

A NEW CAPRELLID-STARFISH ASSOCIATION: *CAPRELLA ACANTHIFERA S.L.* (CRUSTACEA: AMPHIPODA) ON *OPHIDIASTER OPHIDIANUS* AND *HACELIA ATTENUATA* FROM THE AZORES

PETER WIRTZ & WIM VADER



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A new caprellid-starfish association is described from the Azores, northeastern Atlantic. *Caprella n.sp.*, a species in the *Caprella acanthifera* species complex known to occur free-living in the Mediterranean Sea and the eastern Atlantic Ocean, was encountered in groups of up to 77 animals (average 24) on the aboral surface of the starfish species *Ophidiaster ophidianus* and *Hacelia attenuata* at Monte da Guia, Faial island, Azores. There was no correlation between starfish size and caprellid group size. The pinkish colour of the caprellids suggests that they scrape mucus off the surface of their starfish hosts. The known associations between caprellid amphipods and starfish are enumerated.

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Uma nova associação entre um caprelídeo e estrelas-do-mar é descrita para os Açores, Atlântico nordeste. *Caprella n.sp.*, uma espécie do complexo *Caprella acanthifera* conhecida por viver sem hospedeiros no mar Mediterrâneo e no Atlântico oriental, foi encontrada em grupos, que atingiram até 77 indivíduos (em média 24), na superfície aboral das estrelas-do-mar *Ophidiaster ophidianus* e *Hacelia attenuata* na área de Monte da Guia, ilha do Faial, Açores. Não foi verificada nenhuma correlação entre o tamanho das estrelas-do-mar e o tamanho do grupo dos caprelídeos. A cor rosa dos caprelídeos sugere que eles raspam muco da superfície dos seus hospedeiros.

Peter Wirtz, Centro de Ciências Biológicas e Geológicas, Universidade da Madeira, Largo do Colégio, PT-9000 Funchal, Portugal. - Wim Vader, Tromsø Museum, University of Tromsø, NO-9037 Tromsø, Norway.

INTRODUCTION

Among the caprellid amphipods most species live among algae, hydroids, sponges or bryozoans, but a considerable number has also been found to live in more specific associations with invertebrates such as gorgonians (cf. CAINE 1974, 1983; LEWBEL 1978; HIRAYAMA 1988), sea anemones (STROOBANTS 1969), large crustaceans (cf. O'BRIEN 1975; GRIFFITHS 1977; BALDINGER

1992), and echinoderms (see below), and even with marine vertebrates such as the frogfish *Antennarius* (MORI & YAMATO 1993) and sea turtles (CHEVREUX & DE GUERNE 1893; CAINE 1986).

Among echinoderms most known associations are with starfish. Such associations have earlier been reviewed by MCCAIN (1968, 1979) and VADER (1979). An up-to-date list of caprellid-starfish associations is given in Table 1; clearly

incidental records have been omitted (see MCCAIN 1968; VADER 1979). There are a few scattered records of caprellids being found on sea urchins (MCCAIN 1968; COMELY & ANSELL 1988), and *Pariambus typicus* has recently been discovered in some numbers on the ophiuroid *Ophiura* in the North Sea (I. Rachor, pers. commn); we do not know of any records involving holothuroids.

Six associations of caprellid amphipods and starfish have so far been described from the northern hemisphere (see VADER 1979 and Table 1 for references and details). During a photographic survey of the coastal marine fauna of Faial Island, Azores (WIRTZ & MARTINS 1994; WIRTZ 1995), the first author encountered a seventh, previously undescribed such association.

Table 1

Review of known associations between caprellid amphipods and starfish.

