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HARPACTICOID COPEPODS ASSOCIATED WITH HERMIT CRABS IN THE MOLUCCAS

by

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ABSTRACT

Paguridea in the Indo-Pacific have 10 harpacticoid copepod associates: 3 *Sunaristes,* 3 *Brianola,* 1 *Porcellidium,* and 3 *Paraidya.* Four of these copepods are reported from hermit crabs in the Moluccas: *Sunaristes tranteri* Hamond, 1973, from *Dardanus guttatus, Dardanus lagopodes, Calcinus latens, Calcinus minutus, Calcinus gaimardi, Calcinus* sp., and *Trizopagurus strigatus; Porcellidium brevicaudatum* Thompson and A. Scott, 1903, from *Dardanus guttatus, Dardanus lagopodes, Dardanus megistos, Calcinus latens, Calcinus minutus* and *Trizopagurus strigatus; Paraidya minor* Sewell, 1940, and *Paraidya major* Sewell, 1940, from *Dardanus guttatus, Dardanus lagopodes,* and *Dardanus megistos.*

INTRODUCTION

Several harpacticoid copepods live in association with hermit crabs. In Europe *Sunaristes paguri* Hesse, 1867, lives with *Pagurus bernhardus* (L.) (distribution given in Lang, 1948, and Codreanu and Mack-Fira, 1961),*Pagurus cuanensis* Thompson (Bourdon, in Hamond, 1973), *Diogenes pugilator* (Roux) (Codreanu and Mack-Fira, 1961), and *Clibanarius erythroupus* (Latreille) (Stock, 1960).

In the Indo-Pacific harpacticoid copepods have been reported from various Paguridea in widely scattered localities. These copepods belong to four genera —*Sunaristes* Hesse, 1867 (Canuellidae), *Brianola* Monard, **1926** (Canuellidae), *Paraidya* Sewell, 1940 (Tisbidae), and *Porcellidium* Claus, 1860 (Porcellidiidae). The records are as follows:

Sunaristes dardani Humes and Ho, 1969

region of Nosy Be, Madagascar — Humes and Ho (1969a)
from *Dardanus megistos* (Herbst). *Dardanus deformis* (H. Milne Edwards), *Dardanus guttatus* (Olivier), *Dardanus lagopodes* (Forskal), and *Calcinus latens* (Randall).

Mauritius — Humes and Ho (1969a)
from *Dardanus deformis, Dardanus lagopodes,* and from 5 hermit crabs mixed at time of collection [*Dardanus setifer* (H. Milne Edwards), *Dardanus lagopodes,* and *Calcinus elegans* (H. Milne Edwards)].

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Eniwetok Atoll — Humes (1971)
from *Dardanus guttatus, Dardanus megistos, Dardanus lagopodes, Dardanus scutellatus* (H. Milne Edwards), and *Calcinus latens.*
region of Noumea, New Caledonia - Humes (1972)
from *Clibanarius virescens* Krauss, *Dardanus lagopodes,* and *Dardanus megistos.*

Sunaristes inaequalis Humes and Ho, 1969
region of Nosy Be, Madagascar — Humes and Ho (1969a)
from unidentified small hermit crabs and from *Dardanus megistos.*

Red Sea (Ethiopia) — Humes and Ho (1969a) from *Clibanarius carnifex* Heller.
region of Noumea, New Caledonia — Humes (1972)
from *Calcinus latens, Clibanarius virescens, Dardanus megistos,* and *Dardanus scutellatus.*
Sunaristes tranteri Hamond, 1973 Sydney, Australia — Hamond (1973)
from *Diogenes senex* Heller.
Sunaristes sp., undescribed

Auckland, New Zealand — Hamond (1973)
from *Pagurus novaezealandiae* Filhol.
Brianola elegans Hamond, 1973
Sydney, Australia — Hamond (1973)
from *Diogenes senex* Heller.
Brianola pori Hamond, 1973
Sydney, Australia — Hamond (1973)
from *Diogenes senex* Heller.

Brianola sydneyensis Hamond, 1973
Sydney, Australia - Hamond (1973)
from *Diogenes senex* Heller.

Porcellidium breuicaudatum Thompson and A. Scott, 1903
region of Nosy Be, Madagascar — Humes and Ho (1969b)
from *Dardanus megistos, Dardanus guttatus,* and *Dardanus lagopodes*

Mauritius — Humes and Ho (1969b)
from *Dardanus megistos, Dardanus guttatus,* and *Dardanus lagopodes.*

region of Noumea, New Caledonia — Humes (1972)
from *Clibanarius virescens, Pagurus* sp., *Calcinus latens, Dardanus agopodes, Dardanus guttatus, Dardanus megistos, Dardanus deformis,* and *Dardanus scutellatus.*

HARPACTICOID COPEPODS ASSOCIATED

Paraidya occulta Humes and Ho, 1969
region of Nosy Be, Madagascar — Humes and Ho (1969b) from *Dardanus megistos.*

Two Indo-Pacific records of *Sunaristes paguri* Hesse, 1867, exist in the literature. Thompson and A. Scott (1903) reported a few specimens in the general washings of invertebrates in Ceylon. A. Scott (1909) found a single male in washings of dredged invertebrates near New Guinea. Both these identifications need verification, since it seems unlikely that *S. paguri* occurs in the Indo-Pacific, having never been reported in more extensive collections.

