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## Pycnogonida from Malaysian coral reefs, including descriptions of three new species

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**Abstract.** 15 species of Pycnogonida in 5 families are recorded from coral reefs in the Tioman Archipelago, Malaysia. Distributional data for most species are given and supplementary descriptions are provided for *Eurycyde setosa* Child, 1988, *Tanystylum bredini* Child, 1970 and *Anoplodactylus glandulifer* Stock, 1954. *Anoplodactylus tarsalis* Stock, 1968 is redescribed, based on material from Kenya. Three new species, *Cheilopallene coralliophila*, *Anoplodactylus pseudotarsalis*, and *Pycnogonum asiaticum* are described.

**Key words.** Pycnogonida, Malaysia, records, new species.

### Introduction

The present material collected in the Tioman Archipelago, Malaysia, is the best evidence of the previously poor knowledge of the coral reef inhabiting pycnogonids in the Asian region. The author carried out his field work over a period of three weeks in April 1991 on the islands Pulau Babi Besar and Pulau Tioman. Samples of dead coral substratum (mainly *Acropora* sp. and *Pocillopora damicornis*) have been taken on two fringing reefs at the north-west coast of these islands. 15 species pertaining to 5 families could be collected, including 3 species new to science. Three more species were known until now only from their type localities in the Philippines or Australia.

Most of the material is deposited in the Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn, Germany (ZFMK). Some specimens were donated to the Muséum National d'Histoire Naturelle in Paris, France (MNHN), or retained for the author's private collection.

### Systematic Account

#### Ammotheidae

#### *Achelia* Hodge, 1864

#### *Achelia assimilis* (Haswell, 1885)

*Achelia (Ignaphogriphus) assimilis*: Fry & Hedgpeh 1969: 106, figs 152, 153, 156, tab. 13, 14 [literature].  
*Achelia assimilis*: Stock 1973 a: 106. Stock 1973 b: 92. Child 1975: 24. Child 1988 a: 2. Müller 1989: 124, figs 1—10. Child 1990: 312—313. Child 1991: 138. Gonzáles & Edding 1990: 151—156, figs 1—2. Child 1991: 138.

**Material:** 3 ♀, 1 juv. (ZFMK), fringing reef at Pulau Tioman; dead coral substratum, 1—3 m, 12—17 April 1991.

This variable species has a wide distribution in tropical and temperate waters of the south-west Pacific, with some scattered locations known from Indonesia, French Polynesia, Chile and now from Malaysia.

*Ammothella* Verrill, 1900

*Ammothella indica* Stock, 1954

Nakamura & Child 1991: 7 [literature].

Material: 1 ♂, 1 ♀ (Coll. Müller), fringing reef at Pulau Babi Besar; reef flat, under coral rocks covered with coralline algae, intertidal-1 m, 1 April 1991. 3 ♂, 1 juv. (ZFMK), fringing reef at Pulau Tioman; dead coral substratum, 1–3 m, 12–17 April 1991.

The Malaysian specimens do well agree with the original description based on material from the East Indies (Sunda Straits and Singapore) (Stock 1954: 113–119, figs 54, 55, 56c, 57a–c).

*A. indica* is common in the tropical and temperate Indo-Pacific. It is known from Madagascar and South Africa in the West to French Polynesia (Society Islands) in the East.

*Eurycyde* Schiödte, 1857

*Eurycyde setosa* Child, 1988 Figs 1–5

Child 1988a: 8–10, fig. 3. Child 1990: 316–317.

Material: 1 ♂ (ZFMK), fringing reef at Pulau Babi Besar; reef flat, under coral rocks covered with coralline algae, intertidal-1 m, 1 April 1991.

The only specimen available from Malaysia has almost all spines of the ocular tubercle and abdomen broken off. The species is characterised by the slender distal processes on the first coxae of segments 1–3, with the anterior process always shorter than the posterior one, and through the long and slender, posteriorly directed spine on coxae 2 and 3 of all legs. The lateral process tubercles of segments 1–3 are small and cone-shaped, while the fourth lateral processes bear only small, poorly defined dorsal tubercles.

The Malaysian record greatly extends the known range of *E. setosa* westward. Up to now it has been found in the Philippines (Batan Island, Child 1988a) and on the Australian barrier reef (Child 1991).

*Tanystylum* Miers, 1879

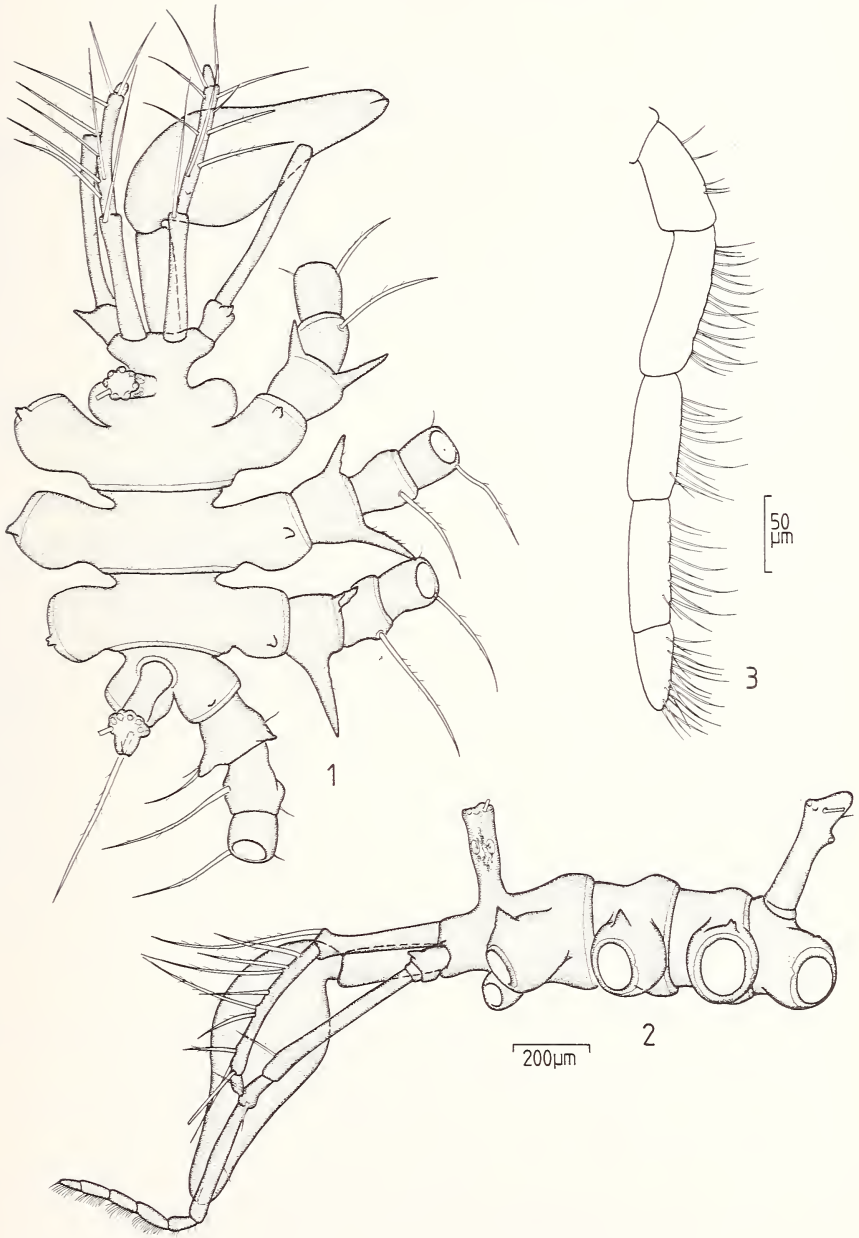
*Tanystylum bredini* Child, 1970 Figs 6–11

Child 1970: 296–299, fig. 3. Child 1977: 441. Child 1988b: 52. Müller 1989: 125, figs 11–21. Müller 1990a: 67, figs 7–15.

