hakuho Maru (KH-72-1 Cruise) 1. Sulu Sea and Sibutu Passage. *Bulletin of the National Museum of Nature and Science, Series A (Zoology)*, 47, 65–97.

- Tavares, M. (1991) Espèces nouvelles de Cyclodorippoidea Ortmann et remarques sur les genres *Tymolus* Stimpson et *Cyclodorippe* A. Milne Edwards (Crustacea, Decapoda, Brachyura). *Bulletin du Muséum national d'Histoire naturelle, Paris*, 4A, 12 (3–4), 623–648. [dated 1990, published 1991]  
<https://doi.org/10.5962/p.289575>
- Tavares, M. (1993a) Description préliminaire de quatre nouveaux genres et trois nouvelles espèces de Cyclodorippoidea Américains (Crustacea, Decapoda Brachyura). *Vie et Milieu*, 43, 137–144.
- Tavares, M. (1993b) Crustacea Decapoda: les Cyclodorippidae et Cyonomidae de l'Indo-ouest-Pacifique à l'exclusion du genre *Cyonomus*. In: Crosnier, A. (Ed.), Résultats des Campagnes MUSORSTOM, 10. *Mémoires du Muséum national d'Histoire naturelle, Paris, Series A, Zoologie*, 156, pp. 253–313.
- Tavares, M. (1994) Description de *Cyonomus leblondi* sp. nov. de Guadeloupe, avec une clef des *Cyonomus* américains (Decapoda, Brachyura, Cyonomidae). *Bulletin du Muséum national d'Histoire naturelle, Paris, Série 4*, 16, 203–208.
- Wyville Thompson, C. (1873) *The depths of the sea. An account of the general results of the dredging cruises of the H.M.S.S. 'Porcupine' and 'Lightning' during the Summers of 1868, 1869, and 1870, under the scientific direction of Dr. Carpenter, F.R.S., J. Gwyn Jeffreys, F.R.S. and Dr. Wyville Thomson, F.R.S.* Macmillan and Co., London, xxi + 527 pp., VIII pls.  
<https://doi.org/10.5962/bhl.title.16330>