PAUROPODA FROM THE AZORES AND MADEIRA[1]

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With 5 figures

INTRODUCTION

In 1957 a Lund University Expedition, composed of Dr. and Mrs. Per Brinck and Dr. and Mrs. Erik Dahl, brought together a collection of Pauropoda from the Azores and Madeira. On the main island of Madeira they found 16 specimens at 6 localities and on the Azorean island Flores they collected 2 specimens at one locality.

I am indebted to Drs. Brinck and Dahl for their permission to examine the material which is dealt with below.

Material Examined

Family *Pauropidae*

1. *Allopauropus alicundus* n. sp.

Fig. 1

Madeira: Terreiro da Luta, 850 m a.s., at the stream, in ravine under stone, 1 ad. 9[3] (♀), 20.IV., (Loc. 112). Type No. 190 in the Zoological Museum of the Lund University.

Length. — 0.4 mm.

Head. — Dorsal surface of head not suitable for study.

Antennae. — The two antennal branches subequal in length. Upper

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3) Abbreviation: ad. ..., an adult specimen with the number of pairs of legs indicated.

branch, *t*, cylindrical, somewhat tapering towards proximal end, 2.5 times as long as broad and equal to the longest seta of 4th antennal branch, *p*. The length of this branch equal to 0.3 of its flagellum, F_1. Lower branch, *s*, widening from the base outwards, 1.9 times as long as broad, 1.5 times

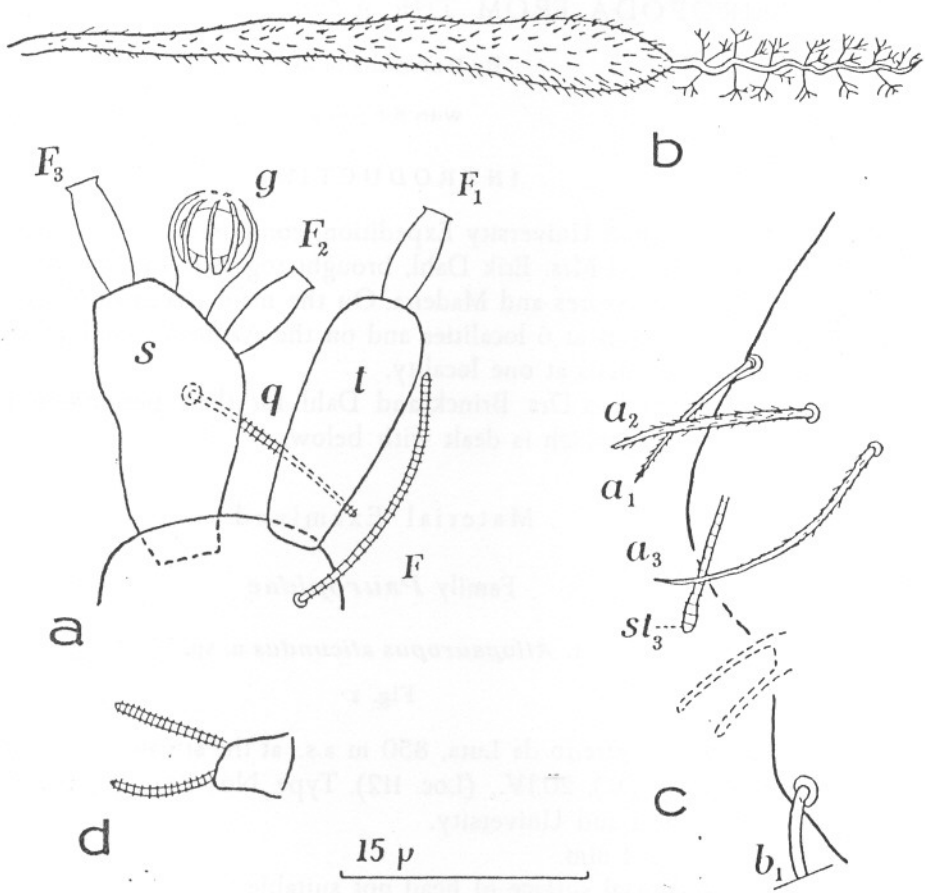

Fig. 1.—*Allopauropus alicundus* n. sp. — *a*, left antenna, from above. — *b*, T_3. — *c*, pygidium, lateral view. — *d*, anal plate.

as long as its seta, *q*, and 0.4 of its anterior flagellum, F_2. This flagellum slightly shorter than the posterior one, F_3. The latter scarcely 0.9 of the length of F_1. Diameter of globulus, *g*, nearly 0.9 of diameter of *t*.