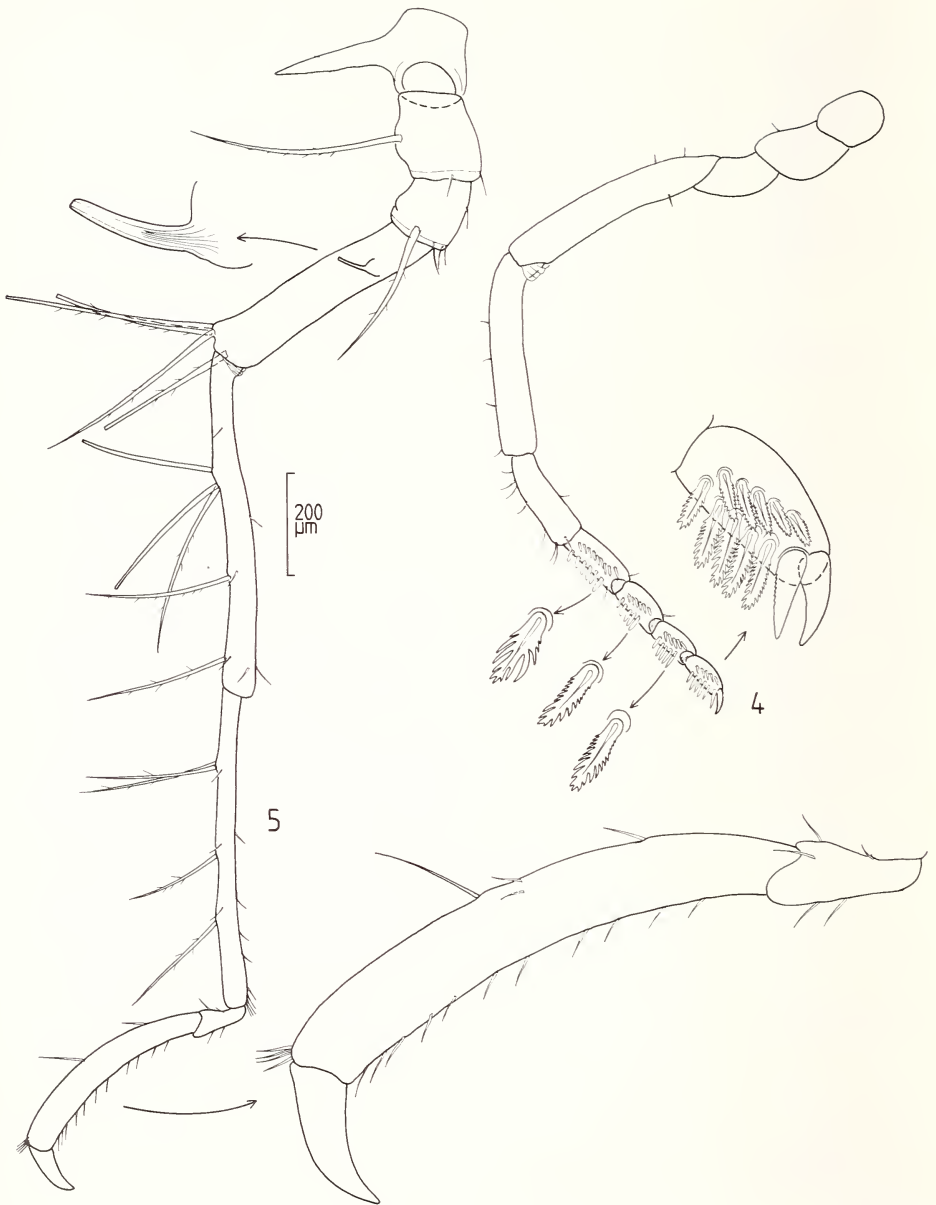
Material: 1 ♂ (ZFMK), fringing reef at Pulau Babi Besar; outer reef flat, reef margin and upper coral slope, dead coral substratum (*Acropora* sp., *Pocillopora damicornis*), 1–2 m, 2–9 April 1991.

Only one ♂ has been found in Malaysia which differs slightly in some respects from the material known from other areas. Compared with the Polynesian ♂ figured by Child (1970) and the ♂ from Sri Lanka recorded by Müller (1990a) the distal palp article of the Malaysian specimen is distinctly longer, while the accessory claws of the walking legs are shorter. The size of the lateral process tubercles and coxal tubercles falls within the variability shown by Müller (1989, 1990a).

*T. bredini* was known from scattered localities in the tropical Indo-Pacific. It was found in French Polynesia (Child 1970, 1977; Müller 1989), the Seychelles (Child



Figs 1—3: *Eurycyde setosa* Child, 1988, ♂: 1) dorsal view; 2) lateral view; 3) 5 distal palp articles.



Figs 4—5: *Eurycyde setosa* Child, 1988, ♂: 4) oviger; 5) 3rd leg.

1988b), also in Kenya and Sri Lanka (Müller 1990a). The present record therefore partially fills the large distributional gap between Sri Lanka and Polynesia.

## Callipallenidae

### *Callipallene* Flynn, 1929

#### *Callipallene dubiosa* Hedgpeth, 1949

Nakamura & Child 1991: 38 [literature],

Material: 1 ♂ (ov.), 1 ♀ (ZFMK), fringing reef at Pulau Babi Besar; outer reef flat, reef margin and upper coral slope, dead coral substratum (*Acropora* sp., *Pocillopora damicornis*), 1–2 m, 2–9 April 1991.

The Malaysian material agrees well with the description given by Stock (1954: 41–43, fig. 17).

*C. dubiosa* is known from shallow waters of the Indo-West Pacific. It has been recorded from East Africa (Kenya, Zanzibar) to Japan and Korea.

### *Cheilopallene* Stock, 1955

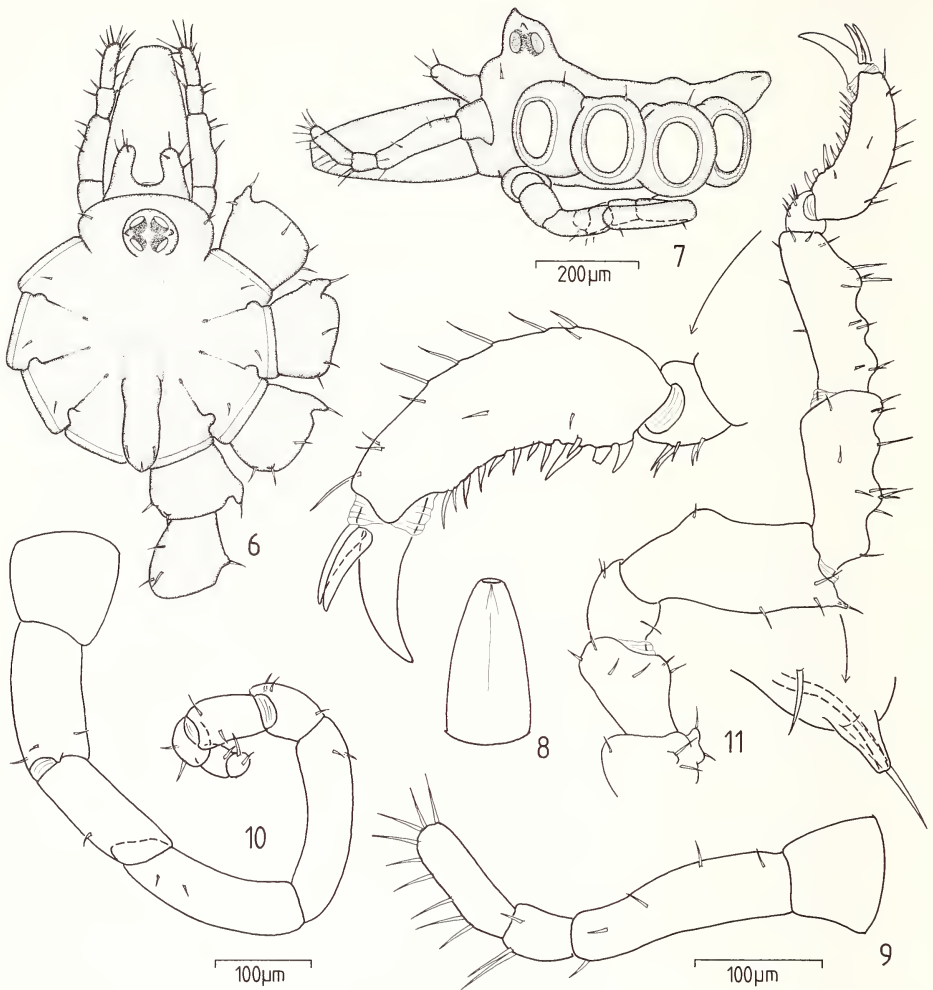
Species of *Cheilopallene* are characterised by the projecting lips of the proboscis and the robust immovable finger of the chelifores with a tuberculate cutting edge. Six species of this genus have been described up to now, of which 3 are known only from the type locality. They may be determined by the following key.

1. Cephalon with paired tubercles over base of chelifore scapes ..... 2
  - Cephalon lacking such tubercles ..... 3
2. Tubercles on cephalon longer than wide; first coxae of all walking legs also with dorso-distal pair of slender tubercles ..... *C. coralliophila* n. sp. (Malaysia)
  - Tubercles on cephalon small, no longer than wide; tubercles on first coxae of all walking legs lacking ..... *C. brevichela* Clark, 1961 (Maldives)
3. Distal half of proboscis slender and tube-shaped ..... 4
  - Distal half of proboscis more robust, not tube-shaped ..... 5
4. Distal part of proboscis densely setulose, propodus almost straight .....
  - ..... *C. hirta* Child, 1988 (Japan, Seychelles)
  - Distal part of proboscis not setulose, propodus well curved .....
    - ..... *C. trappa* Clark, 1971 (New Zealand)
5. Proximal half of neck slender, less than half width of inflated distal part .....
  - ..... *C. gigantea* Child, 1987 (Antarctic)
  - Proximal part of neck much more robust, at least  $\frac{2}{3}$  width of inflated distal part .. 6
6. Outer proximal margin of chelifore scape with conspicuous rounded tubercle .....
  - ..... *C. nodulosa* Hong & Kim, 1987 (Japan, Korea and Australian barrier reef)
  - Chelifore scape without trace of tubercles .....
    - ..... *C. clavigera* Stock, 1955 (Virgin Islands, Caribbean)

#### *Cheilopallene coralliophila* n. sp. Figs 12–17

Holotype: ov. ♂ (ZFMK), fringing reef at Pulau Tioman; dead coral substratum, 1–3 m, 12–17 April 1991.

