

***Decapauropus remyi* (Bagnall, 1935) (Myriapoda, Pauropoda),  
a worm-like pauropod from a sandy beach: first record from Scandinavia,  
neotype selection and redescription**

ULF SCHELLER<sup>1</sup> & ARNE FJELLBERG<sup>2</sup>

<sup>1</sup>Häggeboholm, Häggesled, 53194 Järpås, Sweden. E-mail: ulf.scheller@telia.com

<sup>2</sup>Mageröveien 168, 3145 Tjome, Norway. E-mail: arnecoll@gmail.com

**Abstract**

A species new to the Scandinavian fauna, *Decapauropus remyi* (Bagnall), is reported from Norway. The original description is amended and a neotype is designated.

**Key words:** Myriapoda, Pauropoda, *Decapauropus*, taxonomy, neotype

**Introduction**

In connection with studies of the Norwegian collembolans the second author has found several specimens of a pauropod species belonging to a shore fauna with adaptations for living in a sandy environment, *Decapauropus remyi* (Bagnall, 1935), a very characteristic species both by its living place and the shape of its pygidial setae *a*<sub>1</sub>. The species was originally described from Scotland. The type material appears to be lost.

**Order Tetramerocerata**

**Family Pauropodidae Lubbock, 1867**

**Genus *Decapauropus* Remy, 1931**

***Decapauropus remyi* (Bagnall, 1935)**

Figures 1–10

**Material examined.** Norway, Rogaland, 17 km NW Egersund, Ognastranda, sandy foreshore, in *Ammophila* tufts, N58,51171°, E5,79613°, 1 ad. 9(♀), 4 subad. 8 (♀), 3 juv. 6, 2 juv 5, 13 October 2009, sample 9.325, leg. A. Fjellberg. 10 specimens.

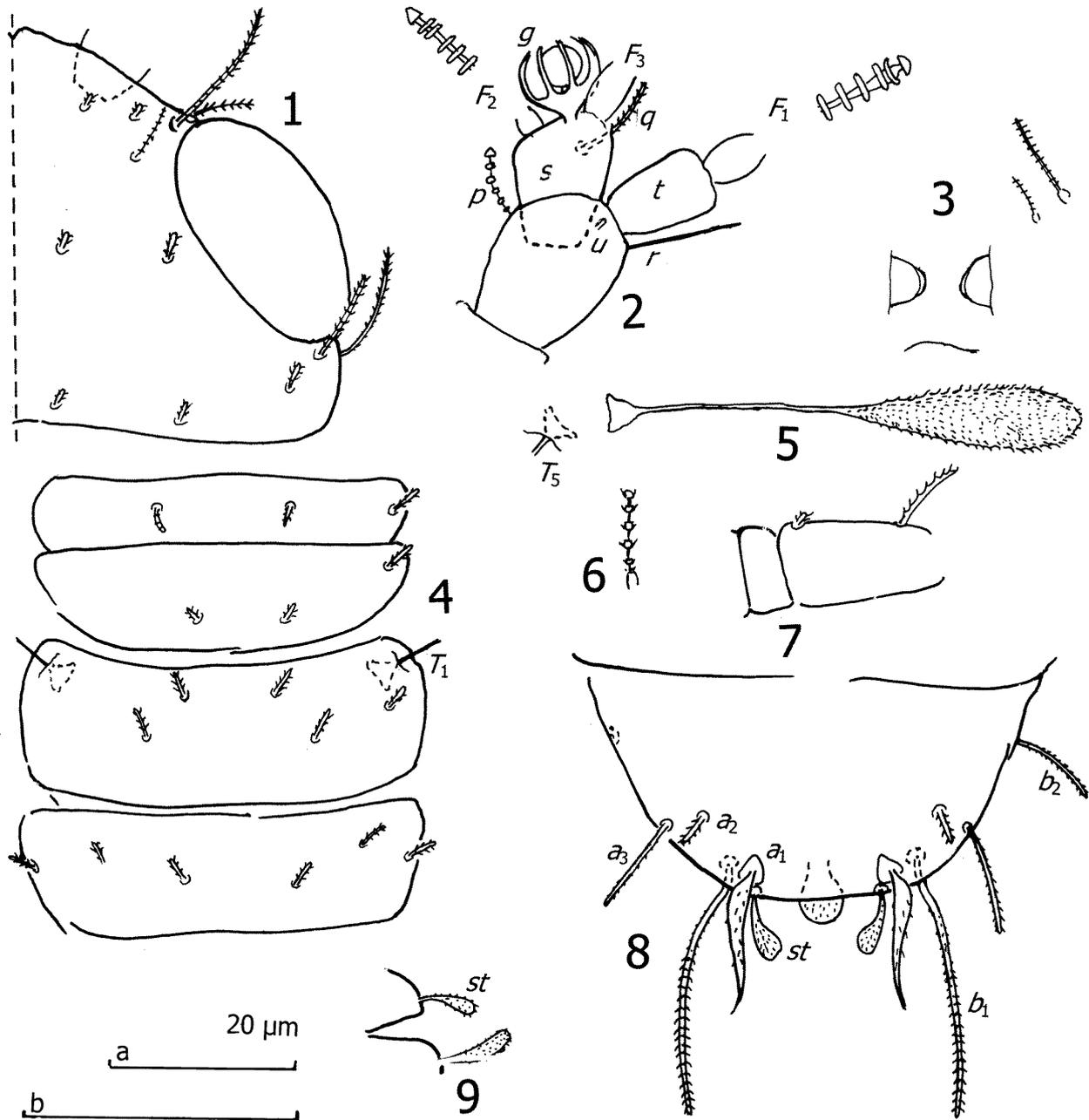
Bagnall's description is brief and incomplete. The material upon which the species was based has been searched for in vain in the Bagnall collections deposited in the Natural History Museum, London, the Oxford University Museum of Natural History, Oxford, and the Great North Museum, Hancock, Newcastle-upon-Tyne, all in Great Britain. The description is amended below and a neotype has been selected and deposited in the collections of the Zoological Museum, Lund, Sweden.

