

STUDIES ON THE FAUNA OF CURAÇAO AND OTHER
CARIBBEAN ISLANDS: No. 184

PYCNOGONIDA FROM THE MEDIOLITTORAL
AND INFRALITTORAL ZONES IN THE
TROPICAL WESTERN ATLANTIC

by

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ABSTRACT

Twenty-seven species of Pycnogonida are recorded from the mediolittoral and infralittoral zones in the West Indies and of the north coast of South America, including two new species. *Eurycyde acanthopus* n. sp. was found on the shelf off the coast of Venezuela. *Anoplodactylus monotrema* n. sp. is widely distributed in the area; it has apparently been confused in the past with *A. robustus* (Dohrn, 1881). The morphology of the latter, and of the closely related *A. virescens* (Hodge, 1864), is discussed. Material from Amsterdam and St. Paul islands (Indian Ocean) attributed to *A. virescens*, is considered to belong to a separate species, *A. dentimanus*. — The range of several species is extended. Two species of *Endeis*, viz. *E. meridionalis* (Böhm, 1879) and *E. biseriata* Stock, 1968, were found for the first time in the Atlantic Ocean; formerly they were recorded from the Indo-West Pacific only. An *Achelia* is provisionally identified as *A. langi* (Dohrn, 1881), a species hitherto known from the eastern Atlantic and the Mediterranean. — The male of *Tanystylum isthmiacum difficile* Stock, 1966, is illustrated for the first time; it is concluded that *T. isthmiacum* and *T. geminum* Stock, 1954, do not form a pair of vicarious species. The male sex of *Ammothella exornata* Stock, 1975, is also recorded for the first time.

INTRODUCTION

After the publication of three papers of mine (Stock, 1954, 1955, and 1975) dealing in some length with the Pycnogonida from the tropical belt in the western Atlantic (including the Caribbean), I received a number of additional collections which contained sufficient new taxonomic data to justify publication of the present note. An important portion of the material came, as in previous cases, from the careful collecting activities in the West Indies of Dr. P. WAGENAAR HUMMELINCK (Utrecht), but additional samples

were collected by Messrs P. HOETJES and E. WESTINGA, and by myself, in Curaçao, and by R. DIJKEMA, biol. drs., in northern Brazil.

In the present paper, the records of *Anoplodactylus robustus* (auct., non Dohrn, 1881) in the West Indies are re-considered. For this small revision, not only West Indian, but also European and Indian Ocean materials were studied, and the data thereon are included in this article.

***Ascorhynchus latipes* (Cole, 1906)**

(Fig. 1a)

Stock, 1975: 969.

CURAÇAO: 1 ♀, Piscadera Bay, depth abt. 1 m, on the coral *Porites astreoides*, Dec. 11, 1973, J. H. Stock coll. – 1 specimen, Jan Thiel Bay, open air swimming pool, abt. 2 m, in corals, Dec. 26, 1973, Stock coll. – 1 ♀, entrance of Awa di Oostpunt, 0.5 m, on *Porites branneri*, Mar. 17, 1974, Stock coll.

The Piscadera Bay specimen (Fig. 1a) differs from the material illustrated by COLE, 1906, and HEDGPETH, 1948 (and also from the two other specimens in the collection) in having the lateral processes separated by a distance of about their own diameter (instead of by much narrower intervals). Otherwise, I could not find any differences, so I provisionally consider this specimen identical with *A. latipes*.

***Eurycyde raphiaster* Loman, 1912**

Stock, 1975: 959.

CURAÇAO: 1 ♂, Sta Martha Bay, in front of former Coral Cliff Hotel, depth 5–6 m, on the coral *Colpophylla natans*, Dec. 16, 1973, J. H. Stock coll. – 1 ♂, about 500 m W. of Piscadera, 5–6 m, on brain-corals, Dec. 18, 1973, Stock coll. – 2 specimens, Jan Thiel Bay, open air swimming pool, on corals, abt. 2 m, Dec. 26, 1973, Stock coll.

A highly characteristic, amphi-atlantic species.

***Eurycyde acanthopus* n. sp.**

(Figs. 2, 3 g-h)

1 ♀ (holotype). "Pillsbury" Sta. 736 (off Venezuela): 10°57' N 65°52' W – 11°03' N 65°55' W, depth 69.5 – 155.5 m, July 22, 1968.

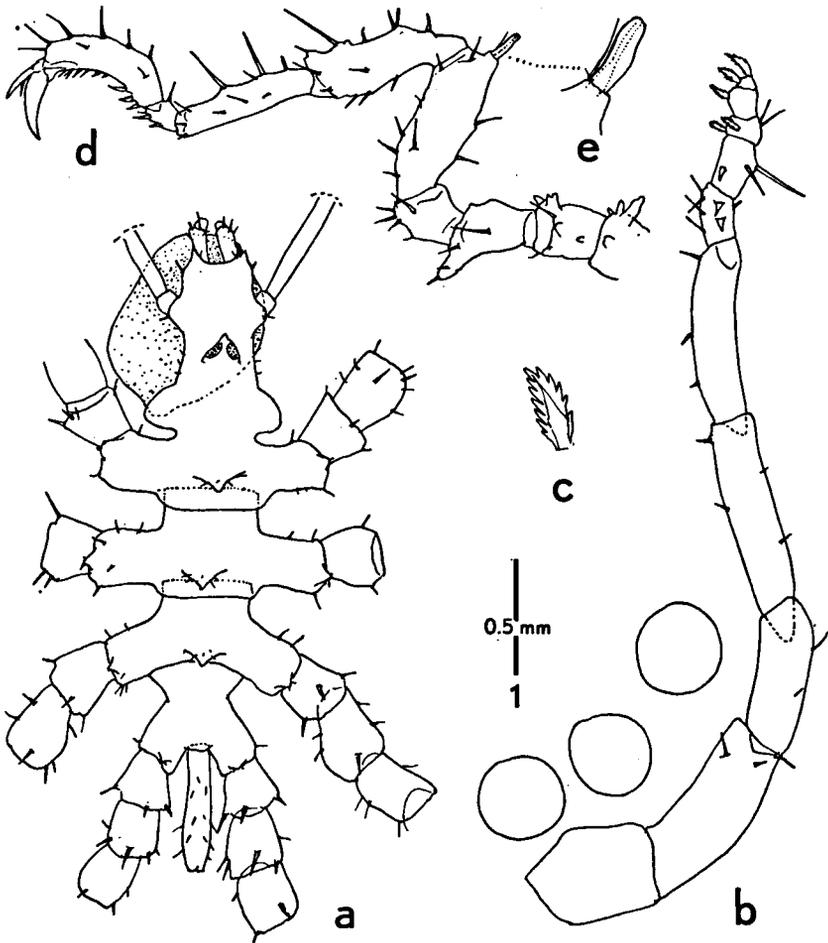


Fig. 1. a, *Ascorhynchus latipes* (Cole, 1906), from Piscadera Bay, CURAÇAO: trunk of a female with unusually widely spaced lateral processes (scale 1). b-e, *Ammothella exornata* Stock, 1975, ♂, from Drunkemans Key, JAMAICA: b, oviger (scale 3); c, proximal compound spine of 10th oviger segment (more strongly magnified); d, third leg (5); e, cement gland duct (more strongly magnified).

Description. – Trunk completely segmented. Cephalon widened considerably in front of the oviger implantation, unarmed. Oviger implantation well in front of the first lateral processes, with a low, pointed tubercle on its anterior margin. Lateral processes long, sep-

arated by narrow but distinct intervals, distally armed with one tall spur (4th lateral process devoid of spur). Ocular tubercle tall, slender, cylindrical, inclined forward, implanted in front of the oviger insertions; eyes subterminal, well-pigmented; the ocular tubercle terminates in a small point, just above the eyes; no distal spines. Abdomen with basal articulation, almost reaching to the end of coxa 2 of leg 4; the abdomen is bent slightly beyond the middle; the basal part is armed with 3 pairs of long spines; the unarmed distal part, which is slightly shorter than the basal part, is inserted under an angle of some 150° on the basal part.

Proboscis with a narrow, well-defined, basal stalk, and a slender, swollen, pointed distal part.

Chelifore scape 2-segmented; segment 1 slightly longer than segment 2; segment 1 with 2 strong distal spines, segment 2 with 2 pairs of strong spines and a few small distal spines. Chelae non-functional, hidden in a distal excavation of the 2nd scape segment.

Palp with 2 short basal segments. Segment 3 the longest; segment 5 slightly shorter than 3; segments 7 to 10 diminishing regularly in length.

Oviger segment 4 the longest, 5 slightly shorter than 4. Special spine formula 6 : 4 : 3 : 6. Distal claw short, smooth, forming a kind of chelate structure with the opposing terminal compound spine of oviger segment 10. Compound spines lanceolate, with 6 to 8 lateral denticles.

