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Halacaridae (Acari) from Pujada Bay (the Philippines): description and biogeography of three new and two known species

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Abstract

Three new and two known Halacaridae species belonging to the genus *Copidognathus* collected among seagrass plants in Pujada Bay (Mindanao, the Philippines) are described. *Copidognathus ivanomorsellii* sp.n. belongs to the '*Copidognathus gibbus*' group and shows the main characteristics of the group but differs from known species as the two triangular porose areolae on AD are joined together, the typical shape of the lateral line of the costae of PD, the distance between the anterior gland pore on PD and the lateral margin of PD, tarsi III and IV with 4:4 dorsal setae, ventral seta on trochanter III almost as long as ventral seta of basifemur III, anterior end of AD with rosette pores, AE and GA only laterally fused but separated in the middle portion and elongated frontal spine (projection) on AD, lateral claws with very fine pecten ventrally. A zoogeographical distribution of the '*C. gibbus*' group is reported. *Copidognathus pujadus* sp.n. belongs to the '*Copidognathus bairdi*' group and is loosely related to *C. sideus* Bartsch, 1982, *C. sidellus* Bartsch, 1985 and *C. euryalus* Bartsch, 1997b. Differences were observed and are discussed. *Copidognathus philippinensis* sp.n. belongs to the '*Copidognathus curassaviensis*' group but differs from the four known species within the group by the elevated ridge below the middle two areolae on AD area which connects the two areolae. In addition, two known species i.e. *Copidognathus uniscutatus* Bartsch, 1984, *C. faubeli* Bartsch, 1986 were collected. The Halacaridae fauna recorded so far from the Philippines is summarised and discussed.

Abbreviations: AD – anterior dorsal plate; AE – anterior epimeral plate; ds – dorsal setae of idiosoma; ds1–ds6 – dorsal setae 1–6; EP – epimeral process; GA – genito-anal plate; GO – genital opening; OC – ocular plate; PAS – parambulacral setae; PD – posterodorsal plate; PGS – perigenital setae; PE – posterior epimeral plate; P1–P4 – first to fourth palpal segment; SGS – subgenital setae; VS – ventral seta

Introduction

Talker et al. (1981) described an *Agauopsis* species in their paper on intertidal mites from Cebu Island, the Philippines. Later, Bartsch (1983, 1984, 1985a, 1986, 1991) published a series of papers on Halacaridae from the Philippines. She described 18 new species from the area.

In the paper at hand, three new species and two known species are described from Pujada Bay, the Philippines.

Materials and methods

During June 1998, an intensive meiofauna sampling campaign was carried out in Pujada Bay on the southern island Mindanao of the Philippines. Pujada Bay is located at the southern tip of Mindanao, about 157 km east-southeast of Davao City, along the coast of the province of Davao Oriental. Samples were taken at the north-eastern coast of Pujada Bay, close to a small community called Guang-guang. Guang-guang point is a small embayment of approximately 39 000 m^2,

bordered by mangroves. The site lies between 6° 56′ N latitude and 126° 15′ and 126° 17′ E longitude. Wide sandy flats and seagrass beds are exposed during spring low tides within a shallow lagoon (1–2 m deep) separating the reef flat from the shore. These areas are subjected to semidiurnal tides just like the neighbouring islands of the Philippines archipelago. Some small rivers flow into Pujada Bay but no freshwater influence could be noted in the sampling site at Guangguang.

Meiofauna samples were taken from seagrass plants in the intertidal and subtidal zone. The halacarid specimens at hand were recovered from root and leaf samples of *Halodule uninervis* (Forsskål) Ascherson, *Halophila minor* (Zollinger) den Hartog, *Syringodium isoetifolium* (Ascherson) Dandy and *Thalassia hemprichii* (Ehrenberg) Ascherson. Samples were taken by placing a PVC meiocore (inner diameter 3.6 cm, surface of 10 cm^2) over one seagrass plant while snorkelling as the maximum depth was about 2 m. After narcotization with an 8% $MgCl_2$-solution, samples were washed in the field with freshwater over a 1 mm sieve and retained on a 38 μm sieve. Meiofauna samples were preserved with a warm (60 °C) formaldehyde solution to a final concentration of 4%. In the laboratory, samples were rinsed with a jet of freshwater over a 1 mm sieve, then decanted ten times over a 38 μm sieve, centrifuged three times with Ludox HS40 (specific density 1.18) and finally stained with Bengal Rose. Meiofauna taxa were sorted using a Wild M5 binocular. Halacarid mites were stored in 75% ethanol and later cleared in lactic acid and mounted in glycerine jelly slides for taxonomical purpose.

Drawings were prepared using a camera lucida (type Sipcon SP-14, microscope type Olympus GB). Type specimens are deposited in the Acari collection of the Royal Belgian Institute of Natural Science (KBIN-IRSNB, Brussels, Belgium) under number 29358.

Results and discussion

Subfamily Copidognathinae Bartsch 1983

***Copidognathus ivanomorsellii* sp.n.** (Figs 1A–L and 2A–F)

Type material One female holotype

Etymology
Named after Dr Ivano Morselli (Italy) for his constant encouragement in the present research.

Type locality
Pujada Bay, the Philippines, among *Thalassia hemprichii* seagrass plants.

Description
Female: Idiosoma 288 μm long. All dorsal plates separate. AD with a raised 'A'-shaped anterior area, with a frontal spine and hyaline flaring flanges on the lateral sides. Two triangular areola on AD joined together at their base by a narrow isthmus, forming a valley in between (Figs 1A and 2A). Posterior to areolar area faintly reticulated; pits present towards the lateral margin of AD near the OC. About 8 rosette pores found on the frontal spine. Distance between frontal spine and posterior margin of middle areolae 72 μm. Dorsal seta 1 (ds1) anterior to the valley shaped areola on AD. OC 88 μm long, posteriorly caudiform going beyond the insertion of leg III. ds2 on the anteromedian portion of OC. Anteriorly OC with two corneae, about 10 rosette pores between two corneae, rest of the portion of OC reticulated (Fig. 1E). Pits present on the reticulation, gland pore and pore canaliculas present on the lateral side below the corneae (Fig. 1E). PD with two costae, costae anteriorly divergent bending towards the lateral margins, costae two rosette pores wide. Costae on posterior portion swollen, about 3 rosette pores wide in the swollen part. Gland pore present near the lateral margin of costae at the middle portion of PD; gland pore and lateral margin of costa away from lateral margin of PD. Area between costa and lateral margin of PD prominently reticulated (Fig. 1A). ds3 present anteriorly on PD, away from the anterior margin of PD, above the costae. ds4 and ds5 present on the costae (Fig. 1F). Area between two costae faintly reticulated; prominent pits present on the anterior half.

