

A collection of sea spiders (Pycnogonida: Pantopoda) in the National Museum, Prague (Czech Republic)

Petr Dolejš



doi: 10.5431/aramit5103

Abstract. The arachnological collection of the National Museum, Prague contains material preserved in ethanol and a microscopic slide of recent sea spiders (Pycnogonida: Pantopoda). The collection is small, containing only twelve specimens. A revision of all of them revealed the presence of nine species from five families: *Anoplodactylus lentus* Wilson, 1878, *Boreonymphon abyssorum* (Norman, 1873), *Callipallene* sp., *Endeis spinosa* (Montagu, 1808), *Nymphon grossipes* (Fabricius, 1780), *Nymphon hirtipes* Bell, 1853, *Nymphon stroemi* Krøyer, 1844, *Nymphon tenellum* (Sars, 1888) and *Pycnogonum litorale* (Ström, 1762). The material preserved in ethanol was collected in the North Atlantic Ocean and adjacent seas, the pycnogonid mounted on the slide was collected in Mediterranean. Four of the sea spiders came from the Sars collection (Bergen, Norway) and four specimens came from the V. Frič collection (Prague, Czech Republic). From these two sources, six specimens were mounted for exhibition and educational purposes. Although the collection contains no types, it introduces an interesting group of marine animals.

Keywords: Callipallenidae, Endeidae, Frič, Nymphonidae, Phoxichilidae, Pycnogonidae, Sars, zoological collection

I would like to dedicate this paper to two scientists who passed away in 2015: Roger Norman Bamber, a specialist on Pycnogonida, and Jan Buchar, an arachnologist and my supervisor.

Sea spiders (Pycnogonida) are strange looking, exclusively marine invertebrates feeding on sessile or slow-moving (or sometimes dead) animals. However, catching quick-moving prey was also reported (Lotz 1968). They are often considered the sister group of Euchelicerata, i.e. a class of the subphylum Chelicerata but alternative hypothesis also exist – see Dunlop et al. (2014) for a review.

Their body, termed the trunk, is extremely reduced and serves just as attachment for the legs. The first segment, the cephalosoma, contains four primordial segments that are telescoped into the first trunk segment – the first for an ocular tubercle with four eyes (may be absent) and a proboscis, and the next three giving rise to the appendage pairs of the chelifores, palps and ovigers. The fourth pair of appendages in the cephalosoma is the first pair of walking legs and belongs to the trunk (Winter 1980). Behind the cephalosoma, there are three trunk segments, each bearing a pair of nine-articled walking legs comprised from coxa 1, coxa 2, coxa 3, femur, tibia 1, tibia 2, tarsus, propodus and the main claw. There has been long-lasting controversy concerning which appendages are homologous among arthropods. According to Jäger et al. (2006), Manuel et al. (2006) and Brenneis et al. (2008), the pycnogonid appendages are homologous to those of euchelicerates and mandibulates as follows: chelifores ~ chelicerae ~ antennae I (innervated from deutocerebrum), palps ~ pedipalps ~ antennae II (innervated from tritocerebrum), ovigers ~ legs I ~ mandibles, legs I ~ legs II ~ maxillae I, legs II ~ legs III ~ maxillae II. The last (fourth) trunk segment bears the abdomen which is reduced to a small protuberance.

The reduced body of sea spiders causes several organ systems, like the intestine and gonads, to protrude into the legs, such that the genital openings are often located on the ventral surface of coxa 2 (usually of legs III and IV). Eggs are stored in the femora of all legs of the female. The typical first lar-

val form (feeding on cnidarians), the protonymphon, usually hatches from the eggs that are carried by the male in many families. The larval body possesses a proboscis, chelifores and two pairs of ambulatory legs that turn into palps and ovigers during ontogeny. Information about biology of sea spider can be found in Arnaud & Bamber (1987).

Catalogues of sea spiders were published by museums in Germany (Dunlop et al. 2007, Weis et al. 2011, Lehmann et al. 2014). The National Museum in Prague has already published catalogues of various non-type zoological material (e.g. Jiroušková et al. 2011, Mlíkovský et al. 2013, Dolejš & Vaňoušová 2015) and this paper continues by providing information about the sea spider collection in Prague.