MATERIALS AND METHODS

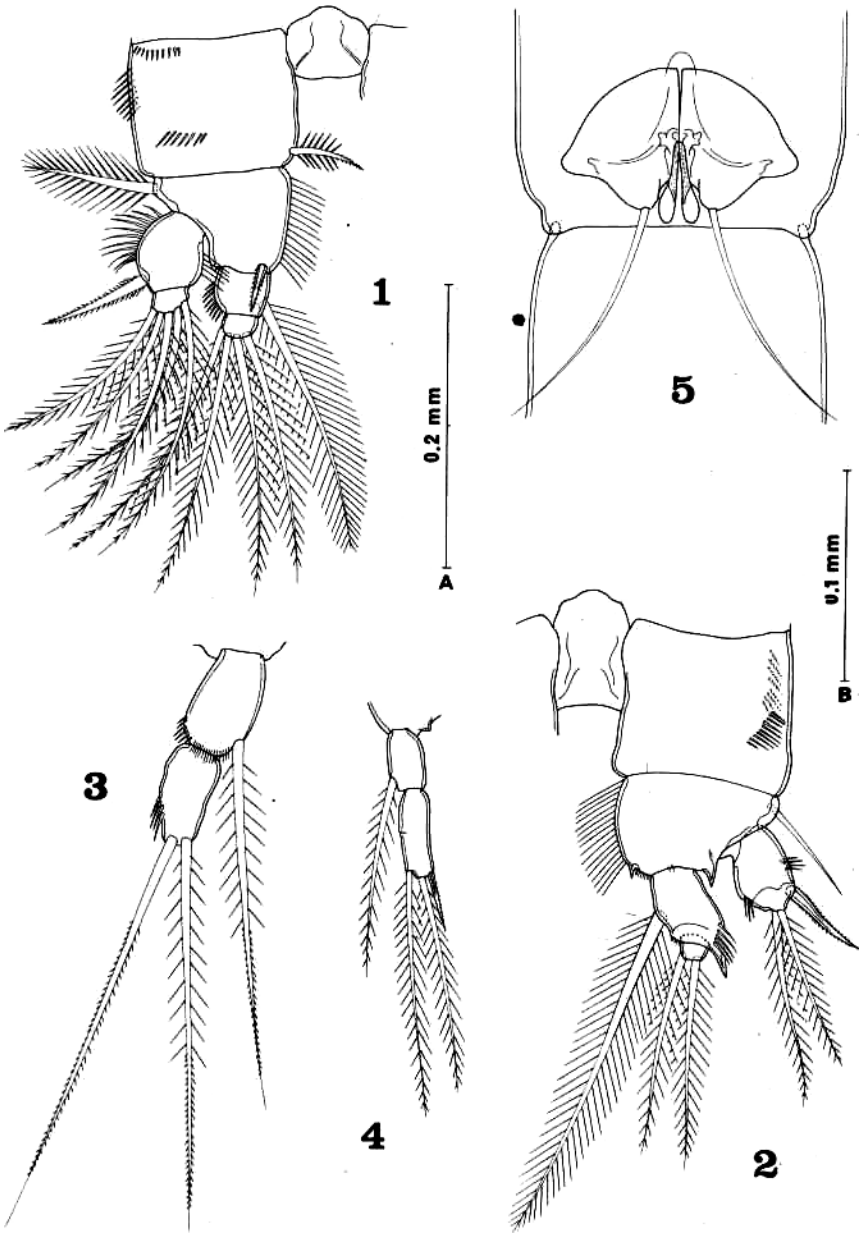
The living hermit crabs were separated by species in plastic bags in sea water. Later a small amount of 95 per cent ethyl alcohol was added, sufficient to make approximately a 5 per cent solution. After several hours the hermit crabs became completely narcotized and could easily be removed from their shells. The empty shells were shaken thoroughly and the entire sea water/alcohol was passed through a fine net (120 holes per 2.5 cm). The copepods were picked from the sediment retained. The study of the copepods was carried out using the wooden slide/lactic acid technique described by Humes and Gooding (1964).

All figures have been drawn with the aid of a camera lucida. The letter after the explanation of each figure refers to the scale at which it was drawn. The measurements were made on specimens in lactic acid.

Sunaristes tranteri Hamond, 1973 (Figs. 1 - 5)

Specimens collected.— From *Dardanus guttatus* (Olivier): 20♀♀, 6 ♂♂ from 2 hosts, in 3 m, Pulau Parang, eastern Ceram, 3°17'00"S, 130°44°48"E, 23 May 1975; 2 ♂♂, 1♂ from 1 hosts, in 2 m, KarangMie, east central Halmahera, 00°20'07"N, 128°25'00"E, 19 May 1975.

From *Dardanus lagopodes* (Forskal): 5 ♂♂, 1 ♂ from 1 host, in 0.5 m, southwestern shore of Goenoeng Api, Banda, 4°31'45"S, 129°51'55"E, 28 April 1975; 1 9 from 2 hosts, in 10 m, same locality, 4 May 1975; 10 99, 1 ♂ from 1 host, in 15 m, southwestern shore of Goenoeng Api, Banda, 4°31'55"S, 129°52'12"E, 8 May 1975; 2 ♀♀, 1 ♂ from 3 hosts, in 15 m, same locality and date; 3 ♀♀, 1 ♂ from 1 host, in 3 m, Pulau Marsegoe, western Ceram, 2°59 WS, 128°03'30"E, 15 May 1975; 1 copepodid from 1 host, in 5 m, Pulau Parang, eastern Ceram, 3°17'00"S, 130°44'48"E, 23 May 1975; 11 ♀♀, 2 copepodids from 1 host, in 3 m, Natsepa, Ambon, Ceram, 3°27'05"S, 128°1700"E, 28 May 1975.



Figs. 1 - 5. *Sunaristes tranteri* Hamond, 1973. Female: 1, abnormal right leg 1, anterior (A); 2, abnormal left leg 2, anterior (A); 3, abnormal endopod of right leg 4, anterior (B). Male: 4, abnormal endopod of left leg 4, anterior (B); 5, genital area' ventral (B).

HARPACTICOID COPEPODS ASSOCIATED

From *Calcinus latens* (Randall): 7 ♀♀, 2 ♂♂, 2 copepodids from 8 hosts, in 15 m, southwestern shore of Goenoeng Api, Banda, 4°31'55"S, 129°-52'12"E, 8 May 1975; 4 ♀♀, 8 copepodids from 11 hosts, same locality and date.

From *Calcinus minutus* Buitendijk: 1 ♂ from 1 host, in 10 m, southwestern shore of Goenoeng Api, Banda 4°31'45"S, 129°51'55"E, 4 May 1975; 1 ♀, 1 ♂, 2 copepodids from 8 hosts, in 15 m, southwestern shore of Goenoeng Api, Banda, 4°31'55"S, 129°52'12"E, 8 May 1975.

From *Calcinus gaimardi* (H. Milne-Edwards): 2 99 from 1 host, in 10m, southwestern shore of Goenoeng Api, Banda, 4°3l'45"S,129°5l'55"E, 4 May 1975.

From *Calcinus* sp., undescribed: 1 ♀, 1 copepodid from 2 hosts, in 10m, southwestern shore of Goenoeng Api, Banda 4°3l'45"S, 129°5l'55"E, 4 May 1975.

From *Trizopagurus strigatus* (Herbst): 1 ♂ from 1 host, in 10 m, southwestern shore of Goenoeng Api, Banda 4°31'45"S, 129°51'55"E, 4 May 1975; 5 ♀♀, 6 ♂♂ from 4 hosts, in 15 m, southwestern shore of Goenoeng Api, Banda, 4°31'55"S, 129°52'12"E, 8 May 1975.