Trunk. — First pair of tactile setae, T_1, not studied. T_2 thin, with a

uniform oblique conspicuous pubescence. T_3 with its base thin, from thence it thickens gradually and rather strongly outwards to the end of the two thirds of the seta, so that this part of the seta becomes club-shaped. Distal third thin with a fairly sparse pubescence comprising of perpendicularly outstanding ramose hairs. T_4 equal to T_2. T_5 very long with a delicate pubescence.

Pygidium. — Tergum. The three pairs of setae, the submedian, a_1, the intermediate, a_2, and the lateral, a_3, are all covered with a fine pubescence; a_1 and a_2 cylindrical throughout, a_3 tapering towards its distal end. a_1 is 1.2 times as long as the distance between them, as long as a_2 and nearly 0.5 of the lengh of a_3. Styli, *st*, cylindrical, setiform, with a small club-shaped end-swelling.

Sternum. The setae of the sternum have not been studied. Anal plate almost square; from its hind margin two cylindrical, setiform, diverging appendages project backwards. They are nearly straight, almost twice as long as the anal plate.

Affinities. — The description given above is not complete as the dorsal side of the head, the legs and partly the pygidium were damaged and cannot be examined carefully. This very small species has the third pair of tactile setae nearly identical with those of *adjacens* Remy from South Africa and they show a high degree of similarity with those of *brasiliensis* Remy from Brazil and resembles in some respects e. g. *furcula* Silvestri from Europe and *grahami* Remy from South Africa. Concerning the anal plate *alicundus* is not very distant from the European *condei* Remy and *furcosus* Remy from Mauritius, perhaps also the widely distributed *gracilis* (Hansen) and the North American *mucronatus* Remy. The resemblances between *alicundus* and the species mentioned above are confined to very few characters so its proper classification must wait until more material is available.

2. *Allopauropus (Decapauropus) aristatus* Remy

Madeira: Funchal, Ribeiro Seco, in ravine under stone close to a damp rock shelter, 1 ad. 9 (♀), 19.IV., (Loc. 111).

A. aristatus is known from Europe, North and West Africa, Madagascar and North America.

3. ***Allopauropus (D.) brincki*** n.sp.

Fig. 2

Madeira: Casa das Queimadas, 880 m a. s., in ravine under stone, 1 ad. 9 (♀), 24.IV., (Loc. 122). Type No. 191 in the Zoological Museum of the Lund University.

Length. — 0.42 mm.

