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Research article

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Onisimus turgidus (Sars, 1879) (Amphipoda, Uristidae), an overlooked amphipod from sea anemones in Northern Norway

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Abstract. Two Norwegian uristid amphipods, obligate associates of sea anemones, have for a long time been confused sub nomine *Onisimus normani* Sars, 1890. In reality this species only occurs in south Norway, while the north-Norwegian material belongs to *O. turgidus* (Sars, 1879), described from the Barents Sea and for a long time forgotten. This paper fully illustrates both species, gives a key, and provides data on their distribution and ecology.

Keywords. Sibling species, Crustacea, species complex.

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Introduction

In his great monograph on Norwegian amphipods G.O. Sars (1891) described the uristid species “*Onesimus normani*, Schneider, ms” on the basis of a single specimen, found in a sample of *O. edwardsi* (Krøyer, 1846), “probably from some place in Finnmark”. He noted (op. cit.: 106): “The present new species was first detected by Mr Schneider in the neighbourhood of Tromsø, Finnmarken (...) I have had an opportunity of seeing his detail drawings of the species.” Unfortunately, neither Schneider’s drawings nor his specimens seem to be extant. Vader (1967, 1970) discovered that *Onisimus normani* Sars, 1891 lives in the gastrovascular cavity of the sea anemone *Bolocera tuediae* (Johnston, 1832) and studied this association in the vicinity of Bergen, W Norway; the amphipods enter the host as 2–3 mm long juveniles in autumn, and leave the sea anemone as 8–9 mm long adults 18 months later. Strangely, ovigerous females have as yet never been found anywhere. (The specimen from Oslofjord described by Sars (1895) as having “reddish ova in the marsupial pouch” in reality carries the isopod

parasite *Parapodascon* Hansen, 1916 (Vader, unpubl. obs.: *Parapodascon* sp.), which also commonly infested *O. normani* in the Bergen population (Vader 1967)). *Onisimus* Boeck, 1871 thus spends a large part of its life-cycle inside the sea anemone and it is almost immune to the proteolytic enzymes in the gastrovascular cavity that quickly kill and digest other amphipods (Vader & Lønning 1973). A later study showed that these amphipods do not, as originally assumed, feed primarily on the semi-digested remains of the prey of the sea anemone, but instead on the mesenterial filaments of the host itself (Moore *et al.* 1994).

When the first author moved from Bergen to Tromsø and again found reddish *Onisimus* specimens inside sea anemones there, it was assumed at first that they too must be *O. normani*, a species originally described from this area (Vader 1975). A few points of difference between the west and north Norwegian animals were nevertheless noted. Although both amphipods were reddish, there was a clear difference in hue between the two, and in addition the animals in the population of Ullsfjorden N of Tromsø were primarily found in the sea anemone *Actinostola callosa* (Verrill, 1882) and only to a lesser degree in *Bolocera tuediae*. The question was tackled by Johnsen (2001) in an unpublished MSc thesis, and he came to the unexpected conclusion that the N Norwegian material does not belong to *O. normani*, which is largely confined to southern Norway, with the northernmost record in Andfjorden in Nordland, but instead represents *Onisimus turgidus* (Sars, 1879), a species further described by Sars in his report on the crustaceans of the Northern Norwegian Sea Expedition (Sars 1885), on the basis of a few specimens collected in the Barents Sea, in fact also with sea anemones. This species was for a long time almost forgotten; it was not mentioned at all in Sars' monograph on the Norwegian amphipods (Sars 1890–1895), and although it figures in Stephensen's "*The Amphipoda of Northern Norway and Spitsbergen*" (Stephensen 1935–1942), it is misrepresented in his key to *Onisimus* species and is impossible to identify correctly with this key. Johnsen (2001) studied presumed *O. normani* samples from different parts of the world (W Atlantic Ocean, E Siberia) and came to the conclusion that they all are closer to *O. turgidus* than to *O. normani*, but that both the W Atlantic and the E Siberian material show some peculiarities, that may lead to these entities needing to be described as separate species. At least the W Atlantic material is also associated with sea anemones (Vader 1967). Johnsen's drawings of *O. turgidus* (Johnsen 2001) are here reproduced in Figs 4–10. They are both re-illustrations of specimens from the type material (from the Barents Sea) (Figs 4–6) and material from Ullsfjord (Figs 7–10). This species has recently also been reported once more from the Barents Sea (Bryazgin 1997; Lyubina *et al.* 2014, again as *O. normani*; Zimina *et al.* 2019); Johnsen has seen some of Bryazgin's material.

Material and methods

This study is based on a combination of museum material (Arctic University Museum of Tromsø (TSZCr-numbers) and the Natural History museum Oslo (F-numbers) and material collected in recent field studies (deposited at the Arctic University Museum of Tromsø). All historic material was initially preserved in formaldehyde before being transferred to 70% ethanol for storing at the museums. The material sampled for the Johnsen thesis work was directly fixed in seawater-diluted ethanol (75%), before being transferred to freshwater-diluted 70% ethanol for longterm storage at the Tromsø Museum (now known as the Arctic University Museum of Tromsø). All material was initially studied and sorted using stereo microscope, dissected and mounted in rose Bengal-stained polyvinyl-lactophenol on microscope slides for morphological examination. All drawings were made using a camera lucida mounted on a Leica compound microscope fit with a camera lucida for pencil drawings. Initial pencil drawings were subsequently inked using the methods described by Coleman (2003, 2009) using Adobe Illustrator CC2019.