AE and PE fused laterally but medially separated. AE with three pairs of setae. An elongated porose areola present near the coxal region of epimera I, areola extends beyond the level of epimeral gland pore present below the epimera II (Fig. 1D). Porose areolae with 4–7 canaliculi present in group, few ostia also present on the lateral side of the areolae. PE with 3 ventral and one dorsal seta, marginal areola present. Perigenital areolae well-developed, three rosette pores wide extends anteriorly up to level of insertion of leg IV and much beyond the anterior end of GO (Figs 1A, G). Area between paragenital areolae and lateral

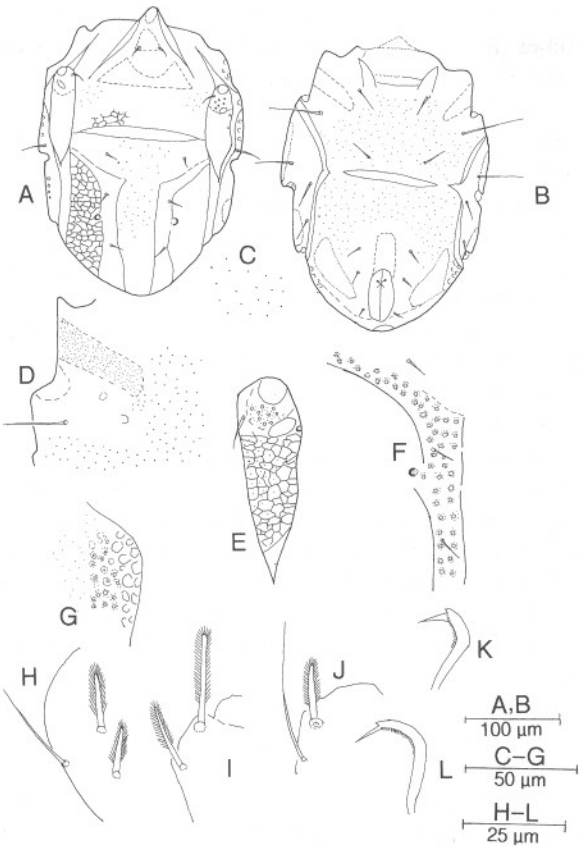

Figure 1. Copidognathus ivanomorsellii sp.n. ♀(A) idiosoma (dorsal); (B) idiosoma (ventral); (C) detail of middle portion of AE; (D) detail of portion of AE showing near vs2; (E) OC; (F) detail of anterior portion of costae on PD; (G) detail of anterior portion of paragenital areola; (H) ventral setae of tibia I; (I) ventral pectinate setae of tibia II; (J) ventral setae of tibia IV; (K) lateral claw of leg I; (L) lateral claw of leg IV.

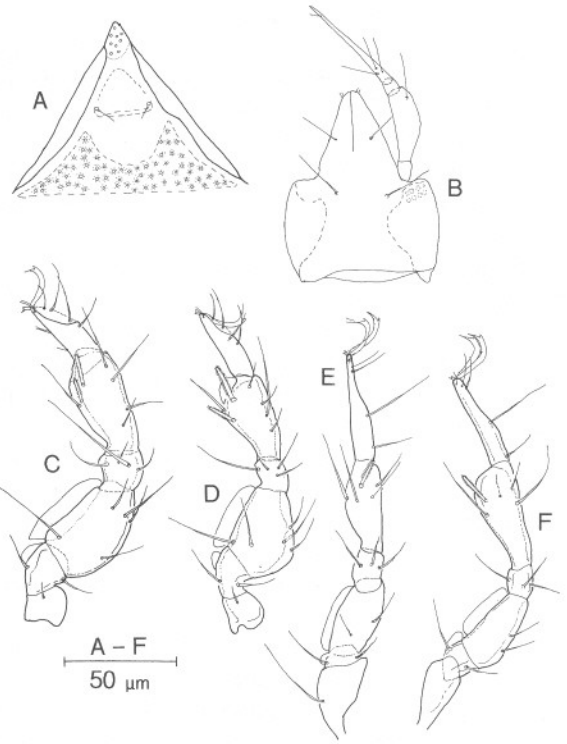

Figure 2. Copidognathus ivanomorsellii sp.n. ♀(A) detail of areolae on AD; (B) gnathosoma; (C) leg I; (D) leg II; (E) leg III; (F) leg IV.

margin of GA foveated. GO 42 μm long. Ovipositor extends anteriorly subequal with the length of GO. Three pairs of PGS and one pair of SGS present. The distance between anterior end of GO and that of GA about 2.3 times the length of GO. Besides areolar portion, rest of the portion of ventral plates almost uniformly punctuated. Rostrum little smaller than gnathosoma base. Ventrolateral side of the gnathosoma porose. Palp consists of four segments, P4 longest. P4 longer than P2 and P3 together. P3 without any seta, P4 with three basal and one distal seta, P2 with one dorsal seta. One pair of proto-, deuto-, trito- and basirostral setae present. Rostral sulcus extends beyond the pair of tritorostral setae (Fig. 2B). Leg chaetotaxy: Trochanter 1-1-1-0, Basifemur 2-2-2-2, Telofemur 5-5-2-2, Patella 4-4-3-3, Tibia 7-7-5-5.

All basifemora with small fungiform lamella ventrolaterally; all telofemora with hyaline ventrolateral lamella; all tibiae with hyaline anteromedial lamella. Tibiae I and II with three ventromedial setae (of which two bipectinate and one filiform). Tarsus I with 4 dorsal setae, one solenidion, one profamulus, three ventral setae (one posteriorly and two anteriorly) besides two doublets PAS. Tarsus II without any ventral seta. Tarsi III and IV with 4 dorsal setae. The distance between two basal dorsal setae more than the height of tarsus. Anterior basal setae longer than posterior basal seta. Ventral seta of trochanter III subequal with ventral setae of basifemur and ventral filiform seta of tibia III of that leg. Trochanter III and IV very high, triangular. Ventral seta on telofemora III and IV absent.

All legs with two lateral claws and a small median bidentate claw. All lateral claws with small accessory processus dorsally, very faintly pectinate ventrally (pecten only clear at higher magnification).

Differential diagnosis

Copidognathus ivanomorsellii sp.n. is a member of the '*Copidognathus gibbus*' group. The main character-

istics of this '*gibbus*' group were reported by Bartsch (1997a).

Among different members of the '*gibbus*' group this species is closely related to *C. cataphractus* (Trouessart, 1899), *C. mesomorpha* André, 1959, *C. caelatus* Bartsh, 1994a, *C. ampliatus* Bartsch, 1994a, *C. multiporus* Bartsch, 1994a, *C. strictulus* Bartsch, 1997a.

Posterior part of AD and anterior part of PD foveated in *C. cataphractus* but almost smooth in the present specimen. In *C. cataphractus* anterior end of costae on PD almost touching/closer to the anterior margin of PD, but in present case away from the anterior margin of PD.

'A' shaped area on AD more elongated in *C. mesomorpha* than in the present species. Areolar area on AD wider in the described species than in *C. mesomorpha*. The distance between posterior part of areolae and posterior margin of AD wider in present case.

A detailed comparison between the species at hand and *C. mesomorpha* or *C. cataphractus* remains impossible until a detail redescription of *C. cataphractus* and *C. mesomorpha* is given after collection of fresh specimen from Gulf of Suez and Djibouti, respectively.

C. ivanomorsellii sp.n. differs from *C. caelatus* on following points.

Two triangular porose areolae on AD joined together in present case but not joined in *C. caelatus*. Pair of ds3 in *C. caelatus* closer to the anterior margin of PD but in present species ds3 away from anterior margin of PD. Shape of lateral line of costae differs in two species. Anterior gland pore on PD much closer to lateral margin of PD in *C. caelatus* but further away in our material.

Tarsi III and IV bears 4:3 dorsal setae in *C. caelatus* but 4:4 dorsal setae in the present case. Ventral seta on trochanter III in *C. caelatus* smaller than ventral filiform seta of tibia III; but in *C. ivanomorsellii* sp.n. the ventral seta on trochanter III almost as long as ventral seta of basifemur III and ventral filiform seta of tibia III. Ventral pecten on lateral claws longer in *C. caelatus*.

