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Article

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Johngarthia cocoensis, a new species of Gecarcinidae MacLeay, 1838 (Crustacea, Decapoda, Brachyura) from Cocos Island, Costa Rica

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Abstract

A new species of Gecarcinidae MacLeay, 1838, *Johngarthia cocoensis* **n. sp.** from Cocos Island (Costa Rica) is described and illustrated. The new species closely resembles *J. malpilensis* (Faxon, 1893), from which it can be separated by the inner apical lobes of the third maxilliped meri mostly separated from each other in resting position, palp of third maxilliped merus partly exposed and epistomial carapace tooth completely exposed.

Key words: taxonomy, biogeography, new species, Central America, Tropical Eastern Pacific region

Introduction

Cocos Island, situated approximately 550 km west from the southern coast of Costa Rica, is distinguished by high rainfall and by being the only oceanic island in the eastern Pacific with a tropical rain forest (Trusty *et al*. 2006). Despite a relatively young age of about two million years (Castillo *et al.* 1988), Cocos I. has a high rate of endemism (Hogue & Miller 1981; Montoya 2001). Among the decapods, the brachyurans are the most diverse taxon on this island, with 68 species, none of which are considered endemic (Vargas & Wehrtmann 2009). Zimmerman & Martin (1999), however, noted that the brachyuran fauna of the island is less known when compared to the other oceanic islands of the tropical eastern Pacific (notably Revillagigedo, Clipperton, and the Galápagos islands). Previous studies of the brachyuran fauna of the island focused on the marine and fresh-water species (Vargas & Wehrtmann 2008). The only published contributions on the terrestrial brachyurans of Gecarcinidae MacLeay, 1838, was a study of *Cardisoma crassum* (Smith, 1870) by Gomez (1977) and a distributional record for *Johngarthia planatus* (Stimpson, 1860) by Vargas & Wehrtmann (2008). Although the latter species is also found on islands of the Gulf of California, Revillagigedo Is. and Clipperton (Rathbun 1918, Bouchard & Poupin 2009), the second eastern Pacific species of this genus, *J. malpilensis* (Faxon, 1893), is considered to be endemic to Malpelo I. (López-Victoria & Werding 2008).

The examination of specimens of *J. planatus* collected from Cocos I. between 1973 and 2001 and deposited in the collection of the zoological museum of the University of Costa Rica revealed that all these specimens actually belong to an undescribed species. *Johngarthia cocoensis* **n. sp.** is thus described and illustrated.

Methods

Measurements were taken with digital calipers. For isometric relationships, mean ratios with standard deviation (STABW) are provided. Ratios of males and females were pooled. Equations are provided for allometric relationships. The description of the first gonopod is based on the terminology of Smalley (1964).

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The following abbreviations are used: MZ-UCR, Museo de Zoología, Universidad de Costa Rica, San José, Costa Rica; LACM, Natural History Museum of Los Angeles County, Los Angeles, California; MNHN, Muséum National d'Histoire Naturelle, Paris, France; USNM, National Museum of Natural History, Smithsonian Institution, Washington, D.C.; W, carapace width; L , carapace length; H , carapace height (between the anterior half of the carapace median carina and the first thoracic sternite); FO , fronto-orbital border; F , carapace front; P , pit at outer orbital angle; MXP3 , third maxilliped; OL , MXP3 merus outer apical lobe; IL , MXP3 merus inner apical lobe; PL , palm length; PH , palm height; A , abdomen; S , thoracic sternite.

Taxonomy

Family Gecarcinidae MacLeay, 1838

Johngarthia Türkay, 1970

Diagnosis (modified from Türkay 1970). Outer dorsal and ventral orbital border converge with carapace anterolateral border at height of widest orbital width when seen in frontal view; MXP3 merus with V-shaped emargination on apical margin; mesial process of first gonopod prominently developed, protruding beyond caudal process, end piece longer than wide, convex, not protruding beyond terminal setae; aperture external, sub-terminal.

Type species. *Gecarcinus planatus* Stimpson, 1860, by original designation.

Remarks. The taxonomy of *Johngarthia* Türkay, 1987, has been somewhat uncertain (see Tavares 1991; Bouchard & Poupin 2009). Türkay (1970) originally described the taxon as a subgenus of *Gecarcinus* Leach, 1814, but later Türkay (1987) decided to recognize it as a distinct genus, and this has been followed by a number of workers (see Hartnoll *et al*. 2006; Cuesta *et al*. 2007; Ng *et al*. 2008; Hartnoll 2010). Some other workers, however, regard *Johngarthia* as a junior synonym of *Gecarcinus* (e.g. Tavares 1991; Bouchard & Poupin 2009). As a taxonomic revision of the Gecarcinidae is beyond the focus of this study, we follow the treatment proposed by Ng *et al*. (2008) for the moment.

Johngarthia cocoensis n. sp.