**Redescription** (by first author).

Neotype. Ad. 9(♀), chosen from the material reported above.

*Length.* 0.83 mm.

*Head* (Figure 1). Short broad; setae cylindrical pubescent-striate, inner tergal setae short blunt, lateral ones tapering, four transversal rows, relative lengths of setae, 1<sup>st</sup> row:  $a_1=a_2=10$ ; 2<sup>nd</sup> row:  $a_1=a_3=35$ ,  $a_2=75$ ; 3<sup>rd</sup> row:  $a_1=10$ ,  $a_2=15$ ; 4<sup>th</sup> row:  $a_1=10$ ,  $a_2=13$ ,  $a_3=15$ ,  $a_4=50$ ; lateral group setae,  $l_1=70$ ,  $l_2=45$ ,  $l_3=35$ . Ratio  $a_1/a_1-a_1$  in 1<sup>st</sup> row 0.4, 2<sup>nd</sup> and 4<sup>th</sup> rows 0.3, 3<sup>rd</sup> row 0.2. Temporal organs short, 0.8 of shortest interdistance, cuticle arched, pistil and pore not ascertained. Head cuticle glabrous.



**FIGURES 1–9.** *Decapauropus remyi* (Bagnall), neotype, ad.9 (♀). 1, head, median and right part, tergal view. 2, right antenna, tergal view. 3, collum segment, median and left part, sternal view. 4, tergites I–II. 5,  $T_5$ , 6, seta on coxa of leg 9. 7, tarsus of leg 9. 8, pygidium and posterior part of tergite VI, tergal view. 9, pygidium, posterior part, lateral view showing *st* and anal plate. Scale a:4; b: 1, 2, 3, 5, 6, 7, 8, 9.