Material and methods

All eleven ethanol-preserved pycnogonid specimens are kept in 80 % ethanol. Eight of them had been identified, three (plus the specimen mounted on the slide) only to genus level. Therefore, all specimens were first revised based on the literature mentioned below each species. Of the formerly identified specimens, only two of them had been identified correctly. Thus, labels with appropriate species names were put on the jars. Second, specimens were cross-referenced with the accessory catalogues. However, data for only four specimens were found in the catalogues (N^os 1876/1902, 19/1960/3066 and 19/1960/3109); the remaining specimens thus have a “general” number for Pycnogonida: P6d-9/2003 (P6j-118/1988 for the specimen mounted on the slide). Conversely, one specimen was not found in the collection despite being mentioned in the accessory catalogue from the year 1902: *Colossendeis proboscidea* (Sabine, 1824) from Bjørnøya (“W von Bären Insel”). This specimen had come to the National Museum in Prague as an exchange from the Museum für Naturkunde Berlin on 21 October 1902 (accessory N^o 1875/1902), but was either lost or destroyed. The remaining specimens in Berlin are deposited under N^o ZMB 19 (Dunlop et al. 2007).

The third step was the determination of sex and measuring body lengths using an Olympus SZX12 stereomicroscope equipped with an ocular micrometer. Males were recognized by the presence of cement gland openings and hairy swellings located distally on the fifth article of the ovigers helping the

This contribution was presented at the 29th European Congress of Arachnology, Brno, 2015 August 24-28.

Petr DOLEJŠ, Department of Zoology, National Museum – Natural History Museum, Cirkusová 1740, CZ-193 00, Praha 9 – Horní Počernice, Czech Republic; E-mail: petr_dolejs@nm.cz

submitted 29.10.2015, accepted 1.12.2015, online 22.12.2015

(nymphonid) males in carrying the eggs. Females were recognized according to the swollen femora of the legs (and sometimes eggs visible inside them) without cement glands and missing ovigers (except members of the families Callipallenidae and Nymphonidae where ovigers are also present in females but the swellings are lacking) (Bamber 2010). The body length in sea spiders means the distance between the anterior margin of the cephalosoma (i.e. without the proboscis) and posterior margin of the last (fourth) segment including the lateral processes but not the abdomen (Just 1972, Bamber 2010).

Current nomenclature and the Life Science Identifier numbers (lsid) were adopted from PycnoBase (Bamber et al. 2015). The species are arranged systematically according to Bamber (2010). Data for each specimen are arranged as follows: Material – number of specimens (with a note in the case they are mounted), their sex (body length), name of the collector, date of collection and locality. Identification – name on the original label and literature used for revision/redetermination/identification. Biology and ecology – any available data. Notes – if any.

Systematic list

Class: Pycnogonida Latreille, 1810

Order: Pantopoda Gerstäcker, 1863

Suborder: Eupantopoda Fry, 1978

Superfamily: Nymphonoidea Pocock, 1904

Family: Nymphonidae Wilson, 1878

Genus: *Boreonymphon* Sars, 1888

Boreonymphon abyssorum (Norman, 1873)

urn:lsid:marinespecies.org:taxname:134676

Material. 1 ♀ (7.0 mm) collected by F. A. Dohrn on an unknown date in the Barents Sea, RUSSIA (Fig. 1).

Identification. Originally labelled as *Boreonymphon robustum* Bell, redetermined according to Just (1972) and Bamber (2010).

Biology and ecology. Depth 500–2000 m (Bamber 2010).

Notes. Came to the National Museum as an exchange from the Museum für Naturkunde Berlin on 21 October 1902 (accessory N^o 1876/1902). The remaining specimens in Berlin are deposited in two vials under N^o ZMB 64 and are labelled as *B. robustum* (Dunlop et al. 2007). It is probable that they were also erroneously identified and that they are in fact *B. abyssorum* like the specimen deposited in Prague.

Genus: *Nymphon* Fabricius, 1794

Nymphon grossipes (Fabricius, 1780)

urn:lsid:marinespecies.org:taxname:134688

Material. 1 mounted pair: ♂ (5.5 mm) and ♀ (4.8 mm) without any data; ex. coll. V. Frič (N^o 19/1960/3066) (Fig. 2).