(Figs. 1A, B; 2; 3; 4; 5B; 6D–F)

Type material. Costa Rica, Cocos Island: male, holotype, MZ-UCR-622-01, 13.08.1973, C. Villalobos and D.G. Robinson leg.; 1 male, paratype, same data; Costa Rica, Manuelita Island: 3 males, 1 female, paratypes, MZ-UCR-623-01, 14.8.1973, N. Scott leg.; Costa Rica, Cocos Island, Bahía Wafer: 10 juveniles, paratypes, MZ-UCR-2401-06, 28.11.2001 M. Montoya leg.

Comparative material examined. *Johngarthia planatus*: Mexico, Socorro I.: 1 male, MNHN- B13154, A. Anthony leg.; 2 males, LACM, 16 Feb. 1971, J. Garth det.; 1 male USNM 20691, A. Anthony leg.; Mexico, San Benedicto I.: 2 males, LACM-170, J. Garth det.; 1 male, USNM 20690, A. Anthony leg.; Mexico, Lower California: 1 male (most likely holotype of *Gecarcinus digueti* Bouvier, 1895), MNHN-B10951, Diguet leg.; 1 male, 1 female, USNM 12465; Mexico, Tres Marias I., María Cleofas: 1 male, USNM 20650, Nelson & Goldman leg., 30-05-1897; Clipperton I.: 4 males, LACM, 12.09.1958, Limbaugh leg., J. Garth det.; 1 male, MNHN-B13156, D. Guinot det.; 1 male, 1 female, USNM 19646, J. Arnheim leg; *Johngarthia malpilensis*: Colombia, Malpelo I.: 3 males, 4 females, LACM, 16.01.1933, Hancock Pacific Expeditions, J. Garth det. Additional high resolution photographs of live *J. planatus* from Clipperton (provided by Michel Montoya, Fundación Amigos Isla del Coco, Costa Rica, and Julian P. Sachs, University of Washington) and *J. malpilensis* (provided by Mateo Lopéz-Victoria, Justus Liebig Universität, Giessen, Germany) were also examined.

Remark. We could not locate the type material of *J. planatus* in the USNM, the Zoological Museum in Copenhagen or the Natural History Museum, London, where some type material of species described by Stimpson has been deposited (see Evans 1967; Vasile *et al.* 2005; Manning & Reed 2006). The material of *J. planatus* was most likely destroyed by the Great Chicago Fire of 1871 (see Vasile *et al.* 2005). The possible holotype of *G. digueti* Bouvier, 1895 (MNHN-B10951) was labeled as *Gecarcinus planatus*, but it is the only specimen in the MNHN concordant with the type specimen of *G. digueti* described by Bouvier (1895) and subsequently reported by Rathbun (1899). Bouvier apparently only had one specimen from "Basse-Californie" (Lower California), which he noted was measuring 67 mm (sex not specified) (Bouvier, 1898). Rathbun (1899) recognized *G. digueti* as a distinct species, recording it from María Cleofa Island off Lower California, and apparently examined the type in the Paris Museum which she stated was a male measuring 69.0 by 46.3 mm. Maria Cleofa Island is situated relatively close to Cabo San Lucas (Cape St. Lucas, the most southern tip of Lower California peninsula), the type locality of *J. planatus* (Stimpson 1860). On the basis of the available data, this MNHN specimen is almost certainly the holotype of *G. digueti* Bouvier, 1895. Rathbun (1918) later synonymized both *G. malpilensis* (Faxon, 1893) and *G. digueti* (Bouvier, 1895) with *G. planatus* (Stimpson, 1860). Türkay (1970) recognized *G. malpilensis* as a distinct species but retained *G. digueti* under the synonymy of *G. planatus*. The presumptive holotype of *G. digueti* has all the diagnostic characters which we here identify with *J. planatus* and we are confident they are conspecific and different from *J. cocoensis* **n. sp.**

FIGURE 1. Live color, A, *Johngarthia cocoensis* **n. sp.**, male (Cocos I., Costa Rica, photo by Michel Montoya); B, idem, female, juvenile (Cocos I., Costa Rica), photo by Michel Montoya); C, *Gecarcoidea lalandii*, male (Taiwan, photo by Hung-Chang Liu, Providence University, Taiwan); D, idem, female (Taiwan, photo by Hung-Chang Liu, Providence University, Taiwan); E, *Johngarthia planatus* (Clipperton Island, March 2008, photo by Julian P. Sachs, University of Washington); F, idem (Puerto Escondido, Oaxaca, Mexico).

