

California “Epicaridean” Isopods

Superfamilies Bopyroidea and Cryptoniscoidea
(Crustacea, Isopoda, Cymothoidea)

by

Timothy D. Stebbins



Presented to SCAMIT
13 February 2012



City of San Diego Marine Biology Laboratory
Environmental Monitoring & Technical Services Division • Public Utilities Department

California Epicarideans

Suborder Cymothoida

Superfamily Bopyroidea

Family Bopyridae *

Subfamily Pseudioninae

- Aporobopyrus muguensis* Shiino, 1964
- Aporobopyrus oviformis* Shiino, 1934
- Asymmetrione ambodistorta* Markham, 1985
- Discomorphus magnifolius* Markham, 2008
- Goleathopseudione bilobatus* Román-Contreras, 2008
- Munidion pleuroncodis* Markham, 1975
- Orthione griffenis* Markham, 2004
- Pseudione galacanthae* Hansen, 1897
- Pseudione giardi* Calman, 1898

Subfamily Bopyrinae

- Bathygyge grandis* Hansen, 1897
- Bopyrella calmani* (Richardson, 1905)
- Probopyria* sp. A Stebbins, 2011
- Schizobopyrina striata* (Nierstrasz & Brender à Brandis, 1929)

Subfamily Argeiinae

- Argeia pugettensis* Dana, 1853

Subfamily Ioninae

- Ione cornuta* Bate, 1864
- Leidya infelix* Markham, 2002

Subfamily Phyllodurinae

- Phyllodurus abdominalis* Stimpson, 1857

Subfamily Athelginae

- Anathelges hyphalus* (Markham, 1974)

Subfamily Hemiarthrinae

- Hemiarthrus abdominalis* (Krøyer, 1840)
- Unidentified species †

Family Dajidae

- Holophryxus alaskensis* Richardson, 1905

Family Entoniscidae

- Portunion conformis* Muscatine, 1956

Superfamily Cryptoniscoidea

Family Cabiropidae

- Cabirops montereyensis* Sassaman, 1985

Family Cryptoniscidae

- Faba setosa* Nierstrasz & Brender à Brandis, 1930

Family Hemioniscidae

- Hemioniscus balani* Buchholz, 1866

† Unidentified species of Hemiarthrinae infesting the shrimp *Betaeus longidactylus* off San Pedro, CA (J. Markham, pers. comm.)

* Plus one possibly new (unexamined) species of bopyrid found infesting the hermit crab *Paguristes ulreyi* (= new bopyrid host record) off San Diego, CA (T. Stebbins, Nov. 2011)

Family Bopyridae

(Superfamily Bopyroidea)

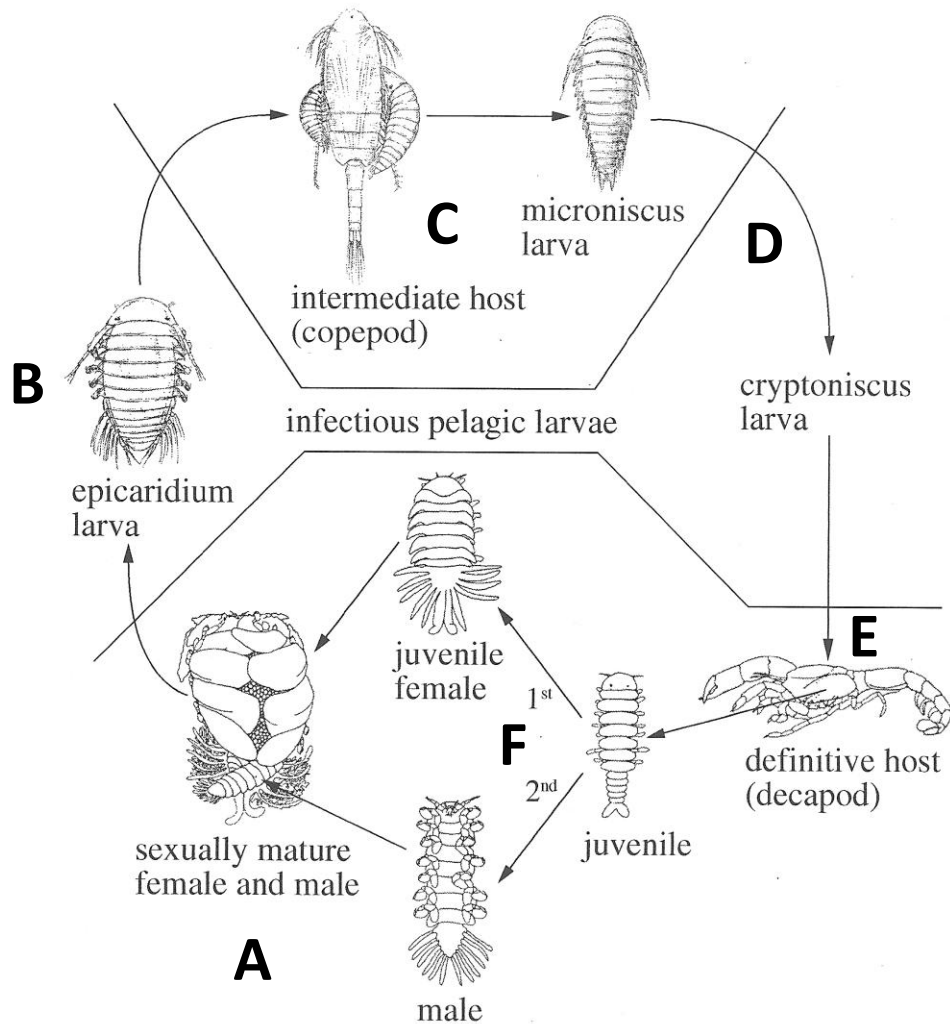
Bopyrids are parasites within the gill cavity or on/under the carapace of decapod hosts (e.g., crabs and shrimps). The parasites often distort the host carapace into a characteristic bulge, which has even been observed in fossil decapods.

*Bopyrid on pistol shrimp**



California bopyrids: ~20 species (18 genera, 7 subfamilies)

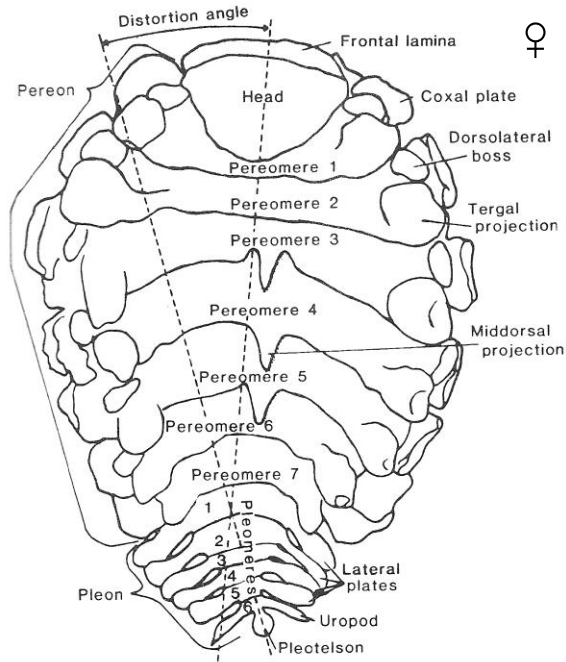
Generalized Bopyrid Life Cycle *



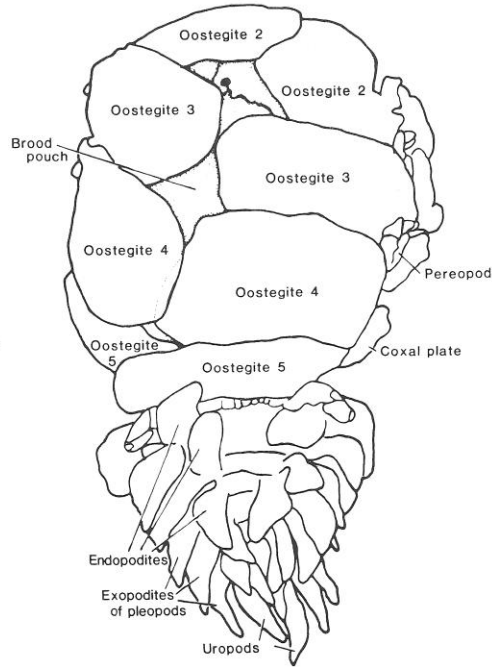
- A. Adult bopyrids typically found in gill chamber or on abdomen of decapod definitive host;
- B. Sexually mature bopyrids release pelagic larvae (epicaridium);
- C. Epicaridium attaches to copepod intermediate host and metamorphoses into an ectoparasitic microniscus larva;
- D. Microniscus transforms into a cryptoniscus larva that detaches and is free-swimming;
- E. Cryptoniscus settles onto suitable definitive host (recently settled juveniles = bopyridia);
- F. First juvenile to settle becomes juvenile female, while subsequent juveniles become dwarf juveniles that live on the host and fertilize eggs in marsupium.

* Modified after Fig. 3 in Boyko & Williams (2009)

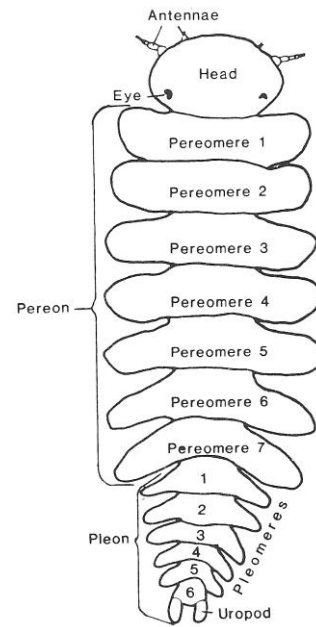
Generalized Bopyrid *



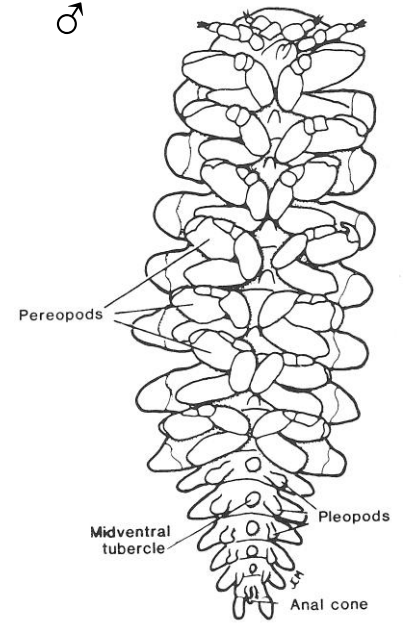
Dorsal view



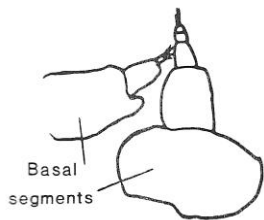
Ventral view



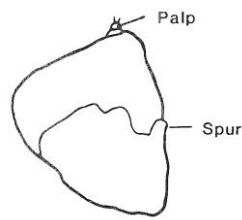
Dorsal view



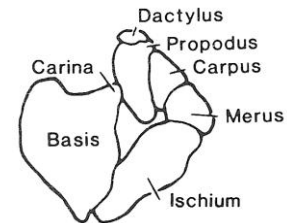
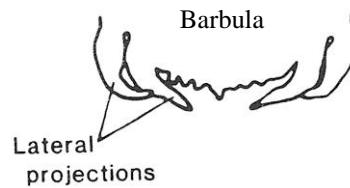
Ventral view