Diagnosis: Tiny species of *Cheilopallene* with moderately robust habitus; cephalon with paired slender tubercles over base of chelifore scapes, combined with paired dorsodistal tubercles on coxa 1 of each walking leg.

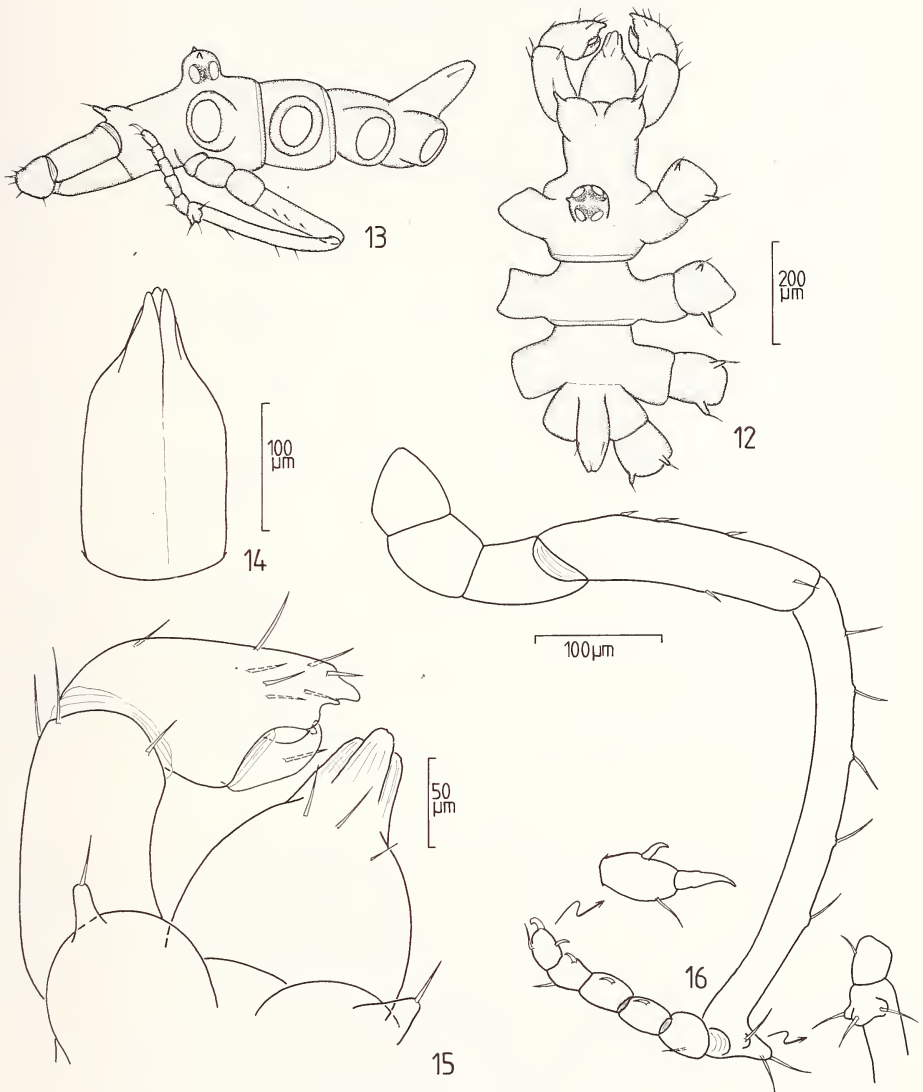


Figs 6–11: *Tanystylum bredini* Child, 1970, ♂: 6) dorsal view; 7) lateral view; 8) proboscis, ventral view; 9) palp; 10) oviger; 11) 3rd leg.

Description (♂ holotype): Trunk oval in outline, suture line between segments 3 and 4 indistinct. Lateral processes as long as wide, smooth, separated by  $\frac{1}{3}$ – $\frac{1}{2}$  their diameters. Ocular tubercle rounded, as wide as long. Anterior part of cephalon laterally expanded, with paired slender tubercles tipped with a short seta over base of chelifore scape.

Eyes relatively large, oval and well pigmented.

Proboscis cylindrical in two proximal thirds, bearing 3 setae dorsodistally; distal third tapering and armed with 3 projecting lips as in other members of the genus.



Figs 12–16: *Cheilopallene coralliophila* n. sp., ov. ♂ holotype (eggs omitted): 12) dorsal view; 13) lateral view; 14) proboscis, ventral view; 15) anterodorsal part of body with left cheliphore; 16) oviger.

Abdomen posteriorly directed, somewhat narrowing distally, with narrowly rounded apex; abdomen slightly extending beyond proximal half of first coxae of 4th walking legs.

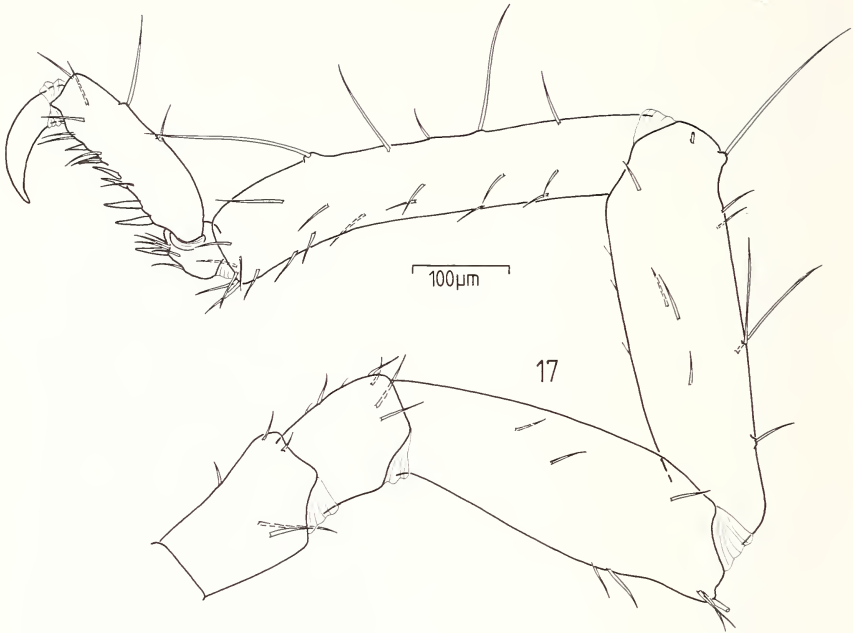


Fig. 17: *Cheilopallene coralliophila* n. sp., ♂ holotype: 3rd leg.

Chelifores robust, with scape somewhat shorter than proboscis; chela robust, fingers shorter than palm; movable finger strongly curved, its tip lying in a small pit formed by small projections of the cutting edge of the more robust immovable finger; movable finger with a single seta and immovable finger with 7 setae.

Oviger slender, strongly curved and 10-articulated; three proximal articles short and subequal in length; articles 4–5 elongate, 5th almost twice length of 4th, with conspicuous distal setose projection, armed with a further small seta-bearing tubercle; five distal articles small and subequal in length; articles 6–10 bearing a short lateral spine and terminal article with a further strong spine apically; the few eggs attached to the oviger measure about 5 times the diameter of the 5th oviger article.

Legs robust, with several slender, scattered setae; coxa 1 and 3 subequal in length; 1st coxa bearing pair of slender dorsodistal tubercles tipped with a short seta; coxae 1 and 3 about  $\frac{2}{3}$  length of coxa; femur without remarkable features, shorter than tibiae, a probably long dorsodistal seta broken off at base; tibia 1 about  $\frac{4}{5}$  length of tibia 2, both bearing a long dorsodistal seta on a small tubercle; tarsus small, as wide as long, with 5 ventral setae and a short robust spine; propodus straight, 3.5 times longer than wide; sole straight, with 2 strong spines in proximal third and 4 more slender spines distally; claw robust and well curved, half length of propodus.



Measurements (mm):	
Length of trunk (anterior margin of first trunk segment to tip of abdomen)	0.73
Width of trunk (across first lateral processes)	0.37
Length of proboscis	0.23
Length of abdomen	0.19
Third leg:	
Coxa 1	0.12
Coxa 2	0.17
Coxa 3	0.12
Femur	0.36
Tibia 1	0.40
Tibia 2	0.44
Tarsus	0.07
Propodus	0.21
Claw	0.11

♀: Unknown.

Etymology: The specific name refers to the habitat of the new species, coral substratum.

Distribution: Tioman Archipelago, Malaysia.

Remarks: The holotype has almost all walking legs broken off, except for the third right leg.

*C. coralliophila* n. sp. is most closely allied to *Cheilopallene brevichela* Clark, 1961 from the Maldive Islands. Both have a moderately robust habitus and a pair of tubercles on the cephalon over the bases of the chelifore scapes. The new species is best distinguished from *brevichela* through the longer pair of tubercles on the cephalon, the presence of a pair of slender tubercles (absent in *brevichela*) on the first coxae of the walking legs and by the simple spines on the 4 distal oviger articles (leaf-like compound spines in *brevichela*) (cf. Clark 1961: 293–295, fig. 8).

## Nymphonidae

### *Nymphon* Fabricius, 1794

#### *Nymphon draconis* Child, 1990

Child 1990: 324–327, fig. 5.