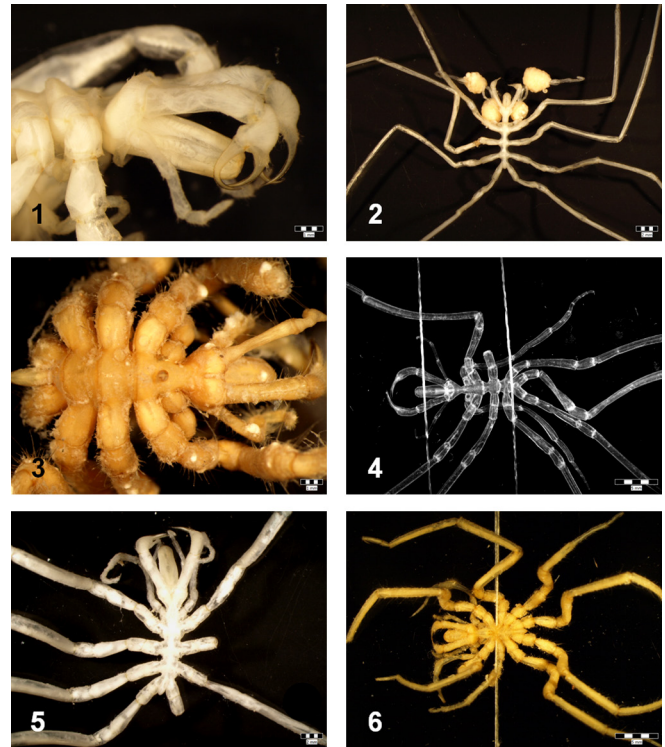
Identification. Originally labelled as *Nymphon* sp., identified according to Turpaeva (2009), Bamber (2010) and de Kluijver & Ingalsuo (2015).

Biology and ecology. Depth usually 6–400 m (Bamber 2010), on silty sand, rock and shells (Turpaeva 2009).

Nymphon hirtipes Bell, 1853

urn:lsid:marinespecies.org:taxname:134690

Material. 1 ♂ (8.0 mm) collected by an unknown collector on an unknown date in the Davis Strait; ex. coll. V. Frič (N^o 19/1960/3109) (Fig. 3).



Figs 1-6: Nymphonidae. **1.** *Boreonymphon abyssorum*, lateral view of the anterior part of the female body; **2.** *Nymphon grossipes*, an ovigerous male; **3.** *Nymphon hirtipes*, a male with malformed left chelifore; **4.** *Nymphon stroemi*, a mounted subadult specimen from Bergen; **5.** *N. stroemi*, a juvenile from the North Sea; **6.** *Nymphon tenellum*, a male from Bergen. Scale bars 1 mm (Figs 1, 3), 2 mm (Figs 2, 5), 5 mm (Figs 4, 6)

Identification. Originally labelled as *Chaetonymphon hirtipes*, revised according to Hedgpeth (1948), Child (1982) and Turpaeva (2009).

Biology and ecology. Depth 3–1506 m, on silty sediments (Turpaeva 2009).

Note. Left chelifore malformed and left oviger with extra projections.

Nymphon stroemi Krøyer, 1844

urn:lsid:marinespecies.org:taxname:134711

Material. 1 mounted subadult specimen (8.0 mm) collected by an unknown collector on an unknown date in Bergen, NORWAY; ex. coll. Sars (Fig. 4).

Identification. Originally labelled as *Nymphon grossipes* Fabr., redetermined according to Turpaeva (2009), Bamber (2010) and de Kluijver & Ingalsuo (2015).

Material. 1 juvenile specimen (8.3 mm) collected by an unknown collector on an unknown date in the North Sea (Fig. 5).

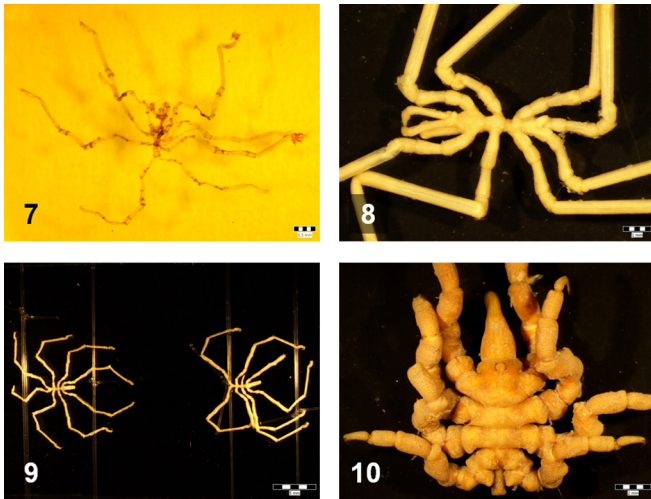
Identification. Originally labelled as *Nymphon* sp., identified according to Turpaeva (2009), Bamber (2010) and de Kluijver & Ingalsuo (2015).