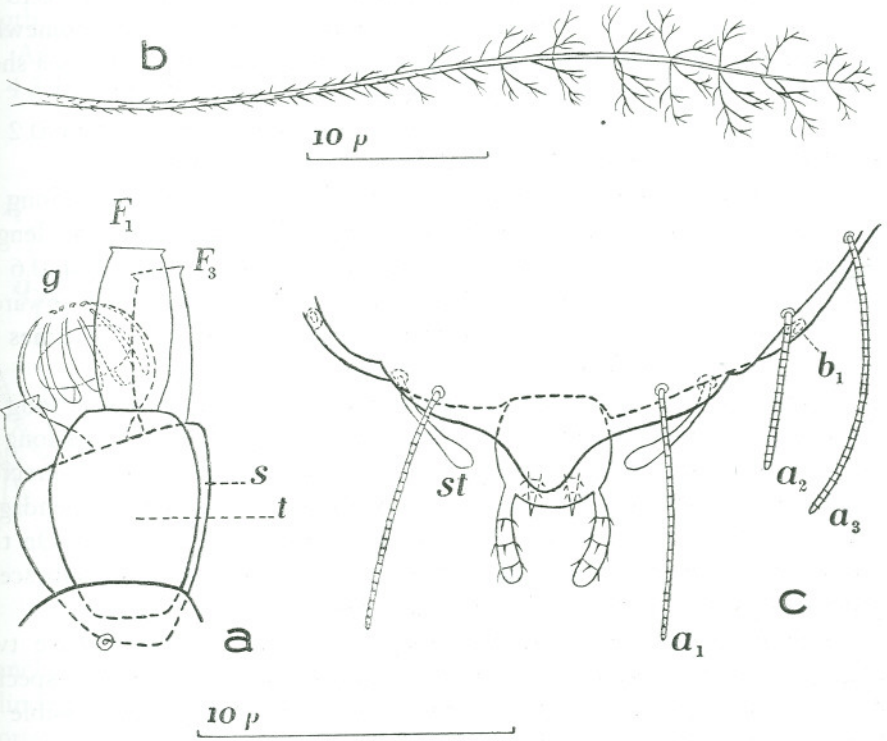

Fig 2.—*Allopauropus (D.) brincki* n. sp. — *a*, right antenna, from above. — *b*, T_3. — *c*, pygidium, from above.

Head. — Distance between temporal organs 3 times as long as their length.

Antennae. — Antennal branches subequal in length. Upper branch, *t*, short, cylindrical, tapering towards proximal end, 1.3 times as long as broad but shorter than *p*, its length equal to 0.17 of F_1. Lower branch, *s*,

strongly widening from the base outwards, only very little longer than broad, its length equal to 0.5 of F_2. This flagellum 0.4 of F_3. The latter 0.8 of the length of F_1. Diameter of globulus, *q*, 0.9 of diameter of *t*.

Trunk. — T_1, T_2 and T_3 of the same shape, the latter 1.1 times as long as the former. Their proximal parts thin and set with short, straight, simple hairs getting longer outwards. This part of the tactile setae changes slowly into the distal part which has ramose and considerably longer hairs all arranged in distinct whorls. Greatest diameter of distal part of T_3 0.15 of the total length of this organ. T_4 as the preceding seta but somewhat thinner. T_5 a little more than 1.1 times as long as T_3 and T_4. It has a short simple pubescence equal to that of the proximal part of T_1 - T_4.

Proximal seta of tarsus of last pair of legs a little more than 0.2 of the length of the joint and 0.6 of the length of the distal seta.

Pygidium. - Tergum. All setae cylindrical. a_1 are 1.1 times as long as the distance between them, 1.6 times as long as a_2 and 0.9 of the length of a_3. Distance a_1 - a_2 1.5 times as long as distance a_2 - a_3 and 0.6 of distance a_1 - a_1. *St* glabrous, feebly clavate and strongly bent inwards; their length is 0.4 of distance between them. The latter is 1.4 times as long as the distance a_1 - a_1.

Sternum. All setae cylindrical. Posterior setae, b_1, 1.7 times as long as the distance between them. Lateral setae, b_2, a little curved and as long as a_1. Anal plate nearly circular with two caudo-lateral, backwardly directed appendages which are nearly as long as the plate itself. These appendages are strongly clavate, sparsely pubescent and bent inwards a little. On the outer part of the ventral side of the plate two small, conical, pubescent processes project downwards and backwards.

Affinities. — There are several *Allopauropus* species which have two large posteriorly projecting appendages from the anal plate, but the species described above is not identical with any of them. Nor is it possible to use the structure of the antennae and the tactile setae or the chaetotaxy of the pygidium to connect it to any particular species.

4. ***Allopauropus (D.) cuenoti*** Remy

Madeira: Funchal, Ribeiro Seco, in ravine under stone at a damp rock, 1 ad. 9 (♀), 19.IV., (Loc. 111).

A. cuenoti is known from Europe, North Africa, Réunion and North America.

5. ***Allopauropus (D.) dahli*** n. sp.

Fig. 3

Madeira: Casa das Queimadas, 880 m a.s., in ravine under stone, 1 ad. 9 (♀), 24.IV., (Loc. 122). Type No. 192 in the Zoological Museum of the Lund University.