*Antennae* (Figure 2). Setae cylindrical blunt, *p* annulate, *r* cylindrical, *u* rudimentary, their relative lengths:  $p=10$ ,  $p'=?$ , *u* rudimentary,  $r=15$ . Tergal seta *p* 0.8 of the length of tergal branch *t*, the latter short subcylindrical, 1.6 times as long as wide and 0.8 of the length of sternal branch *s*, that branch 1.3 times as long

as its greatest diameter, anterodistal corner more truncate than posterodistal one. Setae  $q$  striate, 0.7 of the length of  $s$ . Relative lengths of flagella (basal segments included) and basal segments:  $F_1=100$ ,  $bs_1=7$ ;  $F_2=35$ ,  $bs_2=5$ ;  $F_3=83$ ,  $bs_3=7$ . The  $F_1$  6.8 times as long as  $t$ ,  $F_2$  and  $F_3$  1.9 and 4.3 times as long as  $s$  respectively. Distal calyces flattened on  $F_1$  and  $F_3$ , conical on  $F_2$ , distal part of flagella axes somewhat widened below calyces on  $F_1$  and  $F_3$ , not at all on  $F_2$ . Globulus  $g$  spherical with thin stalk, 9 bracts, capsule spherical; width of  $g$  1.2 times as long as the greatest diameter of  $t$ . Antennae glabrous.

*Trunk* (Figures 3, 10). Body cylindrical with very short legs. Setae of collum segment (Figure 3) short cylindrical blunt striate; appendages small, directed inward, caps low, sternite process small, all parts glabrous.

*Tergites I and II* (Figure 4) divided transversally into pro- and metatergite. Setae on anterior tergites as setae on median part of tergal side of head; 4+4 setae on tergite I, 6+6 on II–V, 4+2 on VI. Submedian posterior setae on VI short clavate, distinctly pubescent, length 0.2 of their interdistance. Tergites glabrous.

*Bothriotricha* (Figure 5). Their relative lengths:  $T_1=100$ ,  $T_2=102$ ,  $T_3=83$ ,  $T_4=?$ ,  $T_5=113$ . Axes simple, all but  $T_3$  thin, the latter (Figure 5) with large clavate end-swelling, length 0.5 of the length of bothriotrix. Pubescence short erect on  $T_1$  and  $T_2$ , oblique on proximal part of  $T_5$ , erect distally; proximal half of  $T_3$  glabrous, swelling with short oblique hairs in irregular transversal rows.

*Legs* (Figures 6, 7). Legs 1 and 9 5-segmented, interposed pairs 6-segmented with short annulate metatarsi. Setae on coxa (Figure 6) and trochanter simple cylindrical annulate, distinctly pubescent. Tarsus of leg 9 (Figure 7) short tapering, 1.9 times as long as greatest diameter, proximal seta rudimentary, distal seta cylindrical blunt, with pubescence on upper side, underside glabrous, length of seta well 0.5 of the length of tarsus.

*Pygidium* (Figures 8, 9). *Tergum*. Posterior margin evenly rounded. Relative lengths of setae:  $a_1=10$ ,  $a_2=2$ ,  $a_3=8$ ,  $st=5$ ;  $a_1$  thickest in proximal half, tapering, somewhat S-shaped, with distinct but sparse oblique pubescence,  $a_2$  straight short cylindrical blunt, distinctly pubescent,  $a_3$  as  $a_2$  but longer and with indistinct pubescence;  $st$  clavate, shortly pubescent, curved downward and somewhat inward. Distance  $a_1-a_1$  as long as  $a_1$ ; distance  $a_1-a_2 \approx 3$  times longer than distance  $a_2-a_3$ ; distance  $st-st$  twice longer than  $st$  and almost as long as distance  $a_1-a_1$ . Cuticle glabrous.