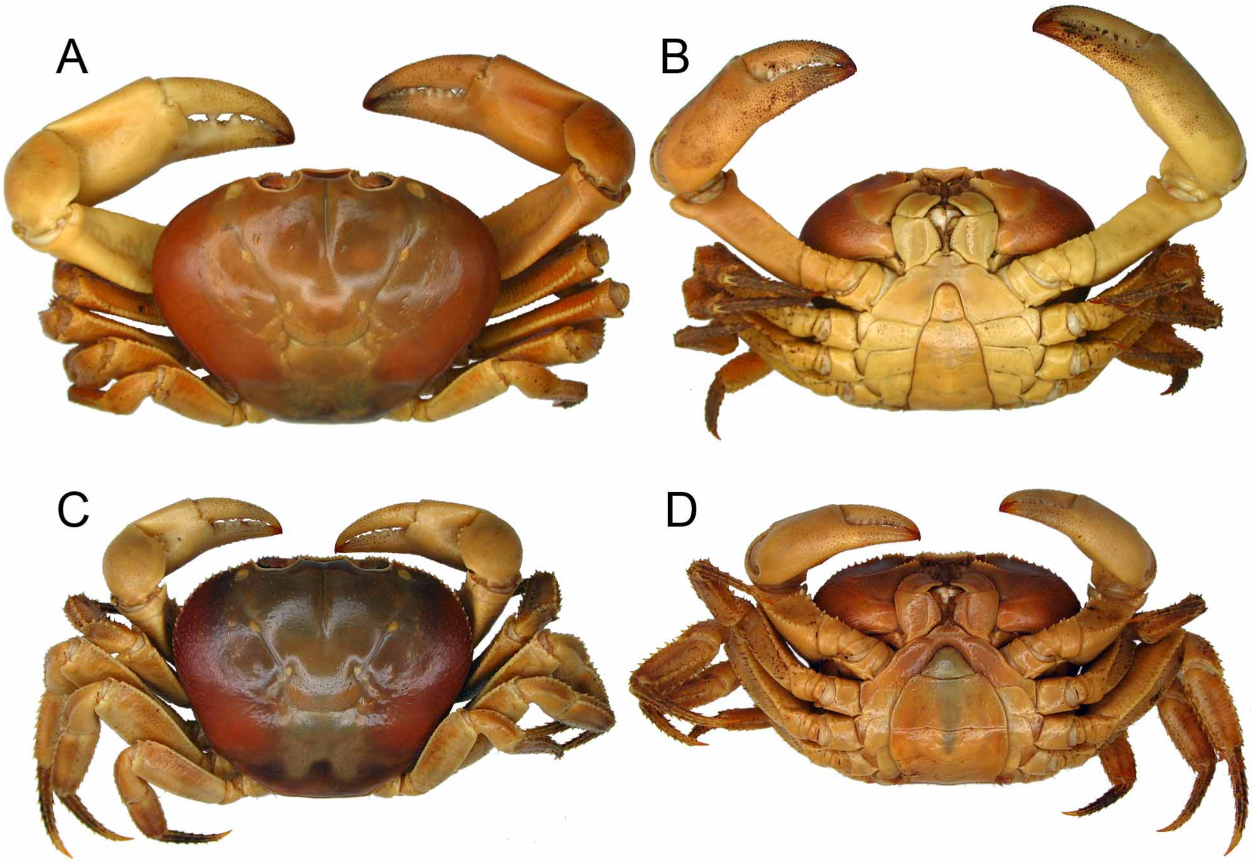

FIGURE 2. *Johngarthia cocoensis* **n. sp.**, A, holotype male, W 89.85 mm, MZ-UCR-622-01 (Cocos I., Costa Rica), preserved in alcohol 70%, dorsal view; B, idem, ventral view; C, paratype female, W 57.35 mm, MZ-UCR-623-01, preserved in alcohol 70%, dorsal view; D, idem, ventral view.

Diagnosis. P about half as wide as orbital width; juvenile, subadults (W 20–60 mm) with well developed exorbital carapace tooth, 6–16 anterolateral carapace teeth; ILs mostly separated from each other when resting against buccal cavity (Fig. 3); palp of MXP3 merus partly exposed, epistomial tooth completely exposed (Fig. 3; 6D–F); MXP3 exopodite not reaching ischium-merus joint, terminal setae protruding beyond ischium-merus joint; male first gonopod relatively straight (Fig. 4A, B)

Measurements. Males 57.2–112.3 mm; females 21.2 –57.35 mm; W/L = 1.24±0.06; W/H = 2.33±0.06; H/ MXP3 length = 1.52±0.03; MXP3 merus length/width = 1.23±0.05; FO width = $1.353W^{0,754}$ (R^2 = 0,99); F width = $0.445W^{0,751}$ (R^2 = 0.99); PL = $0.0894W^{1,4957}$ (R^2 = 0.98)