Abbreviations

A = antenna
Ep = epimeral plate

i.p. = inner plate
LL = lower lip
lMd = left mandible
Mx1 = maxilla 1
Mx2 = maxilla 2
Mxp = maxilliped
P = pereopod
plp = palp
rMd = right mandible
T = telson
U = uropod

Results

Order Amphipoda Latreille, 1816
Class Malacostraca Latreille, 1802
Family Uristidae Hurley, 1963
Genus *Onisimus* Boeck, 1871

Key to the ‘normani-group’

The ‘normani-group’ within *Onisimus* is characterized by a partly cleft telson, a completely constricted uropod 2, and a peculiar 1st epimeral plate, with an anterodistal hook (Vader *et al.* 2005). The group consists of *O. normani*, *O. turgidus*, and 2 or 3 taxa closely related to *O. turgidus*, but strongly deviating in the arrangement of the setal teeth on the outer plate of maxilla 1. Material belonging to these taxa has been found in the W Atlantic Ocean, near Greenland and in the NW Pacific (Johnsen 2001). Most (or possibly all) species in this group appear to be obligate associates of sea anemones, a trait absent in all other *Onisimus* species. In Norwegian waters there are two species in this group, *O. normani* in W Norway north to Andfjorden, and *O. turgidus* in N Norway and the Barents Sea. They can be distinguished as follows:

1. Pereopod 1 palm oblique, propodus subrectangular. Uropod 2 inner ramus with small setae in constriction; uropod 1 outer ramus without spines on inner margin *Onisimus normani* Sars, 1891
- Pereopod 1 palm strongly oblique, propodus triangular. Uropod 2 inner ramus with large spine in constriction; uropod 1 outer ramus with spines on inner margin *Onisimus turgidus* (Sars, 1879)

Onisimus normani Sars, 1891

Figs 1–3

Onesimus normani (Schneider ms) Sars, 1891: figs on pl. 36–2.

Onesimus normani – Sars, 1895: 105.

Onisimus normani – Stephensen 1923: 48; 1935: 38. — Vader 1967: 286, figs 2–3; 1975: 38; 1983: 144. — Vader & Lønning 1973: 29. — Lowry & Stoddart 1993: 169. — Johnsen 2001: 49, fig. 17.

non *O. normani* – Stephensen 1923: 48. — Shoemaker 1930: 11. — Vader 1975: 38. — Moore *et al.* 1994: 206. — Vader & Krapp-Schickel 1995: 65. — Bryazgin 1997: 99. — Lyubina *et al.* 2014: 246. (All these references = *O. turgidus* (Sars, 1879).)

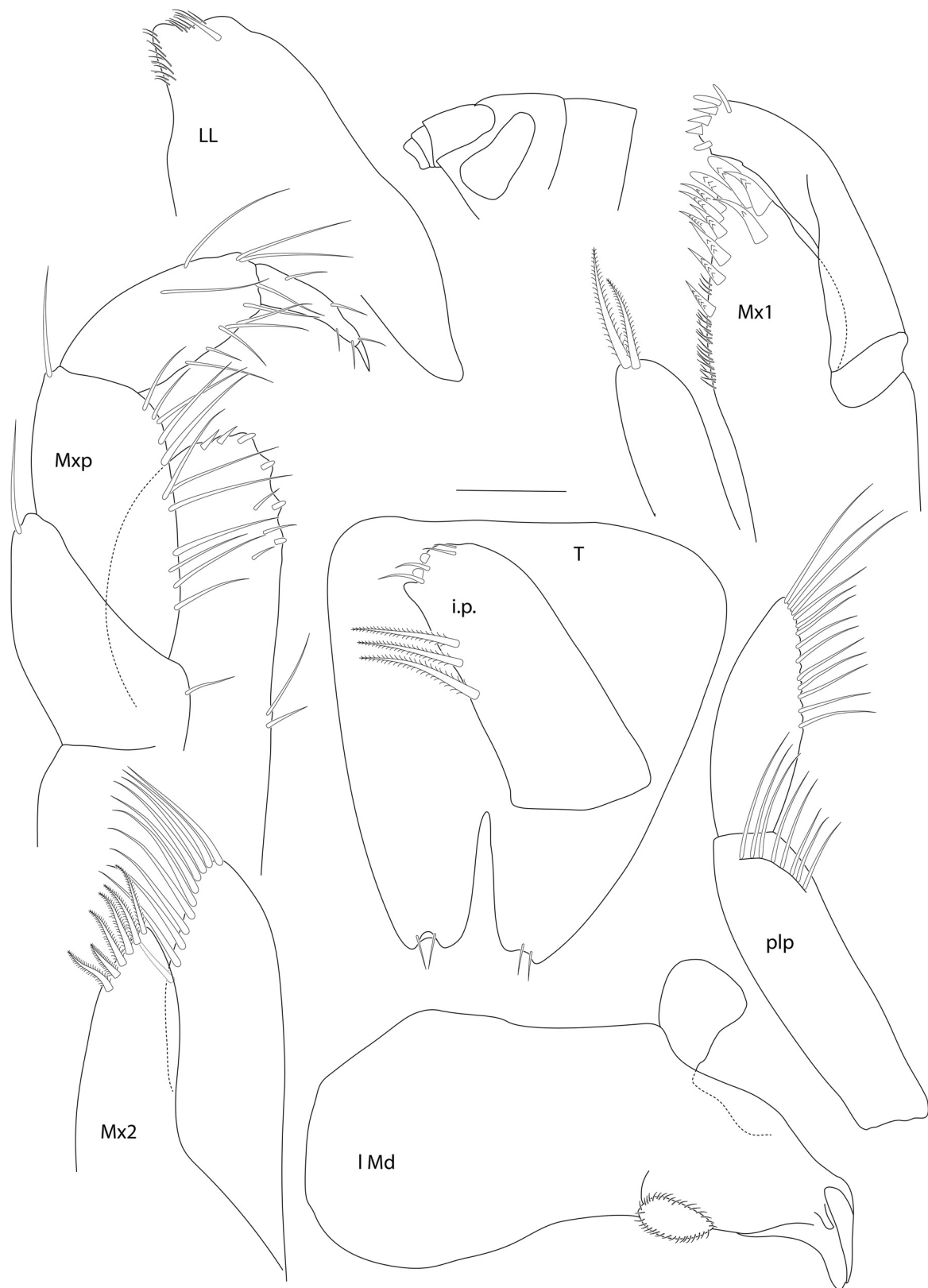


Fig. 1. *Onisimus normani* Sars, 1890, ♀, 10 mm, Korsfjorden, Norway (TSZCr8659). Head, mouthparts (1 mandible, lower lip, maxilla 1, maxilla 2, maxilliped), telson. Abbreviations: see Material and methods. Scale bars = 0.1 mm.