Differences with *C. strictulus*: The outline of costae on PD differs between both species. ds3 in the present case away from anterior margin of PD but in *C. strictulus* it is nearer to the anterior margin of PD. Anterior end of AD foveated in *C. strictulus* but in present case rosette pores present. The distance between anterior end of GO and that of GA is 2.8 times GO length in *C. strictulus* but in the present case it is about 2.3 times. In *C. strictulus* tarsi III and IV with 4:3 dorsal setae but 4:4 dorsal setae in *C. ivanomorsellii* sp.n..

Copidognathus ampliatus Bartsch 1994 and *C. multiporus* Bartsch 1994 can be easily differentiated from the present species.

In *C. multiporus* all ventral plates are fused, in *C. ampliatus* AE and GA completely fused. In *C. ivanomorsellii* sp.n. AE and GA only laterally fused but separated in the middle portion.

Anteriorly divergent two costae on PD bring present species close to *C. longispinus* Bartsch & Iliffe 1985, *C. crassispinus* Bartsch, 1994, *C. vicinus* Bartsch, 1997 and *C. piger* Bartsch (in press).

C. longispinus and *C. crassispinus* readily differ from *C. ivanomorsellii* sp.n. as the first two species have: long elongated frontal spine on AD, which is not that long in the present case. Shape of areolae on AD also completely different.

In the case of *C. vicinus* – frontal spine on AD more elongated, areolae on middle of AD very small and not joined with each other – but in the present case these are joined. Costae on PD narrow in *C. vicinus*. Porose areolae near coxa II on AE is not so well-developed in *C. vicinus*.

Differences with *C. piger*: in *C. piger* costae on PD approximately 4 rosette pores wide while about two rosette pores wide could be observed in our material. Anterior areola on AD more elongated in *C. piger* and contain more rosette pores. Both triangular areolae on AD higher in *C. piger*. In *C. piger* ds1 long and on the anterior end of middle areola but short and away from the anterior end of middle areolae in *C. ivanomorsellii* sp.n.. Porose area near coxa II on AE bigger in present species. Arrangement of canaliculi on ventral plate differs also between both species. Well-developed paragenital areolae made up of rosette pores found in *C. ivanomorsellii* sp.n. but in *C. piger* lateral side foveated. VS2 longer than VS1 and VS3 in the present species but in *C. piger* they are almost equal. Areolae on OC and reticulation more prominent in *C. ivanomorsellii* sp.n..

Bartsch (1984) recorded a *Copidognathus* sp. from the Philippines belonging to the '*gibbus*' group. Present species resembles to that but *Copidognathus* sp. has more elongated frontal spine (projection) on AD. Detailed comparison is not possible because leg and ventral portion of idiosoma has not been drawn in *Copidognathus* sp. and a detailed description is lacking.

Zoogeographical distribution of Copidognathus gibbus – *group*

A brief survey of the '*gibbus*' group was given by Bartsch (1985b, 1997a). Table 1 gives an overview of the detailed records of the '*gibbus*' group including habitat and references.

Newell's (1984) key group 4000 (extension 4001, 4003) were all species that belong to the *gibbus* group.

Sixteen species of the *gibbus* group are known from the Indian Ocean – *viz. C. ampliatus*, *C. bispinus*, *C. bistriatus*, *C. caelatus*, *C. canaliculifer*, *C. crassispinus*, *C. dubiosus*, *C. gibboides*, *C. gibbus*, *C. laminifer*, *C. longispinus*, *C. multiporus*, *C. nasutus*, *C. piger*, *C. punctellus*, *C. strigellus*. This number will increase when specimens of the '*gibbus*' group which are present in the first author's collection will be published. This collection contains species of the '*gibbus*' group from Arabian Sea, Bay of Bengal and will be published in the near future.

Fifteen species recorded from the Western Pacific Ocean – *viz. C. aenigmatus*, *C.asketus*, *C. canaliculifer*, *C. daguilarensis*, *C. ivanomorsellii*, *C. lamelliger*, *C. lubricus*, *C. mactanus*, *C. scutellus*, *C. seductus*, *C. strictulus*, *C. squarrosus*, *C. strigellus*, *C. thompsoni*, *C. vicinus*.

Twelve species are known from the eastern Pacific Ocean: *C. aerolatus*, *C. chilensis*, *C. crusoei*, *C. cumberlandi*, *C. felicis*, *C. fernandezi*, *C. glareus*, *C. incarinatus*, *C. simplipes*, *C. sinuosus*, *C. subgibbus* and *C. ventriscutatus*.

From the Atlantic Ocean (including Mediterranean Sea) only 6 species known *viz. C. culifer*, *C. cristatus*, *C. longispinus*, *C. gibbus*, *C. majusculus*, *C. remipes*.

One species *viz. C. acanthophorus* is known from Antarctic waters.

C. longispinus recorded from the western Atlantic and the south-eastern Indian Ocean; *C. strigellus* and *C. canaliculifer* recorded from the eastern Indian and the western Pacific Ocean. *C. gibbus* reported from the north-eastern Atlantic and the north-western Indian Ocean.

Table 1 also shows that most of the '*gibbus*' group species were found in intertidal to shallow subtidal waters, though some species (*viz. C. felicis*, *C. fernandezi*, *C. gibbus*, *C. sinuosus*, *C. subgibbus*) were also recorded from 100 m or deeper. *C. gibbus* recorded from the intertidal zone to more than 300 m depth.

***Copidognathus pujadus* sp.n.** (Figures 3A–E and 4A–E)

Type material
One male holotype, four males and one female paratypes.

Etymology
Named after the type locality, Pujada Bay (the Philippines).

Type locality Pujada Bay, the Philippines; two males and one female among the seagrass *Halodule uninervis*, two males among *Halophila minor* and one male among *Thalassia hemprichii*.

Description Male: idiosoma 293–314 μm long. All dorsal plates separate. AD with three porose areolae (consists of modified rosette pores), one elongated anteriorly and two rounded in the middle, near the posterior margin also few rosette pores present. Each rosette pore consists of moderately developed ostium and many canaliculi in and around it. Anterior areola with about 20 rosette pores arranged in three to four lines; middle areolae rounded, each of them consists of 12–20 rosette pores. ds1 anterior to the middle areolae. Middle two areolae are not very close but away from each other (Fig. 3A,D). A pair of gland pores almost at the level of ds1 placed laterally on AD. OC tapers posteriorly extends little beyond the level of insertion of leg III. OC anteriorly with two corneae. Areolae present near the corneal zone and in the posterior portion of OC. ds2 on anteromedian margin of OC.

PD broad about 1.4 times longer than wide. Two middle costae and two paracostae on PD. ds3 present at the anterior end of PD near the lateral side of middle costae, between middle and paracostae. ds4 between middle and paracostae just above the level of insertion of leg IV. ds5 below the level of insertions of leg IV. The distance between ds3 and ds4 90 μm, and distance between ds4 and ds5 33 μm. The distance between ds3 and ds4 more than twice (about 2.7 times) the distance between ds4 and ds5. Middle costae swollen below the ds5 and contain anterior gland pore of PD; another gland pore and swelling present at the posterior end. Middle costae two rosette pores wide but at the swelling place three rosette pores wide. Paracostae two rosette pores wide. Rosette pores with moderately developed ostium and 5–8 canaliculi around it. Membranous cuticle between AD and PD with parallel striae.