Description. Relatively large-size, robust species; carapace transversely ovate, strongly longitudinally, transversely convex, widest in anterior half; gastric region particularly well defined; median, cervical, urogastric grooves very pronounced; median groove reaches posterior height of greatest width of carapace; extremities of cervical grooves reaching pits at orbital angles; P about half as wide as orbital width; pit median, posterior of each cervical groove, smaller than pits at orbital angles, posterior very close to cervical groove, converging with urogastric groove; irregular lines of smaller pits lateral to cervical grooves; epigastric carinae absent, cardiac lobe strongly backward prolonged between bases of posterior legs; postfrontal crest strongly curved downwards, terminating as prominent carina, carina slightly curved medially. Suborbital, pterygostomial regions sparsely granular laterally; surfaces smooth. Subhepatic region with rounded postero-lateral margins, with rows of 3–9 small granules. In juvenile, subadult specimens (20–60 mm) carapace in anterior third with small granules, rest of surface smooth; lateral borders swollen, upper border marked by carapace anterolateral border when seen in frontal view, prominently developed exorbital carapace tooth, carapace anterolateral border lined by 6–16 sharp teeth. In adult specimens (>60 mm) dorsal surface of carapace smooth; protogastric area, branchial regions conspicuously swollen; exorbital tooth weakly developed, anterolateral border smooth.

FIGURE 3. Frontal view, A, *Johngarthia cocoensis* **n. sp.**, holotype male, W 89.85 mm, MZ-UCR-622-01 (Cocos I., Costa Rica), preserved in alcohol 70%, dorsal view; B, idem, paratype female, W 57.35 mm, MZ-UCR-623-01, preserved in alcohol 70%.

Orbit deep, broadly oval, height about 3/4 width, eye not completely filling orbit when folded; dorsal border slightly raised, outer angle distinctly defined, outer ventral, dorsal orbital borders converge with carapace anterolateral border at height of widest width of orbit when seen in frontal view; wide gap in ventral orbital border, border weakly carinate, projected, with row of 5 or 6 teeth, inner angle reaches front, separates antennae from orbit, furnished with 2 or 3 teeth.

Epistome sunken, densely covered with short setae, separated from basal segments of antennules by transverse ridge, ridge aligned with suborbital-border; median with band of setae; epistomial tooth exposed, triangular; antennules folded obliquely; antennae very short, nearly longitudinal, almost concealed by front, inter-antennular septum of moderate width; buccal cavern wide, widest in middle, laterally arched, densely covered with long, thick hairs, setae forming dense brush fitting with lateral border of MXP3, not visible when MXP3 rest against buccal cavern.

MXP3 leaving between them wide rhomboidal gap when closed, mandibles exposed, internal border of ischium laterally lined with setae, ischium with well pronounced vertical sulcus; ILs mostly separated from each other when resting against buccal cavity, considerably narrower, shorter than ischium, longer than wide, not reaching epistome, leaving gap between lateral borders of buccal cavern, exposing epistomial tooth, borders of MXP3 merus relatively straight; apex apically divided by wide, V-shaped fissure, deepest point of emargination lateral, palp articulating at this point, palp partly exposed in resting position; IL longer than OL, rounded; exopod concealed by ischium, apex not reaching ischium-merus joint (size about 80% of ischium), terminal setae protrude from ischium-merus joint, flagellum absent.