Biology and ecology. Depth 12–1300 m (Bamber 2010), on silty sediments (Turpaeva 2009).

Nymphon tenellum (Sars, 1888)

urn:lsid:marinespecies.org:taxname:134712

Material. 1 mounted ♂ (5.2 mm) collected by an unknown collector on an unknown date in Bergen, NORWAY; ex. coll. Sars (Fig. 6).



Figs 7-10: Non-nymphonid sea spiders. **7.** *Callipallene* sp., a juvenile mounted on a microscopic slide, scale bar 0.5 mm; **8.** *Anoplodactylus lentus*, a female from Woods Hole, scale bar 1 mm; **9.** *Endeis spinosa*, two mounted females, scale bar 5 mm; **10.** *Pycnogonum littorale*, a female from Puffin Island, scale bar 2 mm

Identification. Originally labelled as *Nymphon hirtum* F., re-determined according to Child (1982), Bamber (2010) and de Kluijver & Ingalsuo (2015).

Biology and ecology. Depth mainly 200-600 m (Bamber 2010). Glandular secretions used by paternal care were described by Dogiel (1911, sub *Chaetonymphon spinosum*).

Family: Callipallenidae Hilton, 1942

Genus: *Callipallene* Flynn, 1929

***Callipallene* sp.**

Material. 1 juvenile specimen (0.7 mm) mounted on a microscopic slide, collected by F. B. Liechtenstern, on 24 September 1879 in Rovinj, CROATIA (Fig. 7).

Identification. Originally labelled as *Pycnogonum*, re-determined according to Bamber (2010), Lehmann et al. (2014) and de Kluijver & Ingalsuo (2015).

Biology and ecology. The callipallenids show a direct development via a postlarva on the male (Bamber 2010).

Note. Five common *Callipallene* species occur in Mediterranean (Lehmann et al. 2014).

Superfamily: Phoxichilidioidea Sars, 1891

Family: Phoxichilididae Sars, 1891

Genus: *Anoplodactylus* Wilson, 1878

***Anoplodactylus lentus* Wilson, 1878**

urn:lsid:marinespecies.org:taxname:158478

Material. 1 ♀ (3.5 mm) collected by an unknown collector in July 1891 in Woods Hole, USA (Fig. 8).

Identification. Originally labelled as *Phoxichilidium maxillare*, re-determined according to Hedgpeth (1948) [generic placement also according to Turpaeva (2009) and Bamber (2010)].

Biology and ecology. Ontogeny was described by Morgan (1891, sub *Phoxichilidium maxillare*) and the coloured granules in the hemolymph by Dawson (1934).

Family: Endeidae Norman, 1908

Genus: *Endeis* Philippi, 1843

***Endeis spinosa* (Montgaut, 1808)**

urn:lsid:marinespecies.org:taxname:134674

Material. 2 mounted (from dorsal and ventral view) ♀♀ (2.2 mm) collected by an unknown collector on an unknown date in Bergen, NORWAY; ex. coll. Sars (Fig. 9).

Identification. Originally labelled as *Pallene spinipes* F., re-determined according to Bamber (2010) and de Kluijver & Ingalsuo (2015).

Biology and ecology. Mainly from the littoral zone to depths of 40 m, feeding on hydroids, but also common on algae (Bamber 2010). Ontogeny was described by Dogiel (1913, sub *Phoxichilus spinosus*).

Superfamily: Pycnogoidea Pocock, 1904

Family: Pycnogonidae Wilson, 1878

Genus: *Pycnogonum* Brünnich, 1764

***Pycnogonum littorale* (Ström, 1762)**

urn:lsid:marinespecies.org:taxname:239867

Material. 1 ♀ (6.3 mm) collected by J. Thompson on an unknown date at the Puffin Island Biological Station, UNITED KINGDOM (Fig. 10).

Identification. Originally labelled as *Pycnogonum littorale*, revised according to Turpaeva (2009), Bamber (2010) and de Kluijver & Ingalsuo (2015).

Biology and ecology. From the littoral to 1262 m, feeding on sea anemones (Bamber 2010), on rocky, stony sediments (Turpaeva 2009). *Pycnogonum littorale* became one of the model species for studying various aspects of sea spiders (e.g. Vilpoux & Waloszek 2003, Ungerer & Scholtz 2009, Machner & Scholtz 2010) given its fairly well known biology (e.g. Tomaschko et al. 1997, Wilhelm et al. 1997 and references therein).