Legs very spiny. Coxa 1 of all legs with 2 tall, pointed spurs: a dorsal and an anterior one; coxa 1 of leg 1 with an additional small posterior spur. Coxa 2 with 2 pairs of long, robust dorsal spines and 1 or 2 posterolateral spines. Femur distorted, with a ventral swelling; armed with 4 strong dorsal spines, at least 8 lateral and ventral spines, and at least 7 distal spines. Tibia 1 slightly longer than the femur, and distinctly longer than tibia 2, armed with 5 long dorsal spines, each of which bears some sparse plumosities, and with several smaller lateral and distal spines. Tibia 2 with 5, sparsely plumose, dorsal spines. Tarsus short, longer than wide, with a row of uniform spinules on the ventral margin. Propodus slender, curved, without heel; sole armed with a row of densely implanted spinules of a size. Claw short (abt. 2/5 of the propodus); no auxiliary claws. Genital pores on the ventral surface of coxa 2 of all legs.

Measurements of the holotype (in μm):	
Length cephalic somite	779
Length trunk somite II	362
Length trunk somite III	366
Length trunk somite IV (to base of abdomen)	191
Length abdomen	998
Width across the 2nd lateral processes	1607
Length distal part proboscis	1598
Greatest diameter distal part proboscis	684
Length basal stalk proboscis	607
Third leg: 1st coxa 376, 2nd coxa 560, 3rd coxa 326, femur 1120, 1st tibia 1141, 2nd tibia 997, tarsus 153, propodus 656, claw 251.	

Remarks. – The species of the genus *Eurycyde* are all very similar to one another. McCLOSKEY, 1967, even supposes that the spination characters currently in use for the discrimination of the species, are less dependable. Personally, I have not found large differences in the spination of *E. raphiaster* Loman, 1912, another West Indian shallow water species.

The present species differs from most others in the genus by the absence of spines on the ocular tubercle, a character shared only by *E. hispida* (Krøyer, 1844), and by a species recorded by McCLOSKEY (1967) as *E. clitellaria* Stock, 1955, but which almost certainly is a different species*.

From *E. hispida*, a Boreal-Atlantic species, the present material differs in having spurs on the lateral processes and first coxae, in having 3 pairs of spines on the abdomen (versus 2 pairs of plumose setae), in a differently armed chelifore scape, in the great elongation of the distalmost compound oviger spine, in a more spinose femur, etc.

From the material recorded by McCLOSKEY as *E. clitellaria* from North Carolina, the present specimen differs in the stronger spination of the chelifore scape and the abdomen, in the stronger spurs on the lateral processes and 1st coxae, in having 1 spur (instead of

*) McCLOSKEY enumerates clearly the differences between his material and *E. clitellaria*. In addition, he describes and illustrates a cement gland protuberance in the female sex, whereas in all other species of the genus the cement glands are restricted to the males.

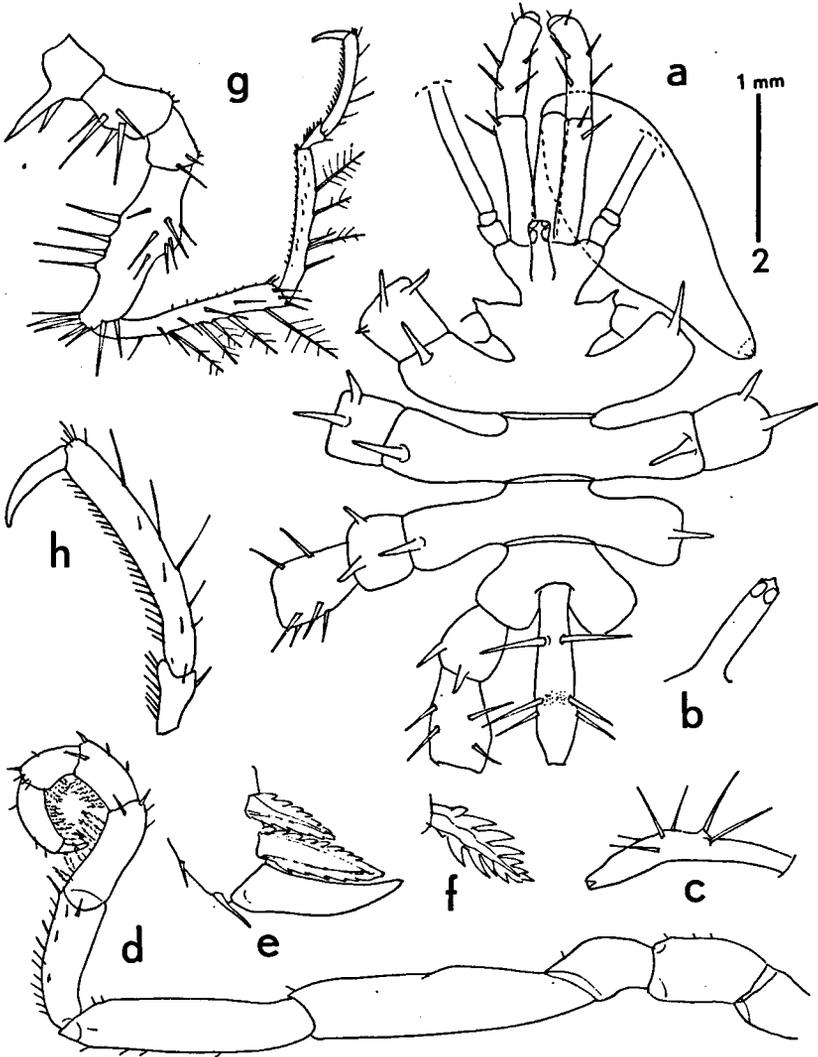


Fig. 2. *Eurycyde acanthopus* n. sp., ♀ (holotype), from "PILLSBURY" Sta. 736: a, trunk, dorsal (scale 8); b, ocular tubercle, from the right (free-hand sketch); c, abdomen from the right (free-hand sketch); d, oviger (5); e, tip of oviger (6); f, most distal compound spine of 7th oviger segment (6); g, third leg (2); h, distal segments of third leg (5).

2) on the anterior lateral processes, in much more strongly spinose legs, etc.

From the two species of *Eurycyde* known so far from the West Indies (*E. raphiaster* and *E. clitellaria* s. str.), the present form differs in the unarmed ocular tubercle, with the eyes almost in terminal position (at some distance of the tip in the other two), in differences in the abdomen (distal part larger than in *raphiaster*; bending at an angle of almost 90° in *clitellaria*), in more strongly spinose legs, etc.

The proposed specific name, *acanthopus*, alludes to the numerous strong spines on the legs.

***Ammothella appendiculata* (Dohrn, 1881)**

Stock, 1955: 250.

ARUBA: 1 ♀, Hummelinck Sta. 1302, iron beam of Wharf of Arend Petr. Comp., May 4, 1955.

CURAÇAO: 1 ♀, Hummelinck 1037A, Spaanse Water, Sta Barbara Beach, S. side, *Rhizophora* in sand, 0-1½ m, Apr. 21, 1949. - 1 specimen, Blauwbaai, depth 20 m, on the sponge *Agelas clathrodes* (Schmidt), Feb. 11, 1976, P. Hoetjes and E. Westinga coll.

BONAIRE: Several hundreds of specimens, Hummelinck 1555, Lagoen, S. W., muddy sheet of water among *Avicennia*, Sep. 19, 1967. - 1 juv., 1557, Lagoen, S. W., sandy shales near *Rhiz.*, Sep. 19, 1967. - 4 juv., probably this species, 1653, Sorobon near [Boca Jewfish, 0-½ m, on *Thalassia* and *Halimeda*, near *Rhiz.*, Mar. 10, 1970.

ANTIGUA: 1 juv., Hummelinck 1541, Dickinson Bay pier, wooden piling in sand, 0-1½ m, July 26, 1967.

***Ammothella rugulosa* (Verrill, 1900)**

Stock, 1975: 972.

ARUBA: 1 ♂ ov., 1 ♀, Hummelinck Sta. 1006b, Boekoeti, N.W. seaside, *Rhizophora*, May 6, 1955.

CURAÇAO: 2 juv., Hummelinck 1668A, St. Joris Bay, N.W., ¼-1 m, muddy sand, debris, *Thalassia* and *Halophila*, Feb. 25, 1970.

Apart from a single specimen collected in Bonaire (Stock, 1954), this species was never recorded from the Leeward Group of the Lesser Antilles.

***Ammothella exornata* Stock, 1975**

(Fig. 1 b-e)

Stock, 1975: 975-978, fig. 7 c-d, 8.

CURAÇAO: 1 ♂, Hummelinck Sta. 1668A, St. Joris Bay, N.W., $\frac{1}{2}$ -1 m, muddy sand, debris, *Thalassia*, Feb. 25, 1970.

BONAIRE: 1 juv., Hummelinck 1555, Lagoen, S.W., muddy sheet of water near *Avicennia*, Sep. 19, 1967.

JAMAICA: 1 ♂ oviger., 7 ♂, 3 ♀, 1 juv., Hummelinck Sta. 1683, Drunkemans Key near Port Royal, 0- $\frac{1}{2}$ m, sandy debris, June 15, 1973.