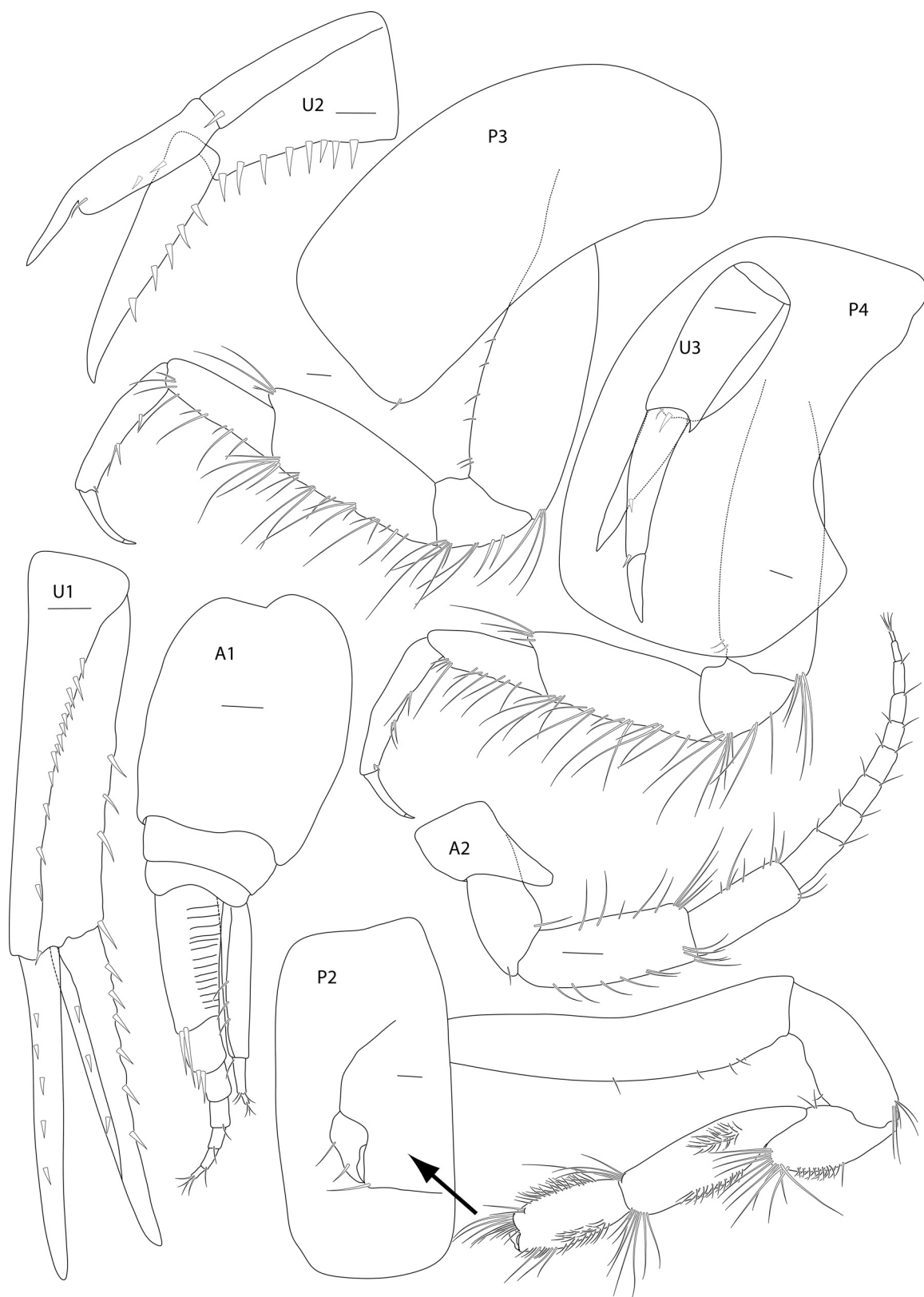


Fig. 2. *Onisimus normani* Sars, 1890, ♀, 10 mm, Korsfjorden, Norway (TSZCr8659). Pereopods 2, 3 and 4, uropods 1, 2 and 3, antenna 1 and 2. Abbreviations: see Material and methods. Scale bars = 0.1 mm.