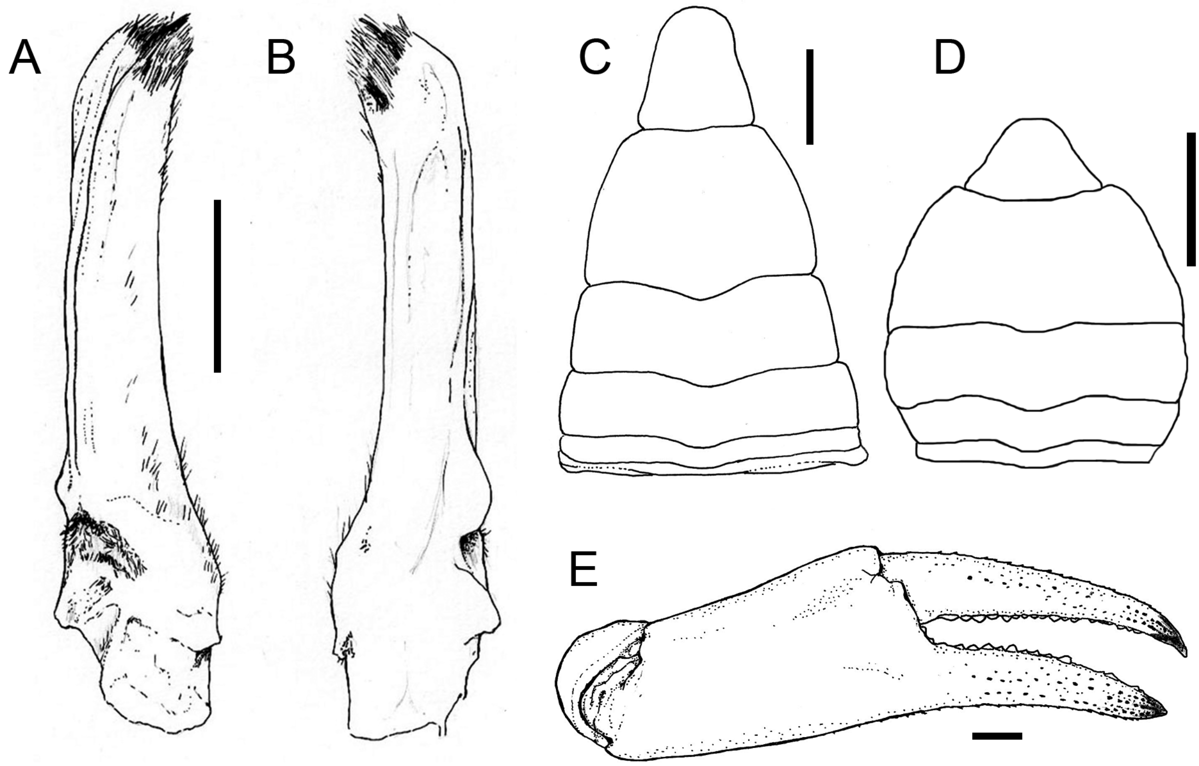

FIGURE 4. *Johngarthia cocoensis* **n. sp.**, holotype male, MZ-UCR-622-01, A, left male first gonopod, lateral view; Scale bar = 5 mm. B, same, mesial view; C, abdomen (segments 3–7), male, Scale bar = 10 mm; D, idem, female, Scale bar = 10 mm; E, right male cheliped (MZ-UCR-623-01, W 112.3 mm); Scale bar = 10 mm.

Meri and chela of chelipeds allometric, in specimens W ≥ 60 mm slightly surpassing carapace anterolateral border, in large males abnormally elongated, widely surpassing carapace anterolateral border; in specimens ≥60 mm surface of merus smooth, anterior proximal border furnished with 6 or 7 distinct teeth increasing in size distally, 3 sub-distal, 2 distal carpal teeth; surface, border of merus smooth in larger specimens.

Specimens < W 100 mm homochelous, males > W 100 mm slightly heterochelous (left palm bigger, biggest difference between palm length 20%), palms elongated, length may exceed W, flattened in height, width, interior-proximal with longitudinal furrow; dactyl, pollex elongated, drop shaped in cross section, gaping moderate in largest chela when closed, not crossing, with triangular teeth, terminal with 7 rows of nearly uniform, oblique conical teeth, arrangement of teeth more diffuse proximally, manus smooth.

Ambulatory legs stout, sparsely furnished with setae; merus triangular in cross section, ventral edges with strongly developed ridges, dentate; carpus pentagonal in cross-section, distal edges with spines; propodus rhomboidal in cross-section, edges strongly dentate; dactylus longitudinally ridged, with 6 rows of spines. Sternum wider than long, S1 triangular, exposed, S2 narrow, S1-S3 fused, indistinct, S2-S3 suture, S3 separated from S4; S4 widest; sulci between S3-S6 distinct, sternites fused at upper border of abdominal cavity, separated medially, fused again near midline; abdominal cavity with longitudinal suture in S6; upper border of abdominal cavity with patches of setae; all abdominal somites and telson distinct, freely articulating; first somite filling space between last pair of ambulatory legs, sixth somite longest, considerably longer than telson, telson sub-triangular, narrow; lateral margins nearly straight, tip rounded.

Male first gonopod (Fig. 4A, B) slightly sinuous from lateral view, relatively straight from mesial view, slender, stiff, heavily chitinized, surfaces concave, mesial suture indistinct, margin distinctly developed; cephalic surface with band of sparse setae, apical border lined with stiff setae, caudal process shorter than mesial process, close-fitting to mesial process from lateral view, separated by emargination in mesial view; mesial process of first gonopod prominently developed, end piece on a level with terminal setae; diagonal, triangular, convex, amber-colored, aperture sub terminal, opening in an external-longitudinal channel.

Color. In adults, carapace reddish brown, carapace pits creamy white. In juvenile specimens, carapace dark brown-purple, carapace pits white, chelipeds and ambulatory legs reddish, tips of fingers white (Fig. 1A, B).

Type locality. Costa Rica, Cocos Island, Manuelita Island.

Etymology. The species is named after the type locality (Cocos Island).

Comparisons. In *Johngarthia cocoensis* **n. sp.** the shape of the third maxilliped merus more closely resembles that of *J. malpilensis* than *J. planatus*. In *J. cocoensis* **n. sp.** and *J. malpilensis*, the V-shaped emargination of the third maxilliped merus is positioned laterally and the outer apical lobe is shorter than the inner apical lobe (Fig. 5B, C; 6D–I).