Acknowledgements

I would like to thank Jason Dunlop and an anonymous reviewer for their useful comments on the manuscript and correcting the English. I also thank Franz Krapp for consultations. This work was financially supported by Ministry of Culture of the Czech Republic (DKRVO 2015/15, National Museum, 00023272).

References

- Arnaud F & Bamber RN 1987 The biology of Pycnogonida. – *Advances in Marine Biology* 24: 1-96
- Bamber RN 2010 Sea-spiders (Pycnogonida) of the north-east Atlantic. Henry Ling Ltd, The Dorset Press, Dorchester. 250 pp.
- Bamber RN, El Nagar A & Arango C (eds.) 2015 Pycnobase: World Pycnogonida Database. – Internet: <http://www.marinespecies.org/pycnobase> (October 15, 2015)
- Brenneis G, Ungerer P & Scholtz G 2008 The chelifores of sea spiders (Arthropoda, Pycnogonida) are the appendages of the deutocerebral segment. – *Evolution & Development* 10: 717-724 – doi: 10.1111/j.1525-142X.2008.00285.x
- Child CA 1982 Deep-sea Pycnogonida from the North and South Atlantic Basins. – *Smithsonian Contributions to Zoology* 349: 1-54
- Dawson AB 1934 The colored corpuscles of the blood of the purple sea spider, *Anoplodactylus lentus* Wilson. – *Biological Bulletin of the Woods Hole Marine Biological Laboratory* 66: 62-68
- Dogiel V 1911 Studien über die Entwicklungsgeschichte der Pantopoden. Nervensystem und Drüsen der Pantopodenlarven. – *Zeitschrift für wissenschaftliche Zoologie* 99: 109-146
- Dogiel V 1913 Embryologische Studien an Pantopoden. – *Zeitschrift für wissenschaftliche Zoologie* 107: 575-741
- Dolejš P & Vaňousová K 2015 A collection of horseshoe crabs (Chelicerata: Xiphosura) in the National Museum, Prague (Czech