The male of this species is new to science. It resembles the female in tuberculation, spination, etc. The oviger (Fig. 1b) has more elongate segments 4 and 5; oviger segment 6 bears 2 triangular, reversed spines ("teeth"), segment 7 bears 1 such "tooth" and 2 setae on a lateral swelling; segments 8 to 10 are provided with compound spines according to the formula 2 : 1 : 2.

The legs 3 and 4 have a strong ventrodiscal genital spur on coxa 2 (Fig. 1d); on legs 1 and 2 this spur is absent. The femur has a robust dorsodistal cement gland duct (Fig. 1e), articulated at its basis. The genital spur is rather remarkable, since such a structure is more usually found in the related genus *Achelia*.

The eggs carried by the ovigerous male are small (diameter 0.07-0.08 mm).

So far only females of this species have been found. Previous records were from Bonaire and St. Martin.

***Ammothella marcusi* Hedgpeth, 1948**

Stock, 1975: 975.

CURAÇAO: 1 juv., Hummelinck Sta. 1666A, Awa di Oostpunt, sand beach, N. shore, $\frac{1}{2}$ -1 m deep, *Thalassia* with *Porites*, Feb. 22, 1970.

Previously recorded from the Tortugas, St. John and Bonaire

***Achelia sawayai* Marcus, 1940**

FRY & HEDGPETH, 1969: 105; Stock, 1975, 982.

ARUBA: 2 ♂, 1 ♀, Hummelinck Sta. 1004A, Lagoen Boekoeti, *Rhizophora* in sandy mud, 0-1 m deep, Dec. 29, 1948. - 3 ♀, 1006b, Boekoeti, N.W. seaside, 0- $\frac{1}{2}$ m with *Porites*, May 6, 1953.

CURAÇAO: 1 ♂, Hummelinck 1020A, Boca Lagoen, rocky beach, 0- $\frac{1}{2}$ m, Sep. 13, 1948. - 1 ♂ ovig., 2 ♂, 1025, large pool at Spaanse Put Bay, coral shingle, muddy sand, Feb. 16, 1949. - 8 ♂, 10 ♀, 2 juv., 1025A, the same, with *Rhiz.* Feb. 16, 1949. - 1 ♂ ovig., 1038, Fuik Bay, Duitse Bad, rock and mud near *Rhiz.*, 0-1 $\frac{1}{2}$ m, Mar. 2, 1949. - 1 ♀, 1038A, the same, *Rhiz.* in mud. - 2 ♂, 1 juv., 1666A, Awa di Oostpunt, N. shore, $\frac{1}{2}$ -1 m, sandy with *Thalassia* and *Porites*, Feb. 22, 1970. - 1 juv., 1668A, St. Joris Bay, N.W., muddy sand with debris, *Thal.* and *Halodule*, $\frac{1}{2}$ -1 m, Feb. 25, 1970.

BONAIRE: 3 specimens, Hummelinck 1653, Sorobon, near Boca Jewfish, 0- $\frac{1}{2}$ m, on *Rhiz.*, Mar. 10, 1970.

ANGUILLA: 1 ♂ ov., Hummelinck 1704, Crocus Bay, N., 0- $\frac{1}{2}$ m, limestone and igneous rock near sand beach, July 3, 1973.

JAMAICA: 1 ♀, Hummelinck 1677, Kingston Harbour, inlet W. of airport, 0- $\frac{1}{2}$ m, *Rhizophora*, decaying timber, May 7, 1973. - 1 ♂, 1683, N. side of Drunkemans Key, 0- $\frac{1}{2}$ m, sandy debris, June 15, 1973.

GRAND CAYMAN: 1 juv., Hummelinck 1694, S. of Jackson's Point, 0- $\frac{1}{2}$ m, limestone in surf, pools, June 9, 1973.

CAYMAN BRAC: 1 ♂, Hummelinck 1703, West Point, The Ledges, 0- $\frac{1}{2}$ m, sandy shore with limestone debris, June 3, 1973.

FLORIDA: 1 ♂, Hummelinck 1410A, Key Biscayne, North Point, *Rhizophora* amidst *Thalassia* bed, Sep. 1, 1963.

A very common, amphi-atlantic shallow water species.

Achelia gracilis Verrill, 1900

Stock, 1975: 983.

CURAÇAO: 1 ♀, Hummelinck s.n., Knip Bay, N. side, 0-1 m, rocky, Oct. 24, 1948. - 2 ♀, 2 juv., Sta. 1017, Knip Bay, S. side, 0-1 $\frac{1}{2}$ m, limestone cliff, Jan. 8, 1949.

This species was never recorded south of Puerto Rico and St. John, V.I.

Achelia cf. *langi* (Dohrn, 1881)

Ammonothea langi DOHRN, 1881: 146-147, pl. 5 figs. 1-8.

Ammonothea Langii; D'ARCY THOMPSON, 1901: 55.

Ammonothea (Achelia) Langi; BOUVIER, 1923: 55, fig. 53; LOMAN, 1925: 50.

Achelia langi; FAGE, 1942: 87; NOGUEIRA, 1967: 324-325; STOCK, 1968b: 16, fig. 9.

Achelia lanzi (err. typ.); LEUNG, 1972: 821.

ANGUILLA: 1 ♀, Hummelinck Sta. 1704, Crocus Bay, N., 0- $\frac{1}{2}$ m, limestone and igneous rock near sandy beach, July 3, 1973.

The specimen resembles *A. langi* very well indeed. In particular the oval (not pointed or tapering) shape of the proboscis is very characteristic. In absence of male specimens, however, I feel that my identification in this difficult genus must remain provisional.

Previous records for this species are limited to the western Mediterranean (Naples, Marseille, Banyuls), and to the adjacent coasts of the Atlantic (Portugal, Gibraltar – an unpublished record based on material in the Muséum royal des Sciences naturelles, Brussels – Morocco, Guinea Bissau, Gambia).

Tanystylum acuminatum Stock, 1954

Stock, 1954: 125–127, fig. 29.

ANGUILLA: 1 ♀, Hummelinck Sta. 1704, Crocus Bay, N., 0–½ m, limestone and igneous rock near sandy beach, July 3, 1973.

This appears to be the second record of this species. The type material, a solitary specimen and likewise a female, was collected in St. Barts, not far from Anguilla.

Tanystylum isthmiacum Stock, 1955, ssp. **difficile** Stock, 1966

(Fig. 3 b-f)

Stock, 1966: 389–390, fig. 2 a–h; FAGE & STOCK, 1966: 318; Stock, 1975: 984.

CURAÇAO: 1 ♂ ov., 2 ♀, Hummelinck s.n., Knip Bay, N. side, 0–1 m, rocky, Oct. 24, 1948. – 2 juv. probably this species, Sta. 1017, Knip Bay, S. side, 0–1½ m, limestone cliff, Jan. 8, 1949.

When I first described *T. isthmiacum* (the typical form) from the island of Taboguilla (= off the Pacific entrance of the Panama Canal), I was under the impression that this species represented a vicarious species of *T. geminum* Stock, 1954, from the West Indies.

However, when STOCK, 1966, and FAGE & STOCK, 1966, discovered specimens morphologically quite similar to *T. isthmiacum* in the Atlantic (coasts of South America, Cape Verde Islands), the original idea was disproved. Moreover, the discovery of the male of *isthmiacum* showed that the 7th oviger segment was provided with a distal lobe (FAGE & STOCK, 1966: 318, and Fig. 2d in the present paper), which indicates relationships of the species with *T. hummelincki* Stock, 1954, *T. tubirostrum* Stock, 1954, and *T. isabellae* Marcus, 1940.

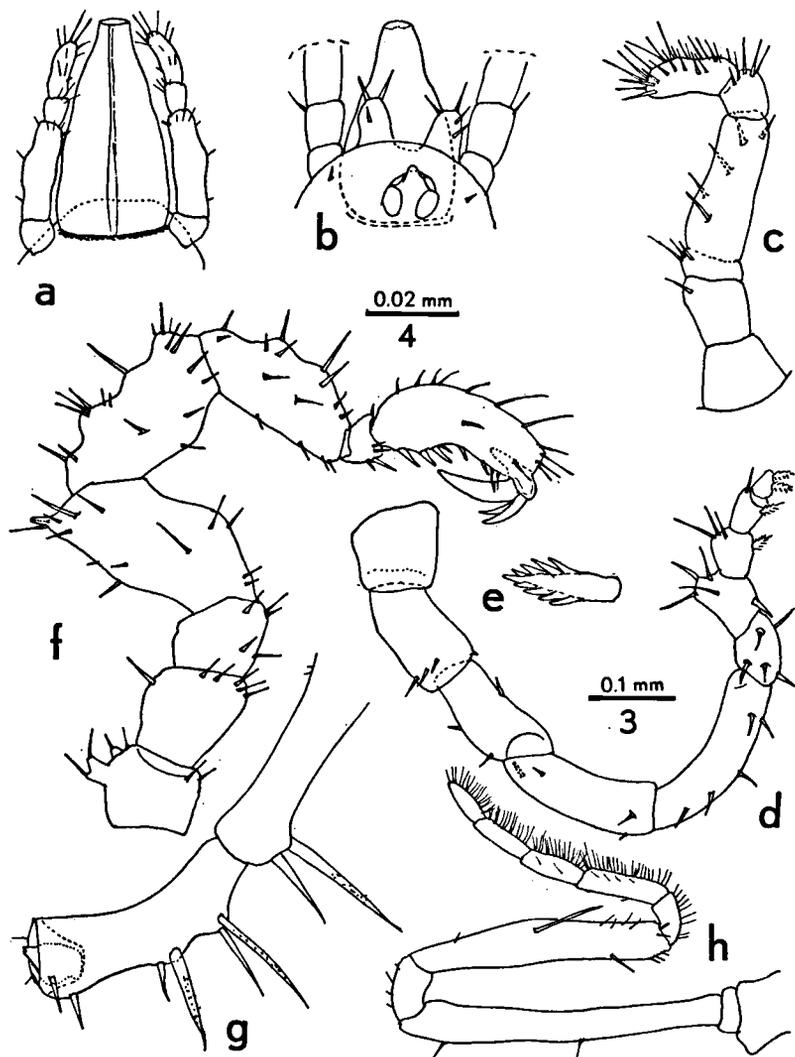


Fig. 3. a, *Tanystylum geminum* Stock, 1954, from Lagoen, BONAIRE (Sta. 1555): proboscis and palps, ♀, ventral (scale 12).