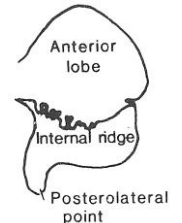
Antennae



Maxilliped



Pereopod



Oostegite 1

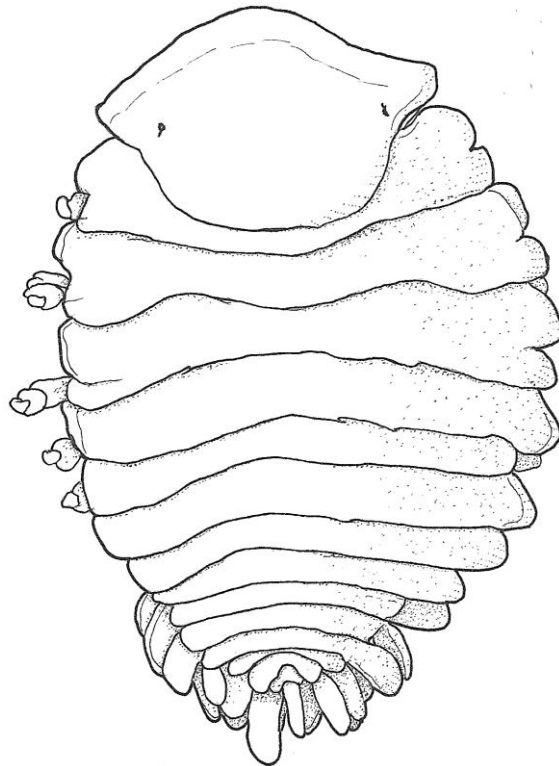
* Modified after Fig. 2 in Markham (1985)

Decapod Hosts of California Bopyrids

Host Families	Host Genera	Bopyrids
Caridean Shrimp		
Alpheidae [A] Hippolytidae [H] Crangonidae [C] Glyphocrangonidae [G]	[A] <i>Alpheopsis</i> , <i>Automate</i> , <i>Betaeus</i> , <i>Synalpheus</i> [H] <i>Eualus</i> , <i>Heptacarpus</i> , <i>Hippolyte</i> , <i>Lebbeus</i> , <i>Spirontocaris</i> , <i>Thor</i> [C] <i>Argis</i> , <i>Crangon</i> , <i>Lissocrangon</i> , <i>Mesocrangon</i> , <i>Metacrangon</i> , <i>Neocrangon</i> [G] <i>Glyphocrangon</i>	[A] <i>Bopyrella calmani</i> , <i>Probopyria</i> sp. A [H] <i>Argeia pugettensis</i> , <i>Hemiarthrus abdominalis</i> , <i>Schizobopyrina striata</i> [C] <i>Argeia pugettensis</i> [G] <i>Bathyygyge grandis</i>
Ghost Shrimp		
Callianassidae	<i>Neotrypaea</i>	<i>Ione cornuta</i>
Mud Shrimp		
Upogebiidae	<i>Upogebia</i>	<i>Orthione griffenis</i> , <i>Phyllodurus abdominalis</i>
Hermit Crabs		
Diogenidae [D] Paguridae [P]	[D] <i>Isocheles</i> , <i>Paguristes</i> * [P] <i>Pagurus</i> , <i>Parapagurodes</i>	[D] <i>Asymmetrione ambodistorta</i> , *Unidentified sp. (new?) [P] <i>Anathelges hyphalus</i> , <i>Pseudione giardi</i>
Squat Lobsters		
Munididae [M1] Munidopsidae [M2]	[M1] <i>Munida</i> , <i>Pleuroncodes</i> [M2] <i>Galacantha</i> , <i>Munidopsis</i>	[M1] <i>Munidion pleuroncodis</i> , <i>Pseudione galacanthae</i> [M2] <i>Goleathopseudione bilobatus</i> , <i>Pseudione galacanthae</i>
Porcelain Crabs		
Porcellanidae	<i>Pachycheles</i> , <i>Petrolisthes</i>	<i>Aporobopyrus muguensis</i> , <i>Aporobopyrus oviformis</i> , <i>Discomorphus magnifolius</i>
Brachyuran Crabs		
Grapsidae	<i>Pachygrapsus</i>	<i>Leidya infelix</i>

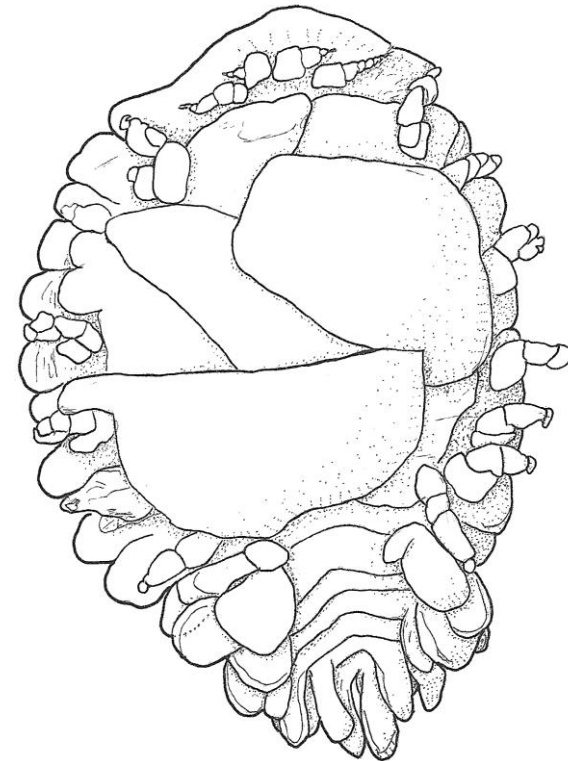


Aporobopyrus muguensis (Shiino, 1964)

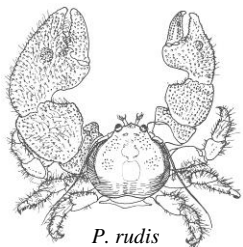


Dorsal view

♀



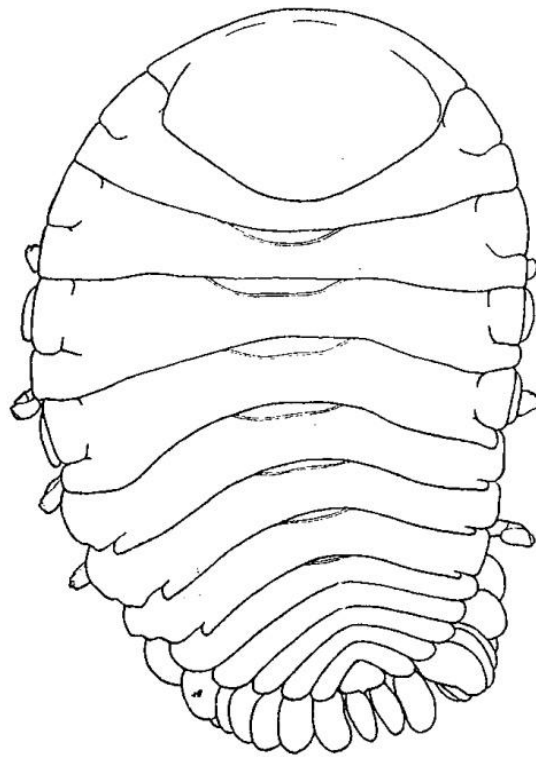
Ventral view



P. rudis

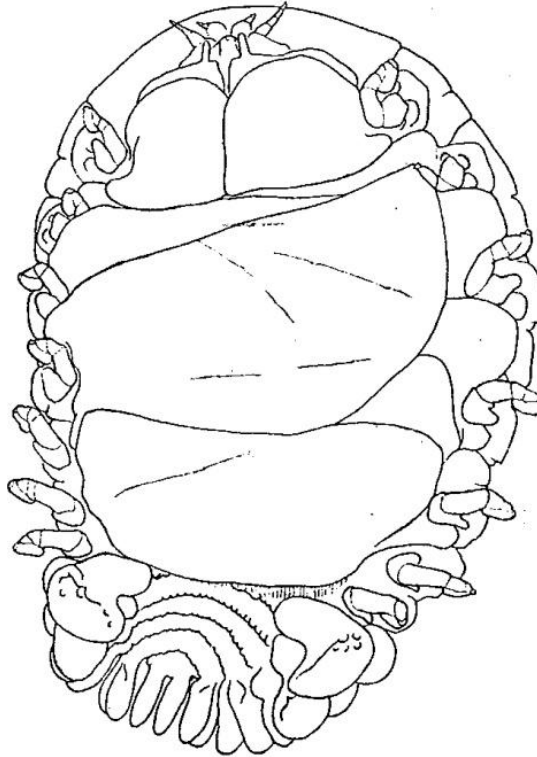
Host/Distribution: Infests the porcelain crabs *Pachycheles holosericus*, *P. pubescens*, and *P. rudis*; Bodega Bay, California to central west Baja California; 10-12 m.