Caprellid	Host	Position	Area	Reference
<i>Caprella acanthifera</i> Leach s.l.	<i>Hacelia attenuata</i>	abor.	Azores	this paper
* <i>C. angulosa</i> Mayer	<i>Ophidiaster ophidianus</i> <i>Asterias rathbunae</i> (<i>Evasterias echinosoma</i>)	abor.	Kamchatka	VASSILENKO 1974; IVANJUSHINA 1989
* <i>C. astericola</i> Jankowski	<i>A. amurensis</i>	or.	Sakhalin	JANKOWSKI & VASSILENKO 1973; VASSILENKO 1974
* <i>C. gracilior</i> Mayer	<i>Luidia foliolata</i>	abor.	Puget Sound	CAINE 1978
<i>C. grahami</i> see <i>C. unica</i>				
* <i>C. greenleyi</i> McCain	<i>Henricia leviuscula</i>	abor.	Oregon	MCCAIN 1969; CAINE 1978
<i>C. laevipes</i> Mayer	"starfish"	??	S. Africa	MAYER 1903
* <i>C. manningi</i> McCain	<i>Calvasterias suteri</i>	??	Antipodes Isl. N. Zealand	MCCAIN 1979
* <i>C. unica</i> Mayer	<i>Asterias forbesi</i>	all	W. Atlantic	cf. PATTON 1968;
(syn. <i>C. grahami</i> Wigley & Shave)	(? <i>A. vulgaris</i>) (? <i>Leptasterias polaris</i>)			LAUBITZ 1972; VADER 1979
<i>Pariambus typicus</i> Krøyer	<i>Asterias rubens</i> <i>Crossaster papposus</i> (<i>Astropecten irregularis</i>)	abor.	W. Europe Mediterranean Sea	cf. MEINERT 1878; JONES 1970; VADER 1979
<i>Phtisica marina</i> Slabber	<i>Asterias rubens</i> <i>Hacelia attenuata</i> <i>Ophidiaster ophidianus</i>	abor.	North Sea Azores	MEINERT 1878; this paper

Position of caprellid on starfish: or.= positioned orally; abor.= positioned aborally; all= found all over; ??= position on host not reported. The asterisk * denotes an obligatory association.

MATERIAL AND METHODS

In August 1993, starfish with caprellids were collected by hand while SCUBA diving at Monte da Guia, near Horta, Faial island, Azores. Upon encountering a starfish with at least one caprellid visible on the aboral surface, the starfish was slowly lifted off the surface and placed individually in a plastic bag. Samples are

therefore biased in excluding starfish without caprellids but not heavily biased as to the numbers of caprellids per starfish. In the laboratory, the contents of the plastic bags were emptied into a white tray containing freshwater. The freshwater had the effect of anaesthetising the starfish and the caprellids. The caprellids dropped off the starfish and because of their pinkish colour were clearly visible against the white tray. The

caprellids were collected with a forceps and stored in 70% alcohol. Largest diameter (arm tip to arm tip) of the starfish was measured with a ruler. The starfish were returned to sea water, where they recovered within a few minutes, and were later returned to the sea.

Attempts to determine sex ratio and age ratio of the caprellids failed. While adult males were recognisable by their thick bulbous claws, no clear distinction could be made between different age groups and between juvenile males and females.

A search for more specimens in August 1995 at the same locality failed to find a single starfish with caprellids on them, although the starfish themselves were as common as in 1993.

RESULTS

Caprellids were seen on two starfish species, *Ophidiaster ophidianus* (Lamarck, 1816) and *Hacelia attenuata* (Gray, 1814), belonging to the family Ophiasteridae. No other starfish were encountered in the same area, a near vertical rock face. *O. ophidianus* and *H. attenuata* with caprellids were seen at depths between 15 and 32 m, the latter being the maximum depth sampled. Starfish from shallower than 15 m had no caprellids visible on their aboral surface. Most caprellids were, at first, identified as *Caprella acanthifera* (Leach, 1814) by Dr D. Bellan-Santini (Marseille). The taxonomy of "this variable species" has been recently revised, with this Azorean material as catalyst. *Caprella acanthifera auct.* proved to be a complex of closely related independent species, and the Azorean material belongs to a hitherto undescribed species, to be described by KRAPP-SCHICKEL & VADER (submitted). This taxon also occurs in the Mediterranean Sea. Reference specimens have been deposited in the collections of Tromsø Museum. In addition to *Caprella n.sp.*, a few specimens of another caprellid, *Phtisica marina* (Slabber, 1769) were found on both starfish species.

Between 1 and 77 caprellids per starfish were found (mean 22, SD 17, n = 25). Large groups

contained adult males (with thick bulbous claws), adult females (with well developed marsupial pouches) and many juveniles of various sizes. Some of the females carried eggs in their marsupial pouches.

