

Short Communication

Note on additional diagnostic characters for *Marphysa sanguinea* (Montagu, 1813) (Annelida: Eunicida: Eunicidae), a recently introduced species in the Netherlands

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Abstract

Recently specimens of the polychaete *Marphysa sanguinea* (Montagu, 1813) (Annelida: Eunicida: Eunicidae) were reported as an introduction to the Eastern Scheldt in southwestern Netherlands. In order to confirm the species identity, material was examined with SEM and compared with material from Devon near the type locality in Cornwall, UK. These studies confirmed that this was a new record of *M. sanguinea*, which can be distinguished from other *Marphysa* species by the pattern of the distribution of pectinate chaetae in posterior parapodia. This new record extends the known distribution of the species based on verified records, eastward along the English Channel. As the specimens from the Netherlands show additional variation, the species description of *M. sanguinea* is expanded, which will facilitate future identifications of this species and comparison with other members of the genus.

Key words: Polychaeta, *Marphysa*, new record, additional characters, pectinate chaetae, introduced species

Introduction

In the literature the eunicid polychaete *Marphysa sanguinea* (Montagu, 1813) has been reported from many locations around the world (Pettibone 1963; George and Hartmann-Schröder 1985; Pardo and Amaral 2006; Wisnes 1989). However, no type material was ever deposited. In order to clarify the identity of *Marphysa* species in Australia, many of which had also been recorded as *M. sanguinea*, Hutchings and Karageorgopoulos (2003) designated a neotype for *M. sanguinea* and expanded the description of the species. This allowed two new Australian species to be described: the similar looking *M. mullawa* Hutchings and Karageorgopoulos, 2003, which forms the basis of an important bait worm industry in eastern Australia; and *M. fauchaldi* Glasby and Hutchings, 2010.

We recently had the opportunity to examine material collected from the Eastern Scheldt, southwestern Netherlands, and we were able to confirm its identity as *M. sanguinea* and that it represented a new record for the species from the area and must be regarded as a recent

introduction to the area (Wijnhoven and Dekker 2010). As the specimens were significantly smaller than those from the type locality, Cornwall, England (neotype 250 mm long, 290 chaetigers, 12 mm maximum width), a detailed examination of the distribution and type of chaetae along the body was necessary, particularly as recent studies have suggested that chaetal distribution varies with body size in different *Marphysa* species (Lu and Fauchald 1998; Glasby and Hutchings 2010) and in other genera in the family (Fauchald 1991). Detailed examination of this newly available material from the Eastern Scheldt enabled us to expand the description of *M. sanguinea* and to provide additional information on the distribution of chaetae along the body. This expanded description will facilitate the correct identification of the species which superficially look very similar to other members of the *M. sanguinea*-group and require detailed examination of chaeta along the body to distinguish between them. This may explain why *M. sanguinea* continues to be reported from around the world (e.g., Amaral et al. 2006; Endo et al. 2007; Yu et al. 2005). In

addition, many of the other species in the genus have been poorly characterized and hopefully this short note will encourage redescriptions of these other species as well as revealing undescribed species which have been confused with *M. sanguinea* and highlights the need for detailed examination of chaetae all along the body preferably under the SEM. The report of the recent introduction of *M. sanguinea* in the Netherlands (Wijnhoven and Dekker 2010) highlights the need for its accurate identification.

Material and methods

Two animals examined were 140 mm in length and 8.5 mm in width with 197 chaetigers, 120 mm in length, 8 mm in width with 180 chaetigers. Parapodia were removed from the following chaetigers 3, 10, 20, 30, 40, 60, 80, 173 and 180 of the larger specimen, AM W36827 (Yerseke, Netherlands, 51°28'16"N, 4°5'29"E), 28 October 2009 and AM W36831 (Mount Edgecombe, Plymouth, Devon, United Kingdom, 50°21'10"N, 4°9'30"W), 25 October 1999. The parapodia were examined under the light microscope and then prepared and mounted for SEM using standard methods. Scanning electronic micrographs were obtained using a Zeiss EVO LS15 SEM with a Robinson Backscatter detector.