Length. — 0.41 mm.

Head. — Distance between temporal organs 1.5 times as long as their length.

Antennae. — Longest seta of 4th antennal segment, *p*, twice as long as *p'*, 4 3 times as long as *p''* and 2.3 times as long as *r*. The two antennal

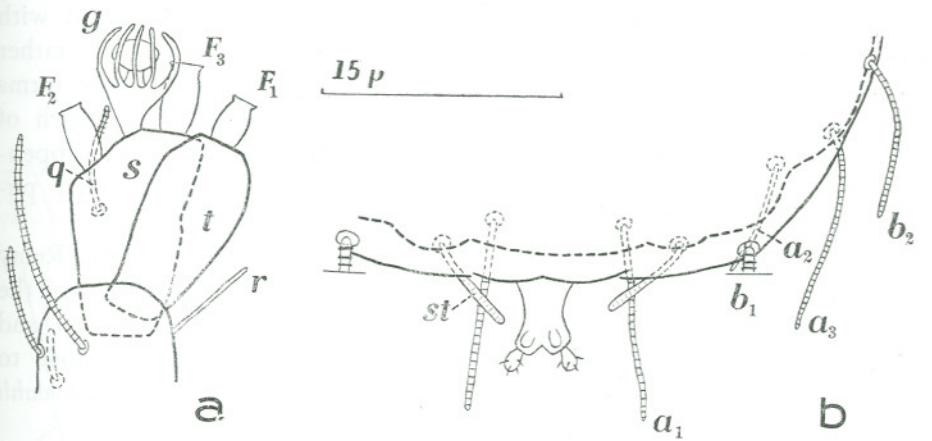

Fig. 3.—*Allopauropus (D.) dahli* n. sp. — *a*, right antenna, from above. — *b*, pygidium, from below.

branches subequal in length. Upper branch, *t*, twice as long as broad, nearly cylindrical with broadest part one third from its distal end. It is a little shorter than 0.9 of *p* and 0.25 of its flagellum F_1. Lower branch, *s*, somewhat more than 1.8 times as long as broad, 1.7 times as long as *q* and equal to 0.6 of F_2. This flagellum is a little shorter than 0.6 of F_3 and the latter is 0.8 of F_1. Diameter of globulus, *g*, 0.8 of diameter of *t*.

Trunk. — T_1-T_3 as in *brincki* but longer. T_4 as long as T_3 but differs from it by having hairs without ramification. These hairs are rather short and depressed on the proximal half but longer and, though irregularly, more outstanding on the distal half. T_5 long with a simple but rather conspicuous pubescence. It is 1.3 times as long as T_3 and T_4.

Proximal seta of tarsus of last pair of legs about 0.1 of the length of the joint and 0.6 of the length of the distal seta.

Pygidium.—Tergum. All setae cylindrical. a_1 1.5 times as long as the distance between them, 1.7 times as long as a_2 and 0.9 of the length of a_3. Distance a_1-a_2 2.7 times as long as distance a_2-a_3 and 1.25 times as long as distance a_1-a_1. *St* nearly glabrous, only very delicately transversely striated, cylindrical and bent inwards; their length is 0.4 of distance between them. The latter is 1.9 times as long as distance a_1-a_1.

Sternum. Setae cylindrical. Posterior setae, b_1, with a delicate pubescence on their distal half; they are as long as the distance between them. Lateral setae, b_2, with their distal two thirds bent inwards; their lengths being 0.8 of the length of a_1. Anal plate 1.5 times as long as broad with lateral margins emarginate and posterior margin cleft by a median, rather broad, triangular incision so that the hindmost part of the plate forms two obliquely backwards and outwards directed broad processes, each of them bearing an almost ovoid appendage on its ventral side. These appendages protrude in a downward-outward-backward direction and their pubescence consists of a few hairs all standing straight out.

Affinities.—This species has a certain resemblance to *perexiguus* Remy from Réunion but is distinguished from it especially by the absence of the terminal bulb of T_3, the glabrous anal plate, the form of the styli and some more features of the pygidium. The Réunion species is close to *rhopalophorus* Remy from Algeria. As for the form of the anal plate *dahli* also shows affinity with *macrosphaerus* from Morocco.