. The Moluccan specimens of *Sunaristes tranteri* conform in most respects to the original description of the type specimens from Sydney, Australia. The following notes are offered as a supplement to understanding the species.

Female.— The body length (measured on 63 specimens without pressure of a coverglass and not including the setae on the caudal rami) is 1.79 mm (1.28 — 2.00 mm) and the greatest width is 0.33 mm (0.25 — 0.41 mm). The first antenna has probably five segments rather than six. There is a small sclerite immediately following the first segment which gives the illusion of a separate segment but which is actually part of the second segment. The formula is : 1, 14, 12 + 2 aesthetes, 4, and 14. The inner (anterior) side of the first segment has a tuft of spinules. The second antenna has inner and outer tufts of spinules on the protopod. The exopod is 8-segmented, with the formula : 1, 0, 1, 1, 1, 1, 1, 4. The endopod is 3-segmented, with the formula: 1, 4, 7.

The mandible has a tuft of spinules on the inner side of the second segment of the exopod.

The normal formula for legs 1-4 is as follows : (abnormal formulae shown in parentheses):

leg 1		leg 2		leg 3		leg 4	
exopod	endopod	exopod	endopod	exopod	endopod	exopod	endopod
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
+ — —	+ + —	+ + +	+ — —	+ + +	+ + —	+ + +	— + —
			(+ + —)				(— — —)

Seven of 56 females (12.5 per cent) showed abnormal ornamentation. Leg 2 showed reduced segmentation in the right leg in one female (Fig. 1) and in the left leg in another female (Fig. 2). Leg 4 showed reduced segmentation in the right leg in one female (Fig. 3). The coxa of leg 4 does not bear spinules.

Male.— The body length (measured as in the female) is 1.41 mm (1.02 — 0.78 mm) and the greatest width is 0.26 mm (0.19 — 0.33 mm). The first antenna has the formula: 1, 17, 6, 5, and 5 + 3.

The normal formula for legs 1 — 4 is as follows (abnormal formulae shown in parentheses):

leg 1				leg 2				leg 3				leg 4			
exopod			endopod	exopod			endopod	exopod			endopod	exopod			endopod
1	2	3	1 2 3	1	2	3	1 2 3	1	2	3	1 2 3	1	2	3	1 2 3
+	—	—	+ + —	+	+	+	— + —	+	+	+	+ + —	+	+	+	— + —
							(— — —)								(+ + —)
															(— — —)

Five of 16 males (31.3 per cent) showed abnormal ornamentation. Leg 4 showed reduced segmentation in the left leg of one male (Fig. 4).

In leg 6 (Fig. 5) the two processes between the setae have broad hyaline tips.

Porcellidium brevicaudatum Thompson and A. Scott, 1903

Specimens collected— From *Dardanusguttatus* (Olivier): 19 ♀♀, 13 ♂♂, 7 copepodids from 2 hosts, in 3 m, Pulau Parang, eastern Ceram, 3°17'00"S, 130°44'48"E, 23 May 1975; 42 ♀♀, 32 ♂♂, 33 copepodids from 1 host, in 2 m, Karang Mie, east central Halmahera, 00°20'07"N, 128°25'00"E 19 May 1975.

From *Dardanus lagopodes* (Forskal): 4 ♀♀, 4 ♂♂, 2 copepodids from 1 host, in 0.5 m, southwestern shore of Goenoeng Api, Banda, 4°31'45"S, 129°51'55"E, 28 April 1975; 10 ♀♀, *1* ♂♂, 8 copepodids from 3 host, in 15 m, southwestern shore of Goenoeng Api, Banda, 4°31'55"S, 129°52' 12"E, 8 May 1975; 3 ♀♀ , *11* ♂♂ , 20 copepodids from 1 host, Pulau Mar-segoe, western Ceram, 2°59'30"S, 128°03'30"E, 15 May 1975; 5 ♀♀, *3*♂♂ froml host, in 5 m, Pulau Parang, eastern Ceram, 3°17'00"S, 130°44'48"E, 23 May 1975; 9 ♀♀ , *21*♂♂ , *2* pairs in amplexus, 24 copepodids from 1 host, in 3 m, Natsepa, Ambon, Ceram, 3°27'05"S, 128°17'00"E, 28 May 1975; 1♀ , *2* ♂♂ , 1 pair in amplexus, 4 copepodids from 1 host, in 1 m, Karang Mie, east central Halmahera. 00°20'07"N, 128°25'00"E, 19 May 1975.

HARPACTICOID COPEPODS ASSOCIATED

From *Dardanus megistos* (Herbst): 31 ♀♀, 18 ♂♂, 9 copepodids from 1 host, in 3 m, Pulau Marsegoe, western Ceram, 2°59'30"S, 128°03'30"E, 15 May 1975.

From *Calcinus latens* (Randall): 13 ♀♀, 10 ♂♂, 5 copepodids from 2 hosts, in 15 m, southwestern shore of Goenoeng Api, Banda, 4°31'55"S, 129°52'12"E, 8 May 1975.

From *Calcinus minutus* Buitendijk: 3 ♀♀, 4 ♂♂ from 8 hosts, in 15 m, southwestern shore of Goenoeng Api, Banda, 4°31'55"S, 129°52'12"E, 8 May 1975; 1 ♀, 2 ♂♂ from 1 host, in 3 m, Pulau Gomumu, south of Obi, l°50'00"S, 127°30'54"E, 30 May 1975.

From *Trizopagurus strigatus* (Herbst): 4 ♀♀, 8 ♂♂, 2 copepodids from 4 hosts, in 15 m, southwestern shore of Goenoeng Api, Banda, 4°31'55"S, 129°5212"E, 8 May 1975.

The Moluccan specimens are a little smaller than the specimens reported by Humes and Ho (1969) from Madagascar. The body length of 10 females from *Dardanus guttatus* at Pulau Parang is 0.63 mm (0.61 — 0.66 mm) and the greatest width is 0.44 mm (0.40 — 0.46 mm). In 10 males the length is 0.43 mm (0.42 — 0.45 mm) and the greatest width is 0.37 mm (0.35 — 0.37 mm). A female from the same species of host in Halmahera measured 0.74 x 0.50 mm. Except for such size differences the Moluccan specimens are like those previously studied from Madagascar.