Abbreviations: AM-Australian Museum, Sydney.

Results

ACICULATA Rouse and Fauchald, 1997

Eunicida Fauchald, 1977

Eunicidae Berthold, 1827

Marphysa Quatrefages, 1865

Nauphanta Kinberg, 1865; Fauchald, 1987

Marphysa sanguinea Montagu, 1813.-Hutchings and Karageorgopoulos, 2003: 88–90, figs 2a–f, 3b,d, 4b,d.

Diagnosis (revised)

Anterior body chaetigers cylindrical, usually becoming dorsoventrally flattened posteriorly; epidermis iridescent anterodorsally. Prostomium with deep anteroventral notch, bearing five similar-looking appendages—three antennae and two lateral shorter palps arranged in more or less curved line near posterior edge. Eyespots present. Peristomium divided into two rings, anterior one longer than posterior one;

peristomial cirri absent. Jaw apparatus includes ventral heavily sclerotised mandibles, anterior margins micro-serrated with calcified oar-shaped tips, carriers slightly rectangular, maxillary formulae: Mx I = 1+1; Mx II = 3–4+4–5, anterior-most teeth largest; Mx III = 4–6 (all teeth small and uniform in size); Mx IV = 3–5 + 5–8 (all teeth uniform in size); Mx V = 1–1. Branchiae present from chaetiger 13–27, to posterior chaetigers, initially consisting of single filament increasing up to 6 arranged along single axis, never covering dorsum; with increasing size, branchiae begin more posteriorly. Chaetae include in dorsal position, limbate capillaries with strongly hirsute blades and pectinate chaetae present from chaetiger 1 or 2. Pectinates of two kinds, fine and coarsely dentated, which may be present within a single chaetiger; anterior chaetigers with 10–25, posterior chaetigers with up to 40 pectinate chaetae per parapodium. Ventral chaetae consist only of compound spinigers, and bifid subacicular hooks. Ventral cirri bluntly conical, small lobes. Pygidium with two anal cirri.

Remarks

The examination of material consisting of two specimens from the Netherlands and two specimens from Devon, UK. This material is listed by Hutchings and Karageorgopoulos (2003) in their redescription of the species where a neotype of the species was designated. Montagu (1813) recorded the type locality as Cornwall. However when Hutchings and Karageorgopoulos (2003), were selecting a specimen to designate as a neotype from the collections of the Natural History Museum in London, they chose a specimen collected in 1867 from Polpero on the southern coast of Cornwall (50°19'40"N, 4°30'45"W), close to the border with Devon, an area that was regarded as pristine at that time. Additional material from nearby Mount Edgecombe, Plymouth, the study site for Karageorgopoulos PhD (University of Newcastle UK unpublished PhD) provided extra information on the ecology and reproduction of this species (Hutchings and Karageorgopoulos 2003). It was this latter material which was re-examined for this study. This has allowed us to provide information on additional variation which is present in this species, especially with regard to the number and type of chaetae present along the body including those present in far posterior chaetigers.