Material: 1 ♂ (ZFMK), fringing reef at Pulau Tioman; dead coral substratum, 1–3m, 12–17 April 1991.

This species is characterised by the slender cement gland tubes along the ventral margin of the femur.

*N. draconis* was known only from the Australian barrier reef. The present record therefore greatly extends its known range westward.

## Phoxichilidiidae

### *Anoplodactylus* Wilson, 1878

#### *Anoplodactylus brevirostris* Child, 1988

Child 1988a: 14–16, fig. 6.

Material: 1 ♂ (ZFMK), fringing reef at Pulau Tioman; dead coral substratum, 1–3 m, 12–17 April 1991.

Up to now this tiny and robust species was known only from the type locality, Batan Island in the Philippines.

*Anoplodactylus chamorrus* Child, 1983

Child 1983: 705–707, fig. 3. Child 1988a: 16. Child 1990: 330–331. Child 1991: 143.

Material: 3 ♂, 3 ♀, 3 juv., deposited as follows. — 2 ♂, 2 ♀, 3 juv. (ZFMK), 1 ♂, 1 ♀ (Coll. Müller); fringing reef at Pulau Babi Besar; reef flat, under dead coral rocks covered with coralline algae, intertidal-1 m, 1 April 1991.

Since its description from Guam the species was collected several times. Child (1988a) recorded it from some places in the Philippines. Later the same author (1990) found it on the Australian barrier reef and again in Guam (1991).

*A. chamorrus* inhabits dead coral substratum and algal vegetation within a bathymetrical distribution from the intertidal to 12 m.

*Anoplodactylus digitatus* (Böhm, 1879) Figs 18–26

*Anoplodactylus digitatus*: Stock 1965: 28 [literature]. Arnaud 1973: 958. Arnaud 1987: 45.

*Anoplodactylus* cf. *digitatus*: Arnaud 1974: 174.

Material: 2 ♂ (ov.), 4 ♀, 5 juv., deposited as follows. — 1 ov. ♂, 3 ♀, 5 juv. (ZFMK), 1 ov. ♂, 1 ♀ (Coll. Müller), fringing reef at Pulau Babi Besar; dead coral substratum (*Acropora* sp., *Pocillopora damicornis*) on outer reef flat, reef margin and upper coral slope, 1–2 m, 2–9 April 1991.

Description (♂): Outline of trunk elongate-oval, suture line lacking between third and fourth segment. Lateral processes smooth, separated by about 1/10 their diameter, each bearing 3 short dorsodistal setae. Ocular tubercle cone-shaped, as long as wide, with few short lateral setae near base.

Eyes large, oval and well pigmented.

Proboscis elongate-cylindrical and smooth, 2.7 times longer than wide.

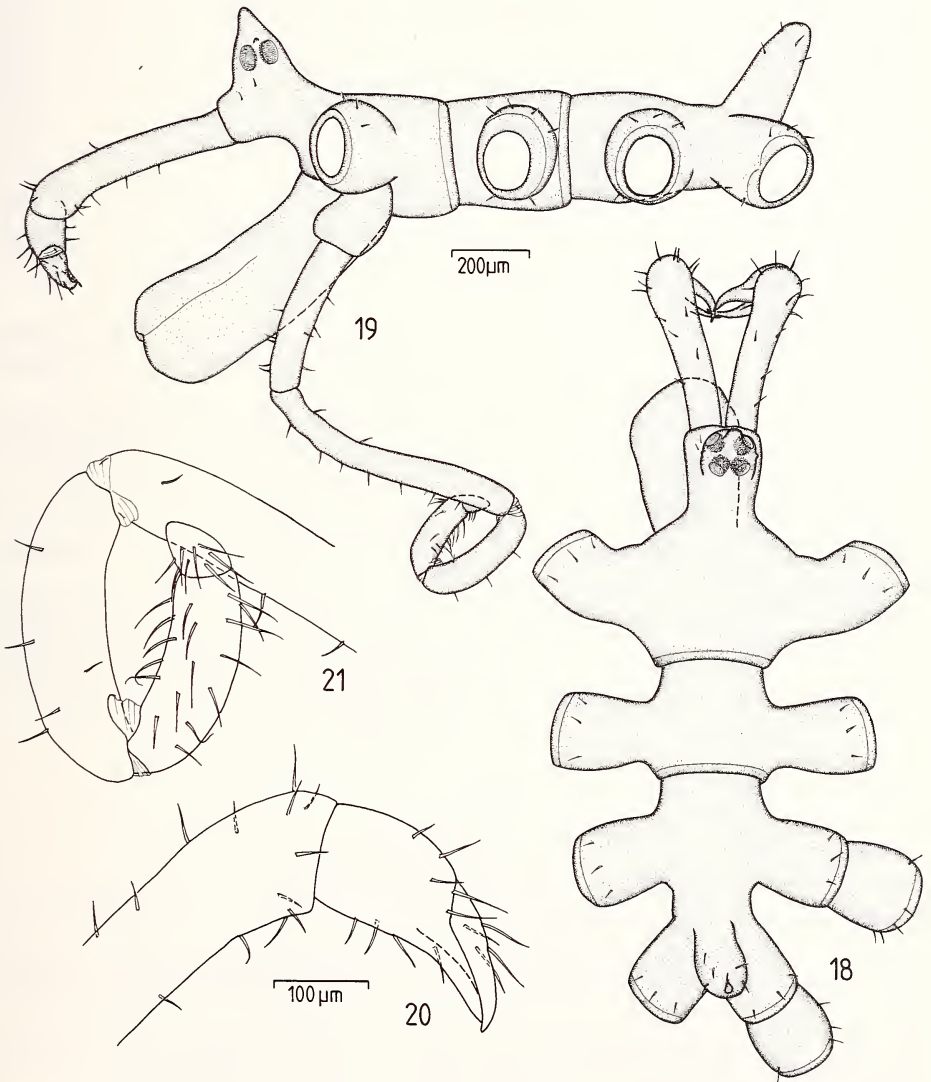
Abdomen almost erect, relatively short with rounded apex and some short distal setae, not extending beyond proximal half of fourth lateral processes.

Chelifores slender with long scapus, slightly reaching beyond distal margin of proboscis. Chela slender; palm ovoid and moderately setose, slightly longer than weakly curved and non-denticulate fingers.

6-articulated oviger slender, typical for genus; proximal article much wider than others, half length of second; third article longest, 1.7 times length of second; articles 3–6 decreasing in length distally; 5th article moderately setose, 3/4 length of weakly setose 4th article; small terminal article cone-shaped, with several short setae in proximal half.

Legs long and slender, armed with several short setae; second coxa of legs 3–4 with long ventrodistal genital process; coxae 1 and 3 subequal in length; femoral cement gland tube slender and straight, anteriorly directed, near dorsal midpoint of article; femur the longest article, with short, rounded dorsodistal tubercle tipped with slender spine; tibiae subequal in length, more densely setose than femur; tibia 1 with 1, tibia 2 with 3 slender dorsodistal spines; setose tarsus very short, of about 1/5 prodopu length; prodopus strongly curved in proximal third and almost straight in two distal thirds, with pronounced heel bearing 2 robust spines and a more slender

spine; sole with 7 curved, anteriorly directed spines; propodal lamina very short, about  $\frac{1}{5}$  length of sole; claw stout and moderately curved, with very short auxiliaries.



Figs 18–21: *Anoplodactylus digitatus* (Böhm, 1879), ♂: 18) dorsal view; 19) lateral view; 20) cheliphore; 21) distal articles of oviger.

Measurements (mm):

Length of trunk (anterior margin first trunk segment to distal margin 4th lateral processes) .....	1.55
Width of trunk (across first lateral processes) .....	0.97
Length of proboscis .....	0.69
Length of abdomen .....	0.29
Third leg:	
Coxa 1 .....	0.25
Coxa 2 .....	0.60
Coxa 3 .....	0.27
Femur .....	1.05
Tibia 1 .....	0.96
Tibia 2 .....	1.00
Tarsus .....	0.12
Propodus .....	0.58
Claw .....	0.35
Auxiliaris .....	0.03

♀: In general habitus and size as ♂, except for sexual characters. A remarkable sexual dimorphism is the deep transverse furrow at the ventral side of the ♀ proboscis.

The genital processes of the second coxae of legs 3–4 are much shorter and more robust in the ♀, bearing several short setae distally. Moreover, the dorsodistal femoral tubercle is slightly shorter than in males.

Distribution: The species is known with certainty from scattered locations in the tropical Indo-Pacific, Caribbean and Mediterranean. Up to now it was unknown from Malaysia, though the type locality and Stock's record (1954: 80, fig. 37c–e, sub *A. saxatilis*) from Singapore are close to the area studied.

Remarks: Though *A. digitatus* is known for more than a century, a detailed description of this species has never been given.

It is very similar to *Anoplodactylus brucei* Child, 1990 from the Australian barrier reef. The only reliable character to distinguish both species seems to be the presence of palp buds in the ♂ *brucei* (cf. Child 1990: 327–330, fig. 6). Unfortunately the ♀ of this species is still unknown as to allow a more detailed differentiation.

### *Anoplodactylus glandulifer* Stock, 1954 Figs 27–30

*Anoplodactylus glandulifer*: Child 1991: 143–144 [literature].