Johngarthia cocoensis **n. sp.** is distinguished from *J. planatus* by having the third maxilliped merus considerably longer than wide (Fig. 3; 5B; 6D–F), in *J. planatus* the third maxilliped merus is as long as wide or slightly longer (Fig. 5D; 6A–C). In *J. planatus* the carapace is more flattened than in *J. cocoensis* **n. sp.** (Tab. 1). In *J. cocoensis* **n. sp.**, the third maxilliped meri are so short that the inner apical lobes are mostly not overlapping in resting position and the third maxilliped palp is partly exposed (Fig. 3; 5B; 6D–F), while in *J. malpilensis*, these lobes are enlarged, mostly overlapping and conceal the third maxilliped palp (Fig. 5C; 6G–I). In *J. malpilensis* and *J. planatus* the base of the male first gonopod is relatively more compact and the apex relatively more slender from mesial and lateral views, the opposite condition is discerned when viewed from the caudal and cephalic views. In *J. cocoensis* **n. sp.** the male first gonopod is relatively much straighter (Fig. 4A, B). In *J. malpilensis* and *J. planatus* the surfaces of the are considerably more concave and the apex of the end piece is longer in relation to the male first gonopod than in *J. cocoensis* **n. sp.**

TABLE 1. Comparison of characters and measurements for *J. cocoensis* **n. sp.**, *J. malpilensis* and *J. planatus*; W , carapace width; H , carapace height; O , Orbit; P , pit at orbital angle; M , MXP3 merus; OL , M outer apical lobe; IL , M inner apical lobe; a, López-Victoria & Werding (2008); b, Rathbun (1918).

	J. cocoensis **n.sp.**	*J. malpilensis*	*J. planatus*
W/H	2.33± 0.06	2.41±0.07	2.6±0.05
Width O:P	1:2	1:3–1:4	1:3–1:4
M length/M width	1.23±0.05	1.07±0.08	1.01±0.03
Lateral border of OL	rel. straight	rel. straight	rounded
Size OL / IL	OL < IL	OL < IL	OL ≥ IL
Position of IL to each other (in resting position)	separated	overlapping	separated/ overlapping
Location emargination of M	lateral	lateral	median
Exposure of MXP3 palp	partly	concealed	concealed
Exposure of epistomial tooth	exposed	concealed	concealed
Spines at ambulatory legs	distinct	distinct	prominent
Maximum W (mm)	112.3	82[a]	104[b]

Johngarthia

Key to Pacific Ocean species of *Johngarthia*

1. Outer apical lobe of third maxilliped merus as long as or longer than inner apical lobe, outer apical lobe lateral border rounded (Fig. 5 D) . . . . *J. planatus*
- Outer apical lobe of third maxilliped merus shorter than inner apical lobe, outer apical lobe lateral border relatively straight . 2
2. Third maxilliped merus longer than wide, inner apical lobe not reaching epistomal tooth, lobes mostly separated in resting position, palp of third maxilliped merus partly exposed (Fig. 5 B) . . . . *J. cocoensis* **n. sp.**
- Third maxilliped merus as long as wide, inner apical lobe reaching epistomal tooth, lobes mostly overlapping in resting position, concealing palp of third maxilliped merus (Fig. 5 C). . . . . *J. malpilensis*