All ventral plates separate. Ventral plates porose, 4–5 canaliculi present in small groups. Marginal are-

Table 1. Zoogeographical distribution of '*Copidognathus gibbus*' group

Species name	Sampling site	Habitat	Major reference
1. *Copidognathus acanthoporus* Viets	South Georgia, Anvers Isl., Palmer Peninsula	algae, bryozoans, brachiopods, 12–13 m	Viets (1950); Newell (1984); Pugh (1993); Bartsch (1993)
2. *C. aenigmatus* Otto	coral sea, South Willist Island, Lihou reef, Flinder's reef, Australia	coral rubble, coarse sand, 0–10 m	Otto (2000)
3. *C. ampliatus* Bartsch	Little Armstrong Bay, Rottnest Isl., Australia	seagrass *Amphibolis* overgrown with epiflora and epifauna. 0.5 m depth	Bartsch (1994)
4. *C. areolatus* Bartsch	Wainiha Bay, Hawaii Isl.	intertidal red algae	Bartsch (1989)
5. *C. asketus* Otto	loadstone reef, Elizabeth reef, Myrmidon reef, Brambel reef, John Brewer reef, young reef, Faradey reef, Australia	coarse sand, rubble with *Halimeda*	Otto (2000)
6. *C. bispinus* Bartsch	Duffield Ridge, Rottnest Isl., Australia	sediment from 30 m depth	Bartsch (1994)
7. *C. bistriatus* Bartsch	Fish Hook Bay, Rottnest Isl., Australia	corallines edge of rocky platform, tidal low water edge	Bartsch (1994)
8. *C. caelatus* Bartsch	Bickley Point, Little Armstrong Bay, Rottnest Isl., Australia	*Amphiroa* and other corallines from vertical rock surfaces	Bartsch (1994)
9. *C. canaliculifer* Bartsch	Fish Hook Bay, Rottnest Isl., Australia	small bushy algae, *Zonaria*	Bartsch (1994)
	Young reef, Howard Patch, Load Stone reef, Bramble reef, Lizard Island, Horse Shoe reef	coarse sand	Otto (2000)
10. *C. cataphractus* (Trouessart)	Djibouti	intertidal	Trouessart (1899, 1900); André (1938, 1959)
11. *C. caulifer* (Trouessart)	Chile, Brazil, Bahia, – Caldera (Pacific Ocean)		Trouessart (1899, 1900); Lohmann (1901)
12. *C. chilensis* Newell	Chile: 16 km south of Punta Arenas; Fuerte Bulnes (about 57 km southwest of Punta Arenas); Punta Caldera, Arica	different algae, on *Mytilus* and barnacles, intertidal	Newell (1984)
13. *C. crassispinus* Bartsch	Little Armstrong Bay, Rottnest Isl., Australia	30 cm sediment from slope	Bartsch (1994)
14. *C. cristatus* Viets	Curaçao (Atlantic Ocean)		Viets (1936)

Table 1. Continued

15.	*C. crusoei* Newell	San Juan Bautista Bay, Robinson Crusoe Isl., Chile; Carvajal Bay, Anton Bruun Stn. 33° 38′ S, 78° 46′ W	green algae in brackish tidal pool; intertidal rocks; also recorded from 210 m depth	Newell (1971)
16.	*C. cumberlandi* Newell	Robinson Crusoe Isl., Juan Fernandez Isl., Chile	coralline red algae, intertidal	Newell (1971, 1984)
17.	*C. daguilarensis* Bartsch	Hong Kong, Cape d'Aguilar	rhizoids from *Sargassum* sp., 20 cm depth	Bartsch (1997a)
18.	*C. dubiosus* Bartsch	Nancy cove, Rottnest Isl., Australia	sediments and algae intertidal	Bartsch (1994)
19.	*C. felicis* Newell	Anton Bruun Stn., 26° 20′ S, 80° 02′ W, San Felix Isl., Chile	160–170 m depth	Newell (1971, 1984)
20.	*C. fernandezi* Newell	Anton Bruun Stn., 33° 38′ S, 78° 48′ W, Cumberland Bay, Robinson Crusoe Isl., Juan Fernandez Isl., Chile	0–100 m depth, intertidal on algae and rocks	Newell (1971, 1984)
21.	*C. gibboides* Bartsch	Galapagos Isl., Pacific Ocean	intertidal, interstitial	Bartsch (1977b)
22.	*C. gibbus* (Trouessart)	Ireland, French Atlantic coast, Italy, Djibouti	intertidal to 318 m depth on algae, barnacles, mussels, bryozoans and sediment	Trouessart (1889); Bartsch (1977a); Morselli & Mari (1984); Green & Macquitty (1987); Somerfield 1991
23.	*C. glareus* Newell	Chile, Fuerte Bulnes; 15 km southeast of Puerto Montt; Tierra Azul; Viña del Mar; Valparaiso; Chile	intertidal, very coarse sand, low to mid tide, red algae and tide	Newell (1984)
24.	*C. incarinatus* Newell	Tierra Azul, about 15 km southeast of Puerto Montt, Vina de Mar; Valparaiso; Chile	on mussels and algae	Newell (1984)
25.	*C. ivanomorselli* n.sp.	Pujada Bay, Guang-guang (Mindanao Isl., the	among intertidal seagrasses	present study
26.	*C. lamelliger* Sokolov	Japanese Sea, Pacific Ocean	–	Sokolov (1952) (based on a protonymph only)
27.	*C. laminifer* Bartsch	Duffield Ridge off Rottnest Isl., Australia	sediment from 30 m depth	Bartsch (1994)
28.	*C. lineatus* Bartsch	Galapagos Isl.	intertidal, interstitial	Bartsch (1977b)
29.	*C. longispinus* Bartsch & Iliffe	Bermuda Andaman Isl., Bay of Bengal	at 6–8 m depth in main pool at cave entrance of Walsingham cave; intertidal coralline algae, *Jania rubens*	Bartsch & Iliffe (1985) Chatterjee (1995)