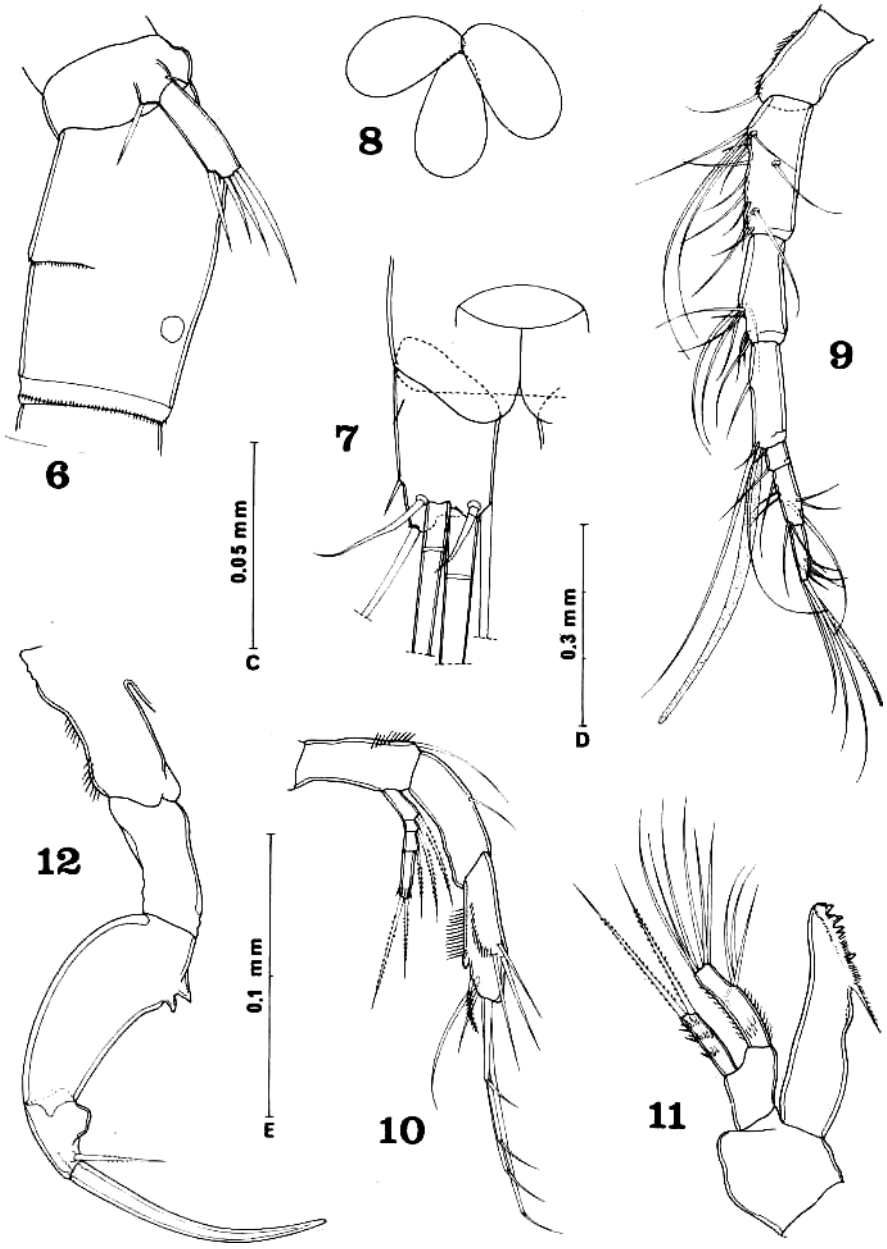
Paraidya minor Sewell, 1940 (Figs. 6 - 18)

Specimens collected.— From *Dardanusguttatus* (Olivier): 53 ♀♀, 23 ♂♂, 8 copepodids from 2 hosts, in 3 m, Pulau Parang, eastern Ceram, 3°17'00"S, 130°44'48"E, 23 May 1975; 8 ♀♀, 15 ♂♂, 4 copepodids from 1 host, in 2 m, Karang Mie, east central Halmahera, 00°20'07"N, 128°25'00"E, 19 May 1975.

From *Dardanus megistos* (Herbst): 10 ♀♀, 10 ♂♂, 8 copepodids from 1 host, in 3 m, Pulau Marsegoe, western Ceram, 2°59'30"S, 128°03'30[5]"E, 15 May 1975.

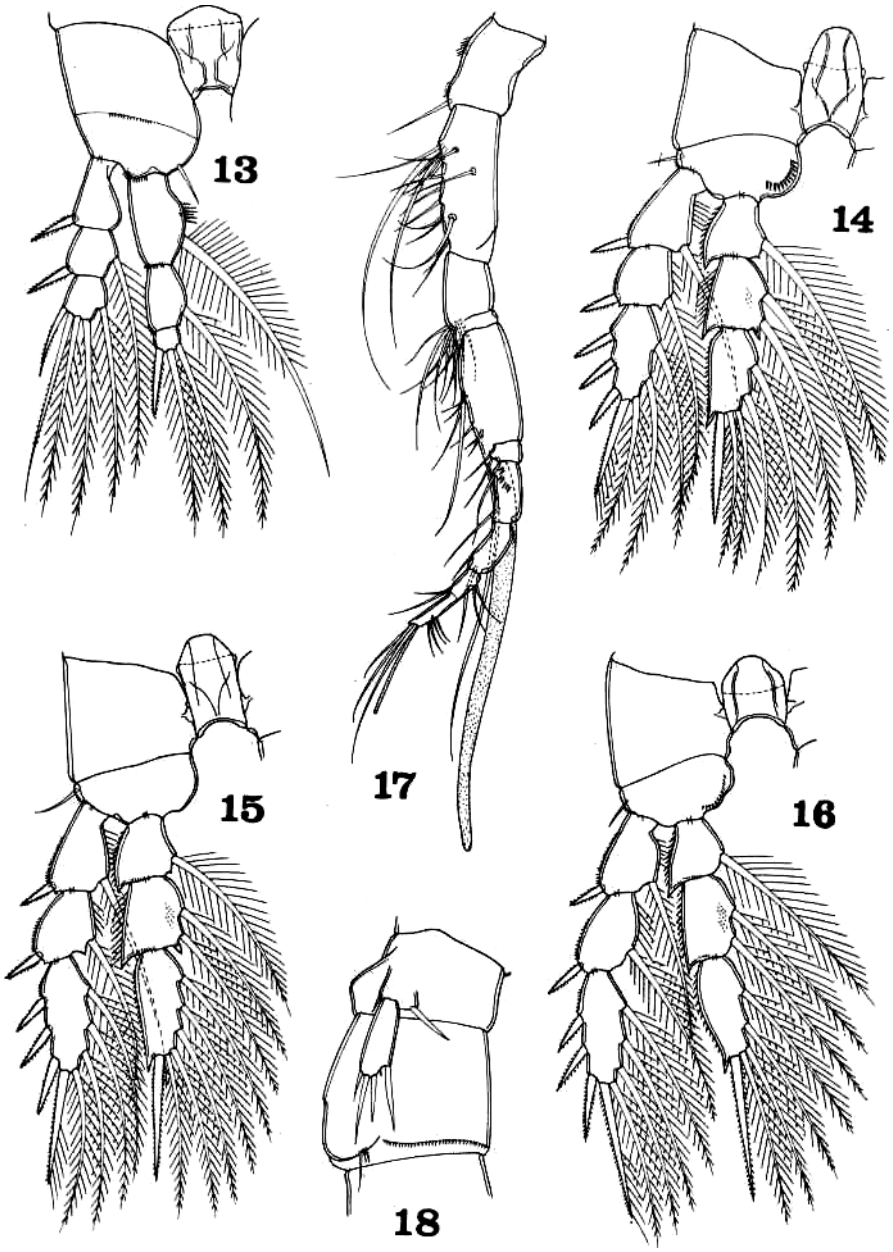
From *Dardanus lagopodes* (Forskal): 4 ♀♀, 3 ♂♂ from 1 host, in 1 m, Karang Mie, east central Halmahera, 00°20'07"N, 128°25'00"E, 19 May 1975; 28 ♀♀, 22 ♂♂ , 17 copepodids from 1 host, in 5 m, Pulau Parang, eastern Ceram, 3°17'00"S, 130°44'48"E, 23 May 1975; 3 ♀♀, *2* ♂♂, 2 copepodids from 1 host, in 3m, Natsepa, Ambon, Ceram, 3°27'05"S, 128°17'00"E, 28 May 1975.