Figure 1 shows the relation between starfish size and number of associated caprellids. There was no correlation between these variables ($r = -0.06$, $p = 0.77$, $n = 25$). Two of three values for *Hacelia attenuata* are within the range of the values for *Ophidiaster ophidianus*. One *Hacelia* of 14 cm diameter had the extraordinary high number of 77 caprellids associated with it.

In the field, caprellids were seen only on the aboral surface of the starfish. Starfish lifted off the surface had no caprellids visible on their oral side. The caprellids were concentrated on the central area of the starfish but also occurred on the arms. Caprellids seen in the field (during daytime) were stationary on the host in an upright position. In large groups, individuals were spaced at regular distances of approximately two body lengths. A colour photograph of the caprellids in situ has been published by WIRTZ (1995, p.97, *sub nom. Caprella acanthifera*).

While appearing white when on the starfish host, the caprellids actually were pink in colour, as evident against the white background of the tray used for sorting.

DISCUSSION

The *Caprella acanthifera* complex, comprising *C. acanthifera* Leach *s.str.*, *C. armata* Heller, and at least two as yet undescribed species is widespread in the Eastern Atlantic and the Mediterranean Sea. Species belonging to this complex have been encountered free-living, associated with the sea anemones *Anemonia sulcata* and *Aiptasia couchii* (STROOBANTS 1969; CHINTIROGLOU & KOUKOURAS 1992), on sponges (COSTELLO & MYERS 1987), hydroids (PEATTIE & HOARE 1981) and even on a hermit crab (CHEVREUX 1908). The Azorean material belongs to one of the new taxa to be described by KRAPP-SCHICKEL & VADER (submitted).

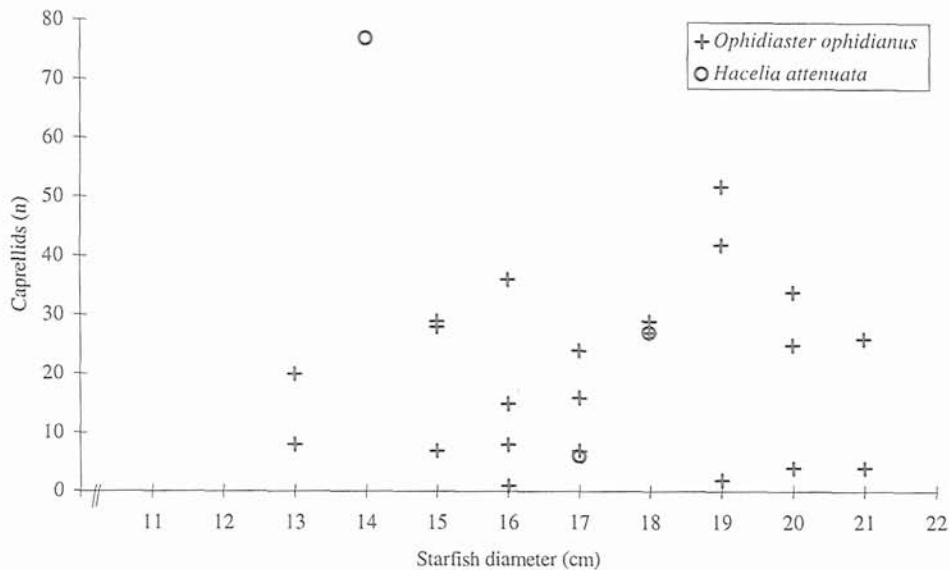


Fig. 1. Relationship between starfish size and number of associated caprellids.

The association of the Azorean *Caprella* with invertebrate hosts probably is a facultative one. The large group sizes of the caprellids on their hosts show, however, that these associations are not merely due to spurious encounters. As yet, no studies exist on host recognition and host selection by *Caprella acanthifera* s.l. Related species, as *Caprella linearis* and *C. unica*, have been shown to be chemically attracted to their hosts and to show clear host selection (PATTON 1968; PEATTIE & HOARE 1981).