6. ***Allopauropus (D.) gracilis*** (Hansen) var. ***sabaudianus*** Remy

Madeira: Terreiro da Luta, 850 m a.s., at stream, in ravine under stone, 1 ad. 9 (♀), 20.IV., (Loc. 112).

A. gracilis s. lat. is know from Europe, North Africa, Madeira (f. *typica*), Réunion and North America.

7. ***Allopauropus (D.) laurinus*** n. sp.

Fig. 4

Madeira: Ravine near Ribeira das Cales, 1200 m a. s., bay forest, 2 ad. 10 (♀♀), 24.IV., (Loc. 127); 1 km E of Encumeada, ca. 800 m a. s., 1 ad. 9 (♀), 28.IV., (Loc. 135). 1 ad. 10 ♀ from Loc. No. 127 is holotype No. 193 in the Zoological Museum of the Lund University.

Holotype. — One of the specimens from Ribeira das Cales.

Length. — 0.47 mm.

Head. — Distance between temporal organs 1.6 times as long as their length.

Antennae. — Longest seta of 4th antennal segment, *p*, at least 1.6 times as long as *p'* and 2.7 times as long as *p''*. The two antennal branches are subequal in length. Upper branch, *t*, cylindrical, nearly 1.7 times as long as broad. It is a little shorter than 0.6 of *p* and 0.2 of its flagellum F_1.

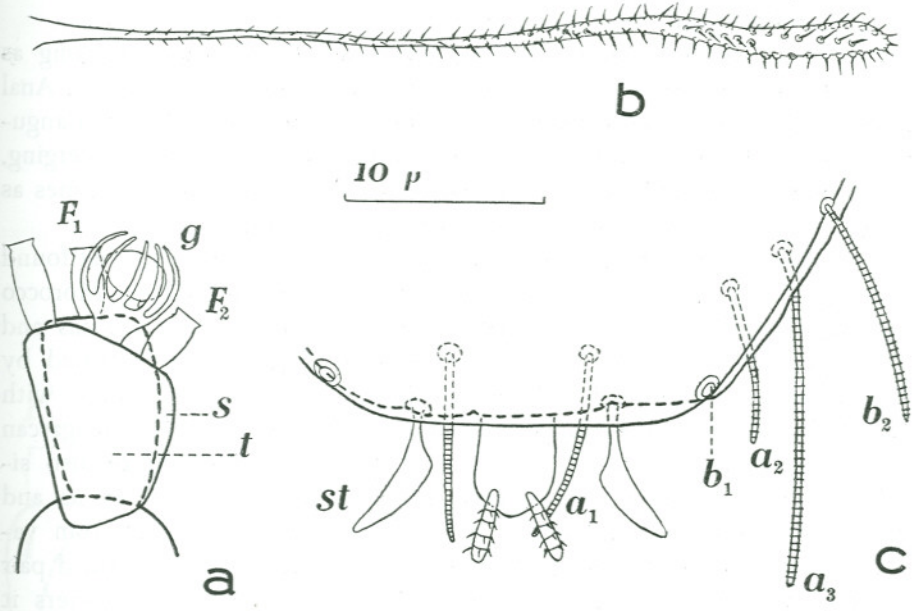

Fig. 4.—*Allopauropus (D.) laurinus* n. sp. — *a*, right antenna, from below. — *b*, T_3. — *c*, pygidium, from below.

Lower branch, *s*, somewhat more than 1.4 times as long as broad, 0.6 of the length of *q* and equal to 0.5 of F_2. The length of this flagellum is 0.5 of F_3 and the latter 0.8 of F_1. Diameter of globulus, *g*, 0.9 of diameter of *t*.

Trunk. — T_1 - T_5 with proximal part almost glabrous and for the rest pubescent, with moderately long and simple hairs. All of them, except T_3, with thin, tapering axes. The axis of T_3 with gradually increasing width towards distal end and set with a fairly sparse but conspicuous pubescence of simple hairs. On the most distal part they are arranged in a few

rows lengthways. T_5 a little longer than T_4 and 1.6 times as long as T_3.