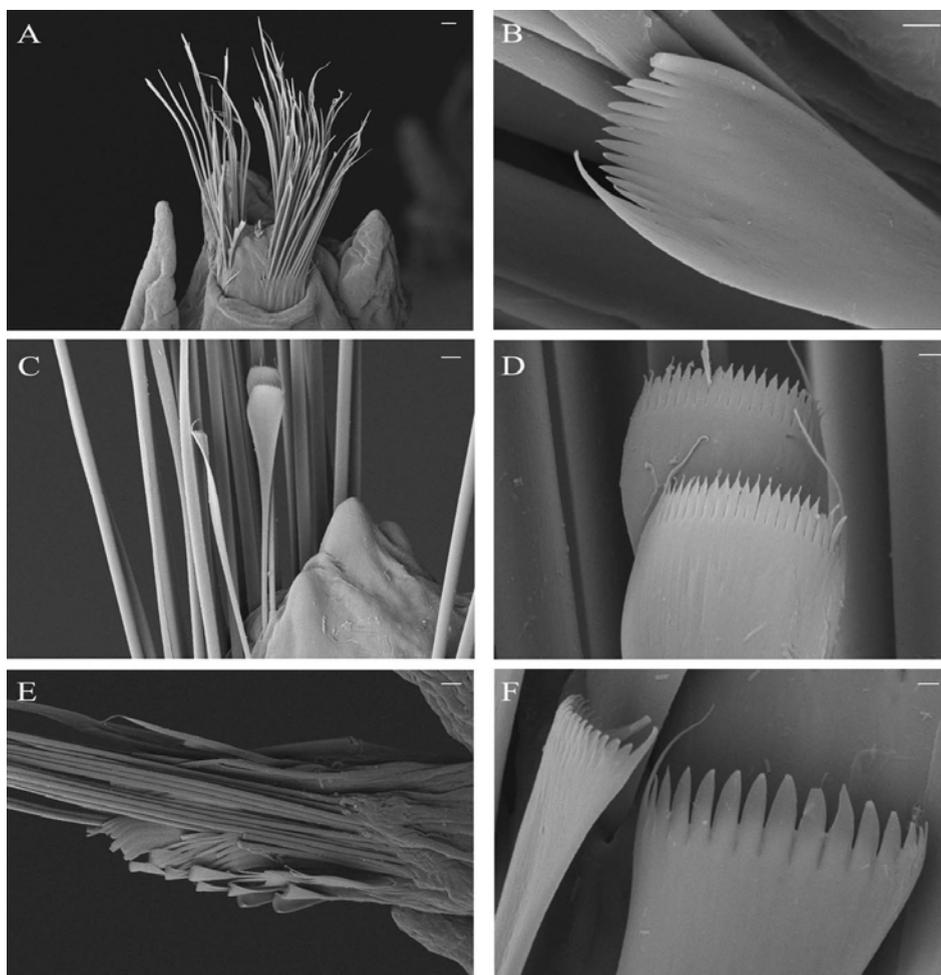


Figure 1. *Marphysa sanguinea* AM W36827 from the Netherlands. SEM photos: **A.** Chaetiger 10, scale 100 μm ; **B.** Pectinate chaeta from chaetiger 10, scale 3 μm ; **C.** Pectinate chaetae from chaetiger 60, scale 10 μm ; **D.** Close up of pectinate chaetae from chaetiger 60, scale 2 μm ; **E.** Chaetae from chaetiger 180 illustrating large numbers of pectinate chaetae, scale 20 μm ; **F.** close up of pectinate chaetae from this parapodia, scale 2 μm . Photographs by Sue Lindsey.

The number of pectinate chaetae per parapodium ranges from 10–25 in the anterior-mid body (Figures 1A, 2B, D) and up to 40 pectinates per parapodium in the posterior body (Figures 1E, 3C, D). As for other species of *Marphysa*, the number of pectinates per parapodium increases posteriorly as does the diversity of forms of these chaetae which were discussed by Zanol et al. (2007). Prior to this, the diversity of pectinate chaetae in the genus had not been documented. In anterior parapodia pectinate chaetae had 13–16 teeth (Figures 1B, 2A); in mid body parapodia the range is about 15–22 teeth (Figures 1D, 2C), and in posterior

parapodia the range of teeth was 7–24 (Figures 1F, 3A, B, C). Hutchings and Karageorgopolous (2003) identified 2 types of pectinates (fine- and coarse toothed ones), whereas we were unable to classify the pectinates with different number of teeth into distinct types; rather there seems to be a continuum of differently toothed forms from about 7 to 24 teeth. Posterior parapodia, which may have up to 40 pectinate chaetae showed the full range of forms within an individual fascicle (Figures 3A–D). Chaetae with a large number of teeth, exhibit fine shorter teeth than the coarser pectinate chaetae, and the distal part of the chaeta becomes broader, curled and more