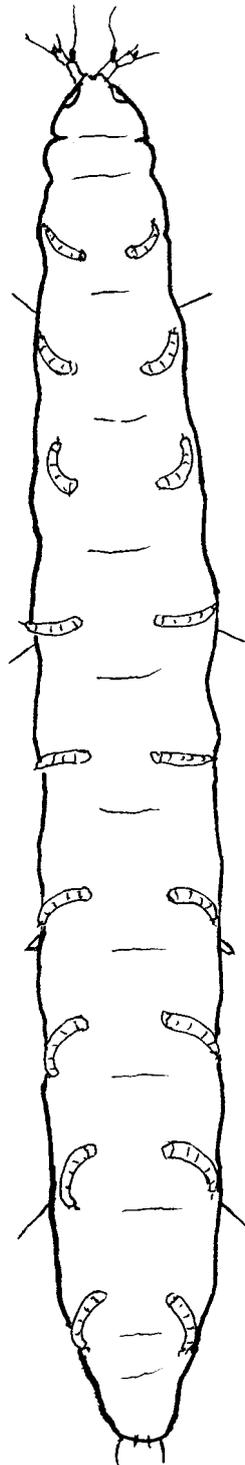
*Sternum*. Posterior margin indented. Relative lengths of setae (pygidial  $a_1=10$ ):  $b_1=18$ ,  $b_2=7$ . Setae thin cylindrical blunt, shortly pubescent;  $b_1$  1.5 times as long as interdistance,  $b_2$  0.7 of distance  $b_1-b_2$ .

*Anal plate* (Figures 8, 9) faintly pubescent, directed obliquely upward, linguiform, narrowest anteriorly, 1.6 times as long as broad, posterior margin evenly rounded. Sternal side may have two very short appendages marked as black spot in figure 9.

**Distribution.** The species was discovered by Bagnall in 1934, in the Forth area in Scotland, at Dalmeny Estate, near Cramond (Bagnall 1935a), and the following year also collected at South Queensferry (Bagnall 1935b). It was briefly described under the name *Thalassophilus remyi* (1935a). In the paper about the Queensferry material (1935b) Bagnall also mentioned that Remy had found the species at a French locality in Roussillon, Banyuls-sur-mer, later confirmed by Remy (1938) who also moved it to the genus *Decapauropus*. Remy described incompletely (1954) a juvenile Algerian specimen too, from between Bou Zadjar and Cape Falcon, under the name of *A. cf. remyi*.

**Taxonomical remarks.** The specimens collected from Scotland and Roussillon seem to be conspecific but there are reasons to suspect that the Algerian material belongs to another species because at least its pygidial setae and the pubescence of the anal plate are different.

**Habitat.** The specimens reported above from a beach were collected in the upper 10 cm of sandy soil in *Ammophila* tufts. Bagnall's sites were probably similar because he says that *D. remyi* was halophilous (1935a) and that it occurred "under stones well embedded in sand at from just below to considerably below high-water mark" (1935b). In the later paper, some accompanying microarthropods were mentioned: *Allopauropus littoralis* Bagnall (incompletely described) and the collembolans *Anuridella submarina* Bagnall and *Onychiurus* spp. In tidal refuse at high-water mark it was accompanied by *Allopauropus danicus* Hansen and *A. littoralis*.



**FIGURE 10.** *Decapauropus remyi* (Bagnall), neotype, ad. 9 (♀, 0.83 mm), fully extended animal, ventral view (somewhat simplified, trunk slightly compressed).

About a tenth of Pauropoda species have been collected in the soils of sandy beaches, some in the upper strata, others close to the ground water surface. Most of them have wide distributions in other biotopes and do not show special adaptations for living in unstable soils, but in two cases the colonization of sand beaches seems to have led to the development of anatomical and functional adaptations. One is the species reported above, *Decapauropus remyi*, and the other is *Amphipauropus rhenanus* (Hüther, 1971). Like *D. remyi* the latter species seems to have a wide distribution, but it has rarely been collected and up to now is known only

from Germany, Denmark, Norway, Sweden and Iceland (Andersson et al 2008, Hüther 1971, Scheller 1998, Scheller 2005, Scheller et al. 2006), and maybe also from France (?*Brachypauropoides moselleus* (Remy, 1960)).