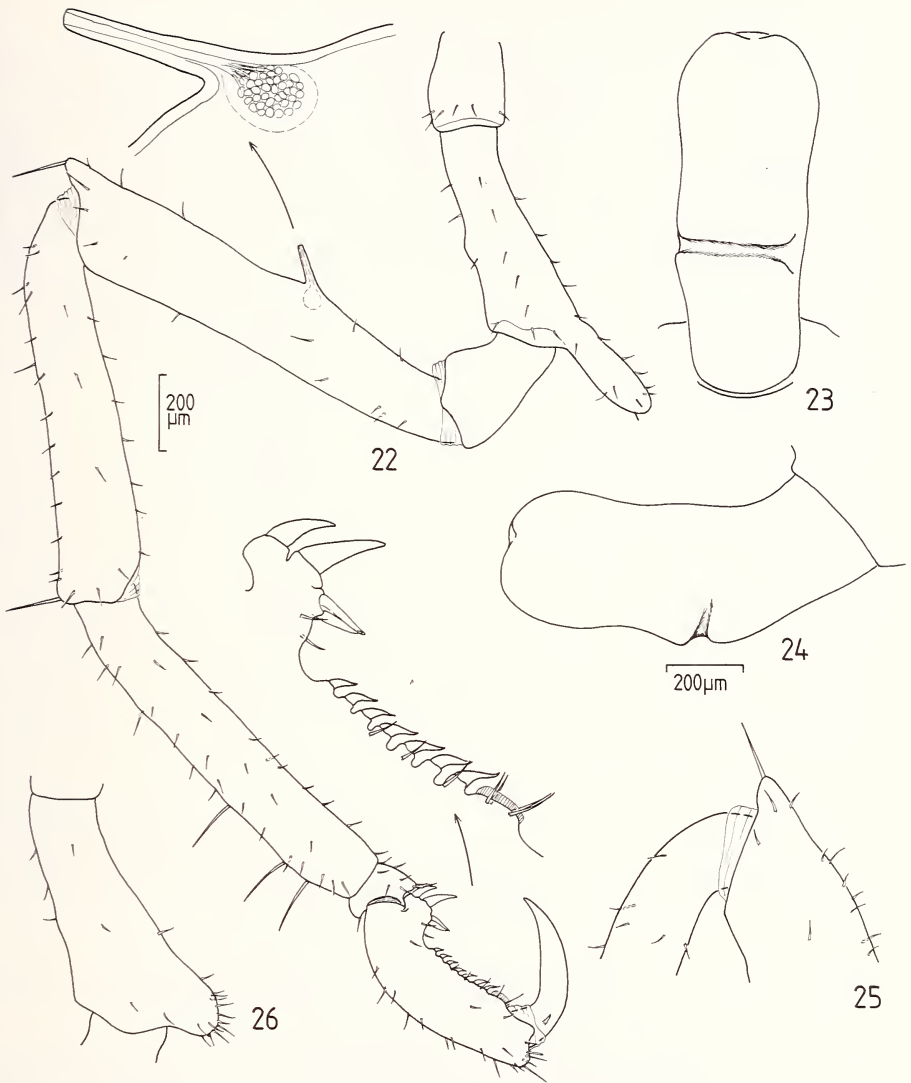
*Anoplodactylus multiclavus* Child, 1977: Stock 1986: 439 [literature].

Material: 3 ♂ (1 ov.), deposited as follows. — 1 ov. ♂ (ZFMK), 1 ♂ (Coll. Müller), 1 ♂ (MNHN); fringing reef at Pulau Babi Besar; reef flat, under dead coral rocks covered with coralline algae, intertidal-1 m, 1 April 1991.

This species has a wide distribution in the tropical Indo-Pacific and the Caribbean.

Sutures are present or absent between the first 3 trunk segments. The number of cement gland cups generally varies from 2–5.

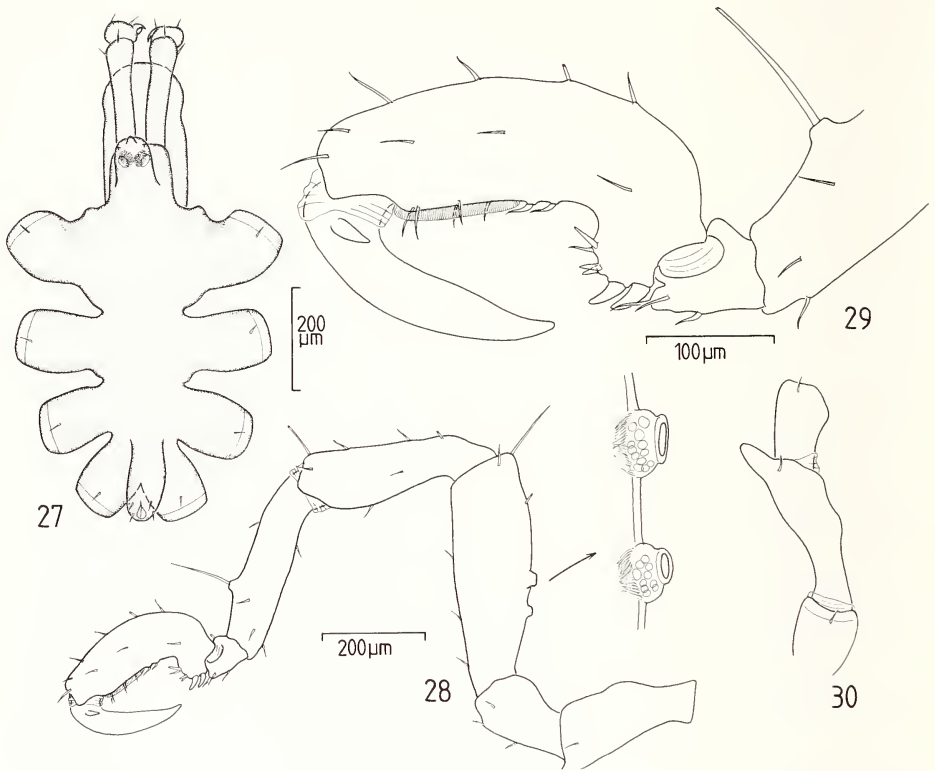
The Malaysian specimens have all trunk segments fused and only 2 cement gland cups on each femur. The second coxa of the 4th legs is elongate, with a relatively slender ventrodistal genital process. The propodal sole bears a long lamella and only 2 proximal, anteriorly directed spines.



Figs 22–26: *Anoplodactylus digitatus* (Böhm, 1879), ♂: 22) 3rd leg. ♀: 23) proboscis, ventral view; 24) proboscis, lateral view; 25) 3rd leg, distal part of femur and proximal part of tibia 1; 26) second coxa of 3rd leg.

*Anoplodactylus pseudotarsalis* n. sp. Figs 31–36

Holotype: ♂ (ZFMK), fringing reef at Pulau Babi Besar; dead coral substratum (*Acropora* sp., *Pocillopora damicornis*) on outer reef flat, reef margin and upper coral slope, 1–2 m, 2–9 April 1991.



Figs 27–30: *Anoplodactylus glandulifer* Stock, 1954, ♂: 27) dorsal view; 28) 3rd leg; 29) distal part of 3rd leg; 30) coxae of 4th leg.

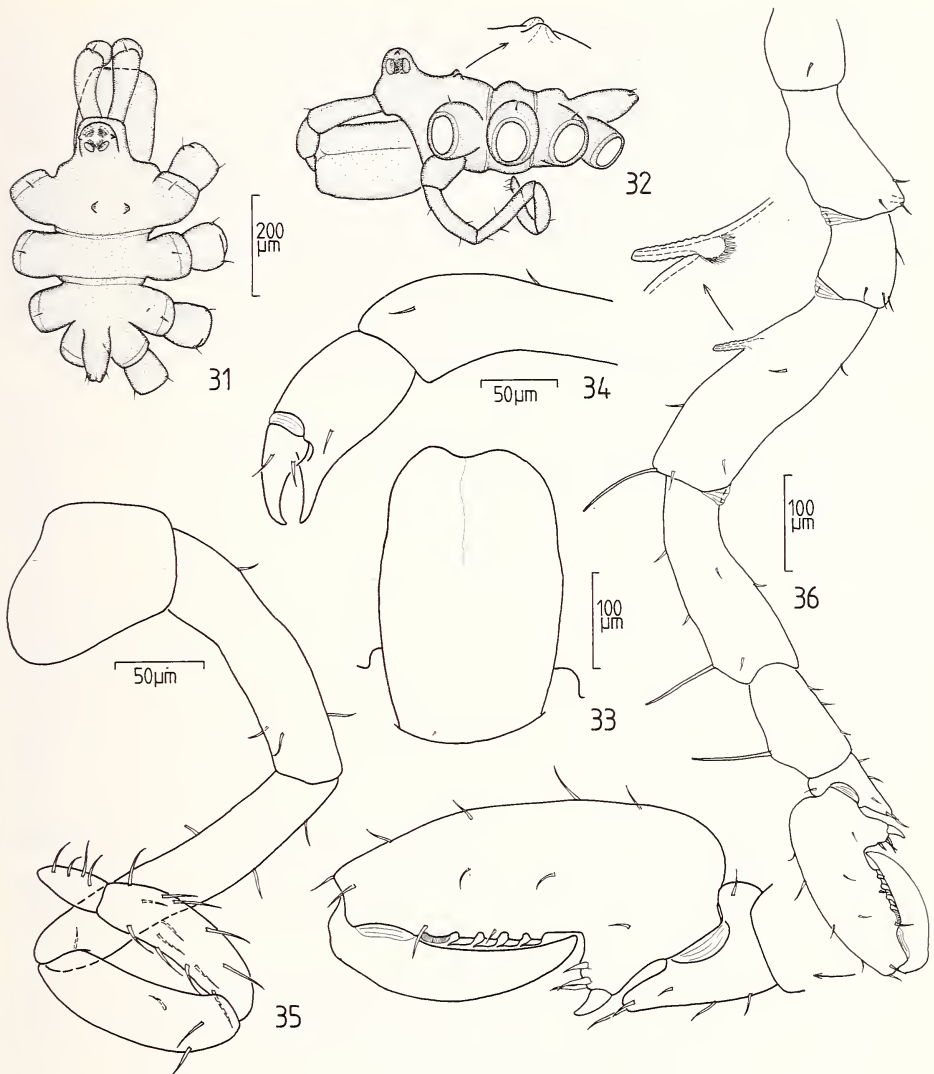
Paratypes: 3 ♂ (2 ov.), 2 ♀, deposited as follows. — 1 ♂ (ov.), 2 ♀ (ZFMK), 2 ♀ (1 ov.) (Coll. Müller); collected together with holotype.