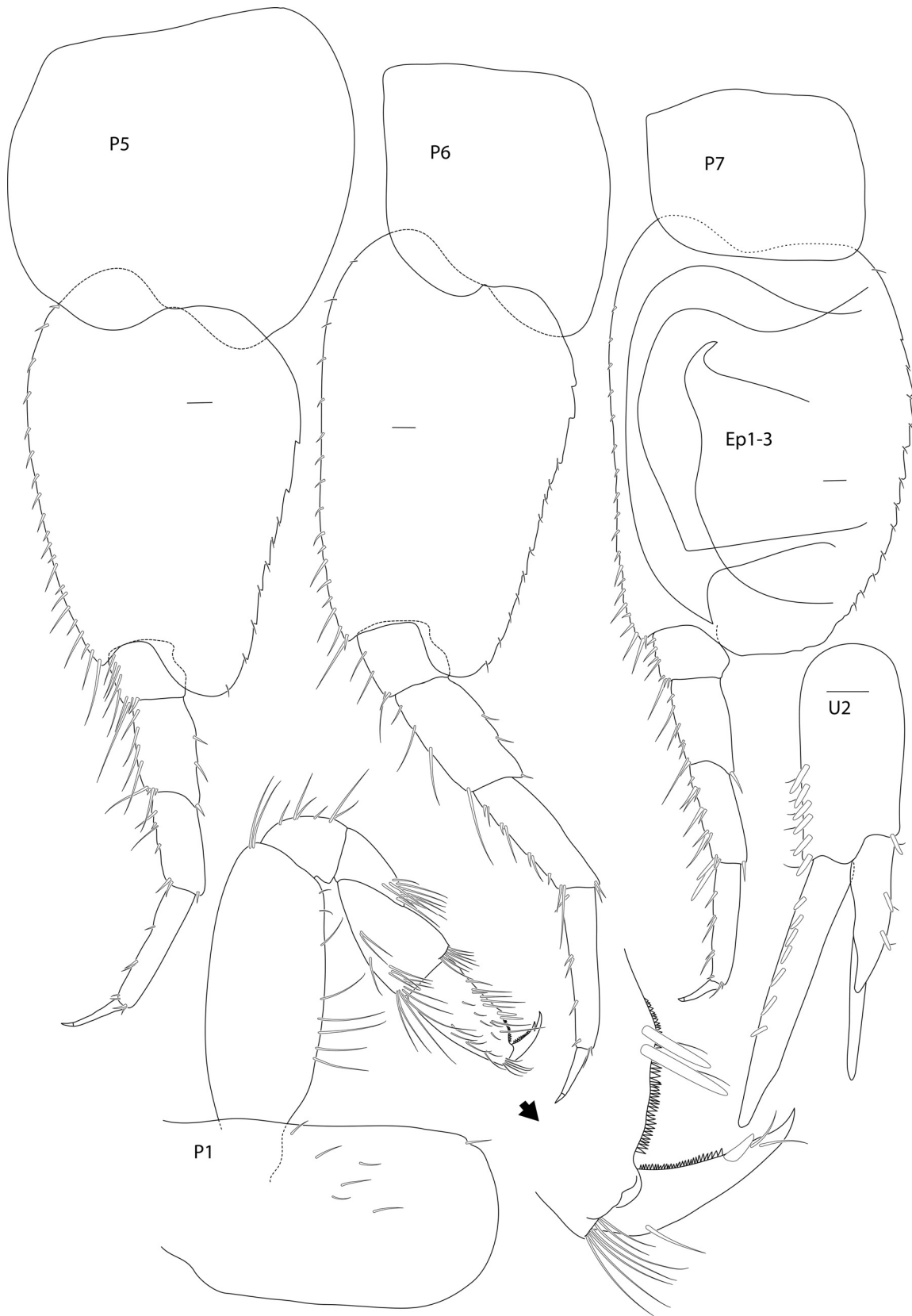


Fig. 3. *Onisimus normani* Sars, 1890, ♀, 10 mm, Korsfjorden, Norway (TSZCr8659). Pereopods 1, 5, 6 and 7, uropod 2, epimeral plates 1–3. Abbreviations: see Material and methods. Scale bars = 0.1 mm.

Material examined

NORWAY • 1 ♀ (10 mm); Korsfjorden; 680 m depth; 1968; Wim Vader leg.; from *Bolocera tuediae*; TSZCr8659 (Figs 1–3) • 1 ♀ immature (8 mm); same collection data as for preceding; TSZCr8659 • 1 spec.; Raunefjorden; 240 m depth; 1968; Wim Vader leg.; from *Bolocera tuediae*; TSZCr8628 • 1 spec.; Korsfjorden; 680 m depth; 1968; Wim Vader leg.; from *Bolocera tuediae*; TSZCr8623 • 1 spec.; same collection data as for preceding; TSZCr8624 • 2 specs; same collection data as for preceding; TSZCr9320 • 7 specs; Andfjorden; 69°18'42" N, 16°23'24" E; 498 m depth; 1 Jul. 1997; Wim Vader leg.; from *Bolocera tuediae*; TSZCr12962

Distribution

Although there are many records of *O. normani* in the amphipod literature, all except those from Southern Norway in reality are either *O. turgidus* or taxa very closely related to that species (Johnsen 2001). Johnsen mentions a record from Andsfjorden at 69° N (material in Tromsø Museum): otherwise this species has only been recorded from the Oslofjord and a number of localities in W Norway (Vader 1967). *Onisimus normani* appears to be an obligate associate of the sea anemone *Bolocera tuediae*, and it has only exceptionally been found in other sea anemones (Vader 1967, 1975), although it is well able to survive also in other sea anemone hosts in the laboratory (Vader & Lønning 1973).

Onisimus turgidus (Sars, 1879)

Figs 4–10

Anonyx turgidus Sars, 1879: no 13.

Onisimus turgidus – Sars, 1885: 147, pl. xii, fig. 5, comb. nov. (described as sp. nov.). — Lowry & Stoddart 1993: 169. — Johnsen 2001: 60, fig. 21. — Zimina *et al.* 2019: 871.

Onisimus normani – Stephensen 1923: 48. — Shoemaker 1930: 11. — Vader 1975: 38. — Moore *et al.* 1994: 206. — Vader & Krapp-Schickel 1996: 65. — Bryazgin 1997: 99. — Lyubina *et al.* 2014: 246. (These are all **not** *O. normani*, but *O. turgidus*.)

Material examined

NORWAY • 1 ♀, syntype (15 mm); Barents Sea; 72°53' N, 21°51' E; 408 m depth; 30 Jul. 1878; G.O. Sars leg.; stn 323 (trawl), Norwegian North sea Expedition; 1.5°C; silt.; F1764 (Figs 4–6) • 1 ♀ (10 mm); Kuberget Ullsfjorden; 100 m depth; Sep. 1974; Wim Vader leg.; from *Actinostola callosa*; TSZCr8573. (Figs 7–10) • 1 spec.; Ullsfjorden; from *Actinostola callosa*; TM IX-95 • 2 specs; Ullsfjorden; 69°39'48" N, 19°45'18" E; 106 m depth; 28 Apr. 1995; Wim Vader leg.; from *Actinostola callosa*; stn JohanRuud 255-95; TSZCr14488 • 21 specs; Ullsfjorden; Jun. 1995; Wim Vader leg.; from *Actinostola callosa*; stn Hvas 6-95; Arctic University Museum of Tromsø • 1 spec., Finnkroken; 50–60 fathoms depth; 1900; J. Sparre Schneider leg.; TSZCr1171.