*Decapauropus remyi* and *Amphipauropus rhenanus* are alike with worm-like, cylindrical, not fusiform, bodies, which are also weakly sclerotized, and with shortened antennal branches, bothriotricha and legs. According to observations on live specimens made by the second author, *A. remyi* moves very slowly. In general pauropods are swift runners adapted for life in soils with a stable system of pores and canals, and are rarely collected in sandy soils. These two species, however, seem to have developed adaptations for life in looser soils such as those on sandy shores, including cylindrical bodies and shortened trunk appendages. *Amphipauropus* has been reported from three continents in the northern hemisphere, in Europe (see above), in North America from Canada (Scheller, 1984) and in Asia from Japan (Hagino 2002, 2003). The wide distribution of *Decapauropus remyi* and *Amphipauropus* may point to the occurrence of a fauna of miniaturized specialized pauropods adapted to the structures and dimensions of sandy soil. This fauna probably has reduced potential for dispersal, maybe also for speciation. Unfortunately it has been neglected in most studies of the shore fauna.

## References

- Andersson, G., Djursvoll, P. & Scheller, U. (2008) Katalog över Nordens mångfotingar. *Entomologisk Tidskrift*, 129, 173–190.
- Bagnall, R.S. (1935a) On *Thalassopauropus remyi* gen. et sp. n., an halophilous pauropod, and the genus *Decapauropus* Remy. *The Scottish Naturalist*, 1935, 79–82.
- Bagnall, R.S. (1935b) Our shore-dwelling pauropods. *The Scottish Naturalist*, 1935, 143–145.
- Hagino, Y. (2002) Pauropoda. (In Japanese.) Pp. 159–172 in: Ishii, K. & K. Furuno (eds), Soil animals of Tochigi Prefecture. A comprehensive Investigation into Tochigi Prefecture's Natural Environment. Research Report of the Ibaraki Nature Museum. Report of the general research of nature in Tochigi Prefecture.
- Hagino, Y. (2003) Pauropoda (In Japanese). Pp 64–65 in: Maehara, T., Hagiwara, Y., Ishii, K., Ryosaku, I., Kurozumi, T., Sakayori, H., Suganami, Y., Tamura, H., Chinone, S., Nakamura, O., Naomi, S., Nunomura, N., Hagino, Y., Miyata, T. & S. Ishibashi. Soil animals from Rishiri Island, Northern Hokkaido. *Rishiri Studies*, 22, 55–72.
- Hüther, W. (1971) Zwei interessante Pauropoden aus dem Oberrheingebiet. *Mitteilungen der Pollichia*, (3)18(132), 170–177.
- Remy, P.A. (1938) Pauropodes de France, d'Allemagne et des Balkans, avec description de quatre formes nouvelles. *Bulletin Société d'Histoire naturelle de la Moselle*, 35, 153–178.
- Remy, P.A. (1954) Pauropodes de la zone subterrestre du littoral Méditerranéen. *Vie et Milieu*, 1953, 4(1), 122–125.
- Remy, P.A. (1960) Symphyles et Pauropodes des alluvions de rivières lorraines. *Bulletin de la Société des Sciences de Nancy*, (n.S.)19, 9–18
- Scheller, U. (1984) Pauropoda (Myriapoda) from Canada. *Canadian Journal of Zoology*, Ottawa, 62(10), 2074–2091.
- Scheller, U. (1998) The Pauropoda of Norway. *Fauna norvegica*, Ser. B, 45, 1–10.
- Scheller, U. (2005) Strandfåfoting, pp. 297, 298. *Nationalnyckeln till Sveriges flora och fauna*. Mångfotingar. Myriapoda. ArtDatabanken, SLU, Uppsala.
- Scheller, U., Fjellberg, A. & Olafsson, E. (2006) New records of Myriapoda (Arthropoda) from Iceland and the Faroe Islands. *Entomologiske Meddelelser*, Copenhagen, 74, 87–89.