As a supplement to the original description of this copepod, which Sewell found in weed-washings at Nankauri Harbor, Nicobar Islands, certain features are described on the basis of Moluccan specimens. Those features



Figs 6 – 12. *Paraidya minor* Sewell, 1940. Female : 6, segment of leg 5 and genital segment, lateral (B); 7, caudal ramus, dorsal (C); 8, cluster of eggs, lateral (D); 9, first antenna, dorsal (B); 10, second antenna, posterior (E); 11, mandible, posterior (E); 12, maxilliped, posterior (E).

HARPACTICOID COPEPODS ASSOCIATED



Figs. 13 — 18. *Paraidya minor* Sewell, 1940. Female : 13, leg 1 and intercoxal plate, anterior (B); 14, leg 2 and intercoxal plate, anterior (B); 15, leg 3 and intercoxal plate, anterior (B); 16, leg 4 and intercoxal plate, anterior (B). Male: 17, first antenna, dorsal (B); 18, segment of leg 5 and genital segment, lateral (B).

not mentioned may be assumed to resemble closely those of *Paraidya occulta* Humes and Ho, 1969.

Female.— The length of the body (not including the setae on the caudal rami) is 0.79 mm (0.75—0.84 mm) and the greatest width is 0.19 mm. (0.16—0.20 mm), based on 10 specimens. In the posterior part of the genital segment there is a ventral internal round sclerotization (Fig. 6) which shows distinctly in specimens cleared in lactic acid. The genital and postgeni-tal segments have a posterior marginal fringe of small spinules. The caudal ramus (Fig. 7) is approximately 44 x 26 µm and lakes the inner marginal hairs shown in Sewell's Text— Fig. 14B. In addition to the six usual setae there is a small seta 12 µm long on the outer margin of the ramus The outer seta (displaced dorsally) is 37 µm, the dorsal seta 23 µm, the outermost terminal seta 39 µm, and the innermost terminal seta 109 µm. All these setae are smooth. The two long median terminal setae, 295 µm (outer) and 540 µm (inner), are barbed along their midregions.

The eggs, usually three in a cluster (Fig. 8), occasionally two or four, are oval, 178 µm (169—185 µm) x 97 µm (96—101 µm).

The first antenna (Fig. 9) is 259 µm long. The lengths of the seven segments (measured along their posterior nonsetiferous margins) are : 31 (38 µm along the anterior margin), 61, 46, 45, 11, 30, and 28 µm respecti-vely. The formula is : 1, 15, 10, 4 + 1 aesthete, 2, 8, and 7 + 1 aesthete. All the setae are naked. The first segment bears anterior marginal spinules.

In the second antenna (Fig. 10) the protopod is 40 µm long, the 2-segmented endopod 88 µm, and the 4-segmented exopod 35 µm. The protopod bears on its inner distal area a smooth seta and a row of hairs. The second endopod segment bears three smooth inner setae, four terminal smooth jointed setae, and three outer setae, two smooth and one conspicuously haired; this segment is ornamented with a posterior surficial crescentic row of spinules, outer marginal hairs, and a small outer process with minute spinules. The formula for the exopod is : 1, 1, 1, and 2, all the setae being minutely barbed. The fourth segment bears distally an anterior surficial row of spines.

Sewell's Text — Fig. 14A, labeled "rostrum", is evidently a drawing of the labrum.

In the mandible (Fig. 11) the endopod is relatively short, not reaching to the end of the corpus mandibulae. The maxilliped (Fig. 12) has two inner proximal conical processes on the second segment. The longer of the two setae on the third segment is minutely barbed. The claw is 81 µm.

Legs 1—4 (Figs. 13—16) have details of ornamentation not shown in Sewell's Text — Fig. 14.

In leg 5 (Fig. 6) the small first segment bears a dorsal seta 30 µm and a ventral seta 10 µm. The unornamented second segment is 47 x 15.5 µm. Of the four setae one is subterminal and 39 Aim, the other three are terminal

and 36, 42, and 52 µm from dorsal to ventral. A small setule 5 µm arises between the subterminal seta and the terminal setae.

The color in life in transmitted light is opaque light brown, the eye red, and the eggs black.

Male.— The length of the body (measured as in the femael) is 0.71 mm. (0.69-0.73 mm) and the greatest width 0. 16 mm (0.16-0.17 mm), based on 10 specimens. .The first antenna (Fig. 17) is 289 µm long. The last segmment is very weakly subdivided. The lengths of the eight segments (measured as in the female) are: 33 *(39 µm.* along the anterior edge), 68, 29, 53, 11, 29, 25, and 35 µm respectively. The formula is: 1, 15,10, 8 + 1 aesthete, 2, 2, 2, and 11 + 1 aesthete. All the setae are smooth.