Aporobopyrus oviformis (Shiino, 1934)

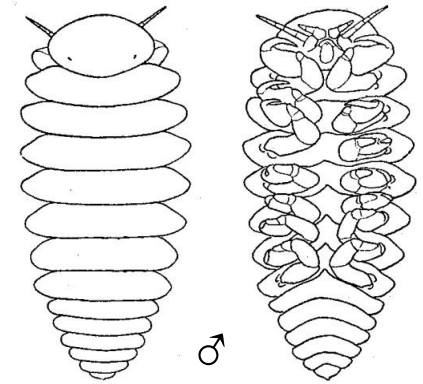


Dorsal view

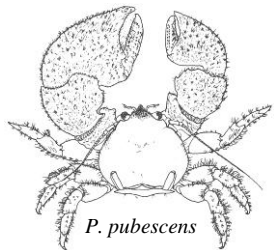
♀



Ventral view



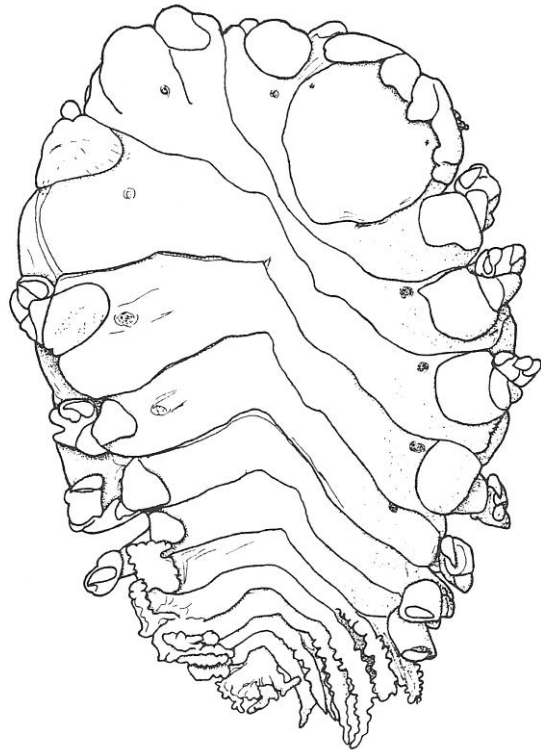
♂



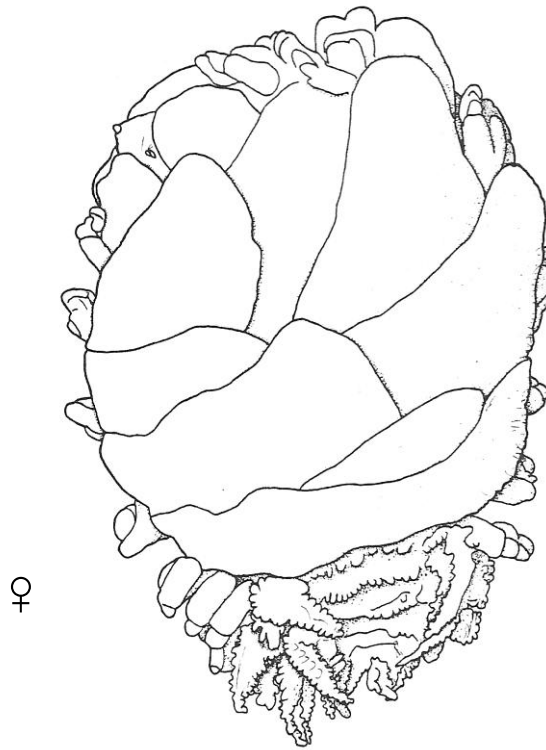
P. pubescens

Host/Distribution: Infests the porcelain crab *Pachycheles pubescens* in California; Point Mugu, California, and Japan; 10-12 m.

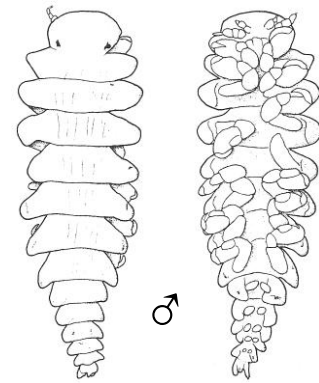
Asymmetrione ambodistorta Markham, 1985



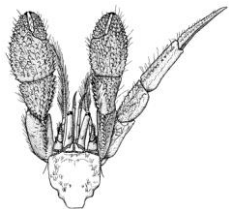
Dorsal view



Ventral view

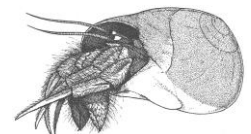


♂

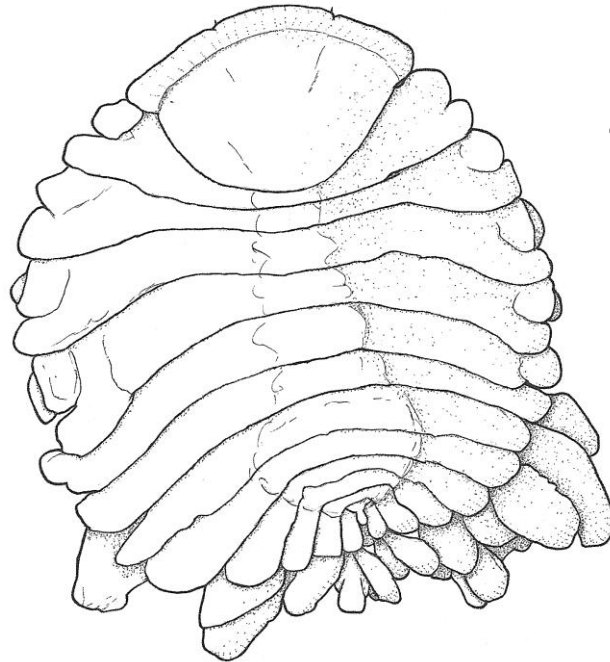


I. pilosus

Host/Distribution: Infests the hermit crab *Isocheles pilosus*.; Southern California; 3 m.

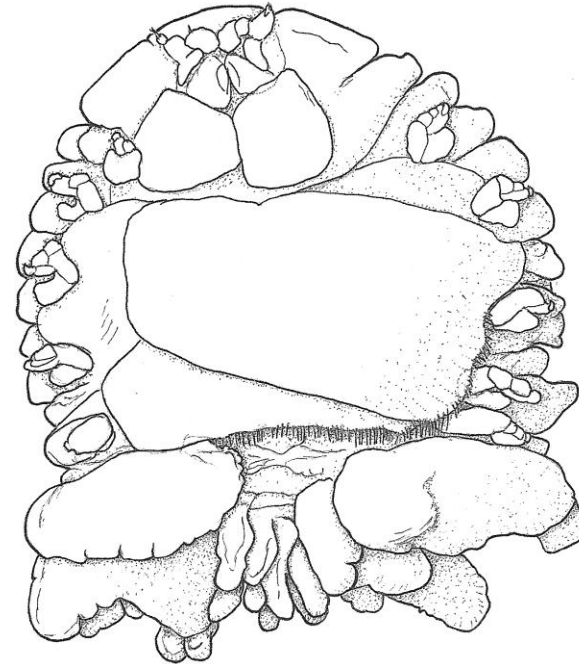


Discomorphus magnifoliatus Markham, 2008

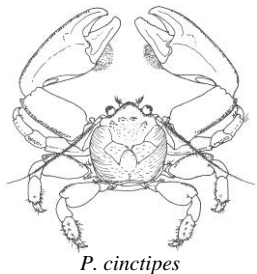


Dorsal view

♀



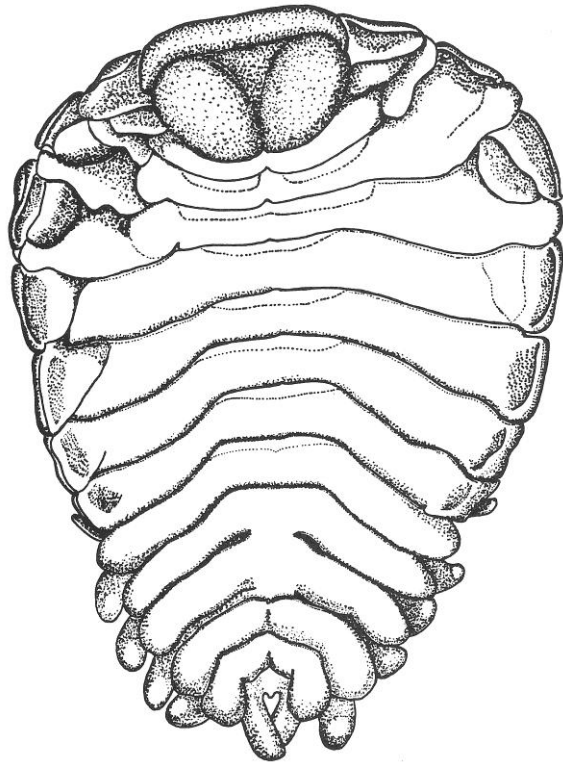
Ventral view



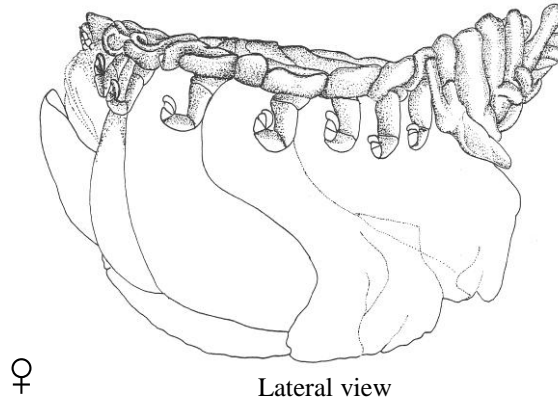
P. cinctipes

Host/Distribution: Infests the porcelain crab *Petrolisthes cinctipes*; Pacific Grove, Monterey County, California; intertidal.