Diagnosis: Tiny species of *Anoplodactylus* of robust habitus and with pair of small tubercles showing an apical pore on dorsum of first trunk segment behind ocular tubercle. Chelifore-fingers non-denticulate. Cement gland tube slender and straight, 0.4 times length of femur diameter; tarsus ventrodistally projected along entire length of propodal heel.

Description (♂ holotype): Outline of trunk oval. Tiny species of robust habitus, two distal trunk segments fused. Lateral processes smooth, those of segments 1–3 bearing a short simple seta dorsodistally; lateral processes separated by about  $\frac{1}{5}$  their diameters. Ocular tubercle as long as wide, broadly rounded distally.

Eyes large, oval and well pigmented.

Proboscis robust and cylindrical, 1.7 times longer than wide, lateral margins slightly convex.



Figs 31–36: *Anoplodactylus pseudotarsalis* n. sp., ♂ holotype: 31) dorsal view; 32) lateral view; 33) proboscis, ventral view; 34) cheliphore; 35) oviger; 36) 3rd leg.

Abdomen almost horizontally directed, somewhat extending beyond distal margins of 4th lateral processes.

Chelifores slender, scape relatively short and slightly extending beyond distal margin of proboscis; chela ovoid, somewhat longer than well curved, non-denticulate fingers; movable finger with 2 short setae in proximal half.

Oviger slender and 6-articulated, typical for genus; proximal article much wider than others,  $\frac{2}{3}$  length of second; third article longest, 1.3 times length of second; ar-

ticles 4 and 5 subequal in length, 5th more densely setose; small terminal article roughly ovate, with 4 short setae.

Legs moderately robust, bearing few short setae and a slender spine at dorsodistal margin of femur and tibiae; short coxae 1 and 3 subequal in length; second coxa more slender, 1.7 times length of first and third; femur the longest article, with a slender, anteriorly directed cement gland tube (granulate margins!) near dorsal mid-point of article, 0.4 times length of femur diameter; first tibia almost twice length of second tibia; tarsus ventrodistally with triangular projection along entire length of propodal heel; propodus robust, the strong propodal heel bearing a strong distal spine and 3 more slender spines at the anterodistal margin; propodal sole straight, bearing 4 short and curved, anteriorly directed spines; distal lamella short, about  $\frac{1}{6}$  length of sole; claw robust and weakly curved, without trace of auxiliaries.

Measurements (mm):

Length of trunk (anterior margin first trunk segment to tip of abdomen) .....	0.52
Width of trunk (across first lateral processes) .....	0.37
Length of proboscis .....	0.21
Length of abdomen .....	0.13
Third leg:	
Coxa 1 .....	0.08
Coxa 2 .....	0.15
Coxa 3 .....	0.09
Femur .....	0.26
Tibia 1 .....	0.22
Tibia 2 .....	0.13
Tarsus .....	0.07
Propodus .....	0.21
Claw .....	0.14

♀: In size and general habitus as ♂, except for sexual characters. The pair of tubercles on the dorsum of the first trunk segment is also present in the ♀.

Etymology: The specific name refers to the close relationships with *Anoplodactylus tarsalis* Stock, 1968.

Distribution: Tioman Archipelago, Malaysia.

Remarks: The new species is closely allied to *Anoplodactylus tarsalis* Stock, 1968. A redescription of *tarsalis* is given below, based on material from Kenya, to point out the differences between both species in detail.

At first sight, viewed with a stereomicroscope, both species do not show striking differences, except for the somewhat larger size of *tarsalis*. Both have a robust habitus, a slender cement gland tube and a ventrodistally projected tarsus. However, a detailed examination revealed some remarkable differences as the pair of tubercles with an apical pore on the dorsum of the first trunk segment in *pseudotarsalis* n. sp. Such a feature is known up to now only from the Caribbean *Anoplodactylus jonesi* Child, 1974, to which the new species does not show close affinities. Moreover, the proboscis, cheliphores and walking legs (particularly the second coxa) are slenderer in *pseudotarsalis*. The cement gland tube of this species is longer (0.4 times length of femur diameter), with granulate margins. The short cement gland tube of *tarsalis* (0.2 times length of femur diameter) has smooth lateral margins.



*Anoplodactylus tarsalis* Stock, 1968 Figs 37–42

Stock 1968: 52–54, fig. 19. Arnaud 1973: 955. Child 1988a: 20. Müller 1990a: 78.

Material: 1 ♂, 1 ♀ (ZFMK), Kenya; near Watamu, south of Malindi, dead corals covered with algae, 0–0.5 m, 24 July–7 August 1989, leg. det. H.-G. Müller.

Description (♂): Small species of robust habitus, trunk oval in outline. Two distal trunk segments fused. Segments 1–3 with 1–2 short middorsal setae and a short dorsodistal seta on each lateral process. Lateral processes smooth, separated by  $\frac{1}{3}$ – $\frac{1}{5}$  of their diameters. Ocular tubercle wider than long, broadly rounded distally.

Eyes large, oval and well pigmented.

Proboscis very robust with convex lateral margins, 1.6 times longer than wide.

Abdomen horizontal, somewhat extending beyond distal margins of 4th lateral processes.

Chelifores relatively robust, short scape somewhat extending beyond distal margin of proboscis; chela ovoid, slightly longer than the well curved, non-denticulate fingers; cutting edges of fingers weakly granulate; movable finger with 3, immovable finger with 5 short setae.

Oviger relatively slender and 6-articulated, typical for genus; proximal article much wider than others,  $\frac{2}{3}$  length of second; third article longest, 1.2 times length of second; 4th and 5th article subequal in length, 4th more densely setose; small terminal article roughly ovate, bearing 5 short setae.

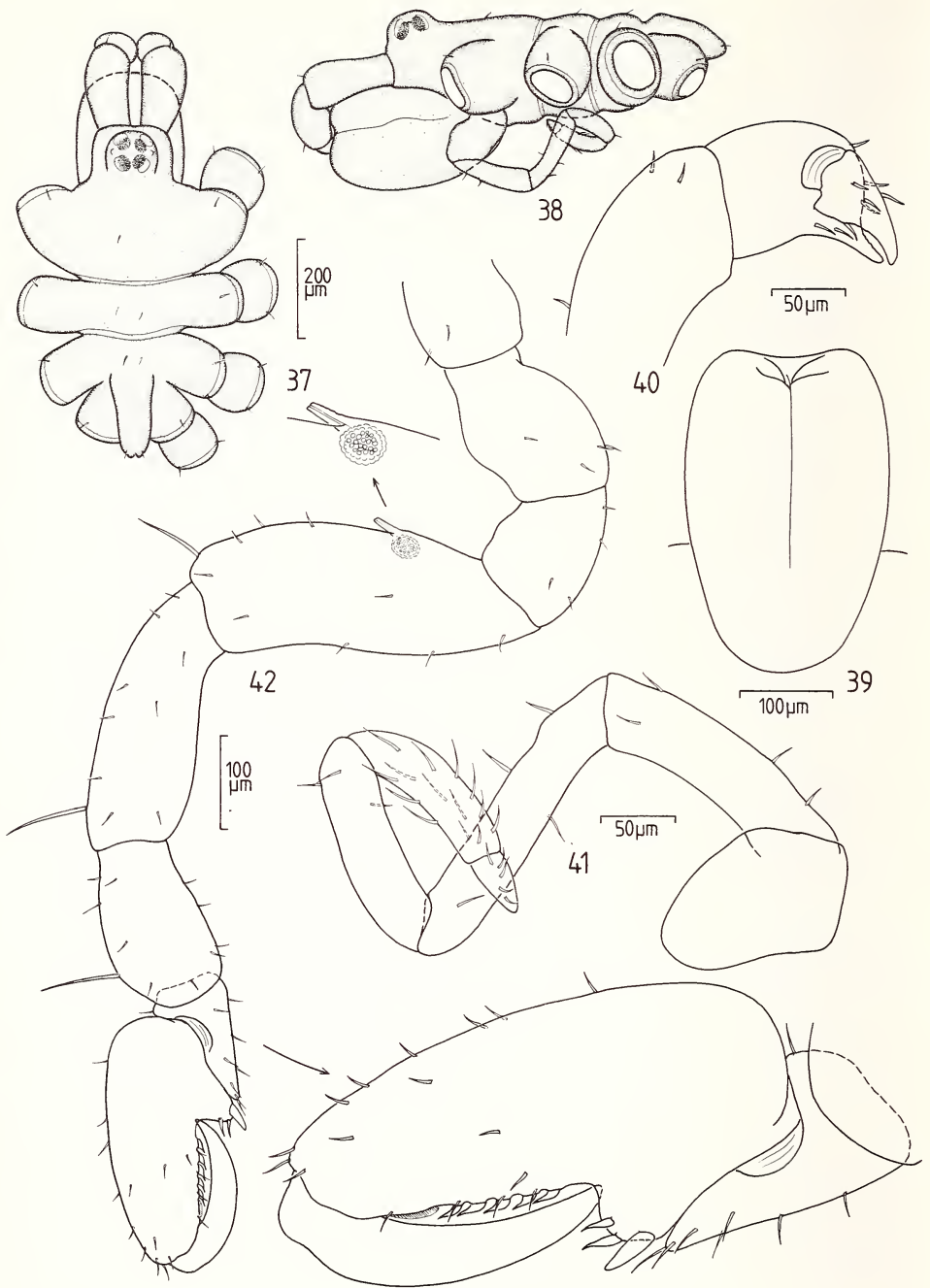
Legs robust, bearing few short setae and a slender spine on dorsodistal margins of femur and tibiae; coxa 1 and 3 subequal in length, second coxa 1.4 times longer; femur the longest article, with a short, slender and anteriorly directed cement gland tube in proximal half of femur, 0.2 times length of femur diameter; first tibia 1.4 times length of second tibia; tarsus ventrodistally with triangular projection along entire length of propodal heel; propodus robust, the strong proximal heel bearing one robust and 2 slender spines; propodal sole straight, bearing 4 short and curved, anteriorly directed spines and a short distal lamella of  $\frac{1}{4}$  sole length; claw robust and moderately curved, without trace of auxiliaries.