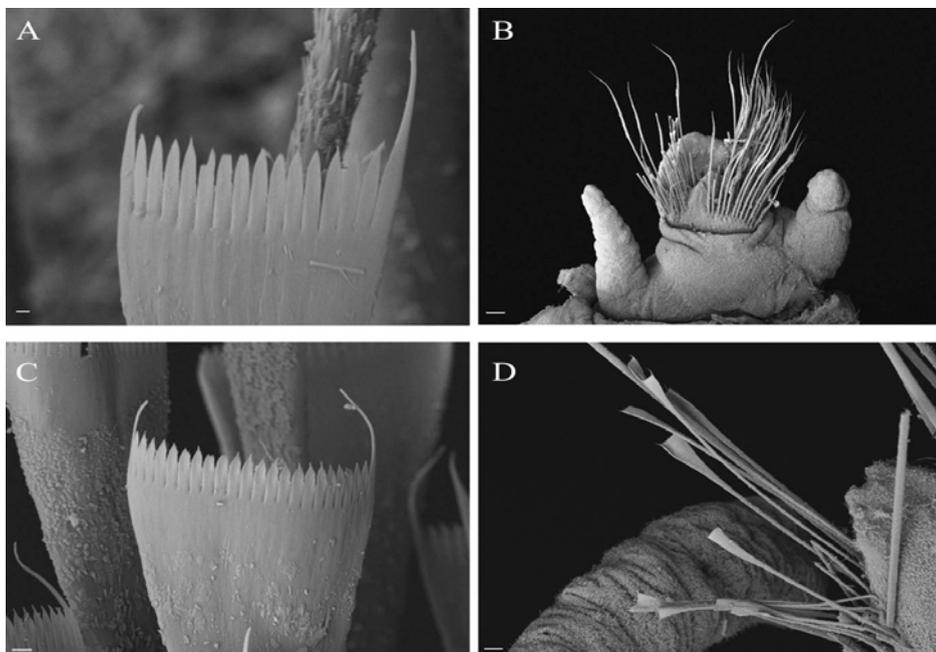


Figure 2. *Marphysa sanguinea* AM W36831 from type locality. SEM photos: **A.** Pectinate chaeta from chaetiger 10, scale 1 µm scale; **B.** Chaetiger 10, scale 100 µm; **C.** Pectinate chaetae from chaetiger 80, scale 2 µm; **D.** Pectinate chaetae from chaetiger 60, scale 20 µm. Photographs by Sue Lindsey.

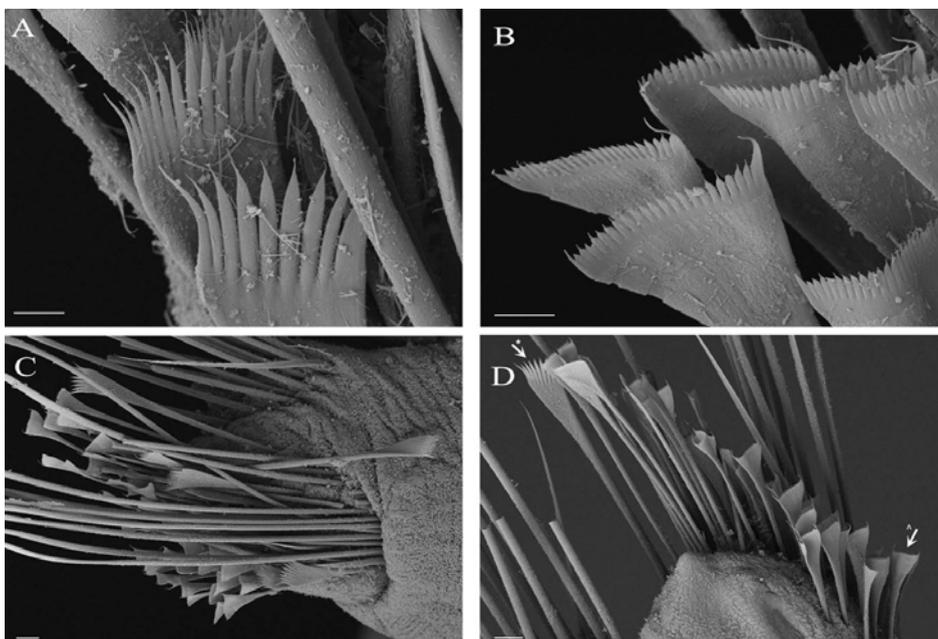


Figure 3. *Marphysa sanguinea* AM W36831 from type locality. SEM photos: **A.** Pectinate chaeta from parapodia from chaetiger 180, scale 10 µm scale; **B.** Close up same pectinate chaetae, scale 10 µm; **C.** Parapodia from chaetiger 180 illustrating large numbers of pectinate chaetae present, scale 30 µm. **D.** Close up of pectinate chaetae from chaetiger 180, * coarse pectinate 8.5-10 µm in width and ^ fine pectinate 15 µm in width, scale 20 µm. Photographs by Sue Lindsey.