Distribution

Johnsen (2001) studied samples of presumed *Onisimus normani* from different parts of the world, and concluded that they all (except the ones from S Norway) belonged in the *turgidus* species complex; unfortunately there was not sufficient material available to be able to revise this entire complex. The type material was collected from the Barents Sea and it has been collected from this area several times since (Bryazgin 1997; Lyubina *et al.* 2014, sub nomine *O. normani*; Zimina *et al.* 2019). Material from N Norway (Ullsfjorden) is quite similar to the type material, but the animals are smaller, 10 mm against 14 mm for the type. No fully adult or ovigerous specimens of *O. turgidus* have been found as yet, similar to the situation in *O. normani*. *Onisimus turgidus* also spends most of its life inside a sea anemone and like *O. normani*, likely leaves the host when almost adult.

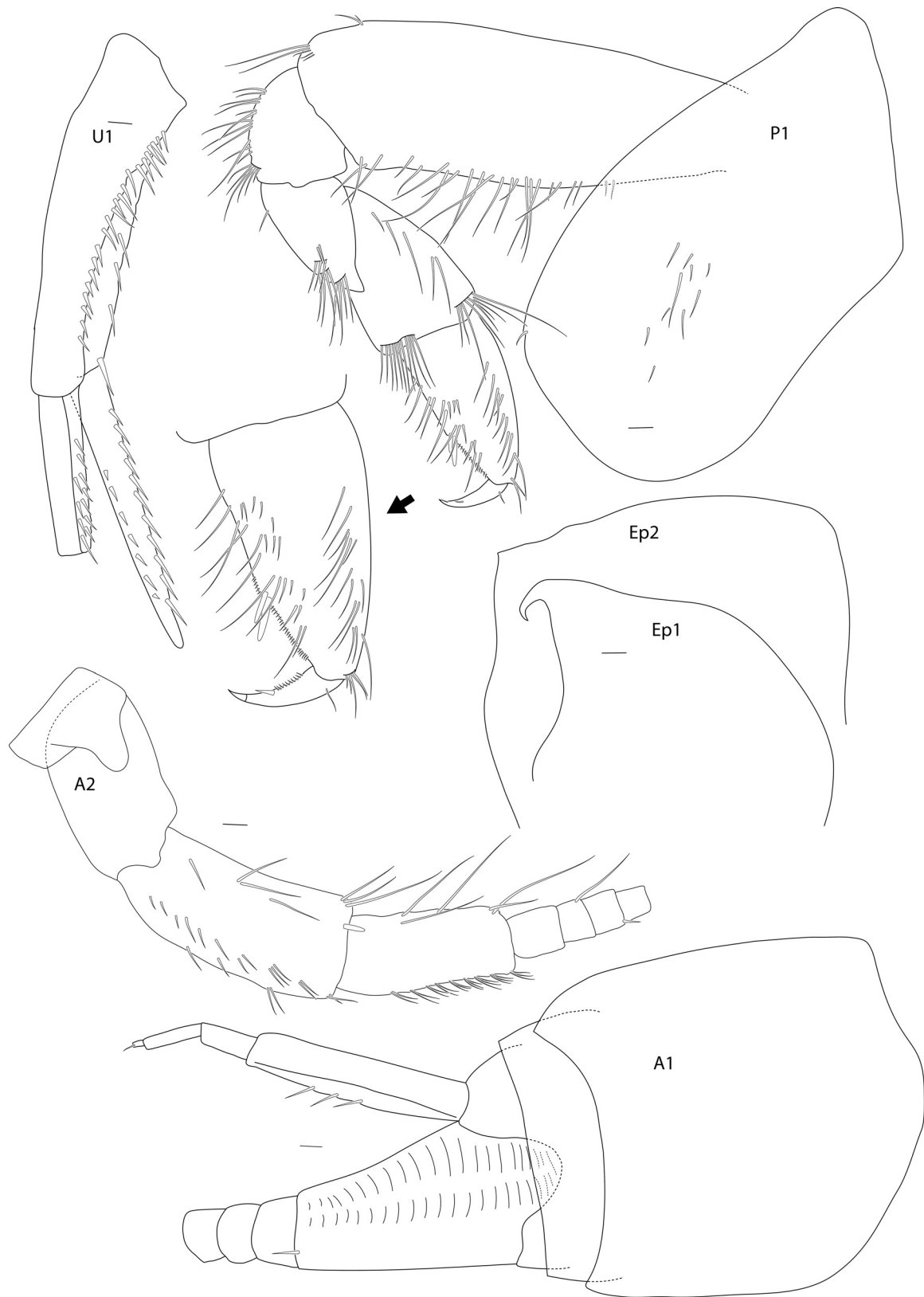


Fig. 4. *Onisimus turgidus* (Sars, 1879), syntype, ♀, 15 mm, Barents Sea (F1764). Antenna 1–2, pereopod 1, epimeral plates 1–2, uropod 1. Abbreviations: see Material and methods. Scale bars = 0.1 mm.