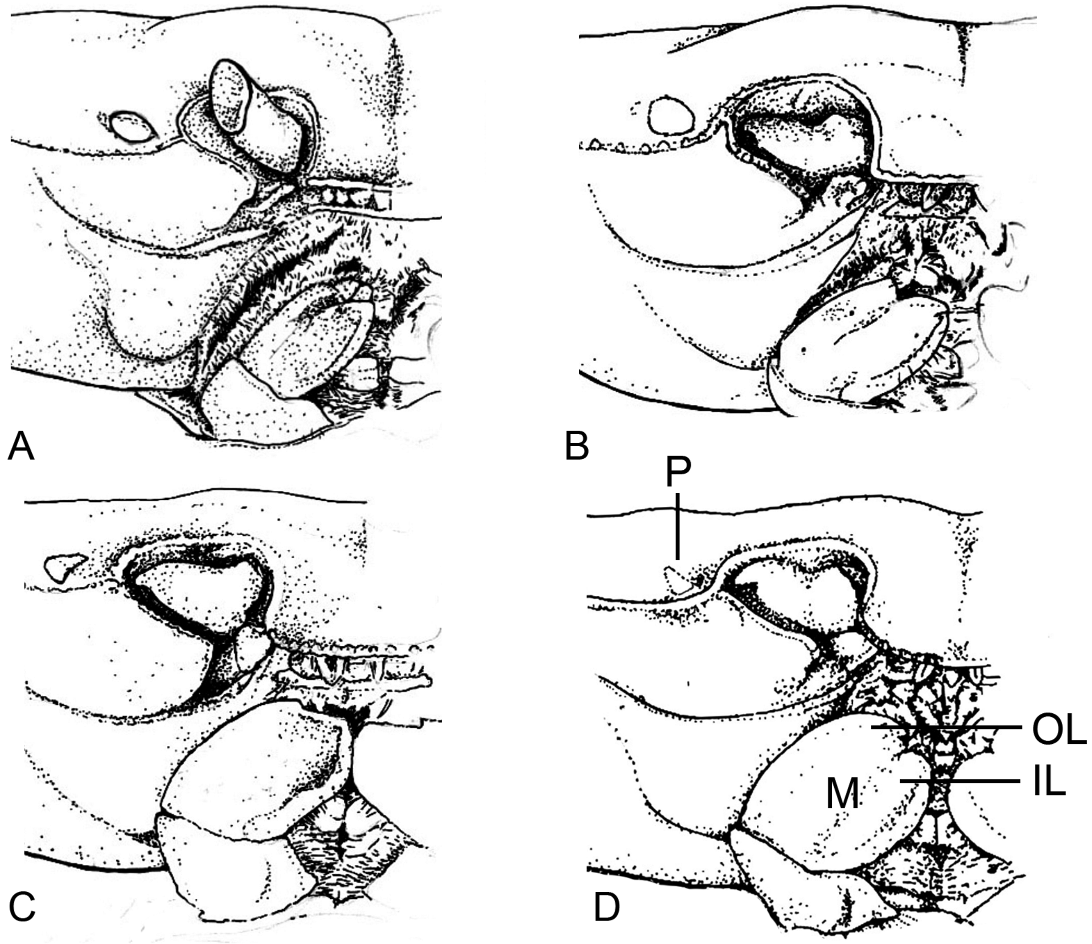

FIGURE 5. Frontal view (P , pit at orbital angle; M , merus of third maxilliped; OL , outer apical lobe of M; IL , inner apical lobe of M), A, *Gecarcoidea lalandii*, female, LACM, JWK-326 (Marshall Islands, Enewetak Atoll, Igurin I.); B, *Johngarthia cocoensis* **n. sp.**, paratype, female, MZ-UCR-623-01 (Manuelita I., Costa Rica); C, *Johngarthia malpilensis*, female, LACM (Malpelo I., Colombia); D, *Johngarthia planatus*, female, LACM (Clipperton I., Mexico).

Discussion

As in other groups with marine larvae, the biogeography of *Johngarthia* is influenced by larval dispersal by sea currents (see Hartnoll *et al.* 2006; Hartnoll 2010). The combination of events in the Eastern Pacific region such as the formation of the Panamanian land bridge about three million years ago, the subsequent changes of sea currents (reviewed by Schmidt 2007) and the emergence of the Coco I. about two million years ago (Castillo *et al.* 2008) is by far too complex to suggest any evolutionary scenario based on morphology alone. The similarity between *J. planatus*, the West Atlantic species *J. lagostoma* and the East Atlantic species *J. weileri* (enlarged outer apical lobe of third maxilliped merus, prominent spines at ambulatory legs) indicates that ancestors already have been dispersed between islands before the Isthmus of Panama closed and Cocos I. emerged. To make matters more complex, in *J. cocoensis* **n. sp.**, the exposure of the third maxilliped palp, the shape of the third maxilliped merus and the coloration of juveniles resemble the Western Pacific *Gecarcoidea lalandii* (H. Milne Edwards, 1837) (Figs. 1B, D; 5A, B). *Gecarcoidea* H. Milne Edwards, 1837, was erected based on an inner orbital border that is separated from the carapace front and a visible third maxilliped palp. Türkay (1973, 1974) had already mentioned that the separation of the inner angle of the ventral orbital border and the front is not a consistent character for *Gecarcoidea*; these regions may be separated or can form a continuous transition. The possibility of a relationship between *G. lalandii* and *J. cocoensis* **n. sp.** is supported by the possibility of long distance dispersal by the larvae of a common ancestor of *G. lalandii* and *J. cocoensis* **n.sp.** between the western Pacific and the Tropical Eastern Pacific region (Fig. 7).

Such dispersal has been previously suggested for sea urchins (Lessios *et al.* 1996), corals (see Cortes 1997) and marine crabs (Castro 2000).

Nevertheless *Gecarcoidea* is distinguished from *Johngarthia* by having a male first gonopod endpiece which is distinctly wider than long (Türkay 1974) and differences in orbital structures (Tavares 1991).

The distinctness of forms on relatively close islands like Cocos I. and Malpelo I. also indicate that dispersal and successful recruitment on other islands are exceptional events. Studies about dispersal of planktonic larvae demonstrate that self-recruitment could play an important role in population dynamics of organisms with marine larvae (Jones *et al.* 1999; Sponaugle *et al*. 2002; Christie *et al*. 2010).