In leg 5 (Fig. 18) the two setae on the first segment are 27 µm and 8 µ*m.* The unornamented second segment is 35 x 14 µm with the four setae from dorsal to ventral 33, 22, 33, and 16 µm respectively. All the setae are smooth. A small setule 5 µm is found between the subterminal seta and the terminal setae.

The three setae of leg 6 (Fig. 18) are 9, 8, and 20 µm from dorsal to ventral.

The color resembles that of the female.

Paraidya major Sewell, 1940 (Figs. 19— 33)

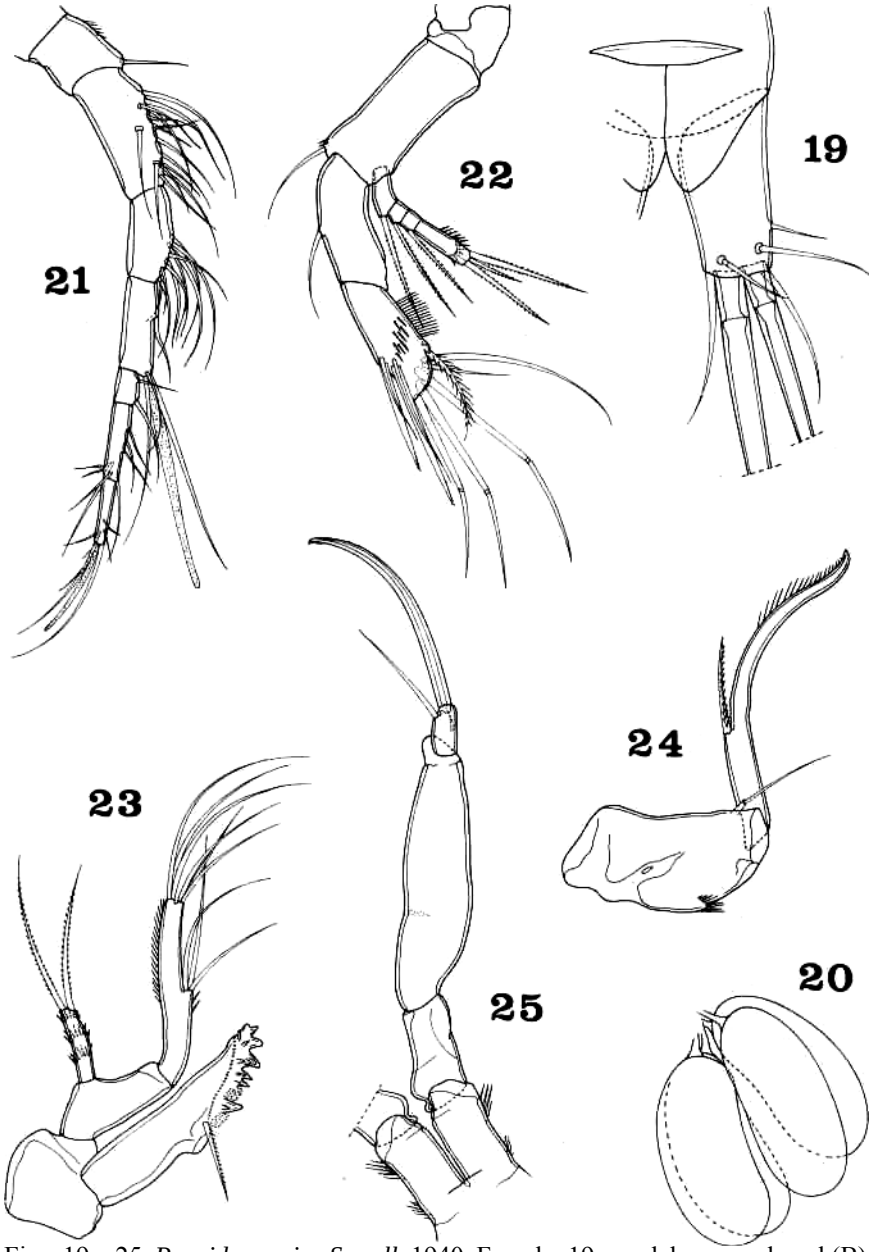
Specimens collected.— From *Dardanus megistos* (Herbst): 10 ♀♀, *5* ♂♂,*1* copepodid from 1 host, in 3 m, Pulau Marsegoe, western Ceram, 2°59'30"S, 128°03'30"E, 15 May 1975.

From *Dardanus lagopodes* (Forskal): 2 ♀♀ , 1 ♂ from 1 host, in 3 m, Pulau Marsegoe, western Ceram 2°59'30"S, 128°03'30"E, 15 May 1975; 1 ♀, 1♂ , 2 copepodids from 1 host, in 1 m, Karang Mie, east central Halma-hera, 00°20'07"N, 128°.25'00"E, 19 May 1975; 1♀ , 2 ♂♂ from 1 host, in 5 m, Pulau Parang, eastern Ceram, 3°17'00"S, 130°44'48"E, 23 May 1975.

From *Dardanus guttatus* (Olivier): 4 ♀♀ , 2 copepodids from 1 host, in 1 m, Karang Mie, east central Halmahera, 00°20'07"N, 128°25'E, 19 May 1975.