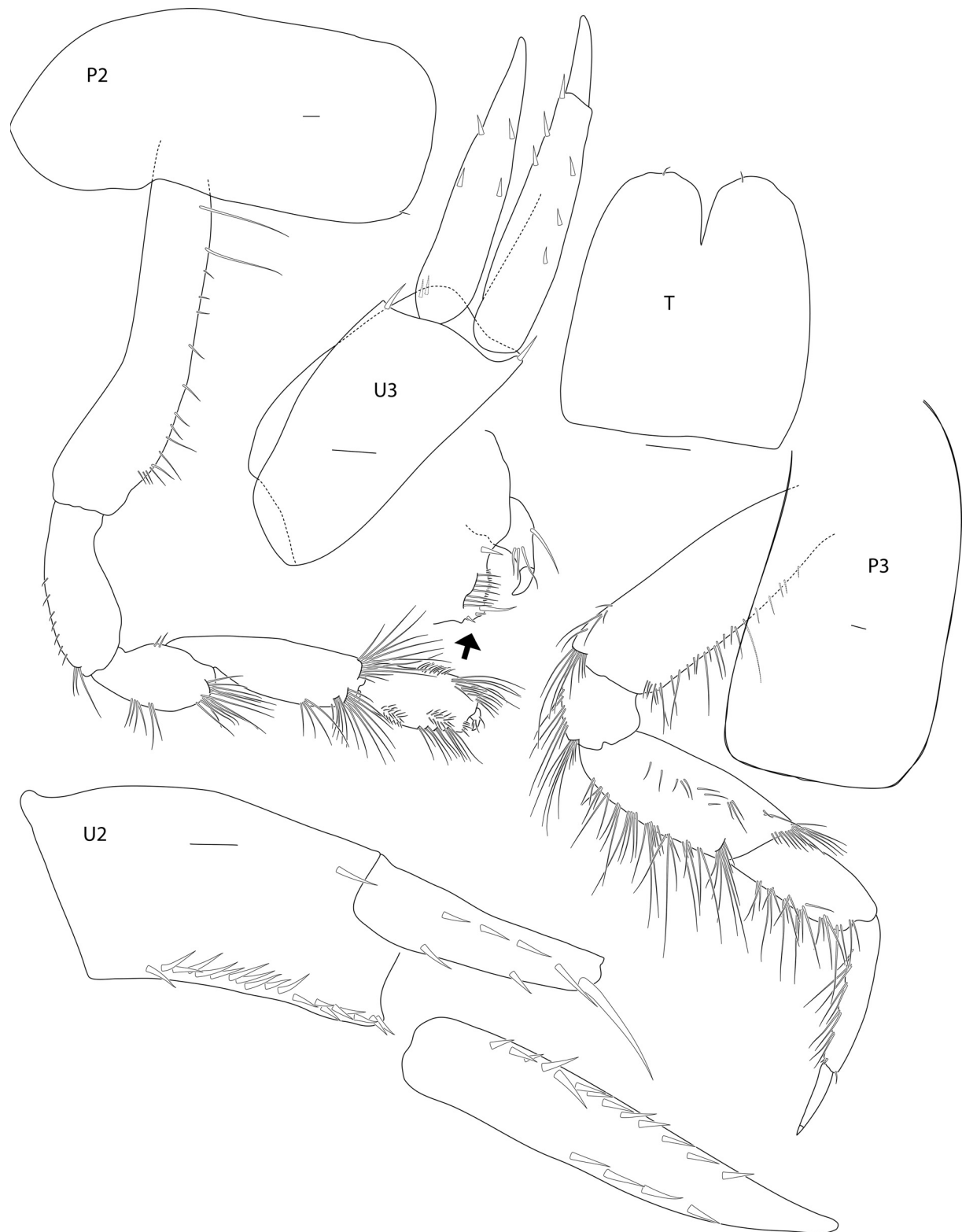


Fig. 5. *Onisimus turgidus* (Sars, 1879), syntype, ♀, 15 mm, Barents Sea (F1764). Pereopods 2–3, uropods 2–3, telson. Abbreviations: see Material and methods. Scale bars = 0.1 mm.



Fig. 6. *Onisimus turgidus* (Sars, 1879), ♀, 15 mm, Barents Sea (F1764). Pereopods 4–7. Abbreviations: see Material and methods. Scale bars = 0.1 mm.

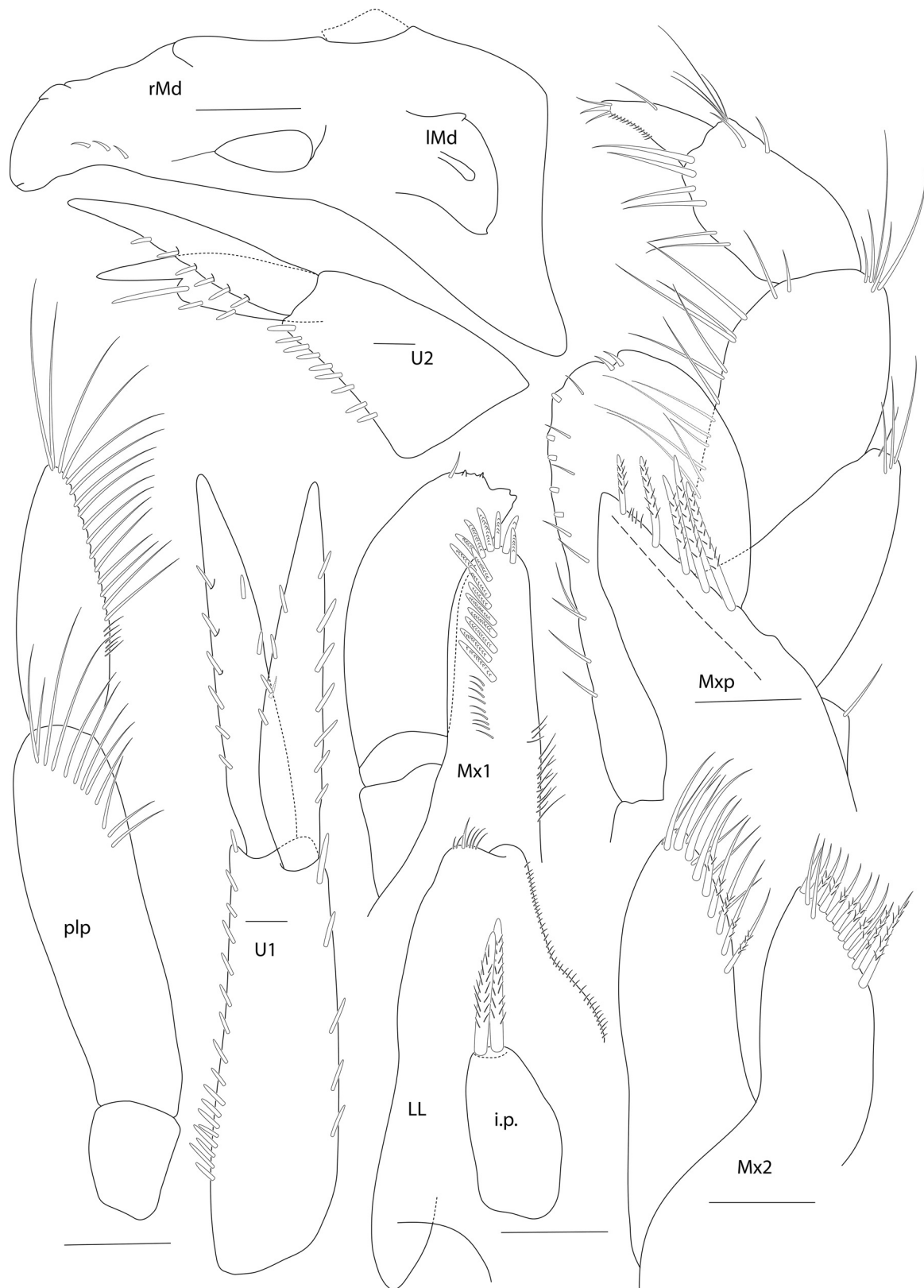


Fig. 7. *Onisimus turgidus* (Sars, 1879), ♀, 10 mm, Ullsfjorden (100 m depth) (TSZCr8573). Mouthparts (r and l mandible, lower lip, maxilla 1, maxilla 2, maxilliped), uropod 1. Abbreviations: see Material and methods. Scale bars = 0.1 mm.