b-f, *Tanystylum isthmicum* ssp. *difficile* Stock, 1966, from Knip Bay, CURAÇAO, ♂: b, head, dorsal (scale 12); c, palp (3); d, oviger (3); e, distal spine of 10th oviger segment (4); f, third leg (12).

g-h, *Eurycyde acanthopus* n. sp., ♀ (holotype), from "PILLSBURY" Sta. 736: g, chelifore (scale 5); h, palp (5).

The legs of the male (Fig. 2f) are more spinous than those of the female; in particular, a bifid, spiniferous process on the distoanterior corner of coxa 1 of all legs is noteworthy.

From *T. isabellae*, *T. isthmiacum* differs by having longer chelifore stumps and a shorter, more pear-shaped proboscis.

From *T. hummelincki*, it differs in the proboscis ending in a short tubular distal part, in a longer abdomen, and in a more heavy propodus.

From *T. tubirostrum*, it differs in having much longer chelifores and in the much shorter tubular part of the proboscis.

From *T. geminum*, it differs in the presence of a lobe on oviger segment 7 (♂), and in having 10 (instead of 9) female oviger segments.

Tanystylum geminum Stock, 1954

(Fig. 3a)

Stock, 1975: 983.

BONAIRE: 40 specimens, Hummelinck Sta. 1555, Lagoon, muddy sheet of water among *Avicennia*, Sep. 19, 1967.

MARGARITA: 1 ♂, Hummelinck 1216 (or 1217), Punta Mosquito, near Porlamar, rocky sand beach (or shallow lagoon with *Rhizophora*), June 4, 1936.

ST. MARTIN: 2 ♂ ovig., 4 ♂, 1 juv., Hummelinck 1132, Simson Bay Lagoon, Flamingo Pond, 0-1 m, muddy shore with *Rhiz.* and *Avic.*, June 8, 1949. These specimens are topotypes.

JAMAICA: 1 ♂ ovig., 3 ♂, 2 ♀, 3 juv., Hummelinck 1683, Drunkemans Key, 0-½ m, sandy debris, June 15, 1973.

The proboscis is sometimes slightly less narrow than in the material illustrated by Stock, 1954. This is, for instance, the case in a female specimen from HUMMELINCK'S Station 1555, illustrated in Fig. 3a. However, in its remaining characters, in particular the long chelifore stumps and the 9-segmented condition of the ♀ oviger, such specimens are identical to *T. geminum*.

This species was hitherto only found in the northern Caribbean (Florida, Puerto Rico, St. Martin). The present records extend the range of the species to the islands off the Venezuelan coast.

Tanystylum conirostre (Dohrn, 1881)

Syn.: See KRAPP, 1973: 60-64.

BONAIRE: 1 ♂, Hummelinck Sta. 1555, Lagoen, S.W., muddy sheet of water, *Avicennia*, Sep. 19, 1967.

This single specimen shows a mixture of characters: the slender legs and ovigers, and the spiniferous chelifore stumps are reminiscent of *T. conirostre*; the shortish abdomen and the unequal spination of the propodal sole resemble *T. orbiculare* Wilson. The best character to separate *conirostre* from *orbiculare* is the number of ♀ oviger segments. In absence of females, the present specimen is tentatively attributed to *T. conirostre*. According to KRAPP (1973), *conirostre* was also encountered at HUMMELINCK'S Station 1130 (St. Martin, Simson Bay Lagoon).

Nymphon cf. floridanum Hedgpeth, 1948

Stock, 1975: 994.

CURAÇAO: 1 ♀ (all legs lacking), Blauwbaai, on a sponge, *Agelas clathrodes* (Schmidt), 20 m deep, Feb. 11, 1976, P. Hoetjes and E. Westinga coll.

Owing to the damaged state of the specimen, the identification is made with some reservation.

Callipallene brevirostris (Johnston, 1837)

Stock, 1975: 1010.

CURAÇAO: 1 ♂ ovig., Hummelinck Sta. 1666A, Awa di Oostpunt, 30-50 m from N shore, $\frac{1}{4}$ -1 m deep, sandy bottom with *Thalassia*, *Porites*, Feb. 22, 1970.

BONAIRE: 7 ♂, 2 ♀, Hummelinck 1555, Lagoen, S.W., muddy sheet of water among *Avicennia*, Sep. 19, 1967. - 4 ♂ ovig., 2 ♂, 2 ♀, 7 juv., 1577a, Lac, Puito, 0- $\frac{1}{2}$ m, *Rhizophora* in mud, Mar. 11, Mar. 1970 - 1 ♂, 1 ♀ 1653. Sorobon. near Boca Jewish, 0- $\frac{1}{4}$ m, *Rhiz.*, Mar. 10, 1970. - 1 ♂, 1653A, same, but $\frac{1}{4}$ -1 m, *Halimeda* and *Thal.* near *Rhiz.*

St. THOMAS: 1 ♀, Hummelinck 1674, Benner Bay lagoon, 0-1 m, *Rhiz.* in mud, Apr. 30, 1973.

This is a species that prefers protected sites (lagoons, etc.) in which soft substrates predominate.

Anoplodactylus pectinus Hedgpeth, 1948

Stock, 1975: 1050 (sub *A. pectinis*, lapsus calami).

CURAÇAO: 2 ♂, Hummelinck Sta. 1038, Fuik Bay, Duitse Bad, 0-1½ m, deep, muddy, near *Rhizophora*, Mar. 2, 1949. - 1 ♀, 1318, Playa Frankie, 0-1 m, shallow lagoon with sandy reef debris, Feb. 27, 1955.

St. THOMAS: 2 ♂, 3 ♀, 5 juv., Hummelinck 1674, Benner Bay lagoon, 0-1 m, *Rhiz.* in mud, Apr. 30, 1973.

A very characteristic species (cheliformes exceptionally feeble; cribriform cement gland; pectinated largest propodal spine), which is widely distributed in the West Indies.

Anoplodactylus portus Calman, 1927

Stock, 1975: 1052.

ARUBA: 1 ♀, Hummelinck Sta. 1302, iron beam of Wharf of Arend Petr. Comp., May 4, 1955, - 1 ♂, 1303, Paardenbaai, sandy reef, *Rhizophora*, Apr. 28, 1955.

CURAÇAO: 1 ♂, 2 ♀, Hummelinck 1668A, St. Joris Bay, N.W., ¼-1 m, mud with rock and other debris *Thalassia* and *Halophila*, Feb. 25, 1970.

St. EUSTATIUS: 1 ♀ juv., probably this species, Hummelinck 1119, Tumble Down Dick Bay, ¼-½ m, andesitic rock with some sand, July 10, 1949.

ANGUILLA: 1 ♂ ovig., 2 ♂, 3 ♀, 3 juv., Hummelinck 1704, Crocus Bay, N., 0-¼ m, limestone and igneous rock, a little sand, July 3, 1973.

A circumtropical species that abounds in sheltered waters and does not avoid polluted conditions.

Anoplodactylus insigniformis Stock, 1975

Stock, 1975: 1058-1063, figs. 45-46.

VENEZUELA mainland: 1 ♀, 2 larvae, Hummelinck Sta. 1202, Guanta, near Barcelona, wooden piles, 0-1 m deep, Aug. 15, 1936.

A widely distributed species in shallow waters in the West Indies, although it was not yet known from Venezuela. It was, up to recently, confused with *A. insignis* (Hoek, 1881).

Anoplodactylus monotrema n. sp.