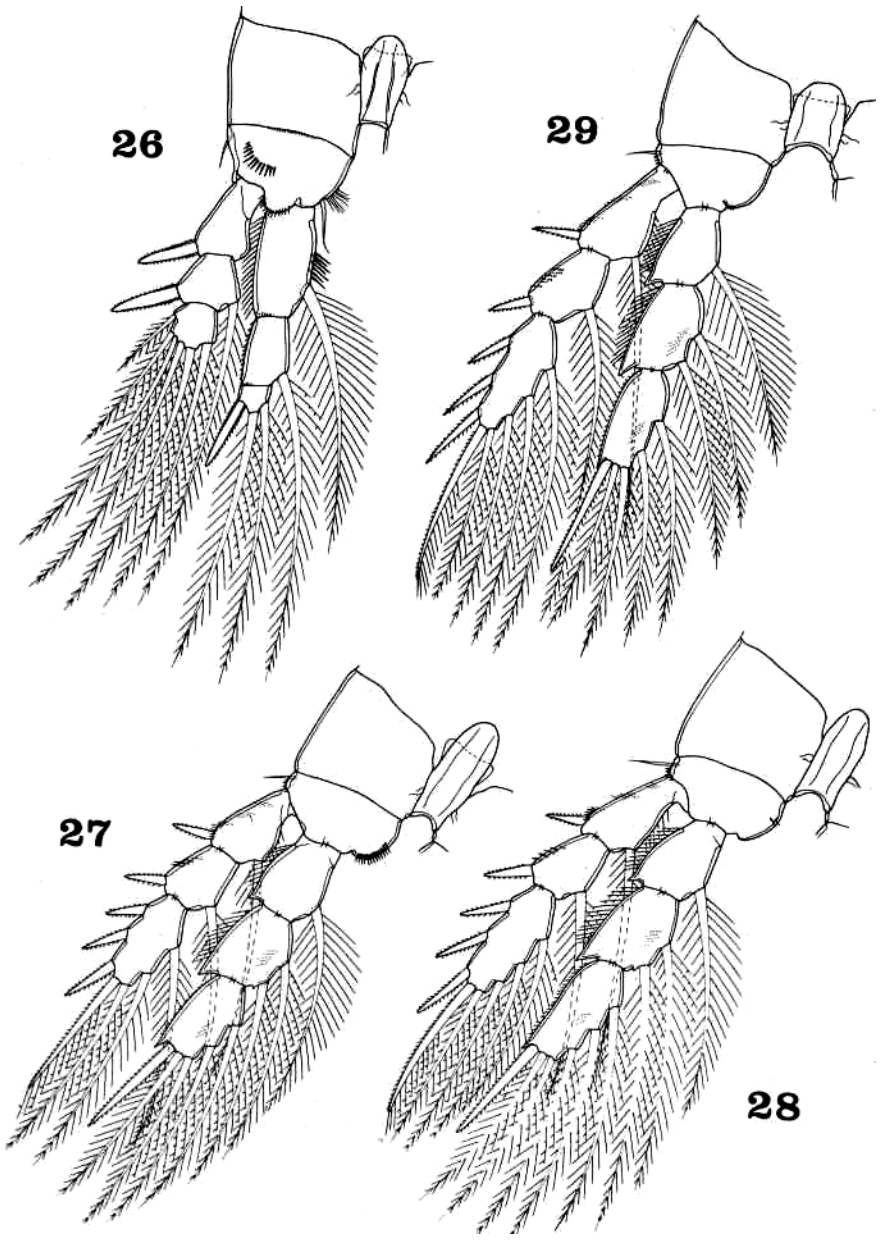
In the partial redescription that follows features not mentioned may be assumed to resemble closely those of *Paraidya occulta* Humes and Ho, 1969.

Female, — The length of the body (excluding the setae on the caudal rami) is 1.37 mm (1.29—1.45 mm) and the greatest width is 0.26 mm (0.23 — 0.29 mm), based on 10 specimens. The genital segment and the post-genital segments lack the posterior marginal fringe of small spinules seen in *Paraidya minor.* The caudal ramus (Fig. 19) is 83 x 34 µm, ratio 2.44:1,

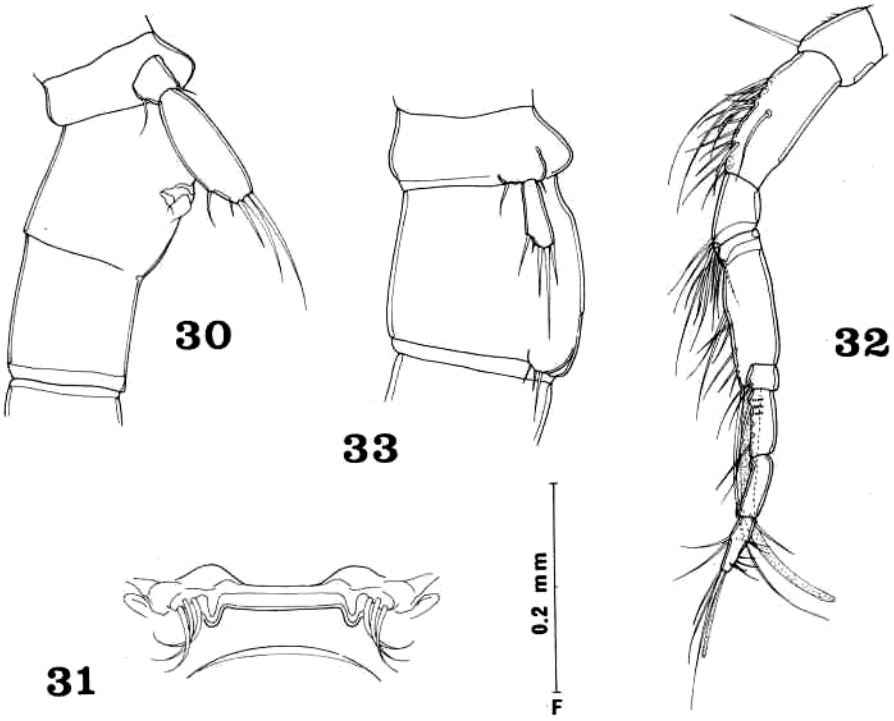


Figs. 19 – 25. *Paraidya major Sewell,* 1940. Female: 19, caudal ramus, dorsal (B); 20, cluster of eggs, lateral (D); 21, first antenna, dorsal (A); 22, second antenna, posterior (B); 23, mandible, posterior (B); 24, second maxilla, postero-inner (B) 25, maxilliped, posterior (A).

HARPACTICOID COPEPODS ASSOCIATED



Figs. 26 — 29. *Paraidya major* Sewell, 1940. Female: 26, leg 1 and intercoxal plate (A); 27, leg 2 and intercoxal plate, anterior (A); 2,8, leg 3 and intercoxal plate, anterior (A); 29, leg 4 and intercoxal plate, anterior (A).



Figs. 30 — 33. *Paraidya major* Sewell, 1940. Female: 30, segment of leg 5 and genital segment, lateral (F); 31, genital area, ventral (F). Male: 32, first antenna, dorsal (A); 33, segment of leg 5 and genital segment, lateral (A).

width taken at the level of the outer marginal seta. The outer seta (displaced dorsally) is 55 *µm,* the dorsal seta 30 µ*m,* the outermost terminal seta 65 µm, and the innermost terminal seta 68 µm. All these setae are smooth. The two long median terminal setae, 500 µm (outer) and 850 µm (inner), have short barbs along their midregions. The small seventh seta on the outer margin of the ramus is 26 µ*m* and smooth.