Table 1. Continued

30.	*C. lubricus* Bartsch	Pipikeretu Beach, New Zealand	among *Mytilus*	Bartsch (1985b)
31.	*C. mactanus* Bartsch	Mactan Isl., the Philippines	at 45 m depth	Bartsch (1985b)
32.	*C. majusculus* (Trouessart)	French Mediterranean coast	–	Trouessart (1894b); Viets (1940); André (1946); Morselli (1969)
33.	*C. mesomorpha* André	Gulf of Suez	intertidal	André (1959)
34.	*C. multiporus* Bartsch	Little Armstrong Bay, Rottnest Isl., Australia	seagrass *Amphibolis* with dense epiflora and epifauna	Bartsch (1994)
35.	*C. nasutus* Bartsch	Fish Hook Bay, Rottnest Isl., Australia	intertidal beaches with sand and gravel	Bartsch (1994)
36.	*C. piger* Bartsch	East coast of Burrup Peninsula, Watering cove, Australia	turf on *Avicennia* pneumatophore	Bartsch in press
37.	*C. punctellus* Bartsch	Nancy cove, Rottnest Isl. Australia	shoreline platform, sand and algae (*Cystophora*, Fucales) with dense epiflora	Bartsch (1994)
38.	*C. remipes* (Trouessart)	English Channel (Britanny), French Atlantic coast, the Azores and the Mediterranean	intertidal, subtidal on algae, barnacles, sediment. Also reported from brackish water	Trouessart (1894a, 1894b); Lohmann (1901); Viets (1940); André (1946); Bartsch (1977a); Green & MacQuitty (1987)
39.	*C. scutellus* Bartsch	Mactan Isl., the Philippines	at 45 m depth	Bartsch (1985b)
40.	*C. seductus* Otto	coral sea, Lihou reef, Flinders reef, Australia	sand, 8 m depth	Otto (2000)
41.	*C. simplipes* Newell	Valparaiso, Chile	*Mytilus* with coralline red algae	Newell (1984)
42.	*C. sinuosus* Newell	Anton Bruun Stn. 33° 38′ S, 78° 48′ W 33° 38′ S, 78° 46′ W, Carvajal Bay, Robinson Crusoe Isl., Juan Fernandez Isl., Chile	62–210 m depth, also on coralline algae, intertidal	Newell (1971, 1984)
43.	*C. squarrosus* Otto	coral sea, Lihou reef, Flinders reef, Australia	sand, 5-10 m, also on *Halimeda* flanks at 15 m	Otto (2000)
44.	*C. strictulus* Bartsch	Mirs Bay, outside Tolo Channel, Hong Kong	7–10 m depth, dead coral blocks	Bartsch (1997a)
45.	*C. strigellus* Bartsch	Fish Hook Bay, Rottnest Isl., Australia	1–1.5 cm thick corallines (*Amphiroa*) on edge of shoreline platform	Bartsch (1994)
		Mirs Bay, Outside Tolo channel, southern China	7-10 m depth, dead coral blocks	Bartsch (1997a)

Table 1. Continued

46.	*C. subgibbus* Newell	Anton Bruun Stn. 26° 20′ S, 80° 02′ W, San Felix Isl., Chile	160–170 m depth on submarine slope	Newell (1971, 1984)
47.	*C. ventriscutatus* Bartsch	Anaeho'omalu Bay, Hawaii Isl.	0 m, medium coarse sand	Bartsch (1989)
48.	*C. thompsoni* Otto	Rosser reef, Australia	sand and rubble, 4 m depth	Otto (2000)
49.	*C. vicinus* Bartsch	outside entrance of Telegraph Bay; Cape d'Aguilar; Mirs Bay, outside Tolo Channel, Hong Kong	7-10 m depth, silty, heterogenous shell sand, gravel and dead coral blocks	Bartsch (1997a)

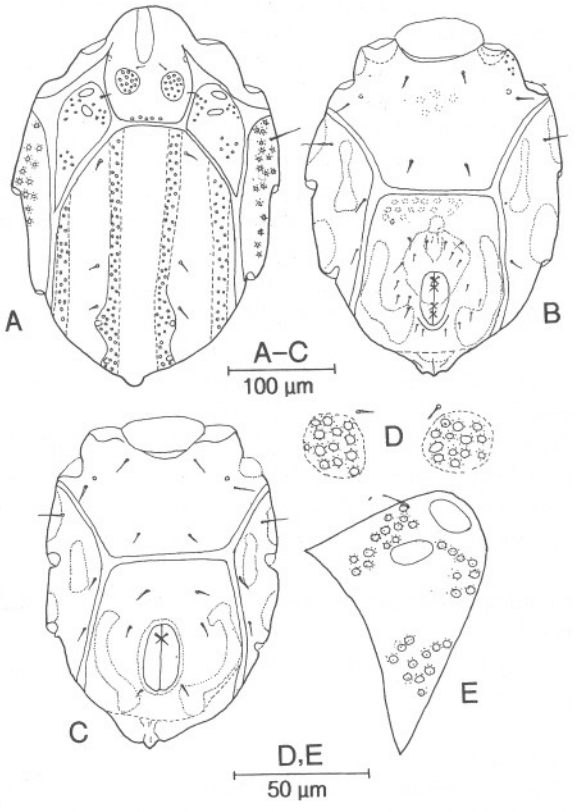

Figure 3. Copidognathus pujadus sp.n. (A) idiosoma (dorsal) ♂; (B) idiosoma (ventral) ♂; (C) idiosoma (ventral) ♀ C; (D) detail of central two areolae on AD; (E) OC.

olae present on coxa I. Three pairs of setae on AE. Epimeral process absent. Each PE ventrally with one areolar area (Fig. 3B). PE with three ventral and one dorsal seta. GA anteriorly truncated. Paragenital areolae well-developed, porose, posteriorly broad, anteriorly going beyond the anterior end of GO. About 50–60 pores present in each paragenital areola. There are 22–25 PGS present. GO guarded by sclerites. 4 pairs SGS. Spermatopositor large, extending beyond GO, almost equal to the length of GO. GO 50 μm long. The distance between anterior end of GO to that of GA about 1.4 times GO length. Posterior end of GO to posterior end of GA 0.8 times GO length.

Gnathosoma 60 μm long. Palp consists of 4 segments; rostrum extends almost up to the end of P2, slightly beyond the level of dorsal seta of P2; ventrolateral portion of gnathosoma porose. 4-15 canaliculi present in small group. P2 with a dorsal seta; P3 without any seta; P4 basally with three setae and singlet small seta anteriorly.

Leg I slightly larger than posterior legs.

Leg chaetotaxy: Trochanter 1-1-1-0, Basifemur 2-2-2-2, Telofemur 5-5-2-2, Patella 4-4-3-4, Tibia 7-7-5-5.

Telofemur I about 2.6 times longer than high. Telofemorae II, III and IV about 2.6, 3.2, 3.75 (respectively) times longer than high. Ventral lamella absent. Telofemora III and IV without any ventral seta. Tibia I with three ventral setae (one short faintly pectinate and other two smooth, long and pointed). Tibia II with three ventral setae (two thick, pectinate and one filiform). Tibia III with two ventral setae (one pectinate and one smooth filiform). Tibia IV with two vent-

ral setae, both smooth filiform. Tarsus II longer than tarsus I. Tarsus I with three dorsal setae, three ventral setae (one filiform seta basally and two eupathidia distally), four PAS, one solenidion and a profamulus. Tarsi II–IV without any ventral setae. Telofemur I with reticulate panel. Patella IV with four setae; tarsi III and IV with four dorsal setae, distance between two basal setae subequals height of the tarsus; two basal setae almost equal in length. Trochanter III with a ventral seta; seta absent on trochanter IV.

All legs with two lateral claws and a bidentate median claw. All lateral claws bear a tooth dorsally. Lateral claws of legs II–IV longer than lateral claws of leg I and contain well-developed pecten ventrally.

Female: female somewhat similar to the male except for the genito-anal region. Female idiosoma 297 μm long. GA 145 μm long, 107 μm wide; GO 53 μm long, 31 μm wide. The distance between anterior end of GO and that of GA subequals the length of GO. Paragenital areolae anteriorly going just above the anterior end of GO, posteriorly going beyond the level of GO. Ovipositor small going very little beyond the GO. Three pairs of PGS and one pair of SGS present.