Goleathopseudione bilobatus Román-Contreras, 2008

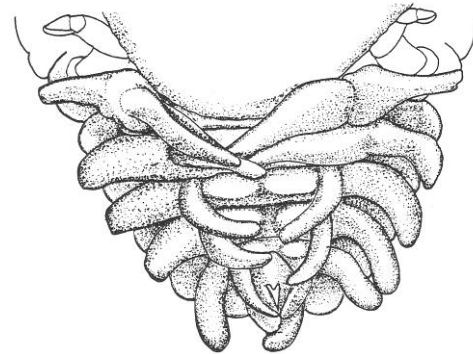


Dorsal view

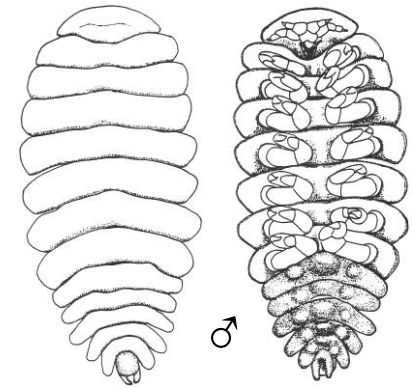


♀

Lateral view



Ventral view
(pleon)



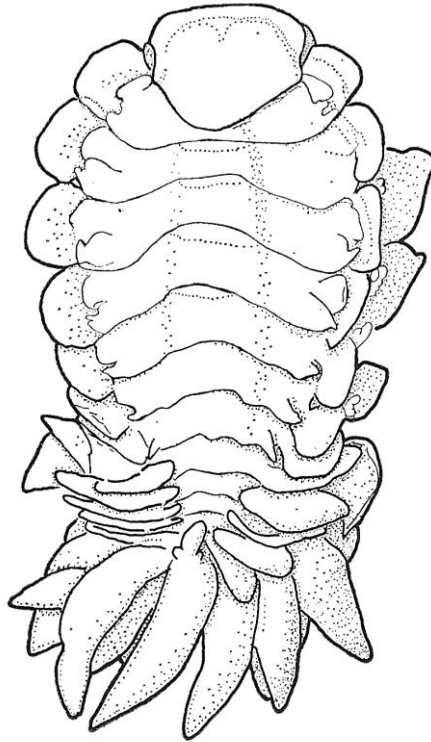
♂



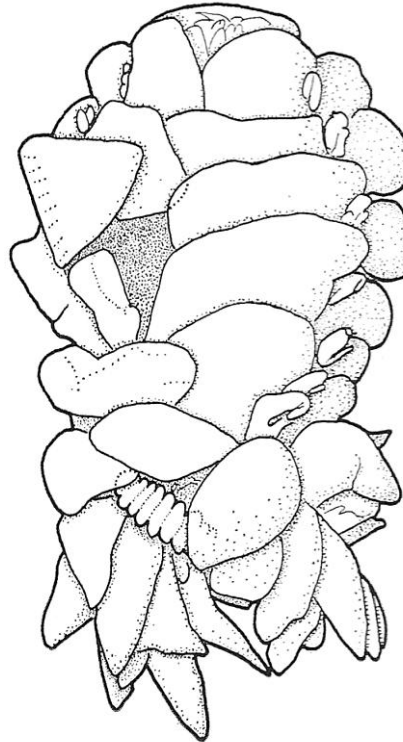
M. antonii

Host/Distribution: Infests the squat lobster *Munidopsis antonii*; Central California; 4100 m.

Munidion pleuroncodis Markham, 1975

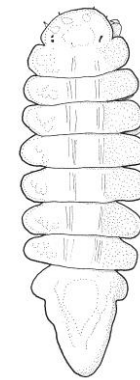


Dorsal view

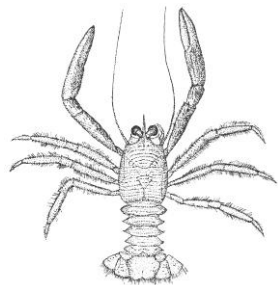
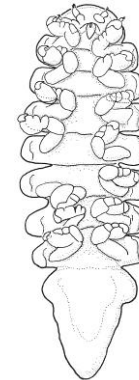


Ventral view

♀



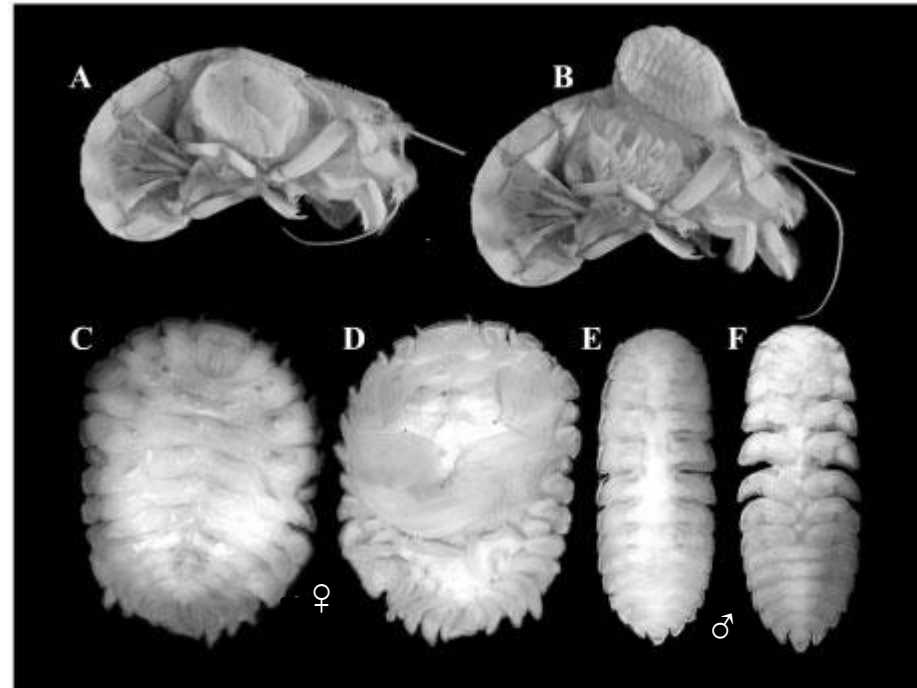
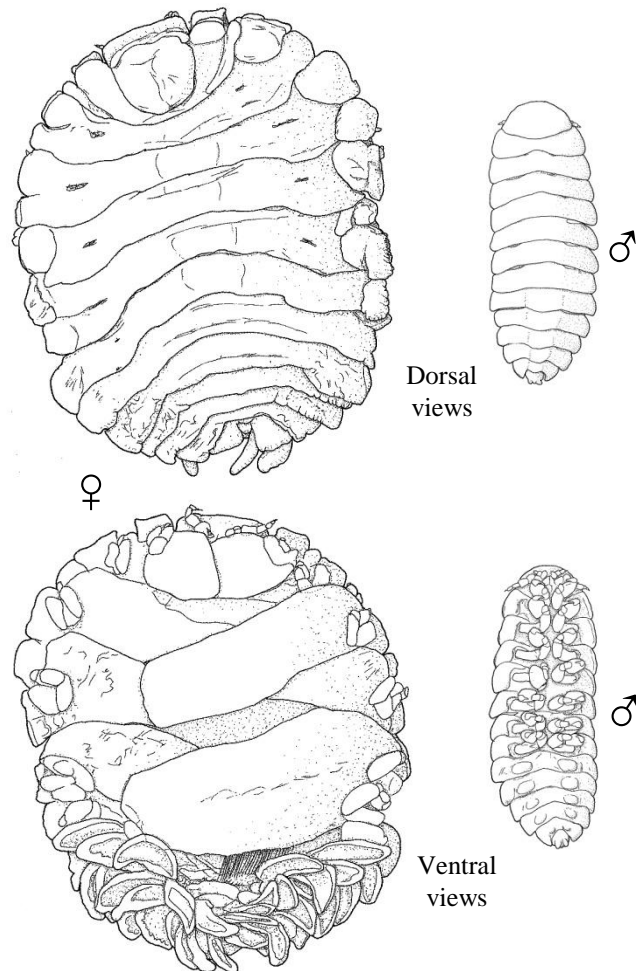
♂



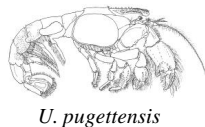
P. planipes

Host/Distribution: Infests the pelagic red crab (tuna crab) *Pleuroncodes planipes*; Central California to central Mexico; pelagic.

Orthione griffenis Markham, 2004

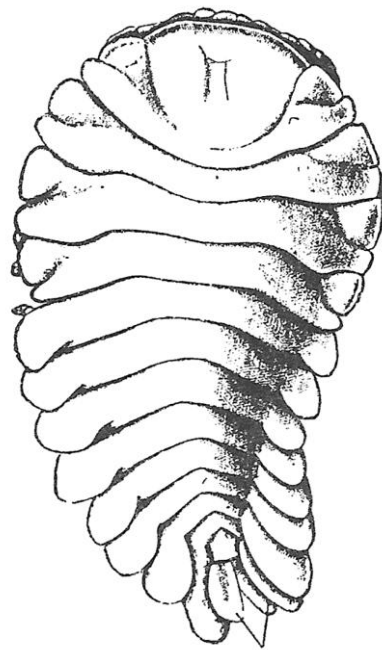


A, B = *Orthione griffenis* infesting *Upogebia pugettensis* from Oregon; C-D = dorsal and ventral views of female *O. griffenis*; E-F = dorsal and ventral views of male *O. griffenis*. [after Fig. 3 in Williams & An (2009)].

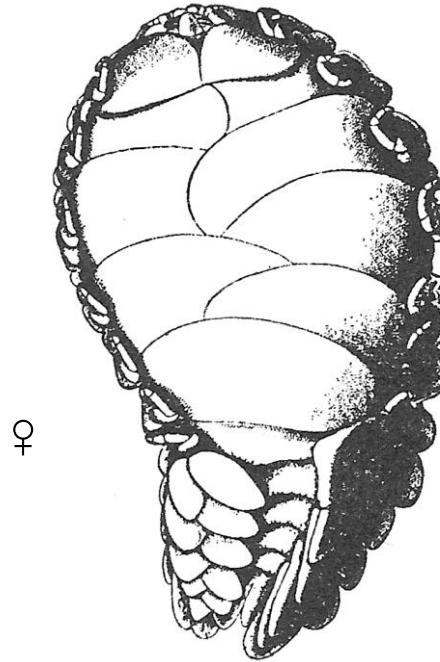


Host/Distribution: Infests the mud shrimp *Upogebia pugettensis* and *U. macginitieorum*; Introduced species from Asia (China, Japan) – British Columbia to southern California along western coast of North America.

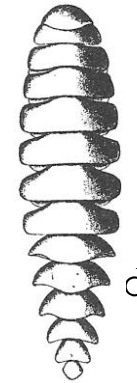
Pseudione galacanthae Hansen, 1897



Dorsal view

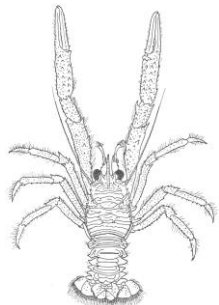


Ventral view



♀

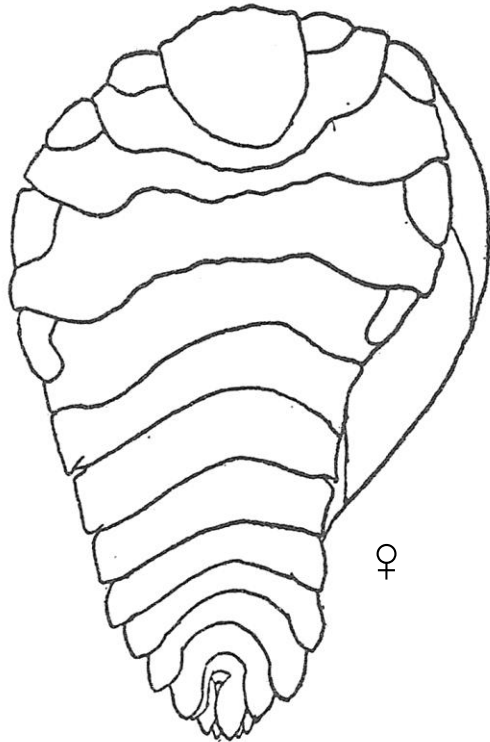
♂



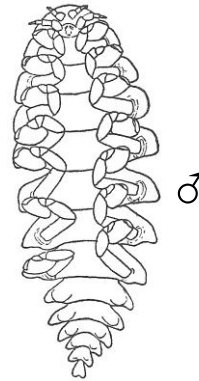
M. quadrispina

Host/Distribution: Infests the squat lobsters *Galacantha diomedea* and *Munida quadrispina*; British Columbia to Gulf of California. [questionable record in California, J. Markham, pers. comm.]