Proximal seta of tarsus of last pair of legs about 0.25 of the length of the joint and nearly 1.2 times as long as the distal seta.

Pygidium.—Tergum. All setae except styli cylindrical. a_1 is 1.4 times as long as the distance between them, 1.2 times as long as a_2 and nearly 0.6 of the length of a_3. Distance a_1-a_2 2.7 times as long as distance a_2-a_3 and 1.1 times as long as distance a_1-a_1. *St* of the form of extendedly triangular blades attached to the tergum by means of short thin stalks. Their length is 0.6 of the distance between them. The latter is 1.4 times as long as the distance a_1-a_1.

Sternum. Setae cylindrical. Posterior setae, b_1, 1.1 times as long as distance between them. Lateral setae, b_2, 1.3 times as long as a_1. Anal plate subrectangular with posterior margin extending into a broad triangular process. From its postero-ventral border two somewhat diverging, subcylindrical and pubescent appendages arise. The plate is 1.25 times as long as broad and 1.3 times as long as its appendages.

Affinities.—The anal plate is to a certain degree similar to that found in several other species, e. g. *zaianus*, *kocheri* and *presbyteri* from Morocco and Algeria, *socius* from the Ivory Coast, *exul*, *lambertoni*, *malgasus* and *nemoralis* from Madagascar and *usingeri* from California, all described by Remy. With regard to the styli it is also impossible to connect it with any distinct species. They are very similar to those in Remy's Madagascan *vicinus* and North African *pistillifer* and to some extent there are also similarities to his European *latistylus* and the two species *scoparius* and *vicarius* from Madagascar. There is also a long series of species from various parts of the world which have the same structure of the third pair of tactile setae as *laurinus*. However, by the combination of characters it is easy to distinguish it from all other species.

8. *Allopauropus (D.) millotianus* Leclerc

Madeira: Terreiro da Luta, 850 m a.s., at the stream, in ravine under stone, 2 ad. 9 (♀♀), 1 ad. 8 (♀), 20.IV., (Loc. 112).

A. millotianus is known from Corsica and Réunion only.

9. *Allopauropus (D.) ramosus* n. sp.

Fig. 5

Azores: Flores, Ribeira d'Além da Fazenda, under stone on a shady

steep, 2 ad. 9 (♀♀), 14.IV., (Loc. 108). Holotype (1 ad. 9 ♀) is No. 194 in the collections of the Zoological Museum of the Lund University.