Differential diagnosis

Copidognathus pujadus sp.n. belongs to the '*Copidognathus bairdi*' group. The characteristics of the '*bairdi*' group were listed by Bartsch (1996). Among the different species, the present form comes very close to *C. sideus* Bartsch, 1982, *C. sidellus* Bartsch, 1985a and *C. euryalus* Bartsch, 1997b but differs from *C. sidellus* Bartsch, 1985a in the following points: middle two areolae on AD, in the present case away from each other, in *C. sidellus* these are closer to each other. PD in present form wider than *C. sidellus*. Anterior end of PD almost flat (straight), but in *C. sidellus* it is clearly concave. Paracostae anteriorly joined with middle costae in *C. sidellus* but paracostae are not fused to the middle costae in *Copidognathus pujadus* sp.n.. Distance between ds3–ds4 and ds4–ds5 subequals in *C. sidellus* but distance between ds3–ds4 more than double compared to the distance between ds4 and ds5 in the present form (Fig. 3A).

Shape of paragenital areolae differs in two species, in the present form it is much bigger. Paragenital areola consists of about 50 pores in each, posteriorly paragenital areolae also broader than *C. sidellus*. Length to width ratio of telofemur IV varies between both species. In *Copidognathus pujadus* sp.n., telofemur IV about 3.75 times longer than wide but in *C. sidellus* it is about three times longer than wide. In the present case, the distance between anterior end of GO to that of GA subequals with the length of GO (in females) but in *C. sidellus* the distance is much more than the length of GO.

Differences between *C. euryalus* Bartsch, 1997b and *C. pujadus* sp.n. are as follows: posterior areolae on AD in *C. euryalus* creasent-shaped but in present form it is circular to pear-shaped. PD about 1.3 times longer than wide in *Copidognathus pujadus* sp.n.. Shape of paragenital areolae differs between both species, paragenital areolae gerland-shaped in *C. euryalus* but in the present form posteriorly little broad anteriorly elongated. Nature of rosette pores on dorsal plates varies between both species. In *C. euryalus* only the ostium present, canaliculi absent in each rosette pores but in the species at hand there are many canaliculi present in and around the ostium.

Differences between *C. sideus* Bartsch 1982 and *C. pujadus* sp.n. are: middle two areolae on AD close together in *C. sideus* but wide apart in the present species. The distance from ds3 and ds4 and from ds4 to ds5 subequals in *C. sideus* but in the present species the distance ds3–ds4 more than twice the distance between ds4-ds5. Shape of paragenital areolae also varies between both species, ds5 in present form present anteriorly of the swollen area of middle costa but in *C. sideus* ds5 present posteriorly of the swollen area.

The present species differs also from *Copidognathus pseudosidellus* Chatterjee, 1997, a species described from the Andaman Islands (Indian Ocean) on the following points: middle and paracostae joined anteriorly in *C. pseudosidellus* but in the present case these are not jointed anteriorly. Middle areolae on AD bean-shaped in *C. pseudosidellus* but circular in the present case. Patella IV with three setae in *C. pseudosidellus* but in the present case it contains 4 setae.

***Copidognathus philippinensis* sp.n.** (Figs 5A–D and 6A–F)

Type material One female holotype and four female paratypes.

Etymology

Named after the country the Philippines, where the specimens were collected.

Type locality

Pujada Bay, the Philippines; three females among *Thalassia hemprichii* and two females among *Halod-*

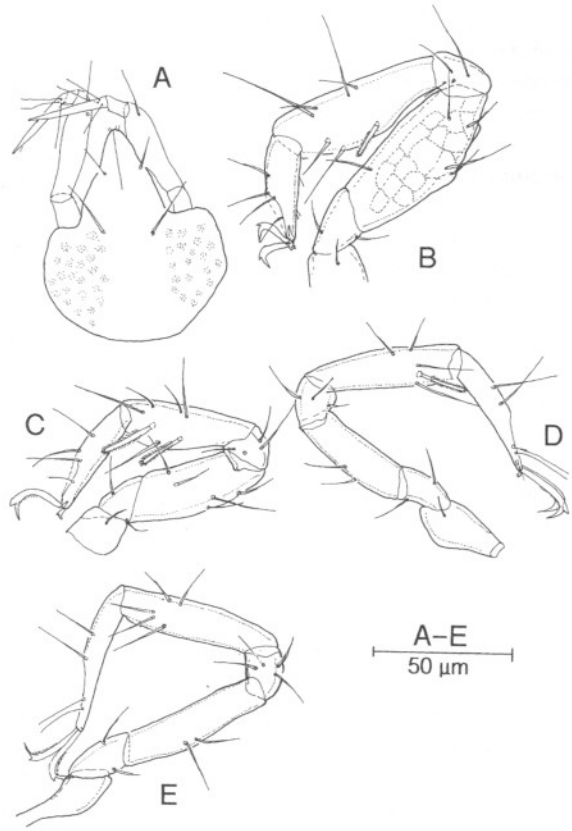

Figure 4. Copidognathus pujadus sp.n. ♂(A) gnathosoma; (B) leg I; (C) leg II; (D) leg III; (E) leg IV.

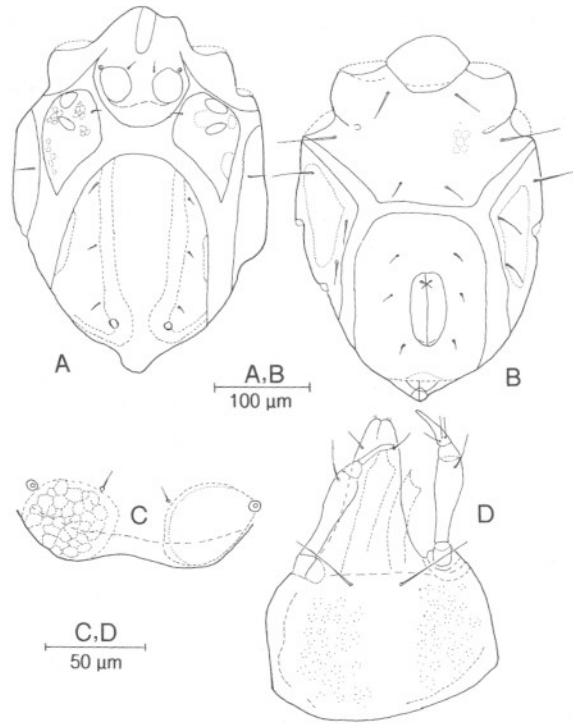

Figure 5. Copidognathus philippinensis sp.n. (A) idiosoma (dorsal) ♀; (B) idiosoma (ventral) ♀; (C) detail of central two areolae on AD; (D) gnathosoma.

ule uninervis.

Description

Female: idiosoma 350–365 μm long. All dorsal plates separate. AD with one anterior, two middle and one posterior porose panelled areolae. Areolae on dorsal plates contain 5–12 canaliculi arranged on a polygon. Middle two areolae on AD large, little oval, consists of about 20–25 porose panels in each. ds1 on anterior-median portion of AD. A pair of gland pores laterally on AD, at the level of ds1. Few porose panels near the posterior margin of AD form posterior areola. An elevated ridge-like structure connects the median areolae; ridge present posteriorly of the median areolae (Fig 5C). OC tapers posteriorly going just beyond the insertion of leg III. Two corneae on OC. One elongated porose panel areola anteriorly near the corneal zone, another along the lateral margin posteriorly. ds2 on anteromedian margin of OC. Two longitudinal middle costae on PD curved posteriorly forming a 'J' shape. Middle costae three porose panel wide (some places four porose panels wide also). Few porose panels present on lateral margin of PD giving an indication of paracostae. ds3, ds4 and ds5 on PD, side of the lateral margin of medial porose costae; ds3 anterior to the level of insertion of leg III, ds4 anterior to the level of insertion of leg IV. ds5 posterior to the level of insertion of leg IV. ds6 on dorsal side of anal papilla. The membrane between AD and PD rugose.