(Figs. 4-5)

CURAÇAO: 1 ♂ ovig. (holotype), Santa Martha Bay, in front of former Coral Cliff Hotel, depth 5-6 m, on corals, Dec. 16, 1973, J. H. Stock coll. - 1 ♂

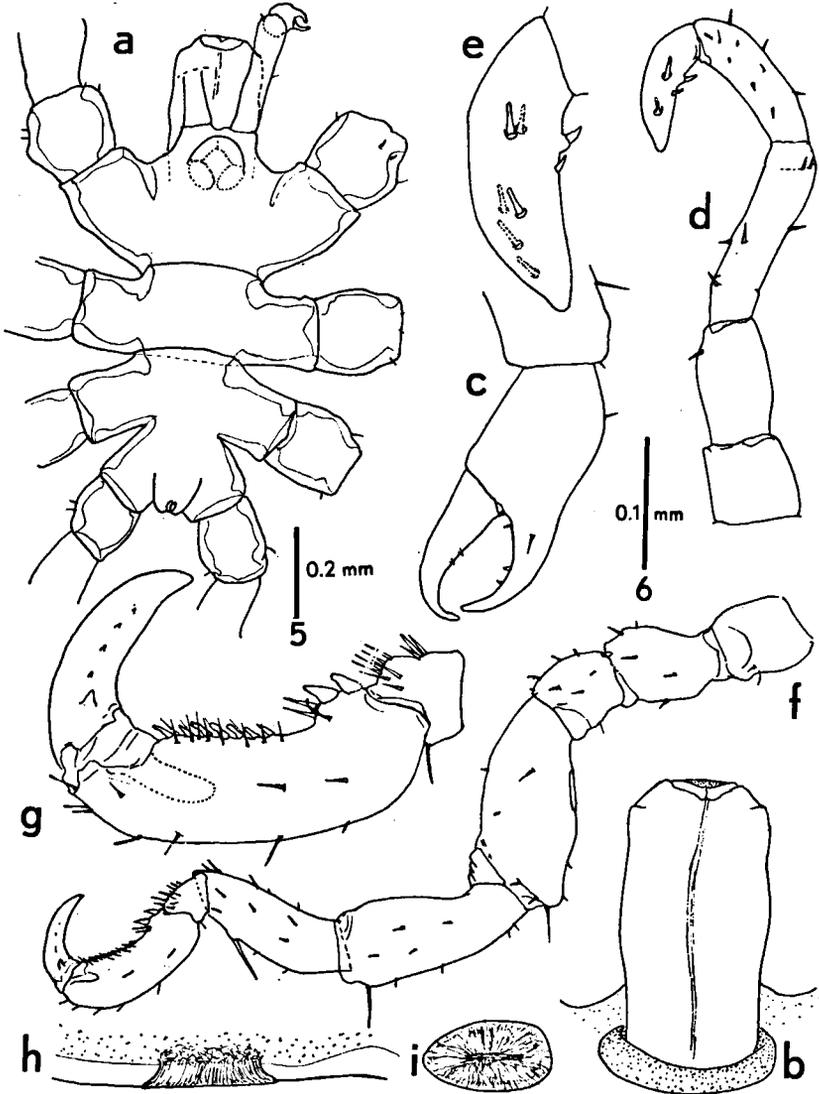


Fig. 4. *Anoplodactylus monotrema* n. sp., ♂ (holotype), from Santa Martha Bay, CURAÇAO. a, trunk, dorsal (scale 5); b, proboscis, ventral (12); c, chela (6); d, oviger (12); e, distal oviger segment (6), f, third leg (5); g, distal segments of third leg (3); h, cement gland aperture, side view (6); i, same, dorsal (6).

ovig., Hummelinck Sta. 1019, Playa Djerimi, N. corner, rock, sand, tidal and lower zone, Dec. 11, 1948.

ARUBA: 3 ♂ ovig., 1 ♂, 2 ♀, Hummelinck 1301, Malmok, Arasji, 0-1 m, rocky beach with sand and boulders, *Thalassia* flat with *Porites*, Aug. 14, 1955.

BONAIRE: 1 ♂ ovig., 2 ♂ juv., 3 ♀, Hummelinck 1057, Kralendijk near Pasanggrahan, 0-1 m, beachrock with small tide pools, Sep. 5, 1930. - 1 ♂ ovig., 4 ♀, 1057a, same, Sep. 20, 1930. - 1 ♂ ovig., 1 ♀, 1058, S of Kralendijk, De Hoop, 0-1½ m, limestone cliff with sandy reef, May 17, 1930. - 1 ♂ ovig., 1 ♀, 1377, Lagoen, N, 0-1 m, diabase rock near sandy beach, Apr. 2, 1955.

JAMAICA: 1 ♂, 2 ♀, Hummelinck 1683, Drunkemans Key, 0-½ m, sandy debris, June 15, 1973.

BAHAMAS: 1 ♂ ovig., Hummelinck 1151, North Bimini, lagoon, Laboratory dock, wooden piles, eelgrass, 0-1 m, Aug. 20, 1949.

FLORIDA: 1 ♂ juv., Hummelinck 1414, Elliott Key, depth 2-6 m, Sep. 5, 1963.

Description. - Very similar to *A. virescens* (Hodge, 1864). Trunk somites 3 and 4 usually fused. Lateral processes smooth, short, separated by narrow but distinct intervals. Abdomen short, almost knob-like, erect, not extending much beyond the tip of the 4th crurigers. Ocular tubercle also very low, rounded; eyes present. Proboscis straight, of type B'''; distal end truncate; distolateral corners distinct but not angulate.

Chelifore scape slender, overreaching the proboscis; chela with curved, gaping fingers, which are slightly shorter than the elongate-rectangular palm; each finger with 2 to 5 small triangular teeth of a size.

Oviger 5-segmented, present in males only; segments 3 and 4 subequal; segment 5 pointed, armed with 1 or 2 reversed tooth-like spines on the inner (= ventral) margin and with 2 to 4 obtuse spines on each lateral surface.

Legs robust; coxae short, without marked tubercles, not angular; femur and tibia 1 subequal, tibia 2 a trifle shorter; femoral cement gland discharging through a single oval aperture, situated on the dorsal surface of the segment, slightly in front of the middle. Propodus with a strong heel, armed with 2 triangular teeth and 2 more slender spines; sole with some 7 or 8 heavier spines and 2 rows of needle-like spinules. Claw heavy, auxiliary claws vestigial; a row of minute denticles ornaments the lateral surface of the claw.

Measurements of the ♂ holotype, in mm (in brackets, those of a ♂ from Hummelinck Sta. 1151 are listed):

Length of body (frontal margin proboscis to tip abdomen)	1.22 (1.04)
Width across 1st lateral processes	0.80 (0.64)
Width across 2nd lateral processes	0.61 (0.48)
Length proboscis, ventral	0.50 (0.37)
Greatest diameter proboscis	0.25 (0.23)
Length scape	0.30 (0.30)
Third leg: 1st coxa 0.25 (0.18), 2nd coxa 0.30 (0.27), 3rd coxa 0.21 (0.17), femur 0.49 (0.56), 1st tibia 0.48 (0.48), 2nd tibia 0.41 (0.47), tarsus 0.07 (0.07), propodus 0.39 (0.36), claw 0.22 (0.23).	
Oviger: 1st segment 0.14 (0.09), 2nd segm. 0.20 (0.16), 3rd segm. 0.33 (0.26), 4th seg. 0.24 (0.19), 5th segm. 0.19 (0.16).	

Variability. – The slenderness of the legs varies somewhat, presumably in relation to the moulting stage of the specimens. The terminal oviger segment is slightly shorter (in proportion to the 4th segment) in the holotype than in certain other specimens. The number of reversed, tooth-like spines on the ventral margin of oviger segment 5 may be 1 or 2; the number of blunt lateral spines varies from 2 to 4. In certain populations, e.g. that from Hummelinck's Station 1301, specimens occur which have clearly articulated trunk somites 3 and 4.

Derivatio nominis. – The specific name is composed of the Greek words $\mu\omicron\nu\acute{o}\varsigma$ (= single) and $\tau\rho\tilde{\eta}\mu\alpha$ (= aperture), and alludes to the single cement gland opening.

COMPARISON WITH THE MEMBERS OF THE *A. robustus* – GROUP

In the West Indies, an *Anoplodactylus* occurs – which is described above – that has 5-segmented male ovigers. This is an unusual character in the genus, which is shared by *A. robustus* (Dohrn) and *A. virescens* (Hodge) only.