The position of the Azorean *Caprella* on the aboral surface of its host corresponds perfectly to that of most other caprellids living on starfish (Table 1). The even spacing out of the animals suggests aggressive interaction of individuals (cf. CONNELL 1964). *Caprella gracilior*, an obligate symbiont of the starfish *Luidia foliolata*, feeds by scraping mucous secretions off the surface of its starfish host; material that settles on the starfish surface is also ingested; in addition, the species feeds by filter-feeding (CAINE 1978). When on the red starfishes *Ophidiaster ophidianus* and *Halcia attenuata*, the Azorean *Caprella* also may scrape mucus off their hosts, as suggested by the pinkish colour of the caprellids from the

starfish. The positioning of the Azorean *Caprella* and most other starfish-associated caprellids on the aboral side of their hosts suggests that commensalism s.str., viz. the partaking of food collected by the host for its own consumption, is not of any importance for the caprellids in this type of associations.

The Azorean *Caprella* and both starfish species are common in the Mediterranean Sea. However, no association between these species has as yet been recorded from that area. This may be due to lack of observations, but could also signify the true absence of this association in the Mediterranean Sea. In the latter case, one could speculate that - as the Mediterranean population is unlikely to have lost the ability to exploit an additional food source - the association of the species with starfish may represent an evolutionarily new development in the Azorean *Caprella*.

The somewhat random distribution of starfish associations over the spectrum of *Caprella* species suggests that this type of association has developed many times independently, although the obligatory nature of many associations probably indicates that they did not develop very recently.

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REFERENCES

- BALDINGER, A.J. 1992. Additional records of the bathyal caprellid, *Caprella unguina* Mayer, 1903 (Amphipoda) from the Central California coast. *Crustaceana* 63: 97-100.
- CAINE, E.A. 1974. Comparative functional morphology of feeding in three species of caprellids (Crustacea; Amphipoda) from the northwestern Florida Gulf coast. *Journal of Experimental Marine Biology and Ecology* 15: 81-96.
- CAINE, E.A. 1978. Habitat adaptations of North American caprellid Amphipoda (Crustacea). *The Biological Bulletin* (Woods Hole) 155: 288-296.
- CAINE, E.A. 1983. Community interactions of *Caprella penantis* Leach (Crustacea: Amphipoda) on sea whips. *Journal of Crustacean Biology* 3: 497-504.
- CAINE, E.A. 1986. Carapace epibionts of nesting Loggerhead Sea Turtles: Atlantic coast of U.S.A. *Journal of Experimental Marine Biology and Ecology* 95: 15-26.
- CHEVREUX, E. 1908. Sur les commensaux du Bernard l'Hermite. *Bulletin du Museum National d'Histoire Naturelle* (1908): 14-16.
- CHEVREUX, E. & J. DE GUERNE 1893. Crustacés et Cirrhipèdes commensaux des tortues marines de la Méditerranée. *Comptes rendus de la 21. Session de l' Association Française pour l'Avancement des Sciences*: 1-3.
- CHINTIROGLOU, C. & A. KOUKOURAS 1992. A population of the sea anemone *Anemonia viridis* (Forskål, 1775) and its associated flora and fauna in the North Aegean Sea. *Internationale Revue der gesamten Hydrobiologie* 77: 483-495.
- COMELY, C.A. & A.D. ANSELL 1988. Invertebrate associates of the sea urchin, *Echinus esculentus* L., from the Scottish West coast. *Ophelia* 28: 111-137.
- CONNELL, J.H. 1964. Territorial behavior and dispersion in some marine invertebrates. *Research on Population Ecology* 5: 87-101.
- COSTELLO, M.J. & A.A. MYERS 1987. Amphipod fauna of the sponges *Halichondria panicea* and *Hymeniacion perleve* in Lough Hyne, Ireland. *Marine Biology Progress Series* 41: 115-121.
- GRIFFITHS, C.L. 1977. Deep-sea amphipods from west of Cape Point, South Africa. *Annals of the South African Museum* 73: 93-104.
- HIRAYAMA, A. 1988. A ghost-shrimp with four-articulate fifth pereopods (Crustacea: Caprellidea: Phtisicidae) from Northwest Australia. *Zoological Science* 5: 1089-1093.
- IVANJUSHINA, E.A. 1989. An association of the amphipod *Caprella angulosa* with the starfish *Asterias rathbunae*. Pp 128-136 in: SHVESHNIKOV, V.A. (Ed.). *Symbiosis of Marine Organisms*. The Institute of Evolutionary Morphology and Ecology Press, Moscow. (In Russian).
- JANKOWSKI, A.W. & S.V. VASSILENKO 1973. Commensological sketches 5. *Caprella astericola* sp.n. (Amphipoda, Caprellidea) from *Asterias amurensis*. *Zoologicheskij Zhurnal* 52: 947-951. (In Russian).
- JONES, M.B. 1970. The distribution of *Pariambus typicus* var. *inermis* on the common starfish *Asterias rubens* L. *Crustaceana* 19: 89-93.
- KRAPP-SCHICKEL & W. VADER (submitted). What is, and what is not, *Caprella acanthifera* Leach, 1814 (Amphipoda, Caprellidea)? *Zoologica Scripta*.
- LAUBITZ, D.R. 1972. The Caprellidea (Crustacea, Amphipoda) of Atlantic and Arctic Canada. *National Museum of Canada. Publications in Biological Oceanography* 4: 1-82.
- LEWBEL, G.S. 1978. Sexual dimorphism and intraspecific aggression, and their relationship to sex ratios in *Caprella gorgonia* Laubitz & Lewbel (Crustacea: Amphipoda: Caprellidae). *Journal of Experimental Marine Biology and Ecology* 33: 133-151.
- MAYER, P. 1903. Die Caprellidae der Siboga-Expedition. *Siboga Expeditie* 34: 1-160.
- McCAIN, J.C. 1968. The Caprellidea (Crustacea: Amphipoda) of the western North Atlantic. *Bulletin of the United States National Museum* 278: 1-147.
- McCAIN, J.C. 1969. A new species of caprellid (Crustacea: Amphipoda) from Oregon. *Proceedings of the biological Society of Washington* 82: 507-510.
- McCAIN, J.C. 1979. A new caprellid (Crustacea: Amphipoda) associated with a starfish from Antipodes Island. *New Zealand Journal of Marine and Freshwater Research* 13: 471-473.
- MEINERT, F. 1878. Crustacea Isopoda, Amphipoda et Decapoda Danica. *Naturhistorisk Tidsskrift* (3) 11: 57-248.
- MORI, A. & S. YAMATO 1993. *Caprella simia* Mayer,