Pseudione giardi Calman, 1898

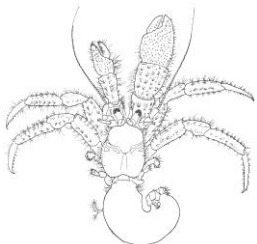


Dorsal view



Ventral view

Note: Species added to SCAMIT Edition 6 list (SCAMIT 2011) based on trawl record off Palos Verdes (D. Cadien, pers. comm). Record considered questionable according to J. Markham since *P. giardi* has not been previously known from California, although a report of a *Pseudione* sp. infesting *Pagurus hirsutiusculus* in central California may refer to it (J. Markham, pers. comm.).



P. hirsutiusculus

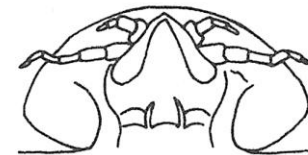
Host/Distribution: Infests hermit crabs of the genus *Pagurus* (Paguridae); Bering Sea to San Juan Islands, Washington – possibly extended into California off Palos Verdes (see Note).

Bathyggye grandis Hansen, 1897



♀

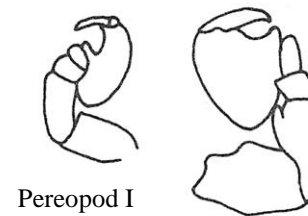
[No female images exist]



Ventral view
(head)



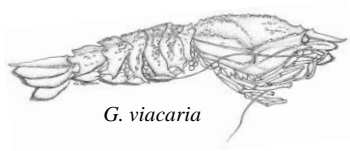
Dorsal view
(whole body)



Pereopod I

Pereopod V

♂

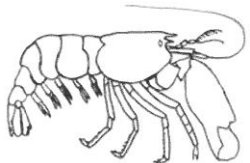
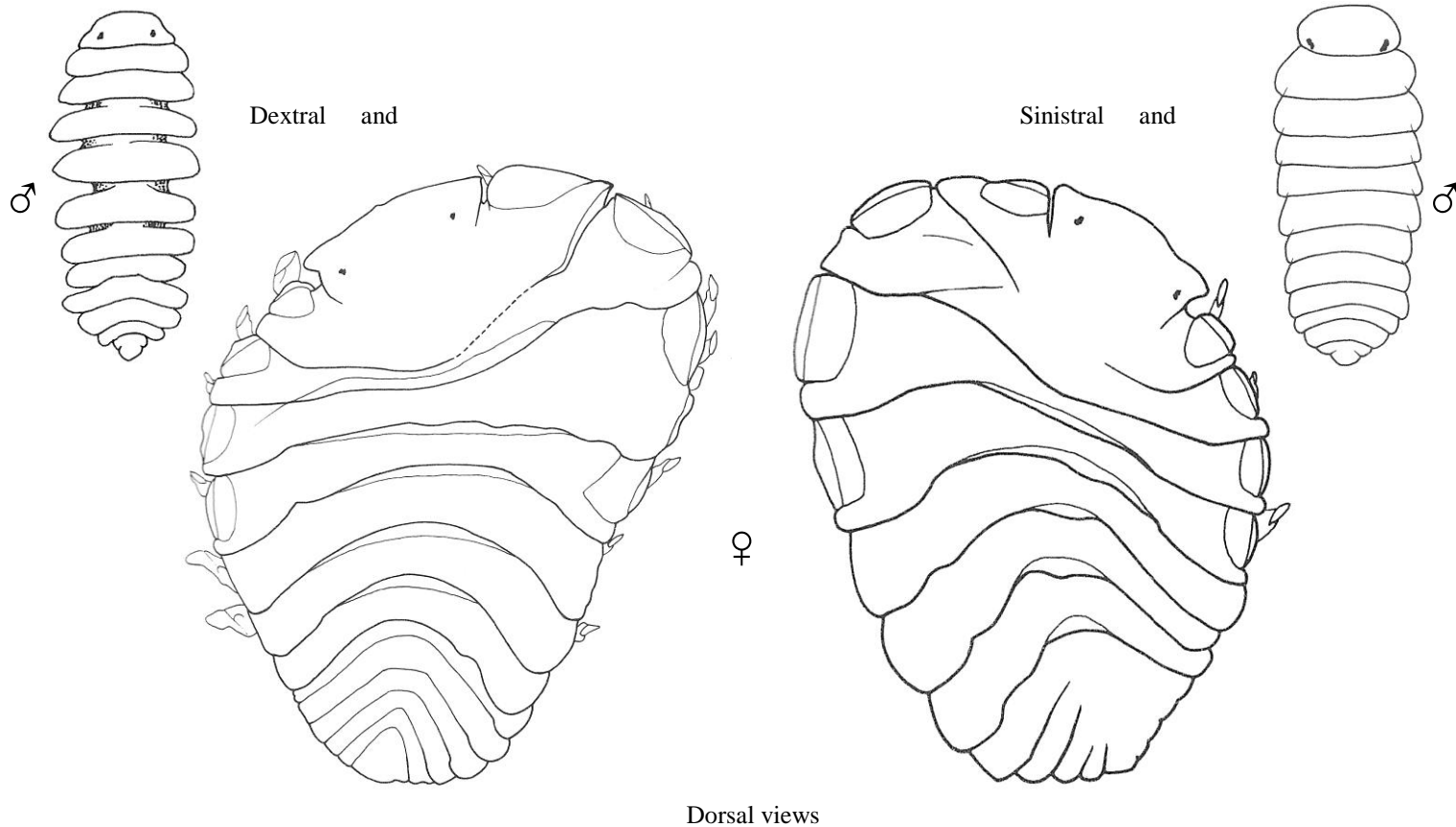


G. vicaria

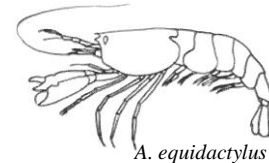
Host/Distribution: Infests the deepwater shrimp *Glyphocrangon vicaria*; San Clemente Basin, California; 1792-1866 m.

Bopyrella calmani (Richardson, 1905) *

* Formerly = *Bopyriscus calmani*



Host/Distribution: Infests the alpheid snapping shrimp *Alpheopsis equidactylus* and *Synalpheus lockingtoni*; Central to southern California; intertidal to 9 m.

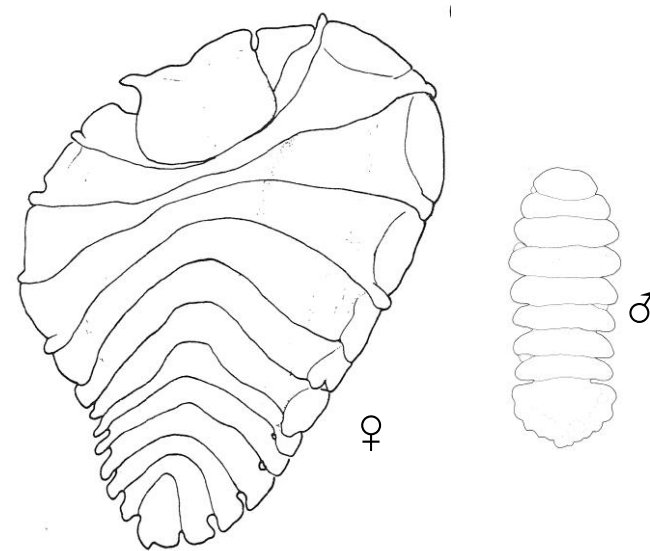


Probopyria sp. A Stebbins, 2011



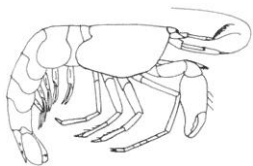
Probopyria sp. A

(Similar in general appearance to *P. alpei*)



Probopyria alpei

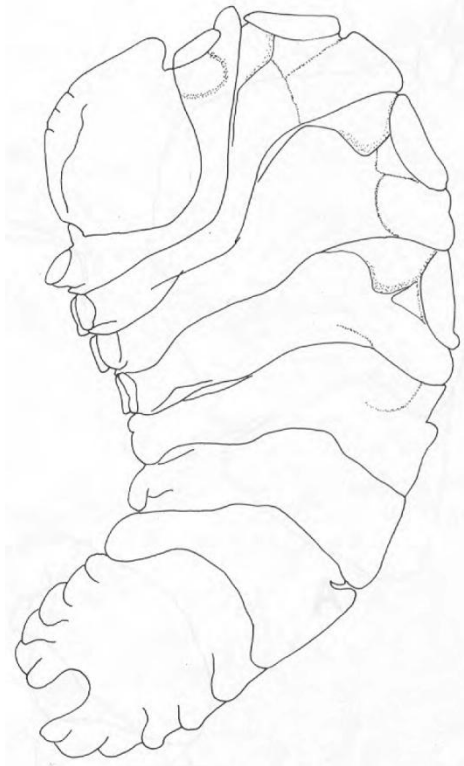
(North Carolina – western Florida, Antigua, Brazil)



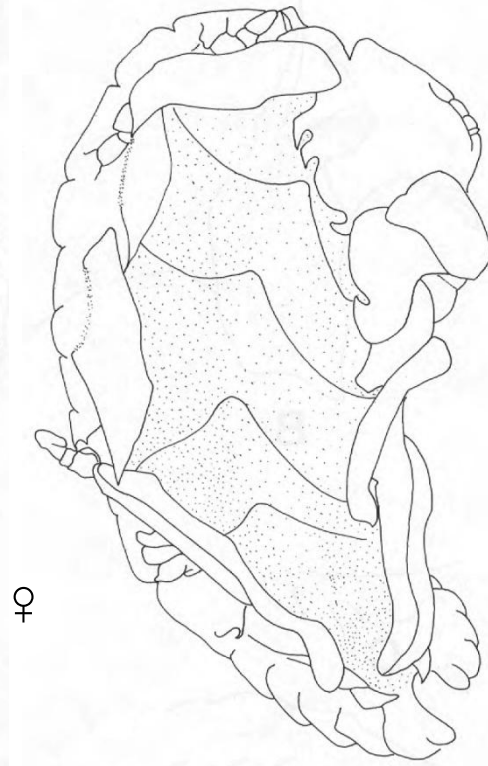
A. dolichognatha

Host/Distribution: Infests the undescribed alpheid shrimp *Automate* sp. A (known from 1 record); Southern California. [genus ID provided by J. Markham, 8/1/08]