Anoplodactylus robustus (Dohrn, 1881)

(Fig. 6)

A. robustus has been described by Dohrn (1881) from the Mediterranean (GILTAY, 1929, Banyuls; KRAPP & KRAPP, 1975, isle of

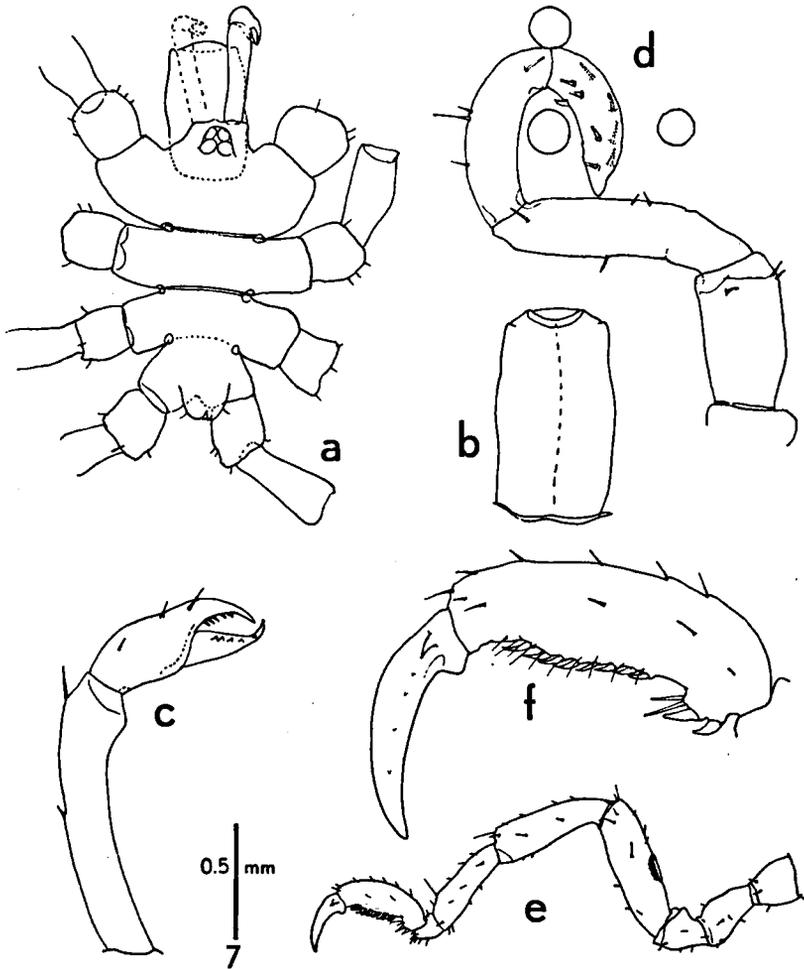


Fig. 5. *Anoplodactylus monotrema* n. sp., ♂ from NORTH BIMINI, Bahamas. a, trunk, dorsal (scale 5); b, proboscis, ventral (12); c, chelifore (3); d, oviger (3); e, third leg (7); f, propodus and claw of third leg (3).

Banjole in the Adriatic; unpublished material in ZMA from Cap l'Abeille, Banyuls; NORMAN, 1908 and LEBOUR, 1945, Naples). The only record for the Atlantic coast of Europe appears to be that of SALDANHA, 1974, from Arrábida (Portugal), but it is uncertain on whose authority the identification was made.

FAGE (1949a, 1949b) cites the species from Banana (Zaire), but his paper is unaccompanied by figures, hence it is impossible to judge the correctness of his identifications.

Certainly incorrect is ZILBERBERG's (1963) record from Trinidad Island in the western Atlantic off Rio de Janeiro. She illustrates a species with a 6-segmented oviger (5-segmented in *robustus*), and with a chimney-shaped, single cement gland aperture (3 to 6 pore-like openings in *robustus*). ZILBERBERG's material might belong to *A. marculsi* (de Mello Leitão, 1949), described (as *Halosoma*) from shallow waters near Rio de Janeiro.

The species described as *A. robustus* n. sp. by HILTON, 1939, is a homonym of *A. robustus* (Dohrn) and is in reality a junior synonym of *A. portus* Calman, 1927 (vide CHILD, 1975).

Phoxichilidium truncatum Hilton, 1942, from Oahu (Hawaii), is considered by CHILD (1975) to be identical with *A. robustus* (Dohrn). I have re-examined HILTON's material and found it to have 6-segmented ovigers and to be a junior synonym of *A. pycnosoma* (Helfer, 1938), a widely distributed Indo-Pacific species.

CHILD & HEDGPETH (1971) record *A. robustus* from Santa Cruz and Santa Maria islands (Galápagos). This material should be re-studied, in the light of the recently acquired taxonomic insights in this group of species (KRAPP, 1973; KRAPP & KRAPP, 1975; present paper).

A. robustus has also been recorded several times from the warm-water regions in the western Atlantic: Santos, Brazil (MARCUS, 1940); Tortugas, Florida (HEDGPETH, 1948); Bonaire and Bimini, Bahamas (STOCK, 1954); the Virgin Islands (STOCK, 1955); Bonaire and Florida (STOCK, 1975). Of these records, HEDGPETH's find must remain uncertain, since it is based on a solitary female (females in this genus are almost unidentifiable); HEDGPETH's figure (1948, fig. 24b) shows an animal with a long abdomen, very unlike the situation found in *A. robustus* (or *A. marculsi*, which is in the female sex very much like *A. robustus*), and rather unlike that in *A. virescens*. The presence of two intersegmental lines on the trunk, and the well-separated crurigers 1 and 2 are suggestive of either *A. virescens* or *A. monotrema*, but the long abdomen (as illustrated by HEDGPETH) remains disconcerting.

A re-examination of Mediterranean material of *A. robustus* made

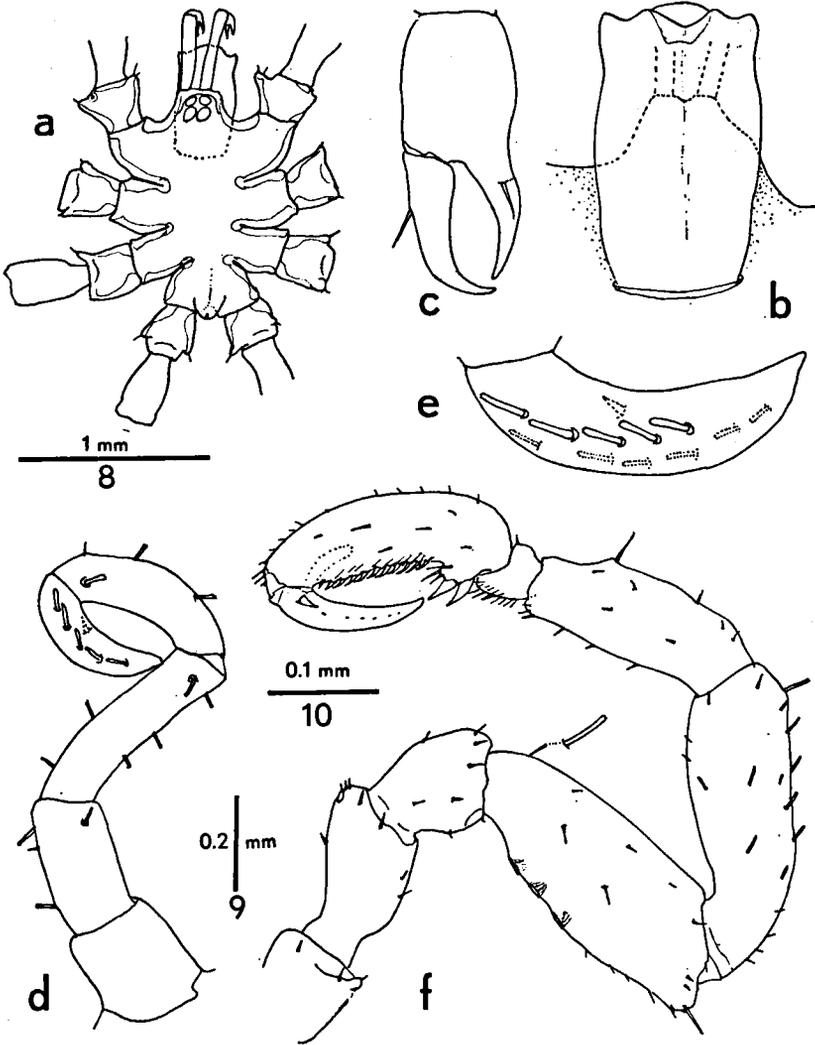


Fig. 6. *Anoplodactylus robustus* (Dohrn, 1881), ♂ from Banyuls, FRANCE. a, trunk, dorsal (scale 8); b, proboscis, ventral (9); c, chela (10); d, oviger (12); e, distal oviger segment (6); f, third leg (5).

it clear to me that at least all the Antillean specimens recorded in my various papers (1954, 1955, 1975) belong to another, though closely related, species, that is described above as *A. monotrema* n. sp. Judging from the figures, also MARCUS' material from Brazil belongs to this new species.

To show the affinities of *A. monotrema* more clearly, I include in the present paper a number of new figures (Fig. 6) of the typical (= Mediterranean) *A. robustus*, to supplement DOHRN's (1881) excellent drawings, as well as the additional illustrations by GILTAY (1929) and KRAPP & KRAPP (1975). *A. robustus* is strongly characterized by the combination of the following characters: (1) All trunk somites fused; (2) anterior margin of lateral process 2 contiguous over its entire length with the posterior margin of lateral process 1; (3) abdomen very short, hardly overreaching the distal end of the 4th lateral processes; (4) coxa 1 distally of angular appearance (through the presence of tubercles); (5) distal corners of the proboscis very markedly "angular"; (6) oviger 5-segmented, segment 5 not much shorter than segment 4, armed with a row of 5 or 6 blunt spines on each side and with a reversed tooth-like spine; (7) fingers of chela unarmed; (8) cement glands discharging through 3 to 6 pores in the proximal half of the femur.