The eggs, usually four in a cluster (Fig. 20), occasionally three, are elongate oval, 279 µm (275—286 µm) x 122 µm (121—126 µm).

The first antenna (Fig. 21) is 357 µm Long. The lengths of the seven segments (measured along their posterior nonsetiferous margins) are: 39 (52 µm along the anterior margin), 81, 49, 58, 23, 49, and 45 µm respectively. The formula for the armature is like that of *Paraidya minor.* All the setae are smooth. The first segment bears a few anterior marginal spinules.

In the second antenna (Fig. 22) the protopod is 68 µm long, the endopod 122 µm, and the exopod 57 µm. The terminal segment of the exopod bears three setae instead of two as in *Paraidya minor.* The last-segment of the endopod bears 10 setae as in *P. minor,* but only three are jointed and two are stout with minute clawlike tips.

In the mandible (Fig. 23) the endopod is elongate, reaching well beyond the distal end of the corpus mandibulae. The second maxilla (Fig. 24) has a long smooth seta on the first segment.

The maxilliped (Fig. 25) lacks processes on the elongate second segment. The claw is 143 µm.

Legs 1—4 (Figs. 26—29) show details in ornamentation not indicated in Sewell's Tex — Fig. 13.

In leg 5 (Fig. 30) the small first segment bears a dorsal seta 21 µm and a ventral seta 13 µm. The second segment is 125 x 44 µm, with smooth margins, not haired as shown in Sewell's Text — Fig. 13K. Of the four setae one seta is distinctly subterminal and 34 µm, the other three setae are terminal and 52, 96, and 120 µm respectively from dorsal to ventral, A small setule 13 µm arises between the subterminal seta and the terminal setae. All the setae are smooth.

Leg 6 (Fig. 31) is represented in the genital field by three equal smooth setae approximately 27 µm.

The color in life in transmitted ligth resembles that of *Paraidya minor.*

Male.— The length of the body (measured as in the female) is 1.08 mm (0.94—1.18 mm) and the greatest width is 0.21 mm (0.19—0.22 mm), based on seven specimens. The first antenna (Fig. 32) is 389 µm long. The lengths of the eight segments (measured as in the female) are : 30 (48/am along the anterior margin), 88, 34, 78, 18, 42, 42, and 39 µm respectively. The sixth segment has three rows of spinules on its dorsal surface. The aesthete on the fourth segment is shorter than in *Paraidya minor.* The third segment has a dorsal bandlike sclerite giving a false appearance of a segment.

This sclerite, however, is not present on the ventral surface of the segmnet. The formula for the armature is like that in *Paraidya minor*. All the setae are smooth.

In leg 5 (Fig. 33) the two setae on the first segment are *19 µm* and 6 µm. The second segment is 44 x 17 µm with the four setea 29, 39, 62, and 27 µ*m* from dorsal to ventral. A small setule 5 µ*m* is located between the dorsal subterminal seta and the terminal setae. All the setae are smooth.

The three setae on leg 6 (Fig. 33) are 15, 15, and *39 µm* from dorsal to ventral.

The color is similar to that of the female.

Remarks.— The four harpacticoid genera known from Paguridea have different numbers of species living with these crustacean inhabitants of gastropod shells. Species of the genus *Sunaristes* live with hermit crabs "in Europe (including the Mediterranean Sea and the Black Sea) and in the Indian Ocean and the western half of the Pacific Ocean. Only one species of the large genus *Porcellidium* (containing numerous species) lives with hermit crabs. *P. brevicaudatum* occurs commonly with these hosts in the Indian Ocean and the western Pacific Ocean. Three species of *Brianola* living with *Diogenes* in Australia became known as a result of recent work of Hamond (1973). The genus *Paraidya* contains three species associated with hermit crabs in Madagascar and the Moluccas. It is possible that Sewell's type specimens of *Paraidya minor* and *Paraidya major* found in the Nicobar Islands in weed-washings may have been dislodged from shells inhabited by hermit crabs.

A list of the Paguridea in the Indo-Pacific known to have associated harpacticoid copepods follows.

Indo-Pacific Paguridea and their associated harpacticoid copepods

Calcinus gaimardi (H. Milne-Edwards)
    Sunaristes tranteri Calcinus latens (Randall)
Porcellidium brevicaudatum
Sunaristes dardani
Sunaristes inaequalis
    Sunaristes tranteri Calcinus minutus Buitendijk
Porcellidium brevicaudatum
    Sunaristes tranteri Calcinus sp., undescribed
    Sunaristes tranteri Clibanarius carnifex Heller
Sunaristes inaequalis

HARPACTICOID COPEPODS ASSOCIATED

Clibanarius virescens Krauss
Porcellidium brevicaudatum
Sunaristes dardani
Sunaristes inaequalis
Dardanus deformis (H. Milne-Edwards)
Porcellidium brevicaudatum
Sunaristes dardani Dardanus guttatus (Olivier)
Paraidya major
Paraidya minor
Porcellidium brevicaudatum
Sunaristes dardani
Sunaristes tranteri Dardanus lagopodes (Forskal)
Paraidya major
Paraidya minor
Porcellidium brevicaudatum
Sunaristes dardani
Sunaristes tranteri Dardanus megistos (Herbst)
Paraidya major
Paraidya minor
Paraidya occulta
Porcellidium brevicaudatum
Sunaristes dardani
Sunaristes inaequalis Dardanus scutellatus
Porcellidium brevicaudatum
Sunaristes dardani
Sunaristes inaequalis Diogenes senex
Brianola elegans
Brianola pori
Brianola sydneyensis
Sunaristes tranteri
Pagurus novaezealandiae Filhol
Sunaristes sp., undescribed *Pagurus* sp.
Porcellidium brevicaudatum Trizopagurus strigatus (Herbst)
Porcellidium brevicaudatum
Sunaristes tranteri

ARTHUR G. HUMES CONCLUSIONS

Hermit crabs in the Indo-Pacific, and especially in the Moluccas, may be expected to have several species of harpacticoid copepods associated with them. These include *Sunaristes dardani* Humes and Ho, 1969, *Sunaristes inaequalis* Humes and Ho, 1969, *Sunaristes tranteri* Hamond, 1973, *Brianola elegans* Hamond, 1973, *Brianola pori* Hamond, 1973, *Brianola sydney-ensis* Hamond, 1973 *Porcellidium brevicaudatum* Thompson and A. Scott, 1903, *Paraidya occulta* Humes and H, 1969, *Paraidya major* Sewell, 1940, and *Paraidya minor* Sewell, 1940.

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