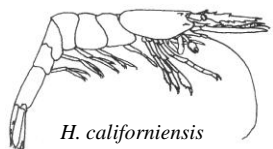
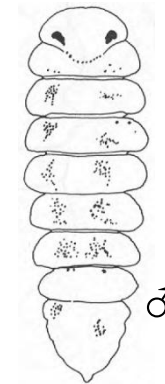
Schizobopyrina striata (Nierstrasz & Brender à Brandis, 1929)



Dorsal view



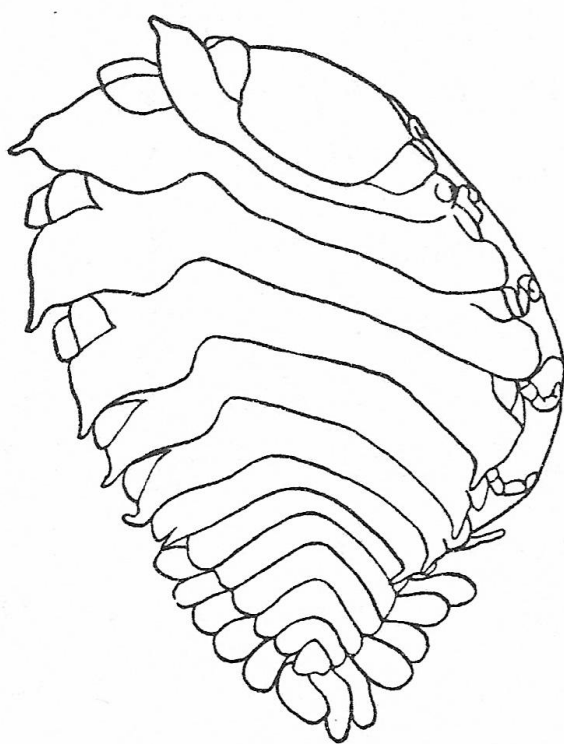
Ventral view



H. californiensis

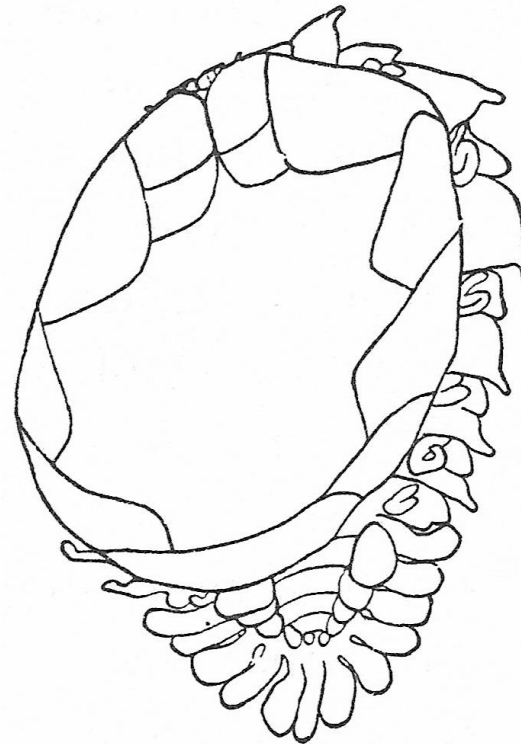
Host/Distribution: Infests the hippolytid shrimps *Hippolyte californiensis* and *Thor algicola* (*T. algicola* may actually be *T. manningi*, J. Markham, pers. comm.); California to Baja California, and Gulf of California; shallow water.

Argeia pugettensis Dana, 1853

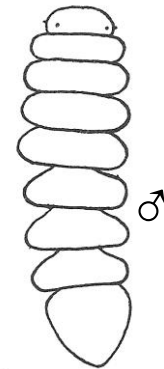


Dorsal view

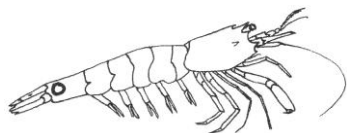
♀



Ventral view



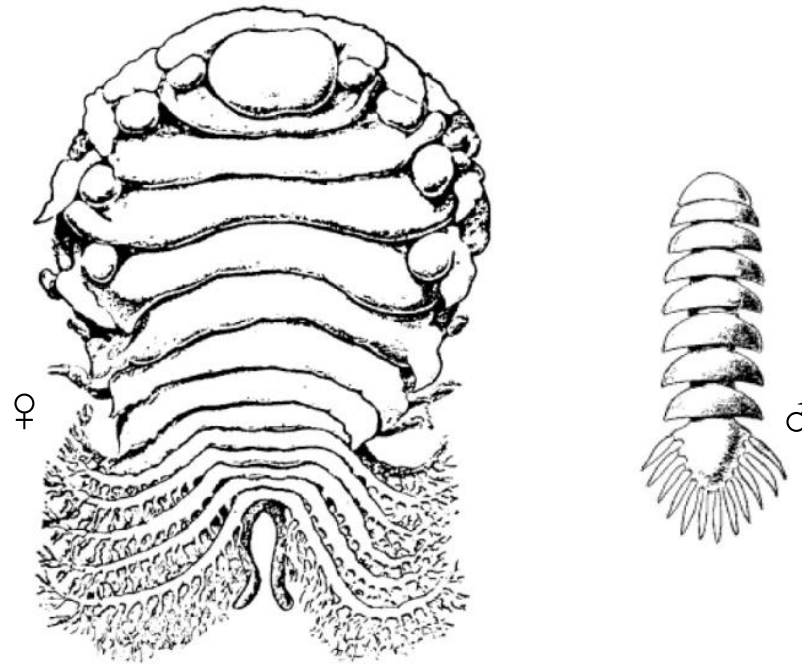
♂



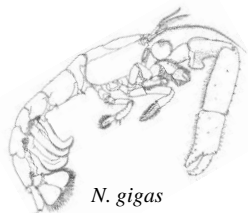
C. nigromaculata

Host/Distribution:; Infests multiple genera/species of shrimp in the families Crangonidae (e.g., *Argis*, *Crangon*, *Lissocrangon*, *Mesocrangon*, *Metacrangon*, *Neocrangon*) and Hippolytidae (e.g., *Eualus*); Bering Sea to southern California, Japan and Korea; intertidal to 188 m.

Ione cornuta Bate, 1864



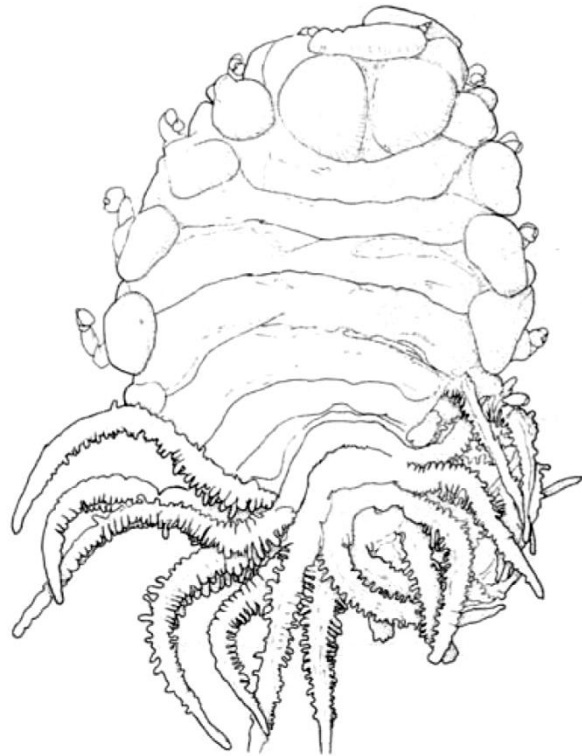
Dorsal views



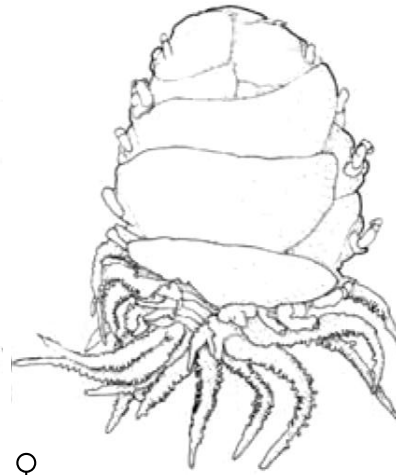
N. gigas

Host/Distribution: Infests ghost shrimps in the genera *Callinassa* and *Neotrypaea* (except no California hosts retained in *Callinassa*); British Columbia to San Francisco, California; intertidal to shallow water.

Leidya infelix Markham, 2002

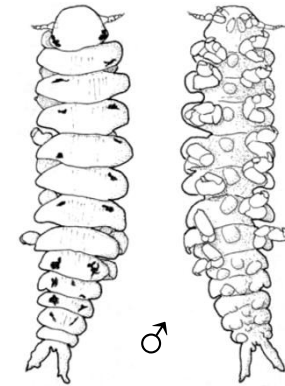


Dorsal view

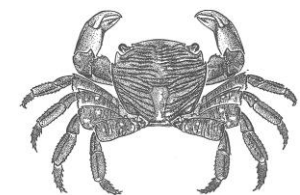


♀

Ventral view



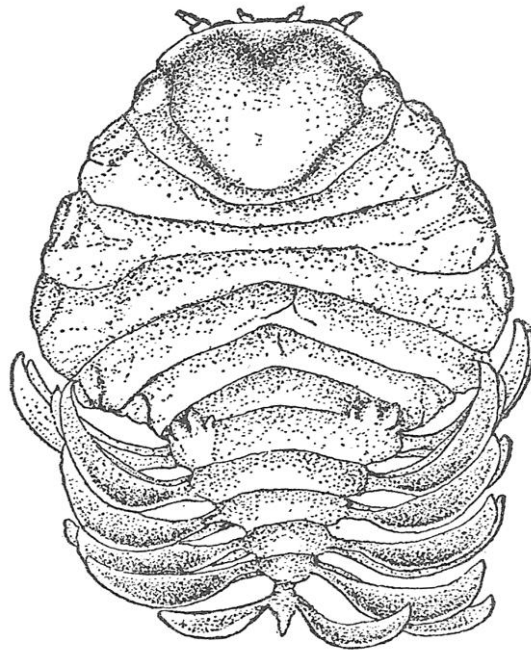
♂



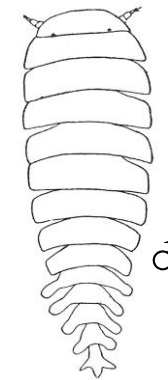
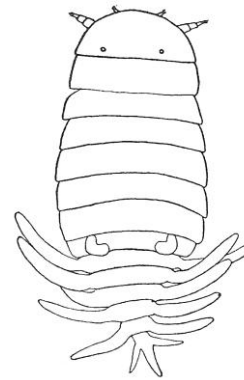
P. crassipes

Host/Distribution: Infests the lined shore crab *Pachygrapsus crassipes*; Southern California; intertidal.