## Measurements (mm):

Length of trunk (anterior margin first trunk segment to tip of abdomen)	0.66
Width of trunk (across first lateral processes)	0.47
Length of proboscis	0.36
Length of abdomen	0.18
Third leg:	
Coxa 1	0.11
Coxa 2	0.17
Coxa 3	0.12
Femur	0.32
Tibia 1	0.26
Tibia 2	0.19
Tarsus	0.13
Propodus	0.27
Claw	0.17

♀: In size and habitus as ♂, except for sexual characters.

Distribution: Known only from the Philippines, Madagascar and Kenya.



Figs 37—42: *Anoplodactylus tarsalis* Stock, 1968, ♂ from Kenya: 37) dorsal view; 38) lateral view; 39) proboscis, ventral view; 40) cheliphore; 41) oviger; 42) 3rd leg.

Remarks: A detailed redescription of *A. tarsalis* became necessary to feature all the differences from the new species *A. pseudotarsalis* described above. The present material of *A. tarsalis* has already been recorded from Kenya by Müller (1990a: 78).

*Anoplodactylus pycnosoma* (Helfer, 1938) Figs 43–48

Nakamura & Child 1991: 30 [literature].

Material: 2 ♂ (1 ov.) (ZFMK), Pulau Babi Besar; reef-flat, under dead coral rocks covered with coralline algae, 0–1 m, 1 April 1991. 1 ♂ (MNHN), Pulau Babi Besar; dead coral substratum (*Acropora* sp., *Pocillopora damicornis*) on outer reef flat, reef margin and upper coral slope, 1–2 m, 2–9 April 1991. 1 ov. ♂ (Coll. Müller), Pulau Babi Besar; in heap of dead coral rocks on outer reef flat, intertidal, 2 April 1991.

The Malaysian material shows some differences to the specimens reported by Stock (1954: 75–77, fig. 33) from Japan and Müller (1990b: 100, figs 7–13) from La Réunion, which makes a supplementary description useful to show the variability.

Specimens from Malaysia are slenderer than the material mentioned above and the lateral processes are more widely separated, more or less by their diameter. The suture lines between body segments 1–2 and 2–3 are incomplete dorsally. Moreover, the suture line between 5th and 6th oviger segment is partially obliterated in the Malaysian material. The number of cement glands varies from 3–5 on each femur.

*A. pycnosoma* is very common in shallow waters of the temperate and tropical Indo-West-Pacific.

Pycnogonidae

*Pycnogonum* Brünnich, 1764

*Pycnogonum asiaticum* n. sp. Figs 50–55

Holotype: ♂ (ZFMK), Pulau Babi Besar; dead coral substratum (*Acropora* sp., *Pocillopora damicornis*) on outer reef flat, reef margin and upper coral slope, 1–2 m, 2–9 April 1991. Paratypes: 1 ♂, 8 ♀, deposited as follows. — 7 ♀ (ZFMK), 1 ♂, 1 ♀ (Coll. Müller), collected together with holotype.

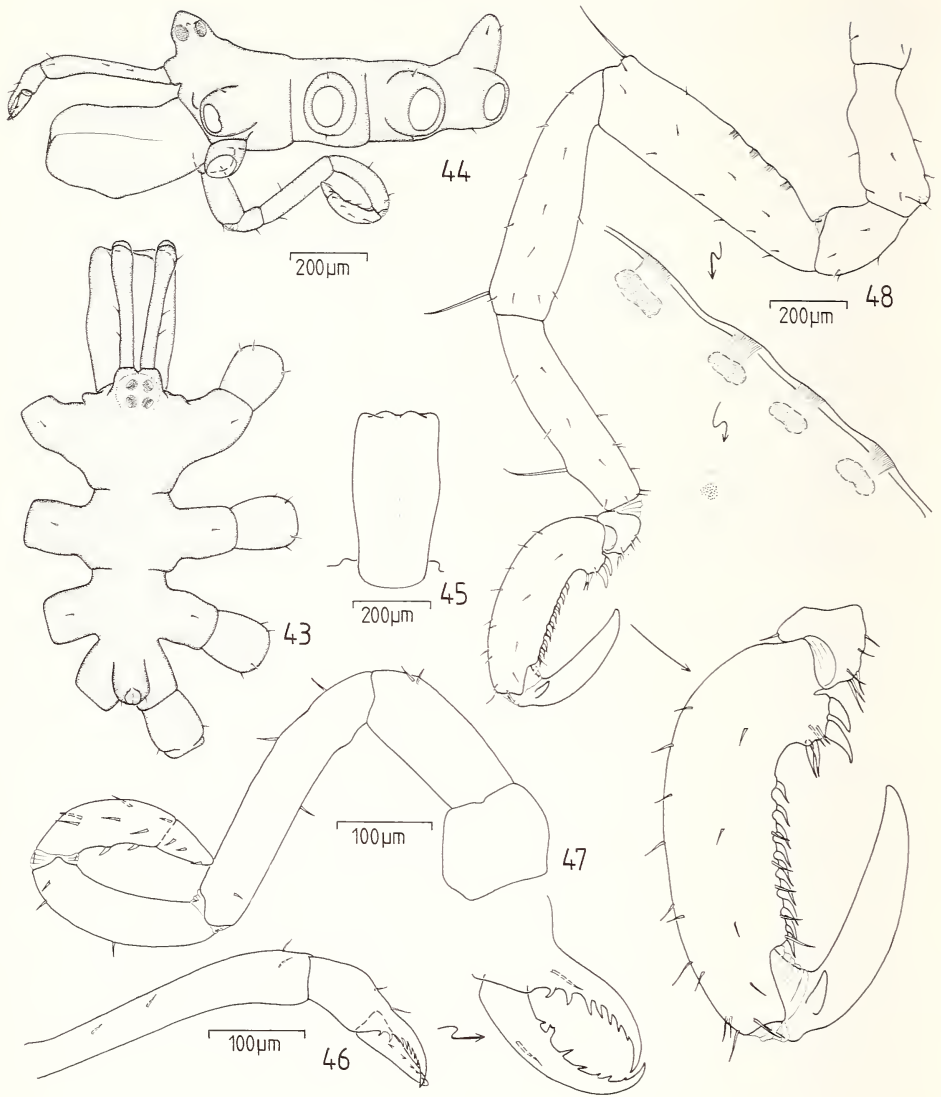
Diagnosis: *Pycnogonum* of robust habitus, body elongate-ovate in outline; rounded tubercle behind ocular tubercle and on dorsum of each trunk segment; moreover, dorsodistally rounded tubercle present on each lateral process; propodus of walking legs weakly curved with some sole spines, relatively large auxiliaries present.

Description (♂ holotype): Body robust, oval in outline, all segments well separated and covered with numerous papillose pores. Lateral processes separated by  $\frac{1}{3}$ – $\frac{1}{2}$  their diameters, with a dorsodistal rounded tubercle. Each trunk segment with a dorsomedially rounded tubercle in posterior half; moreover, another more broadly rounded tubercle just behind the ocular tubercle. Ocular tubercle rounded, 1.5 times wider than long.