Fig. 8. *Onisimus turgidus* (Sars, 1879), ♀, 10 mm, Ullsfjorden (100 m depth) (TSZCr8573). Head, backbody, pereopods 1–2. Abbreviations: see Material and methods. Scale bars = 0.1 mm.

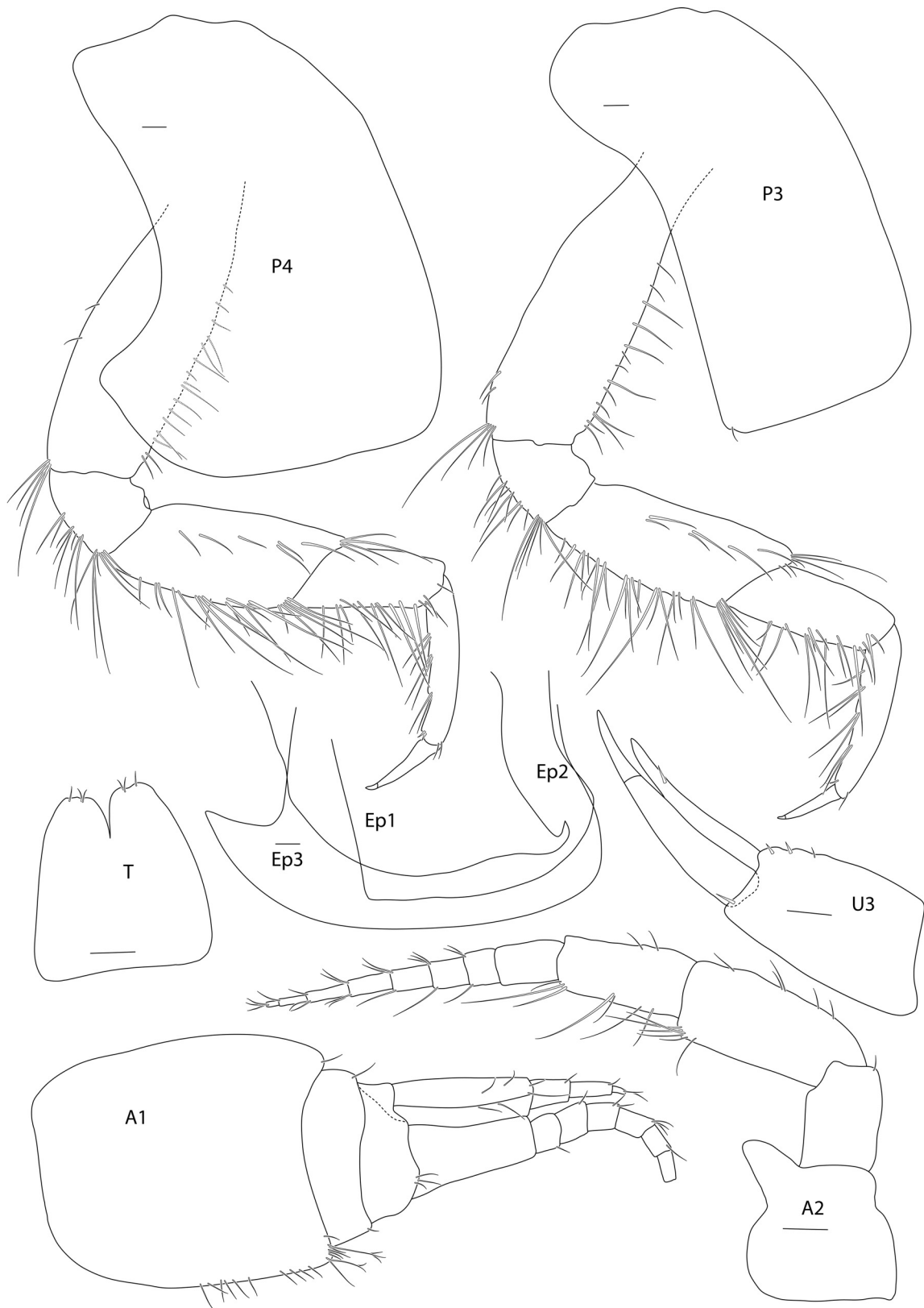


Fig. 9. *Onisimus turgidus* (Sars, 1879), ♀, 10 mm, Ullsfjorden (100 m depth) (TSZCr8573). Antennae 1–2, pereopods 3–4, epimeral plates 1–3, uropod 3, telson. Abbreviations: see Material and methods. Scale bars = 0.1 mm.