All ventral plates separate. AE porose, pores present as polygons, lateral areola absent. EP absent. Three pairs of setae on AE. PE with three ventral setae and one dorsal seta. Anterior portion of GA truncate. Three pairs of PGS, one pair of SGS. Paragenital areolae present, made up of porose panel, little darker than the porose area present on the rest of the GA. The distance between anterior portion of GA to that of GO about 0.82 of the GO length. GO 74 μm long. The distance between posterior portion of GO to the tip of the anal papillae 56 μm (about 0.75 of the GO length). GA 191 μm long, GO covering about 0.39 of the total length of GA (when GA is considered as one). Ovipositor small and extending just little beyond the GO.

Rostrum stout, extends almost up to the end of the palpal femur, palps only slightly extending beyond the rostrum. Palp contains 4 segments. P3 and P4 together are shorter than P2. Ventrolateral side of the gnathosoma porose. A pair of proto-, deuto-, trito-, and basirostral setae present.

Leg chaetotaxy: Trochanter 1-1-1-0, Basifemur 2-2-2-2, Telofemur 5-5-2-2, Patella 4-4-3-3, Tibia 7-7-5-5.

Leg I larger than other legs (Fig. 6A). Tibiae and telofemur subequal in length in both legs I and II. Tibia III and IV longer than the respective telofemora. Tibia I with three ventral setae, out of which two thick bluntly ending spur, posterior one thicker than the anterior thick seta. Telofemur I with small, pointed, thick, spur (spine-like seta) ventrally (Fig. 6A, F). Telofemorae III and IV without any ventral seta. But in one specimen telofemur III of one side leg bears one seta ventrally. Tibia III with two setae ventrally out of which one pectinate, thick and another one long and smooth. Tibia IV with two ventral long, smooth setae. Tarsus I with three dorsal setae, three ventral setae (one filiform seta basally and two eupathidia distally), four PAS, one solenidion and a profamulus. Tarsi III and IV with four dorsal setae besides two PAS. The distance between two basal setae in tarsi III and IV almost equal to the width of the respective tarsus. Out of two basal setae proximal dorsal seta shorter than distal one.

Each leg with two lateral claws and one bidentate median claw. Lateral claws of legs II–IV with a minute teeth dorsally and pecten ventrally.

Remarks

The present species is a member of the '*Copidognathus curassaviensis*' group. The characteristics of this group are given by Bartsch (1996). So far, four species were described in this group (including the present new species) *viz. C. curassaviensis* Viets, 1936, *C. glandulifer* Bartsch, 1996, *C. kenyae* Chatterjee & De Troch, 2000 and *C. philippinensis* sp.n. After examination of *C. kenyae* it is found that areolae of AD, PD, OC made up of porose panels, 5–12 canaliculi present in polygons, in some cases very small ostium found on AD areolae; P4 small, rostrum extends almost half of P4; membrane between AD and PD slightly rugose.

Present species differs from all the above mentioned species by an elevated ridge below the middle two areolae on AD area, which connects the two areolae.

Among all the above mentioned species, *C. philippinensis* comes closer to *C. glandulifer* due to the shape of the middle costae of PD. In the present species and in *C. glandulifer* middle two costae posteriorly curved. *C. kenyae* has only few porose panels on curved area. Present species and *C. glandulifer* contains more elongated curved area. In *C. curassaviensis* this curve is absent. In the present case, the middle two areolae on AD are bigger than *C. kenyae* and contain more areolar panels.

The distance between the anterior end of GA and that of GO about 0.8 (of the GO length) in the present case; 0.75 in *C. curassaviensis* and *C. glandulifer*; 0.57 in *C. kenyae*.

Although it is illustrated that the species of this group are very similar to each other, there are many small differences between them. When more specimens of this group from different areas will be collected, additional taxonomical characters should be described from each species to resolve the confusion among them. In the future, we hope to perform a SEM study of the different species of this group.

It is assumed that the '*curassaviensis*' group will be a common group of *Copidognathus* found in warm temperate and tropical areas. In the future, more species of this group will certainly be recorded from different areas.

***Copidognathus uniscutatus* Bartsch 1984** (Figs 7A–C)

Material studied

Two males and two females among *Thalassia hemprichii*, one male and one female among *Syringodium isoetifolium*, one male among *Halodule uninervis*, one female among *Halophila minor* from Pujada Bay (the Philippines).

Description

Male idiosoma ranged between 257 to 266 μm and female idiosoma between 273 and 297 μm. All dorsal plates fused together. An elevated transverse subtriangular porose areolae on AD area. Posterior portion of the areola concave. Two corneae present on OC area. Posterior cornea subdivided. Two small glandular pores present lateral to posterior cornea just above the level of dorsal seta of PE. ds3 present below the glandular pores of OC area and very close to the lateral border of the fused dorsal plates. All ventral plates separate. EP absent. AE punctate with pycnotic pores, posterior portion of AE arched; about 20–25 PGS present in male, three pairs PGS in female. GO

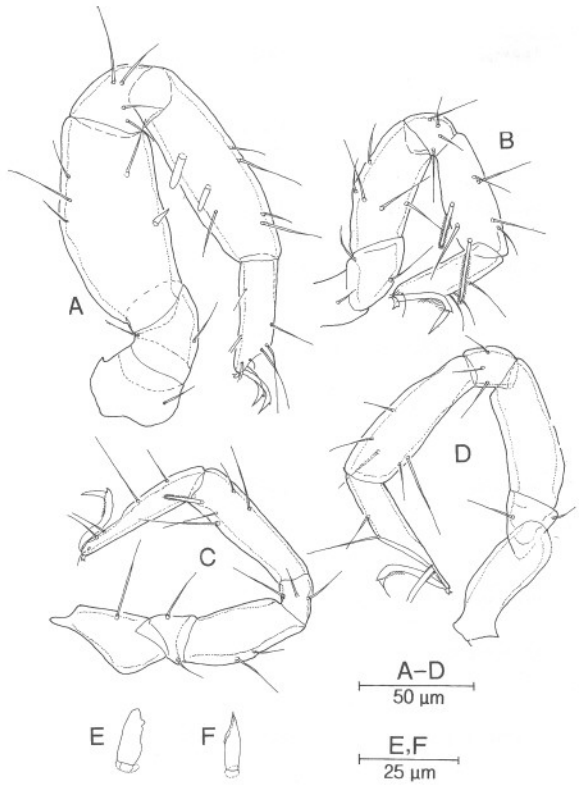

Figure 6. Copidognathus philippinensis sp.n. ♀(A) leg I; (B) leg II; (C) leg III; (D) leg IV; (E) basal ventral thick seta of tibia I; (F) ventral seta – spur- of telofemur I.

guarded by sclerites, three pairs SGS in male, one pair SGS in female. Gnathosome porose, base ventrolaterally porose. Leg I longer than leg II. Tibia I with one denticulate thick spine and two smooth long slender setae ventrally (Fig. 7B). Tarsi III and IV with three dorsal setae. Spermatopositor very large (Fig. 7A).

Remarks

This is a member of the '*pulcher*' group. Characteristics of '*pulcher*' group are reported in Bartsch (1984b).

This species was earlier recorded from Mactan Island, Cebu, the Philippines by Bartsch (1984b). Recently, Chatterjee & De Troch (2001) recorded this species from the Caribbean coast of Mexico.