- Republic) and a review of their immunological importance. – *Arachnologische Mitteilungen* 49: 1-9 – doi: [10.5431/aramit4901](https://doi.org/10.5431/aramit4901)
- Dunlop JA, Friederichs A, Krapp F & Ring C 2007 An annotated catalogue of the sea spiders (Pycnogonida, Pantopoda) held in the Museum für Naturkunde der Humboldt-Universität zu Berlin. – *Mitteilungen aus dem Museum für Naturkunde in Berlin, Zoologische Reihe* 83: 43-74 – doi: [10.1002/mmnz.200600017](https://doi.org/10.1002/mmnz.200600017)
- Dunlop J, Borner J & Burmester T 2014 Phylogeny of the chelicerates: Morphological and molecular evidence. In: Wägele JW & Bartolomaeus T (eds.) *Deep metazoan phylogeny: the backbone of the tree of life*. Walter de Gruyter, Berlin. pp. 399-412
- Hedgpeth JW 1948 The Pycnogonida of the western North Atlantic and the Caribbean. – *Proceedings of the United States National Museum* 97: 157-342
- Jager M, Murienne J, Clabaut C, Deutsch J, Le Guyader H & Manuel M 2006 Homology of arthropod anterior appendages revealed by Hox gene expression in a sea spider. – *Nature* 441: 506-508 – doi: [10.1038/nature04591](https://doi.org/10.1038/nature04591)
- Jiroušková J, Kandert J, Mlíkovský J & Šámal M (eds.) 2011 Emil Holub's collection in the National Museum. National Museum, Prague. 204 pp.
- Just J 1972 Revision of the genus *Boreonypmhon* G. O. Sars (Pycnogonida) with a description of two new species, *B. ossiansarsi* Knaben and *B. compactum* Just. – *Sarsia* 49: 1-27
- Kluijver MJ de & Ingalsuo SS 2015 Macrobenthos of the North Sea – Pycnogonida. – Internet: <http://wbd.etibioinformatics.nl/bis/pycnogonida.php?menuentry=sleutel> or http://species-identification.org/species.php?species_group=pycnogonida&menuentry=plaatjessleutel (October 29, 2015)
- Lehmann T, Heß M & Melzer RR 2014 Common littoral pycnogonids of the Mediterranean Sea. – *Zoosystematics and Evolution* 90: 163-224 – doi: [10.3897/zse.90.7520](https://doi.org/10.3897/zse.90.7520)
- Lotz G 1968 Nahrungsaufnahme und Beutefang bei einem Pantopoden, *Anoplodactylus petiolatus* Krøyer. – *Oecologia* 1: 171-175 – doi: [10.1007/BF00383137](https://doi.org/10.1007/BF00383137)
- Machner J & Scholtz G 2010 A scanning electron microscopy study of the embryonic development of *Pycnogonum litorale* (Arthropoda, Pycnogonida). – *Journal of Morphology* 271: 1306-1318 – doi: [10.1002/jmor.10871](https://doi.org/10.1002/jmor.10871)
- Manuel M, Jager M, Murienne J, Clabaut C & Le Guyader H 2006 Hox genes in sea spiders (Pycnogonida) and the homology of arthropod head segments. – *Development Genes and Evolution* 216: 481-491 – doi: [10.1007/s00427-006-0095-2](https://doi.org/10.1007/s00427-006-0095-2)
- Mlíkovský J, Benda P, Dolejš P, Moravec J & Šanda R 2013 Jirušův odkaz a zoologické sbírky Národního muzea v Praze (Jiruš's bequest and zoological collections of the National Museum in Prague). – *Acta Musei Nationalis Pragae, Series A – Historia* 67: 47-52 (in Czech, English abstract)
- Morgan TH 1891 A contribution to the embryology and phylogeny of the pycnogonids. – *Studies from the Biological Laboratory of the Johns Hopkins University, Baltimore* 5: 1-76
- Tomaschko K-H, Wilhelm E & Bückmann D 1997 Growth and reproduction of *Pycnogonum litorale* (Pycnogonida) under laboratory conditions. – *Marine Biology* 129: 595-600 – doi: [10.1007/s002270050201](https://doi.org/10.1007/s002270050201)
- Turpaeva EP 2009 Class Pycnogonida (Order Pantopoda). In: Vasilenko SV & Petryashov VV (eds.) *Illustrated keys to free-living invertebrates of Eurasian Arctic seas and adjacent deep waters*. Vol. 1. Rotifera, Pycnogonida, Cirripedia, Leptostraca, Mysidacea, Hyperiidea, Caprellidea, Euphausiacea, Natantia, Anomura, and Brachyura. Alaska Sea Grant, University of Alaska, Fairbanks, USA. pp. 17-47 – doi: [10.4027/ikflieasaw.2009](https://doi.org/10.4027/ikflieasaw.2009)
- Ungerer P & Scholtz G 2009 Cleavage and gastrulation in *Pycnogonum litorale* (Arthropoda, Pycnogonida): morphological support for the Ecdysozoa? – *Zoomorphology* 128: 263-274 – doi: [10.1007/s00435-009-0091-y](https://doi.org/10.1007/s00435-009-0091-y)
- Vilpoux K & Waloszek D 2003 Larval development and morphogenesis of the sea spider *Pycnogonum litorale* (Ström, 1762) and the tagmosis of the body of Pantopoda. – *Arthropod Structure & Development* 32: 349-383 – doi: [10.1016/j.asd.2003.09.004](https://doi.org/10.1016/j.asd.2003.09.004)
- Weis A, Friedrich S & Melzer RR 2011 Antarctic Pycnogonida housed at the Bavarian State Collection of Zoology. – *Zoosystematics and Evolution* 87: 297-317 – doi: [10.1002/zoos.201100008](https://doi.org/10.1002/zoos.201100008)
- Wilhelm E, Bückmann D & Tomaschko K-H 1997 Life cycle and population dynamics of *Pycnogonum litorale* (Pycnogonida) in a natural habitat. – *Marine Biology* 129: 601-606 – doi: [10.1007/s002270050202](https://doi.org/10.1007/s002270050202)
- Winter G von 1980 Beiträge zur Morphologie und Embryologie des vorderen Körperabschnitts (Cephalosoma) der Pantopoda Gers-taecker, 1863: Entstehung und Struktur des Zentralnervensystems. – *Zeitschrift für zoologische Systematik und Evolutionsforschung* 18: 27-61 – doi: [10.1111/j.1439-0469.1980.tb00726.x](https://doi.org/10.1111/j.1439-0469.1980.tb00726.x)