asymmetrical (Figures 1D, F, 2C, 3B). Pectinates with the fewest, coarsest teeth are inserted deep within the chaetal fascicle and could be easily overlooked. Hutchings and Karageorgopolous (2003) did not count the pectinates of posterior parapodia, and they only report a tooth range of 14–17 for the neotype. Earlier descriptions of *M. sanguinea* did not indicate the considerable variation in the number of teeth of the pectinate chaetae along the body and they did not report the presence of any of the coarsely toothed pectinate chaetae. Finally, we also observed that the specimens from Devon, UK had chaetae that were more spinose than those of the Netherlands form. In particular, the basal part of the limbate chaetae and the shafts of the compound spinigers of the Devon specimens were finely spinose. Whereas these structures could also be seen on the Netherlands specimen, they were lying flat rather than being erect. However, this difference may reflect a difference in the preservation of the two specimens rather than a true intraspecific difference.

Discussion

This newly reported introduction of *Marphysa sanguinea* into Eastern Scheldt in the south-western part of the Netherlands (Wijnhoven and Dekker 2010) appears to have become established. Since *Marphysa* species appear to have broad feeding ecologies including omnivory (Fauchald and Jumars 1979), *M. sanguinea* may be impacting on the benthic ecology. So while many records of *M. sanguinea* are erroneous (Hutchings and Karageorgopoulos 2003) the possibility of human-assisted translocation of populations highlights the need for accurate identification, especially examination of chaetae all along the body of a mature worm preferably under the SEM. We hope this will encourage others to carefully examine their species of *Marphysa* including such detailed chaetal studies.

At this stage we are supporting Wijnhoven and Dekker (2010) who recorded this as a new record of *M. sanguinea* from the Netherlands, as this area is regularly sampled and has never previously been recorded from this location and they regarded it as an introduction possibly through shellfish transport. An alternative view is that the new record represents a range extension but further studies are required to

check if the species occurs all along the northern French coast and Belgium with the examination of material rather than relying on a published record such as George and Hartmann-Schröder (1985).

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References

- Amaral ACZ, Nallin SAH, Steiner TM (2006) Catálogo das espécies de Annelida Polychaeta do Brasil. Available at: http://www.ib.unicamp.br/projbiota/bentos_marinho/prod_cien/texto_poli.pdf (Accessed May 2011)
- Crossland C (1903) On the marine fauna of Zanzibar and British East Africa, from collections made by Cyril Crossland in the years 1901 and 1902.—Polychaeta. Part II. *Proceedings of the Zoological Society of London* 2: 129–144
- Endo N, Kan-No N, Nagahisa E (2007) Purification, characterization, and cDNA cloning of opine dehydrogenases from the polychaete rockworm *Marphysa sanguinea*. *Comparative Biochemistry and Physiology B—Biochemistry and Molecular Biology* 147(2): 293–307, <http://dx.doi.org/10.1016/j.cbpb.2007.01.018>
- Fauchald K (1987) Redescription of the genus *Nauphanta* Kinberg, 1865 (Polychaeta: Eunicidae). *Proceedings of the Biological Society of Washington* 100(2): 375–380
- Fauchald K (1991) A morphometric study of eunicid polychaetes from Belize, western Caribbean Sea. *Ophelia supplement* 5: 47–53
- Fauchald K, Jumars PA (1979). The diet of worms: a study of polychaete feeding guilds. *Annual Review of Oceanography and Marine Biology* 17: 193–284
- George JD, Hartmann-Schröder G (1985) Polychaetes: British Amphinomida, Spintherida and Eunicida, Synopses of the British Fauna no. 32. *The Linnean Society of London and the Estuarine and Brackish Water Association*, EJ Brill/Dr W Backhuys, London, 221 pp
- Glasby CJ, Hutchings PA (2010) A new species of *Marphysa* Quatrefages, 1865 (Polychaeta: Eunicida: Eunicidae) from northern Australia and a review of similar taxa from the Indo-west Pacific, including the genus *Nauphanta* Kinberg, 1865. *Zootaxa* 2352: 29–45
- Hayward PJ, Ryland JS (1995) *Handbook of the Marine Fauna of North-West Europe*. University Press, Oxford, 800 pp
- Hutchings PA, Karageorgopoulos P (2003) Designation of a neotype of *Marphysa sanguinea* (Montagu, 1813) and a description of a new species of *Marphysa* from eastern Australia. *Hydrobiologia* 496: 87–94, <http://dx.doi.org/10.1023/A:1026124310552>
- Lu H, Fauchald K (1998) *Marphysa belli* (Polychaeta: Eunicidae) and two related species, *Marphysa oculata* and *M. tospinata*, a new species, with notes on size-dependent features. *Proceedings of the Biological Society of Washington* 111(4): 829–842