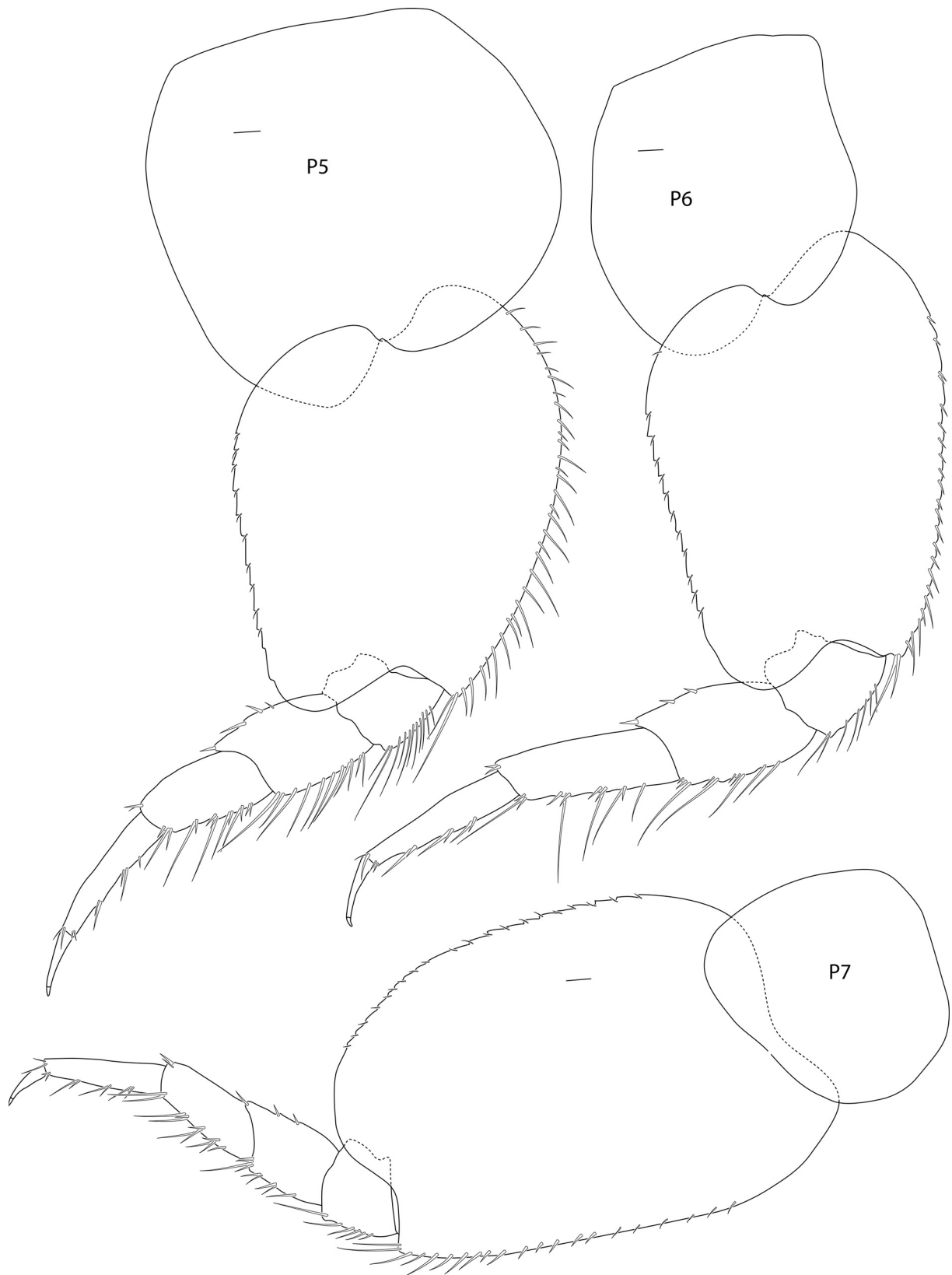


Fig. 10. *Onisimus turgidus* (Sars, 1879), ♀, 10 mm, Ullsfjorden (100 m depth) (TSZCr8573). Pereopods 5–7. Abbreviations: see Material and methods. Scale bars = 0.1 mm.

Biology

Onisimus turgidus appears to be an obligate associate of sea anemones for most of its life-cycle. The preferred host of *Onisimus turgidus* in N Norway is *Actinostola callosa*. The numbers vary quite a lot from year to year (Moore *et al.* 1994; Vader & Krapp-Schickel 1996: table 2, sub nom. *O. normani*) but the species is never numerous even there: in 714 specimens of *Actinostola* Verrill, 1883 from Ullsfjorden 116 specimens of *O. turgidus* were found, an infection percentage of 0.16 amphipods per host. There is a significant positive correlation between the size of the *Actinostola* hosts and the number of *Onisimus* found inside: in the large sample of January 1974 sea anemones of 10–50 g wet weight contained 0.03 amphipods per host, those of 60–100 g 0.54 and the few of 100–150 g 3.00. *Actinostola callosa* in Ullsfjorden also is the host of another amphipod species, *Stenothoe brevicornis* Sars, 1883, that likewise feeds on host tissue, but this amphipod lives on the outside of the host, among the tentacles (Moore *et al.* 1994; Vader & Krapp-Schickel 1996).

Onisimus turgidus in Ullsfjorden is also sometimes found inside *Bolocera tuediae*, the almost exclusive host of *O. normani* in S Norway (Vader 1973), but here it is even less common than in *A. callosa*: in 297 specimens of *Bolocera* Gosse, 1860 from Ullsfjorden only 14 specimens of *Onisimus* were found (0.05 amphipods per host). The parasitic isopod *Parapodascon* sp. that is quite common on *O. normani* in S Norway, has also been found a few times on *O. turgidus* from the Ullsfjord.

Discussion

The discovery that all *Onisimus* material collected in N Norway and identified as *O. normani* in reality belongs to *O. turgidus*, causes a nomenclatural problem, since Sars (1891) states that his material came from a sample of *O. edwardsii* (Krøyer, 1846) (a species that probably does not occur in S Norway, although in older literature it has been reported a few times) from ‘somewhere in Finnmarken’ (which at the time included also Troms province). Sars’ description and illustrations clearly show ‘the real *O. normani*’, i.e., the species from W Norway, and not *O. turgidus*, which is the sole species in this group in ‘Finnmarken’, and Sars’ specimen therefore most probably came from S Norway somewhere, even though in 1890 he emphatically declared that he had not yet found *O. normani* there. Similar problems with Sars’ type specimens have occurred before: d’Udekem d’Acoz (2004) discussed the case of *Bathyporeia sarsi* Watkin, 1938, where Sars material of ‘*B. robertsoni* Spence Bate, 1862’, on which Watkin based his *B. sarsi*, has Sørøya, Finnmark, as type locality; this species has never been found in Norway north of the Oslofjord (d’Udekem d’Acoz loc. cit.)

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