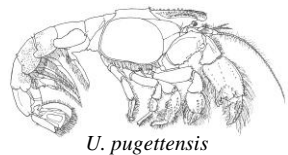
Phyllodurus abdominalis Stimpson, 1857



Immature



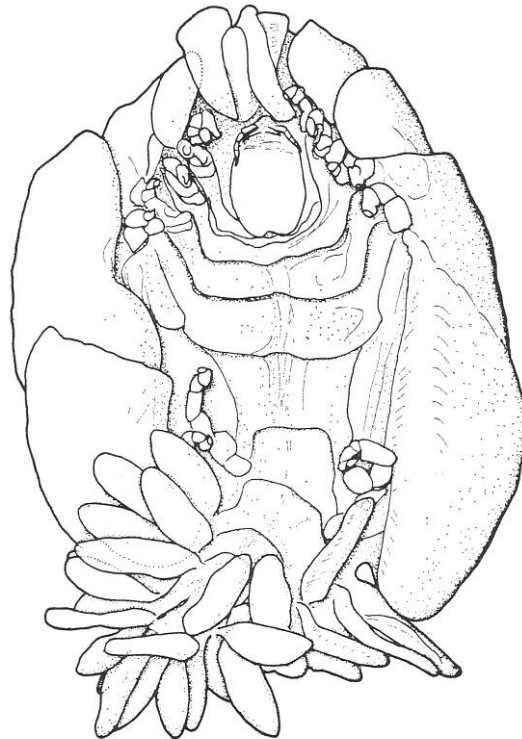
Dorsal views



Host/Distribution: Infests the mud shrimps *Upogebia lept*a, *U. macginitieorum*, and *U. pugettensis*; British Columbia to NW Baja California; intertidal.

Anathelges hyphalus (Markham, 1974) *

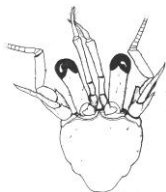
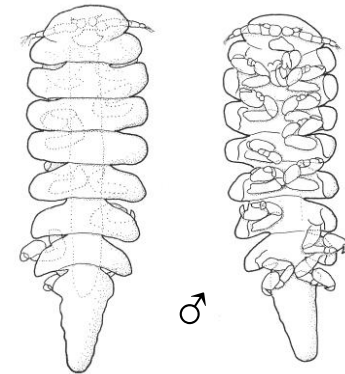
* Formerly = *Stegophryxus hyphalus*



Dorsal view



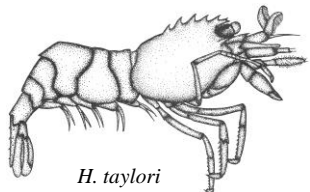
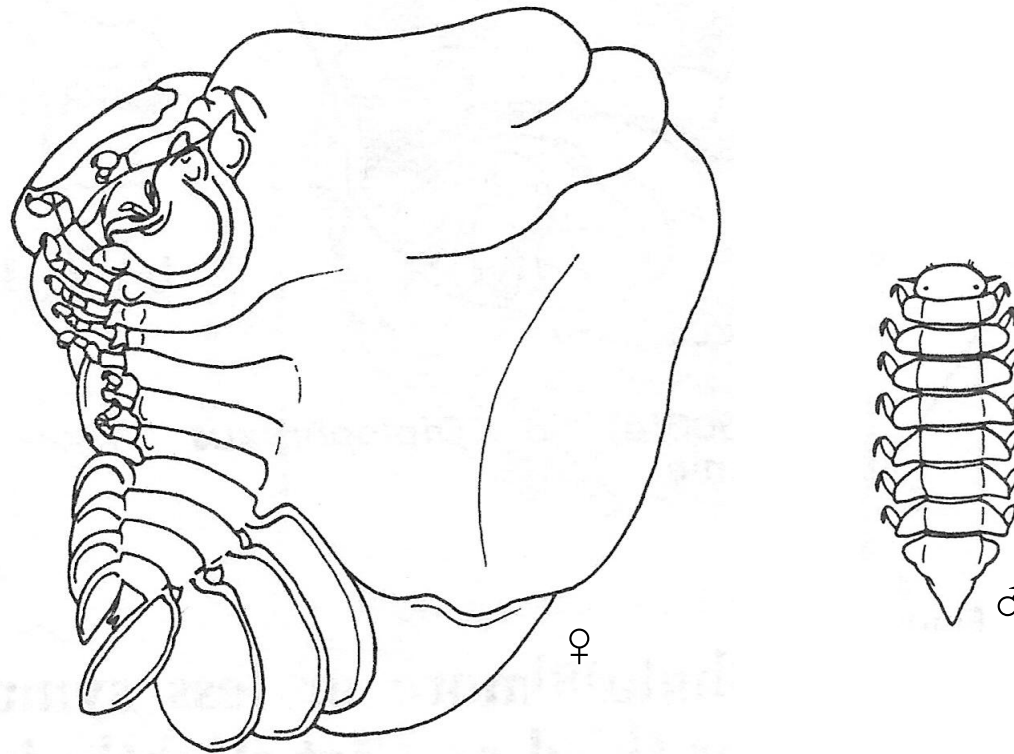
Ventral view



P. laurentae

Distribution/Hosts: Infests the hermit crabs *Parapagurodes laurentae* and *P. makarovi*; Carmel, California to Baja California; 69-319 m.

Hemiarthrus abdominalis (Krøyer, 1840)



H. taylori

Host/Distribution: Infests multiple species of hippolytid shrimp in the genera *Eualus*, *Heptacarpus*, *Lebbeus*, and *Spirontocaris*; North Pole to Monterey, California (circumboreal).

Family Dajidae

(Superfamily Bopyroidea)

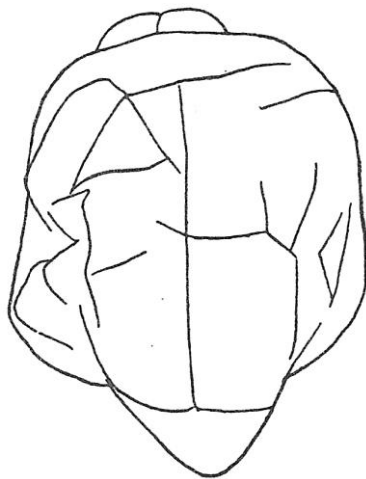
Dajids are external parasites of euphausiids, mysids and midwater shrimp that live on the backs of their hosts appearing like hitchhikers. The parasites are often mistaken as fleshy growths.

*Dajid on Pasiphaea**



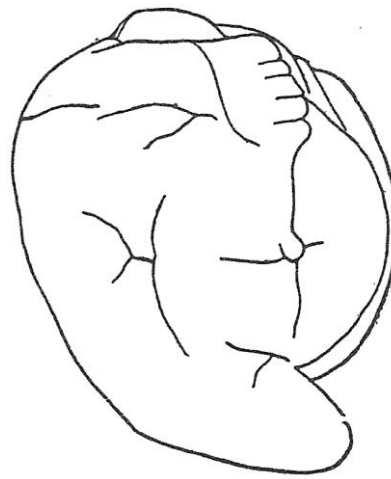
California dajids: 1 described species

* *Image:* www.pac.dfo-mpo.gc.ca/science/oceans/plankton-plancton/zooplankton-zooplankton/images/amphipoda/caridea/Pasiphaeadajidaeaclose.jpg

Holophryxus alaskensis Richardson, 1905

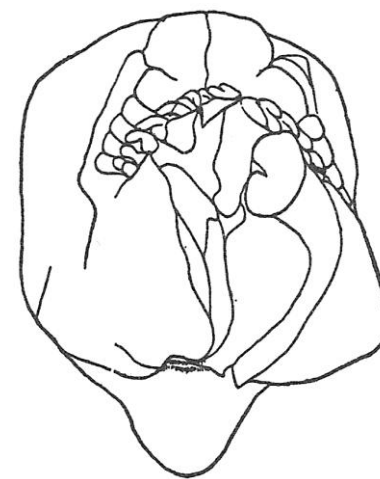
Dorsal view

♀

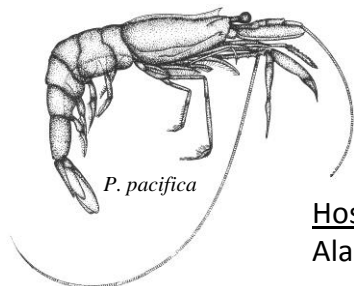


Lateral view

♀



Ventral view

*P. pacifica*

Host/Distribution: Ectoparasite on the dorsal carapace of the Pacific glass shrimp *Pasiphaea pacifica*; Alaska to Santa Barbara Channel, California; 44-700 m.