Bartsch (1984b, Fig. 12, 19 and 20) showed two longitudinal lines present on the posterior side of the posterior area of the dorsal shield but these lines are not observed in either the specimens from the Philippines (except one) or from Mexico collected by us.

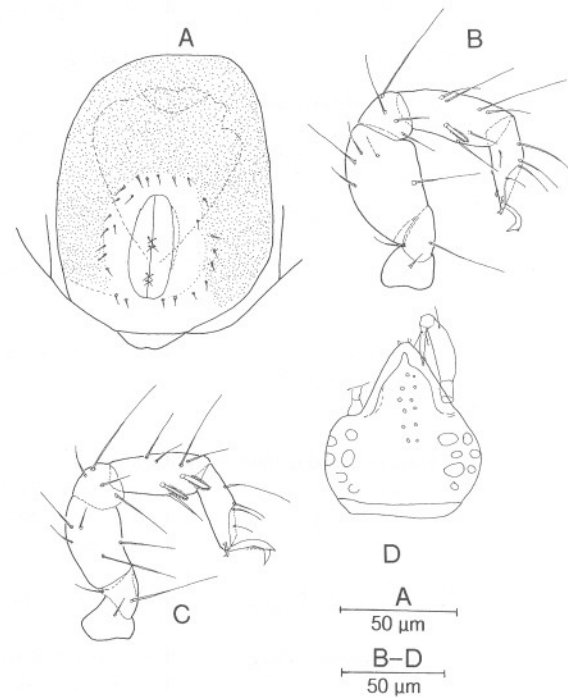

Figure 7. Copidognathus uniscutatus Bartsch: (A) GA ♂; (B) leg I; (C) leg II; *C. faubeli* Bartsch: (D) gnathosoma dorsal.

Reticulation on dorsal shield absent in our specimen, but this may be due to preservatives or it can be absent in recently hatched specimens. In the Mexican specimens a brownish porose area was found between the two corneae while it is absent in the present material. For further details on variation and possible explanations for this we refer to Chatterjee & De Troch (2001).

***Copidognathus faubeli* Bartsch 1986** (Fig. 7D)

Material studied

One male and two females collected among *Thalassia hemprichii* from Pujada Bay (the Philippines).

Description

Male idiosoma 288 μm long and female idiosoma 274–293 μm long dorsally. All dorsal and ventral plates separate. Dorsal plates with rosette pores and fovea. AD with gable-like area on the frontal side. PD with 4 costae, middle costae 2–3 rosette pores wide and paracostae 1–2 rosette pores wide. ds2 on OC. Tectum stout, long, projected anteriorly with acutely small pointed tip (Fig. 7D). Anterior portion of tectum consists of an elongated rosette porose portion, rest portion of dorsal side of the gnathosoma contains fo-

Table 2. Marine Halacaridae recorded from the Philippines

Species name	Sampling site	Habitat	Major reference
Subfamily Halacarinae Viets 1927			
1. *Agauopsis pseudornata* Bartsch	Mactan Island, Cebu	shallow water	Bartsch (1985a)
2. *Agauopsis* sp.	Cebu Island	intertidal	Talker et al. (1981)
3. *Atelopsalis pacifica* Bartsch	Mactan Island, Cebu	shallow water	Bartsch (1985a)
4. *Arhodeoporus mactanus* Bartsch	Mactan Island, Cebu	sediment among intertidal *Sargassum*, *Diadema*, 10 and 15 m depth	Bartsch (1991)
Subfamily Copidognathinae Bartsch 1983			
5. *Copidognathus acnemus* Bartsch	Marine station of the Univ. of San Carlos at Maribiago, Mactan Island	low water, to 45 m depth	Bartsch (1986)
6. *C. bunofer* Bartsch	Mactan Island, Cebu	intertidal, to 10 m depth	Bartsch (1984a)
7. *C. faubeli* Bartsch	Marine station of the Univ. of San Carlos at Maribiago, Mactan Island	15 m depth	Bartsch (1986)
	Guang-guang, Mindanao Isl., Pujada Bay	among seagrass	present study
8. *C. festivus* Bartsch	Mactan Island, Cebu	intertidal, to 15 m depth	Bartsch (1984a)
9. *C. mactanus* Bartsch	Mactan Island, Cebu	subtidal, 45 m depth	Bartsch (1985a)
10. *C. mirus* Bartsch	Mactan Island, Cebu	15 m depth	Bartsch (1984a)
11. *C. philippinensis* n.sp.	Guang-guang, Pujada Bay, Mindanao Isl.	among intertidal seagrasses	present study
12. *C. pujadus* n.sp.	Guang-guang, Pujada Bay, Mindanao Isl.	among intertidal seagrasses	present study
13. *C. rostratellus* Bartsch	Marine station of the Univ. of San Carlos at Maribago, Mactan Island	low water, to 42 m depth	Bartsch (1986)
14. *C. scutellus* Bartsch	Mactan Island, Cebu	subtidal, 45 m depth	Bartsch (1985a)
15. *Copidognathus sidellus* Bartsch	Mactan Island, Cebu	10 m depth	Bartsch (1985a)
16. *C. ivanomorsellii* n.sp.	Guang-guang, Pujada Bay, Mindanao Isl.	intertidal seagrasses	present study
17. *C. uniscutatus* Bartsch	Mactan Island, Cebu	intertidal to 15 m	Bartsch (1984b)
	Guang-guang, Pujada Bay, Mindanao Isl.	among seagrasses	present study
18. *Copidognathus* sp.	Mactan Island, Cebu	middle part of beach	Bartsch (1985a)

Table 2. Continued

Subfamily Rhombognathinae Viets 1927				
19.	*Rhombognathus caudiculus* Bartsch	Mactan Island, Cebu	*Diadema* zone	Bartsch (1983)
20.	*R. cebuus* Bartsch	Mactan Island, Cebu	littoral, associated with *Thalassia*, *Padina* and *Diadema* zone	Bartsch (1983)
21.	*R. scutulatus* Bartsch	Negros Isl. 9° 20′ N, 123° 19′ O 9° 25′ N, 123° 14′ O	eulittoral to sublittoral	Bartsch (1983)
22.	*R. semiarmatus* Bartsch	Mactan Island, Cebu	intertidal to 15 m depth	Bartsch (1983)
23.	*R. setifer* Bartsch	Mactan Island, Cebu	1–3 m	Bartsch (1983)

vea. Gnathosoma ventrolaterally also contains rosette pores.

Remarks
This species was recorded earlier from Mactan Island, the Philippines (Bartsch, 1986) and from the Andaman Islands, Bay of Bengal (Chatterjee, 1999).

Halacaridae fauna of the Philippines

Table 2 shows 21 named and two undetermined halacarid species of five genera, belonging to three subfamilies that were reported from the Philippines (including the present report).

Four species are also known from other localities besides the Philippines. *Atelopsalis pacifica* Bartsch and *Copidognathus faubeli* Bartsch from Andaman and Nicobar Islands, India (Sarma & Chatterjee, 1993; Chatterjee, 1999); *C. uniscutatus* Bartsch also reported from Mexico (Chatterjee & De Troch, 2001); *Rhombognathus scutulatus* Bartsch also collected along the east and west coast of India (Chatterjee, 1995) and also from Kenya (Chatterjee & De Troch, 2000).

Most of the species from the Philippines are known from its type locality only. In many of these cases, the distribution will be extended when other new areas of the Pacific and Indian Ocean will be explored for Halacaridae.

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