- Kinberg JGH (1865) *Annulata nova. Öfversigt af Kongliga Vetenskaps-Akademiens Förhandlingar (Stockholm)* 21: 559–574
- Montagu G (1813) Descriptions of several new or rare animals, principally marine, found on the south coast of Devonshire. *Transactions of the Linnean Society of London* 11: 18–21, <http://dx.doi.org/10.1111/j.1096-3642.1813.tb00035.x>
- Pettibone MH (1963) Marine polychaete worms of the New England region. I. Aphroditidae through Trochochaetidae. *U.S. National Museum Bulletin* 227: 234–238
- Pardo EV, Amaral ACZ (2006) Foraging and mobility in three species of aciculate (Annelida: Polychaeta). *Brazilian Journal of Biology* 66: 1065–1072, <http://dx.doi.org/10.1590/S1519-69842006000600014>
- Quatrefages A de (1865) *Histoire naturelle des Années marins et d'eau douce*. Paris: Librairie Encyclopédique de Roret, pp 1–794
- Rouse GW, Fauchald K (1997) Cladistics and polychaetes. *Zoologica Scripta* 26: 139–204, <http://dx.doi.org/10.1111/j.1463-6409.1997.tb00412.x>
- Savigny JC (1818) Annelida. In: Lamarck, J.P. *Histoire Naturelle des animaux sans vertèbres, présentant les caractères généraux et particuliers de ces animaux, leur distribution, leurs classes, leurs familles, leurs genres, et la citation des principales espèces qui s'y rapportent; précédées d'une I*. Paris: Déterville Vol. 5, pp 1–612
- Treadwell AL (1936) Polychaetous annelids from Amoy, China. *Proceedings of the United States National Museum* 83(2984): 261–279, <http://dx.doi.org/10.5479/si.00963801.83-2984.261>
- Wijnhoven S, Dekker A (2010) Records of a new alien polychaete worm species, *Marphysa sanguinea* (Montagu, 1813) (Eunicidae) in the Eastern Scheldt, the Netherlands. *Aquatic Invasions* 5: 431–436, <http://dx.doi.org/10.3391/ai.2010.5.4.13>
- Winsnes IM (1989) Eunicid polychaetes (Annelida) from Scandinavian and adjacent waters. Family Eunicidae. *Zoologica Scripta* 18: 483–500, <http://dx.doi.org/10.1111/j.1463-6409.1989.tb00142.x>
- Yu H-Z, Zhu L-Y, Zheng J-S (2005) Development of sex gonad and reproduction cycle of *Marphysa sanguinea*. *Journal of Fishery Sciences of China* 12(6): 669–674
- Zanol J, Fauchald K, Paiva PC (2007) A phylogenetic analysis of the genus *Eunice* (Eunicidae, polychaete, Annelida). *Zoological Journal of the Linnean Society* 150: 413–434, <http://dx.doi.org/10.1111/j.1096-3642.2007.00302.x>