- 1903 (Crustacea Amphipoda) collected from the body surface of a frogfish *Antennarius striatus* (Shaw & Nodder, 1794). *Namki-Seibutu* 35: 41-16.
- O'BRIEN, F.X. de 1975. *Caprella equilibra* Say, 1818, first report of its occurrence in Massachusetts and its association with the stomatopod *Squilla empusa* Say, 1818. *Crustaceana* 29: 220-221.
- PATTON, W.K. 1968. Feeding habits, behavior and host specificity of *Caprella grahmi*, an amphipod commensal with the starfish *Asterias forbesi*. *The Biological Bulletin* (Woods Hole) 134: 148-153.
- PEATTIE, M.E. & R. HOARE 1981. The sublittoral ecology of the Menai Strait. II. The sponge *Halichondria panicea* (Pallas) and its associated fauna. *Estuarine, Coastal and Shelf Science* 13: 621-635.
- STROOBANTS, G. 1969. Associations entre les anemones de mer (Anthozoaires) et une Crustacé Amphipode. *Les Naturalistes Belges* 50. 309-313.
- VADER, W. 1979. Associations between amphipods and echinoderms. *Astarte* 11(1978): 123-135.
- VASSILENKO, S.M. 1974. Caprellids of the seas of the USSR and adjacent waters. *Keys to the fauna of the USSR* 117: 1-288. (In Russian).
- WIRTZ, P. 1995. *Unterwasserführer Madeira Kanaren Azoren Niedere Tiere-Unterwater Guide Madeira Canary Islands Azores Invertebrates*. Nagelschmidt Verlag, Stuttgart. 248 pp.
- WIRTZ, P. & H.R.MARTINS 1994. Notes on some rare and little known marine invertebrates from the Azores, with a discussion of the zoogeography of the region. *Arquipélago. Life and Marine Sciences* 11A: 55-63.

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