***Anoplodactylus virescens* (Hodge, 1864)**

(Fig. 7)

It proved likewise worthwhile to re-examine European material of *A. virescens*, the only other *Anoplodactylus* with a 5-segmented oviger. Illustrations of this species can be found in the works of LEBOUR (1945) and KRAPP (1973). In the latter paper, the cement glands of *virescens* are illustrated, but their number is not mentioned.

I found 3 gland pores in KRAPP's material (from Pantelleria, Italy) and 6 gland pores in a male from Roscoff (French Channel coast). The chela of this species has never been illustrated before; it has a short palm and unarmed fingers (Fig. 7b). The abdomen distinctly overreaches the 4th lateral processes (LEBOUR's, 1945, fig. 4a shows this clearly; see also Fig. 6d in the present paper). The oviger is well illustrated by KRAPP (1973, fig. 7b); it is 5-segmented, with

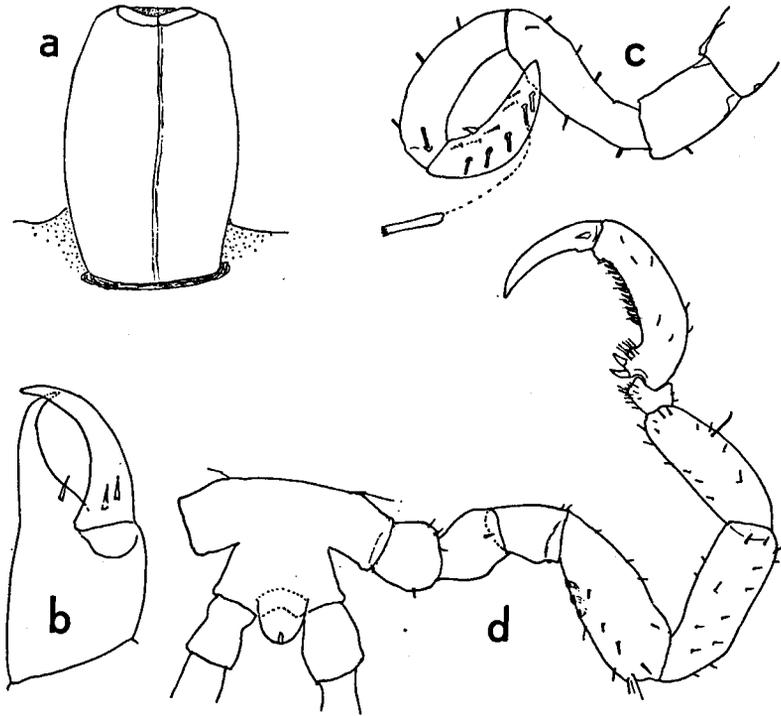


Fig. 7. *Anoplodactylus virescens* (Hodge, 1864), ♂ from Roscoff, FRANCE (a-c) and ♂ from Pantelleria, ITALY (d). a, proboscis, ventral (scale 12); b, chela (6); c, oviger (12); d, posterior end of trunk with third leg (5).

segments 4 and 5 subequal. The anterior margin of the 2nd lateral process is separated from the posterior margin of the 1st over its entire length by a narrow but distinct interval. Trunk somites 1, 2, and 3 are clearly articulated, but 3 and 4 are fused. The proboscis is not markedly angular (Fig. 7a) and the 1st coxae are not angular or tuberculate.

The West Indian material matches *A. virescens* in several respects (spaced 1st and 2nd lateral processes, no marked angularity in the proboscis, 1st coxae not angular, trunk partly segmented). However, a closer inspection showed that the West Indian specimens could not be identical with European *virescens*. The two features that separate the West Indian samples at once from both *virescens* and *robustus*

are the presence of only one, oval cement gland aperture, and the presence of teeth on the fingers of the chela. The short abdomen forms an additional distinction from *virescens*. The presence of trunk segmentation, the spacing of the lateral processes, the lack of angularity in the proboscis and in the coxae, form clear discrimination points from *robustus*.

For what concerns the teeth on the chela, it must be pointed out that ARNAUD (1974) found specimens which she attributed to *A. virescens* from Amsterdam and St. Paul islands (southern Indian Ocean), that possessed teeth on the fingers. I have seen several specimens, including ovigerous males and females, that Mrs. ARNAUD donated to the Zoölogisch Museum, Amsterdam, and I must admit that these are very similar indeed to *virescens*. The form and armature of the chela are rather different, however, and the Indian Ocean specimens have a completely segmented trunk. The typical *virescens* is only known from the warm-temperate parts of the eastern Atlantic (Azores to the English Channel¹) and the Mediterranean, and thus is not only separated by thousands of miles from Amsterdam island, but also found in a quite different climatic zone. I take it therefore for granted that the Amsterdam island population is not identical with the European ones, and I propose to call the former *A. dentimanus* n. sp. (vide infra).

Quite parenthetically, it may be noted that the members of the *robustus-virescens*-complex all have obtuse or spatulate spines, especially on the oviger segments, but also on the legs (cf. Figs. 6e, f; 7c). This fact has been mentioned by DOHRN, 1881, but – as far as I know – never again.

***Anoplodactylus dentimanus* n. sp.**

(Fig. 8)

Anoplodactylus virescens (non Hodge, 1964). – ARNAUD, 1974: 784, figs. 6–9.

AMSTERDAM ISLAND (Ind. Ocean): 1 ♂ ovig. (holotype), 1 ♀, Station AMS-a 4, N. coast, upper infralittoral, Feb. 11, 1971, J. Beurois coll. – Through the

1) In the Zoölogisch Museum, Amsterdam, there is one specimen from Zandvoort, The Netherlands. This was found, however, on a floating object (a life belt) which no doubt was transported by wind and currents from more southern waters.

courtesy of Mme. F. Arnaud, of Marseille, I could furthermore examine the greater part of the material used for her 1974 paper from Amsterdam island (viz. 1 ♂ from Sta. P. 49; 1 ♀, 2 juv. from Sta. a1; 1 ♂ from Sta. a5; 1 juv. from Sta. c1) and ST. PAUL ISLAND (viz. 1 ♂, 3 ♀ from Sta. 7a; 1 ♂ ovig. from Sta. 24a; 2 ♂, 1 juv. from Sta. 90; 1 ♂ ovig. from Sta. 93).

Diagnosis. – Very similar to *A. virescens*, but with a completely segmented trunk. Proboscis widest near its tip, of type D' (widest in the middle in *virescens*), non-angulate. Chela with a globular palm (more rectangular in *virescens*); immovable finger much shorter than the palm (about as long as the palm in *virescens*); both fin-

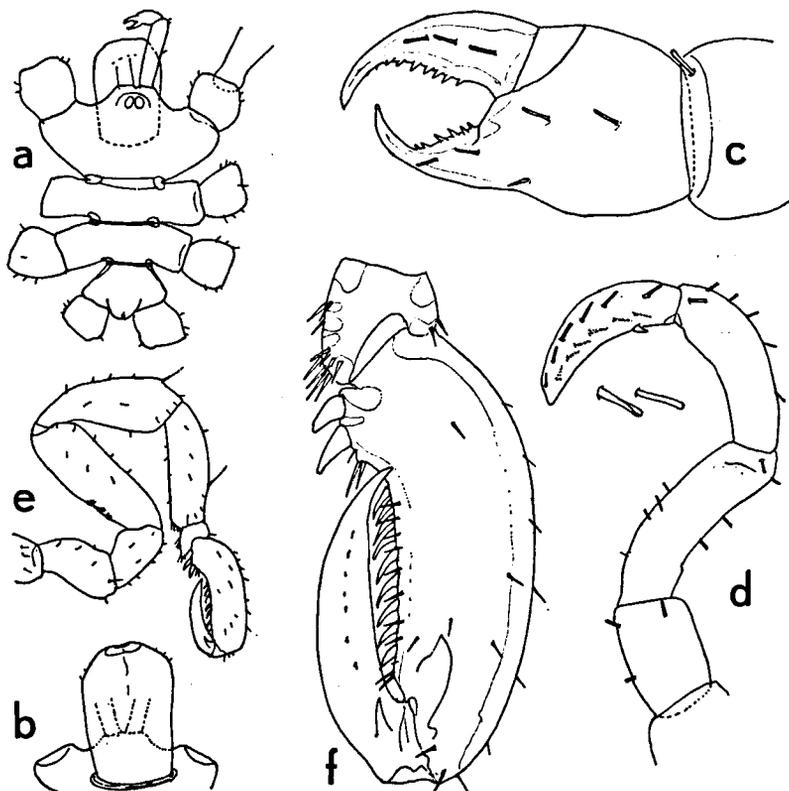


Fig. 8. *Anoplodactylus dentimanus* n. sp., ♂ (holotype) from Amsterdam island, southern INDIAN OCEAN. a, trunk, dorsal (scale 7); b, proboscis, ventral (7); c, chela (6); d, oviger (12); e, third leg (7); f, distal segments of third leg (3).

gers with 6 to 8 small but distinct triangular teeth of about a size (fingers unarmed in *virescens*). Oviger segment 3 perhaps a trifle shorter than in *virescens*. Three cement gland pores.