Eyes large, oval and well pigmented.

Proboscis broad and cylindrical, somewhat narrowing distally to blunt distal margin; proboscis of  $\frac{2}{5}$  body length.

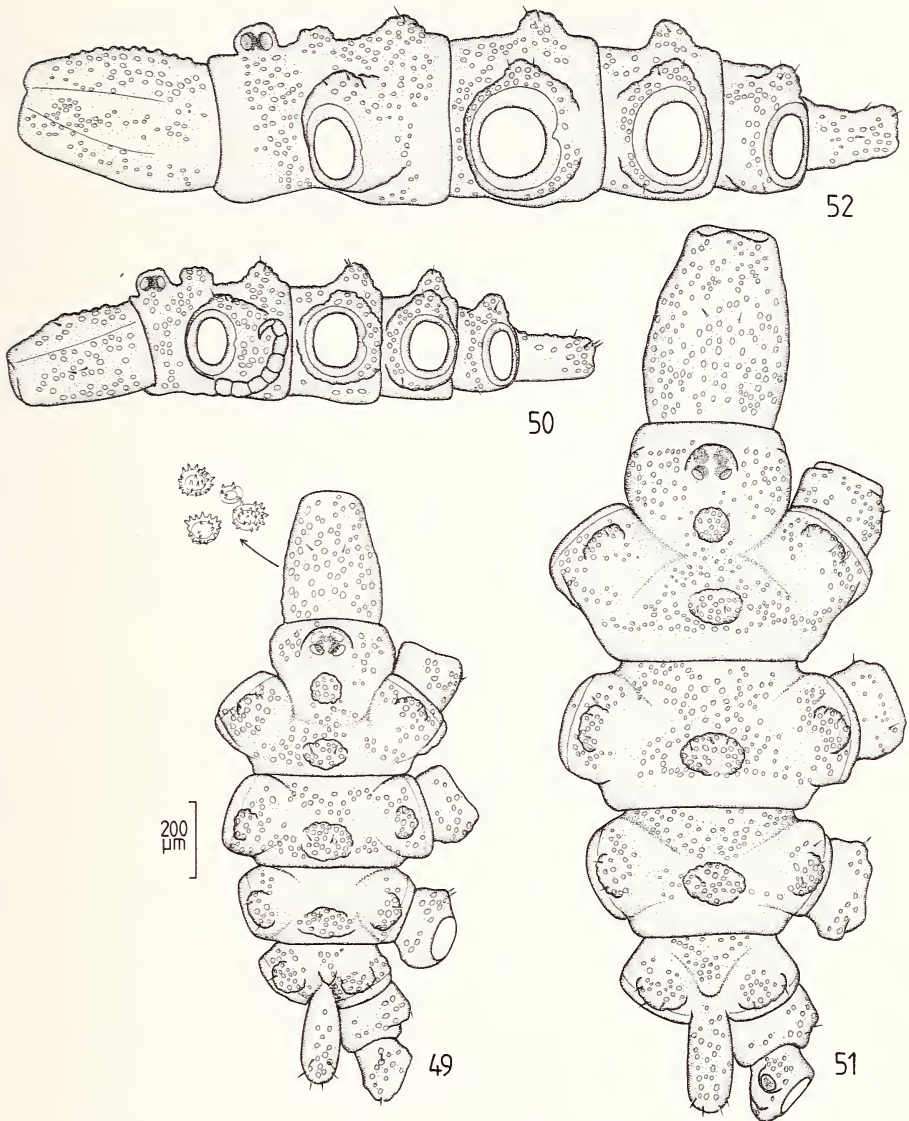
Abdomen carried horizontally, slightly widening distally with a rounded apex bearing 5 short setae; abdomen well extending beyond the first coxae of 4th lateral processes.



Figs 43–48: *Anoplodactylus pycnosoma* (Helfer, 1938), ♂: 43) dorsal view; 44) lateral view; 45) proboscis, ventral view; 46) cheliphore; 47) oviger; 48) 3rd leg.

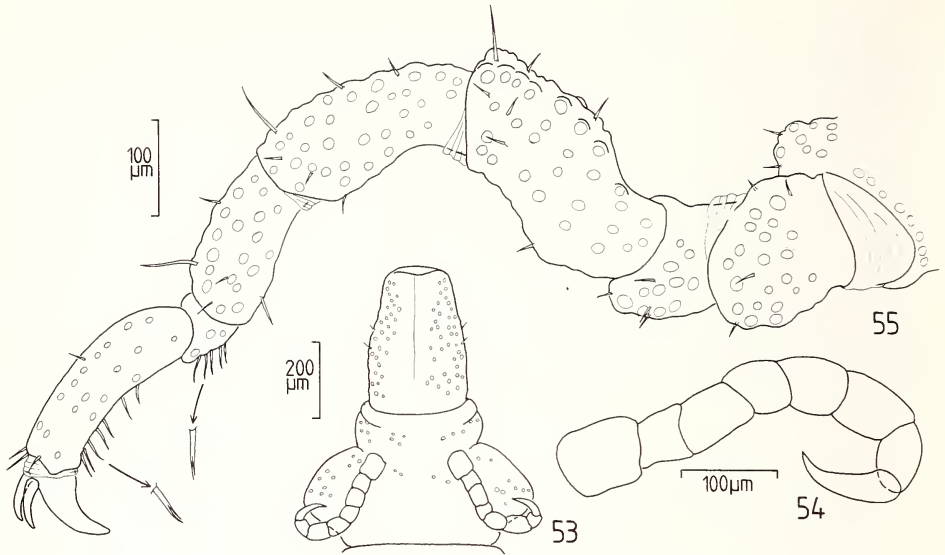
Oviger small and 8-articulated, articles 1–7 subequal in length; terminal article claw-shaped, as long as articles 6–7 together.

Legs very robust and sparsely setose, 1st and 3rd coxae subequal in length; second coxa longest, 1.3 times length of 1st and 3rd; femur the longest and widest article with shallowly rounded hump on ventral side; 1st tibia 1.4 times length of 2nd; femur



Figs 49–52: *Pycnogonum asiaticum* n. sp., ♂ holotype: 49) dorsal view; 50) lateral view. ♀ paratype: 51) dorsal view; 52) lateral view.

and tibiae with a slender dorsodistal spine; tarsus short, as wide as long, with some slender ventral spines; propodus weakly curved, palm with 7 slender spines; claw relatively short and well curved,  $\frac{2}{3}$  length of propodus; auxiliaries relatively slender, 0.6 times length of claw.



Figs 53–55: *Pycnogonum asiaticum* n. sp., ♂ holotype: 53) anterior part of body, ventral view; 54) oviger; 55) 3rd leg.

Measurements (mm):

Length of trunk (anterior margin first trunk segment to tip of abdomen).....	1.21
Width of trunk (across first lateral processes) .....	0.60
Length of proboscis .....	0.38
Length of abdomen .....	0.26
Third leg:	
Coxa 1 .....	0.29
Coxa 2 .....	0.41
coxa 3 .....	0.33
Femur .....	0.67
Tibia 1 .....	0.53
Tibia 2 .....	0.38
Tarsus .....	0.18
Propodus .....	0.55
Claw .....	0.21
Auxiliaries .....	0.13

♀: In general features quite similar to ♂, except for the lack of ovigers. Females are distinctly larger, about 1.6 mm in length.

Etymology: The specific name refers to the continent where the type locality of the new taxon is situated.

Remarks: The affinities of *P. asiaticum* n. sp. are difficult to discuss, because it shows similarities to several other, partly incompletely described species. Its characteristic features are the arrangement of dorsal trunk tubercles, shape of proboscis, the weakly curved propodus and the presence of relatively large auxiliary claws. The large auxiliaries are the best feature to distinguish *P. asiaticum* n. sp. from

other species of similar habitus, except for the Japanese *Pycnogonum benokianum* Ohshima, 1935. This species is very similar to *asiaticum*, but has a distally slenderer proboscis and no tubercles on the lateral processes. Moreover, the dorsomedian trunk tubercles are slenderer in *benokianum* (cf. Hedgpeth 1949: 304, fig. 49).

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#### Zusammenfassung

Eine dreiwöchige Feldarbeit zur Erfassung der mit totem Korallensubstrat vergesellschafteten Evertebraten zweier malaysischer Korallenriffe im Tioman-Archipel erbrachte 15 Pantopodenarten. Von diesen erwiesen sich 3, *Cheilopallene coralliophila* n. sp., *Anoplodactylus pseudotarsalis* n. sp. und *Pycnogonum asiaticum* n. sp., als neu für die Wissenschaft. Eine Wiederbeschreibung von *Anoplodactylus tarsalis* Stock, 1968, basierend auf Material aus Kenia, wird ergänzend eingefügt, um die Unterschiede zu *pseudotarsalis* n. sp. zu verdeutlichen. Drei weitere bereits bekannte Arten waren bisher nur vom Locus typicus auf den Philippinen bzw. von Australien nachgewiesen. Soweit das spärlich vorhandene Material überhaupt eine biogeographische Beurteilung zulässt, zeigt die Flachwasser-Pantopodenfauna des Tioman-Archipels engere Beziehungen zur Fauna Ostasiens und Australiens. Etwa die Hälfte der gesammelten Arten hat eine weite Verbreitung im Indo-West-Pazifischen Raum.

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