FIGURE 6. Frontal view (differences in shape of the third maxilliped merus are indicated by arrows; the meri of specimens stored in ethanol are often not in resting position) A, *Johngarthia planatus*, male, W 82.67 mm, LACM-170 (San Benedicto I., Mexico); B, idem, male, W 104 mm, USNM 20650 (María Cleofas I., Mexico); C, idem, male, W 90.15 mm, USNM 19646 (Clipperton I.); D, *Johngarthia cocoensis* **n. sp.**, holotype male, W 89.85 mm, MZ-UCR-622-01 (Cocos I., Costa Rica); E, idem, male, W 112.3 mm, MZ-UCR-623-01 (Manuelita I., Costa Rica); F, idem, female, W 34.7 mm, MZ-UCR-2401-06 (Cocos I., Costa Rica); G , *Johngarthia malpilensis*, male, W 68.08 mm, LACM (Malpelo I., Colombia); H, idem, female, W 74.9 mm, LACM, (Malpelo I., Colombia); I, idem, female, W 48.23 mm, LACM (Malpelo I., Colombia).

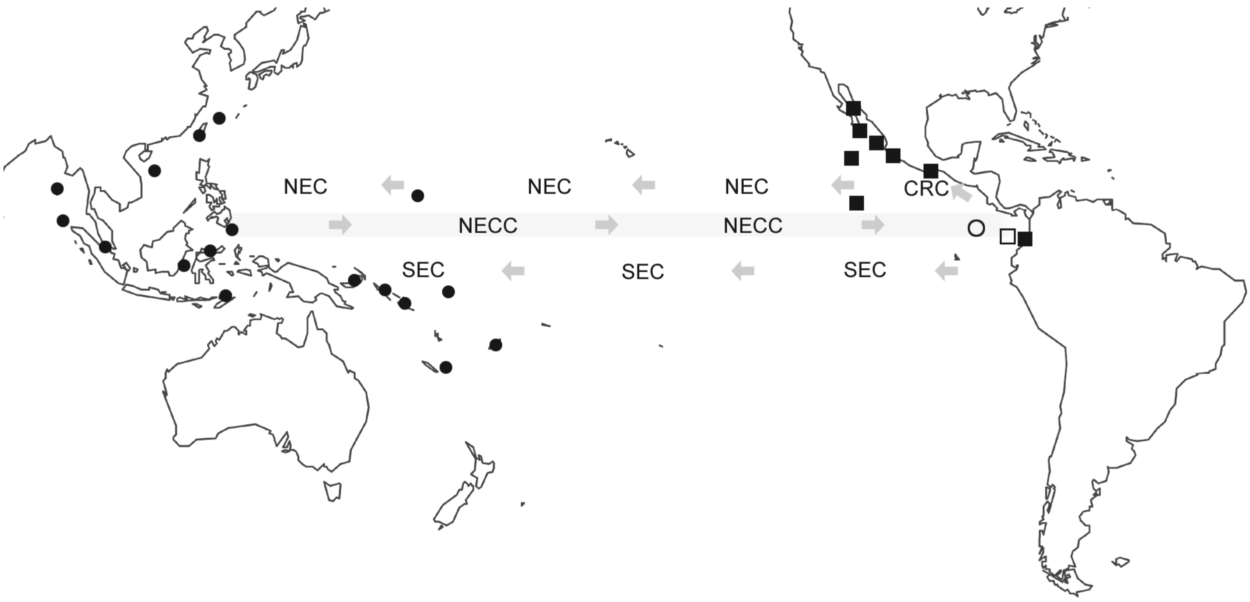

FIGURE 7. Geographical distribution (partly adapted from Türkay,1974), (●) *Gecarcoidea lalandii*; (○) *Johngarthia cocoensis* **n. sp.**; (□) *Johngarthia malpilensis;* (■) *Johngarthia planatus*; main sea currents (modified from McPhaden et al. 1998): (NEC) North Equatorial Current; (NECC) North Equatorial Countercurrent; (SEC) South Equatorial Current; (CRC) Costa Rica Coastal Current.

Another explication for the evolution of distinct taxa could be that different ecological conditions in the islands prevent a successful establishment of other populations. Cocos I. is distinguished by having soil, which is needed to construct burrows, and covered with rainforest (Trusty *et al*. 2006), whereas Clipperton and Malpelo islands have little soil and comparatively sparse vegetation (Jost & Andréfouët 2006; López-Victoria & Werding 2008; Bouchard & Poupin 2009). The ecological differences are also indicated by the occurrence of *Cardisoma crassum* in Cocos I. (Gomez 1977) and its absence in Clipperton, Revillagigedo and Malpelo islands. *Cardisoma crassum* is distributed on the west coast of Central and South America (Türkay 1970) and constructs burrows that descend to groundwater or burrows in moist soils (Gifford 1962; Herreid & Gifford 1965). While *J. planatus* does not seem to occur in Cocos Island, the presence of *C. crassum* and the new species of *Johngarthia* highlights the unique ecological character of this island.

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