Family Entoniscidae

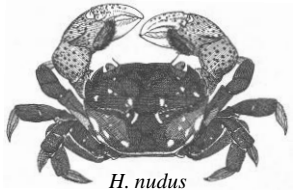
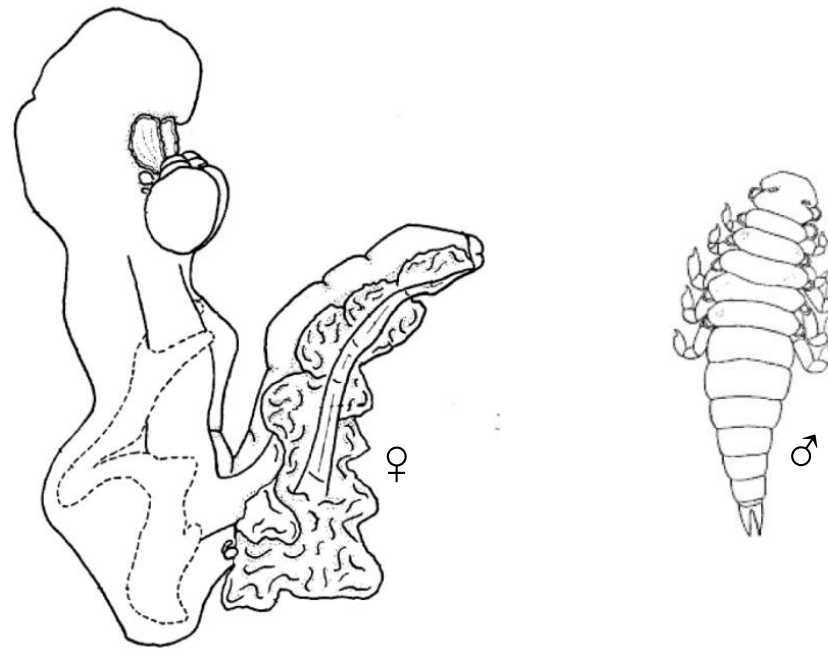
(Superfamily Bopyroidea)

Entoniscids are highly modified internal parasites that live in the hemocoel of crab hosts, although one species has also been found in a snapping shrimp (Synalpheus sp). Adult females of these parasites bear little morphological resemblance to free-living isopods.



California entoniscids: 1 described species

Portunion conformis Muscatine, 1956



H. nudus

Host/Distribution: Parasite in visceral cavity of the shore crabs *Hemigrapsus oregonensis* and *H. nudus*; San Francisco to Marin County, California; intertidal.

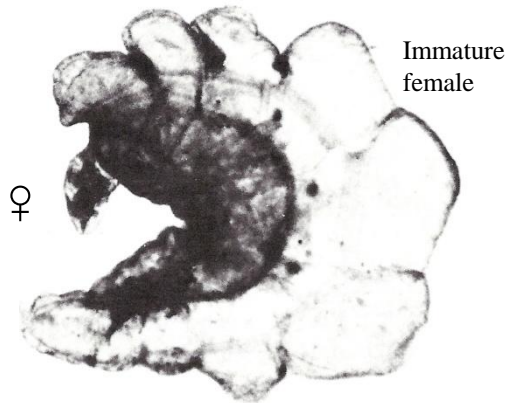
Family Cabiropidae

(Superfamily Cryptoniscoidea)

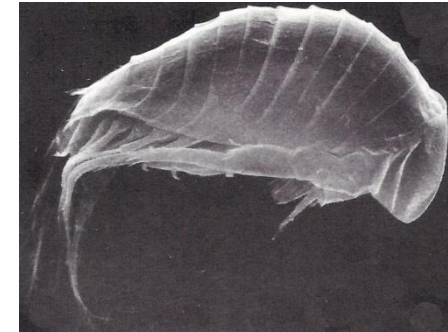
Cabiropids are parasitic on free-living isopods and hyperparasitic on other epicaridean isopods. The family may also include a few parasites of cumaceans.

California cabiropids: 1 described species

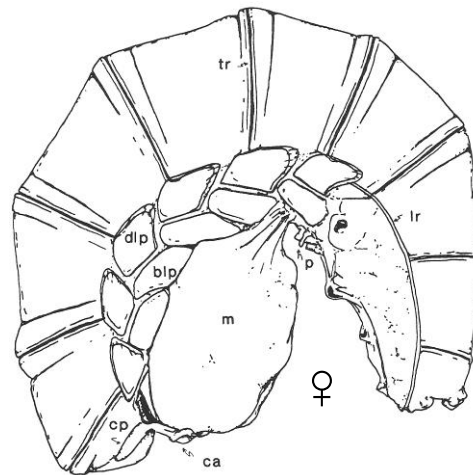
Cabirops montereyensis Sassaman, 1985



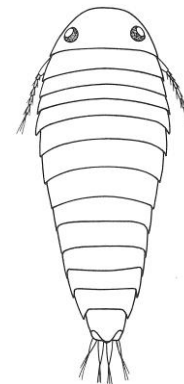
Immature female



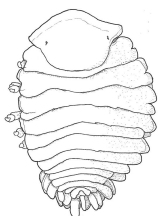
Epicaridium larva



Mature female



Cryptoniscus stage larva



A. muguensis

Host/Distribution: Parasite on the marsupium of the bopyrid isopod *Aporobopyrus muguensis*; Monterey Bay, California.

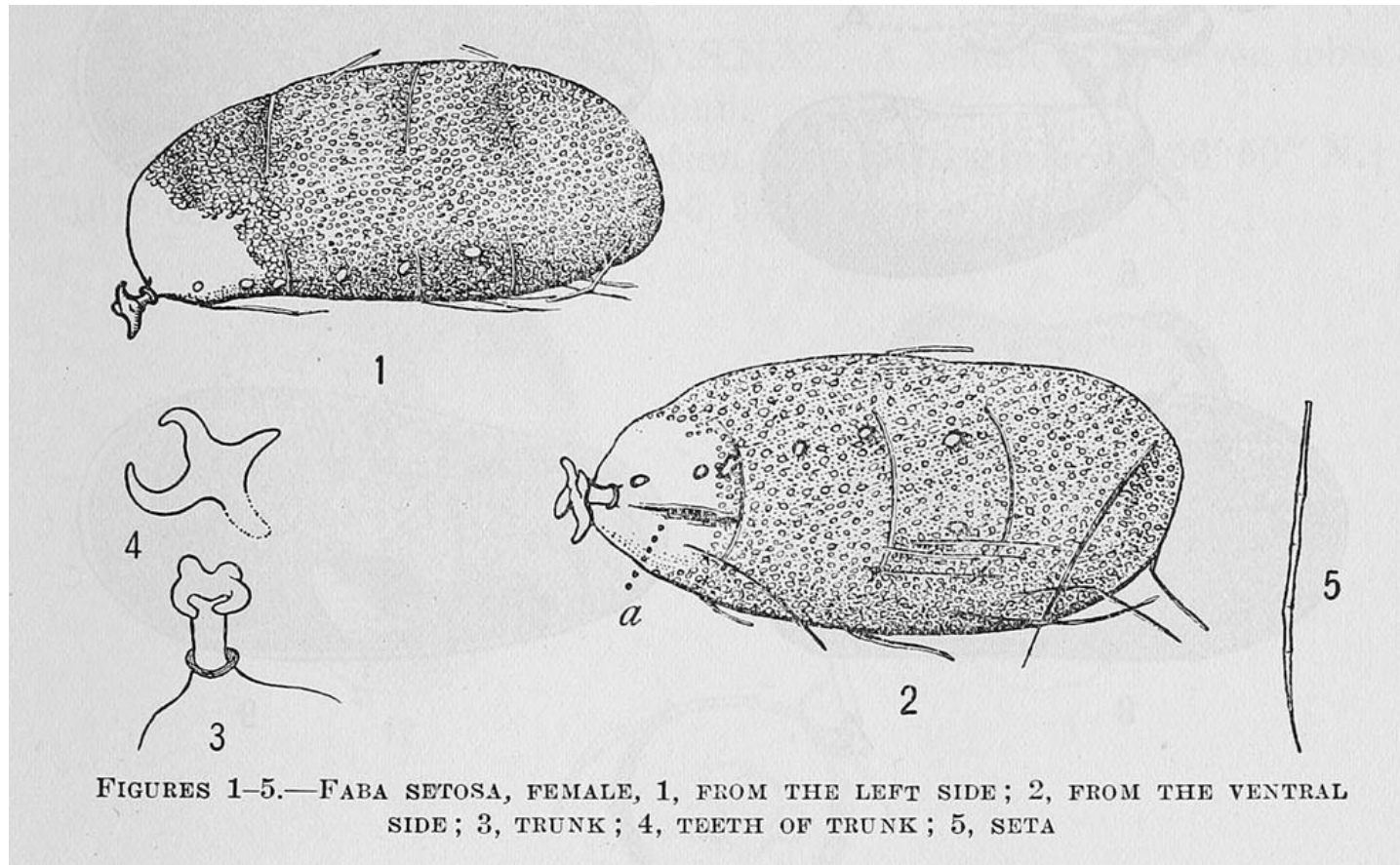
Family Cryptoniscidae

(Superfamily Cryptoniscoidea)

Cryptoniscids are hyperparasites of rhizocephalin barnacles that parasitize decapod crustaceans or are directly attached to decapod hosts themselves.



California cryptoniscids: 1 described species

Faba setosa (Nierstrasz & Brender à Brandis, 1930)

Distribution/Host: Parasite of the hippolytid shrimp *Spirontocaris holmesi* (i.e., *S. bispinosa*); Central California; 300 m.

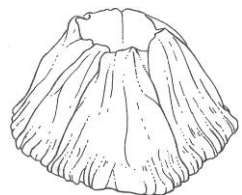
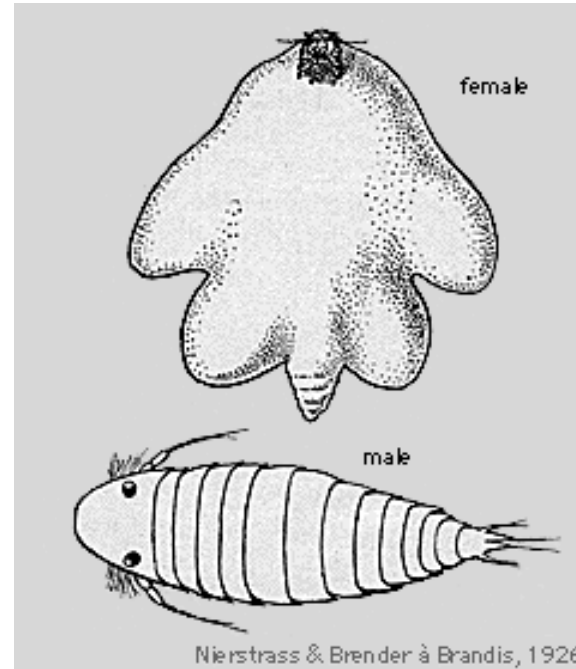


Family Hemioniscidae

(Superfamily Cryptoniscoidea)

Hemioniscids are parasites or hyperparasites of mostly thoracican and acrothoracican barnacles. Adult females are highly modified and bear little resemblance to free-living isopods .

California hemioniscids: 1 described species

Hemioniscus balani Buchholz, 1866*B. glandula*

Host/Distribution: Parasite on barnacles of the genera *Balanus* and *Chthamalus*; Introduced species – British Columbia to Baja California in eastern Pacific; intertidal.