Measurements (in mm) of the ♂ holotype (those of the ♀ in brackets):

Length trunk (frontal margin neck to tip abdomen)	1.09 (1.15)
Width across 2nd lateral processes	0.69 (0.84)
Length proboscis (ventral)	0.48 (0.65)
Greatest diameter proboscis	0.32 (0.39)
Length scape	0.33 (0.39)
Length chela	0.26 (0.27)
Third leg: 1st coxa 0.18, 2nd coxa 0.36, 3rd coxa 0.22, femur 0.61, 1st tibia 0.54, 2nd tibia 0.52, tarsus 0.08, propodus 0.51, claw 0.35.	
Oviger: 1st segment 0.12, 2nd segm. 0.21, 3rd segm. 0.31, 4th segm. 0.28, 5th segm. 0.28.	

Remarks. — Another southern Hemisphere species, viz. *A. haswelli* (Flynn, 1918) from Port Jackson, Australia, resembles the present species in having toothed fingers in the chelae (see CLARK, 1963, fig. 24C). However, in this species, oviger segment 3 is about twice as long as segment 4, in the present species only 1.1 times longer.

Anoplodactylus spec. A (see CLARK, 1963: 53) from New South Wales, is very similar to the present species. Since it is known, however, in the female sex only, a positive identification cannot be made.

Anoplodactylus micros Bourdillon, 1955

A. micros BOURDILLON, 1955: 591–592, pl. 1 figs. 3–8; STOCK, 1973: 124–125, fig. 12.

CURAÇAO: 1 ♀ Hummelinck Sta. 1018A, Knip Bay, N. side, 0– $\frac{1}{4}$ m, rocky shore with sand, Feb. 6, 1949.

The identification of a solitary female in this large genus must be taken with some reservation. *A. micros* was originally described from Martinique, but found again later on the coast of southern Australia.

Anoplodactylus batangensis (Helfer, 1938)

Stock, 1975: 1082.

CURAÇAO: 1 ♀, Piscadera Bay, 1–2 m, on the sea anemone *Condylactis gigantea*, Nov. 16, 1973, J. H. Stock coll. – 2 ♀, Jan Thiel Bay, swimming pool, on corals, abt. 2 m, Dec. 26, 1973, Stock coll.

JAMAICA: 1 ♂, 1 juv., Hummelinck Sta. 1683, Drunkemans Key, 0–½ m, sandy debris, June 15, 1973.

CAYMAN BRAC: 1 ♂ juv., Hummelinck 1703, West Point, Ledges, 0–½ m, boulders, sand, June 3, 1973.

A very characteristic species with a tubiform (or styloform) proboscis; circum-tropical.

Anoplodactylus evelinae Marcus, 1940

Stock, 1975: 1083.

JAMAICA: 20 specimens, Hummelinck Sta. 1683, Drunkemans Key, 0–½ m, sandy debris, June 15, 1973.

A quite distinctive species, characterized by its short 2nd tibia. It presumably has a psammophilous habitat.

Anoplodactylus sp. 1 (cf. **trispinosus** Stock, 1951)

CURAÇAO: 1 ♀, Hummelinck Sta. 1019, Plaja Djerimi, 0–1½ m, rocky shore with sand, Dec. 11, 1949.

I do not dare to make a firm identification of this solitary female.

Anoplodactylus sp. 2 (n. sp. ?)

CURAÇAO: 1 ♀, Hummelinck Sta. 1016a, Boca Grandi, 0–½ m, sandy beach with beachrock, tide pools, Feb. 24, 1970.

Unfortunately, only a female was found. It might represent a new species, characterized by a very straight propodus and a very long, straight claw.

Endeis meridionalis (Böhm, 1879)

Phoxichilus meridionalis BÖHM, 1879: 189–191, pl. 2 fig. 4; SCHIMKEWITSCH, 1890 20; 1891: 509–510; 1929: 186–188.

Endeis meridionalis (Böhm), CALMAN, 1923: 291–293, fig. 15; STOCK, 1965: 30–31; 1968: 59 (in key); FRY & HEDGPETH, 1969: 64, 66 (in key); UTINOMI, 1971: 327–328; CLARK, 1973: 33, fig. 3; ARNAUD, 1973: 959.
 Non *Phoxichilus meridionalis* sensu LOMAN, 1908: 78–79 (= *E. biseriata* + *E. flaccida*).

CURAÇAO: 1 ♂ ov., 1 ♂, 1 ♀, Jan Thiel Bay, open air swimming pool, in corals, abt. 2 m. Dec. 26, 1973, J. H. Stock coll.

This species was recorded before from several localities throughout the Indian and western Pacific oceans, from Madagascar to Suez, and from Japan to New Britain. The species is new to the Atlantic basin; this is another *Endeis* with a circumtropical distribution (see under *E. biseriata*).

The species is characterized by a combination of characters, each of which might seem of minor importance, but taken together, they make *E. meridionalis* a rather well-characterized taxon: body and legs fairly spinose; lateral processes separated by a distance of more than twice their own diameter; proboscis rather short, spindle shaped; femur distorted; femoral cement gland pores rather numerous (21–35), arranged in one row; tibia 2 not much longer than the femur; propodus feebly curved, particularly “heavy” in aspect, etc.

The present West Indian specimens agree completely with the Indo-Pacific material. The number of cement gland pores is about 31.

***Endeis biseriata* Stock, 1968**

(Fig. 9)

Endeis biseriata STOCK, 1968a: 57–60, fig. 21; 1974: 17.

BRAZIL: 2 ♂ ov., 1 ♀, Alazão, evaporation pond near Macau (prov. Rio Grande do Norte), on stones, depth 0.30 m, running water, salinity 40‰, Apr. 17, 1976, R. Dijkema coll.

This species was recorded before from Indonesia, the Strait of Malacca, Hawaii, India, and Madagascar. It is new, therefore, to the Atlantic. A distribution somewhat similar to that of the present species is shown by three other *Endeis* species, *mollis*, *flaccida*, and *meridionalis*.

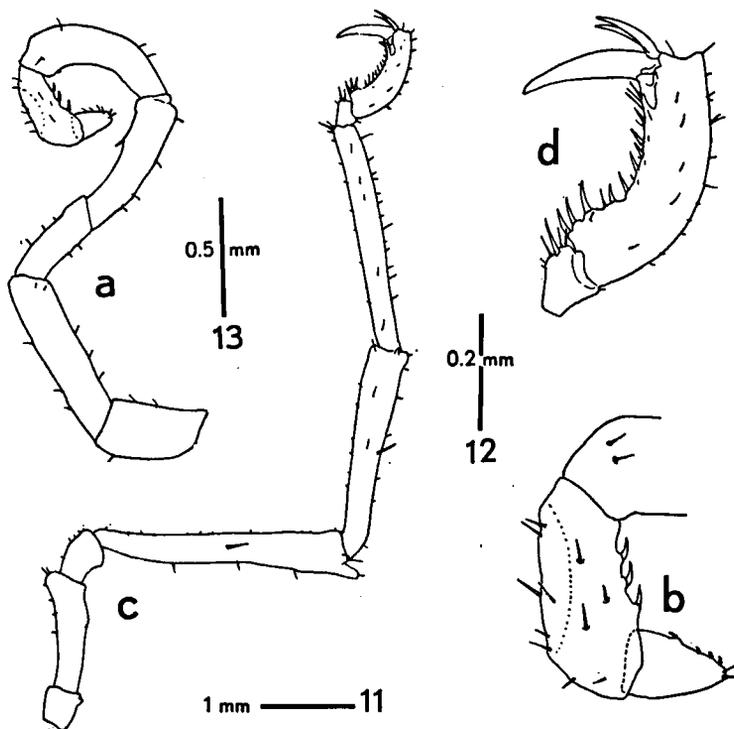


Fig. 9. *Endeis biseriata* Stock, 1968, ♂ from Macau, BRAZIL. a, oviger (scale 13); b, distal oviger segments (12); c, third leg (11); d, distal segments of third leg (7).

The very small cement gland pores (only visible under high magnification, in dissected legs on slides) lie in 2 sinuous rows on the posterior surface of the male femur. In two legs (P ? and P 3), I counted 38 and 34 pores in the longest row, respectively.

The trunk length of the present specimens is about 3 mm, the proboscis is about 2 mm long. The 3 distal spurs on the femur are present (Fig. 9c), though they are not as long as in the holotype from New Guinea. They resemble more closely the situation found in the specimens (Stock, 1968a) from Galathea St. 325 (Strait of Malacca). On the other hand, the elongation of the 2nd coxa in the Brazilian material is in agreement with that found in the holotype.

This species differs from *E. spinosa*, the more commonly reported

Endeis from the Atlantic coasts of South America, in a number of characters: (1) the cement gland pores are arranged in 2 rows (1 row in *spinosa*); (2) the femur has 3 marked distal processes (none in *spinosa*); (3) the relative length of the oviger segments is different (in *spinosa*: segment 3 subequal to 4, 5 longer than 4; in *biseriata*: segment 3 much shorter than 4, 5 slightly shorter than 4).

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