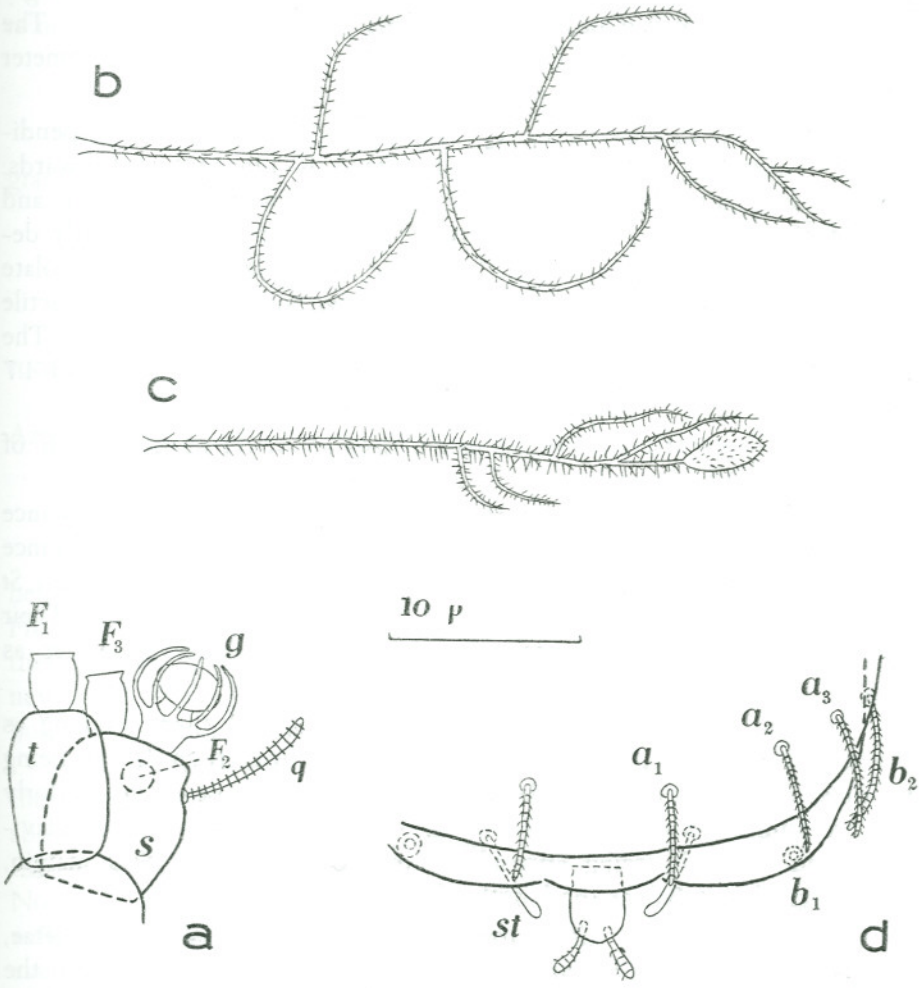

Fig. 5.—*Allopauropus (D.) ramosus* n. sp. — *a*, left antenna, from behind. — *b*, T_2. — *c*, T_3. — *d*, pygidium, from above.

Length. — 0.40 mm.

Head. — Distance between temporal organs 1.5 times as long as their length.

Antennae. — Antennal branches equal in lengrh. Upper branch, *t*, short, cylindrical, 1.5 times as long as broad and shorter than *p*. Its length equal to 0.2 of F_1. Lower branch, *s*, only very little longer than broad. Its length is a little shorter than *q* and 0.5 of F_2. This flagellum is 0.4 of F_3. The latter is 0.9 of the length of F_1. Globulus, *g*, shortstalked, its diameter being 0.6 of diameter of *t*.

Trunk. — T_1-T_4 ramose. T_1, T_2 and T_4 with their branches perpendicularly outstanding and with the distal parts of the branches bent inwards, towards the axis of the seta. Proximal half of T_3 without branches and distal half with a few proximally outwards directed and distally fairly depressed branches. The central axis bears apically a flat, broadly lanceolate bulb about twice as long as broad. T_5 simple without branches. All tactile setae with a vertical pubescence, most conspicuously on T_3 and T_5. The latter more than twice as long as T_1 and T_3, twice as long as T_4 and 1.7 times as long as T_2.

Proximal seta of tarsus of last pair of legs about 0.1 of the length of the joint and 0.7 of the length of the distal seta.

Pygidium. — Tergum. All setae cylindrical. a_1 is 0.7 of the distance between them, 0.9 of the length of a_2 and 0.8 of the length of a_3. Distance a_1-a_2 2.2 times as long as distance a_2-a_3 and 0.9 of distance a_1-a_1. *St* bent inwards, cylindrical and glabrous with small end-swellings. Their length is nearly 0.5 of distance between them. The latter 1.5 times as long as distance a_1-a_1.

Sternum. Setae cylindrical. Posterior setae, b_1, 1.4 times as long as distance b_1-b_1. Lateral setae, b_2, strongly bent inwards, their length being 1.4 times as long as a_1. Anal plate 1.4 times as long as broad, posteriorly broadly rounded without lateral angles. Two slender, striated and claviform, somewhat diverging appendages originate from its hind margin, their length being 0.8 of the length of the plate.

Affinities. — Several *Allopauropus* species have ramose tactile setae, especially some from Madagascar and the African continent. As to the structure of the third pair of tactile setae *ramosus* is not very distant from *tenuis* Remy which is known from various parts of the African continent, from Madagascar, Mauritius, Australia and South America. In this respect there are resemblances to *barbarus* Remy and *bouini* Remy too. The former is North African, the latter West African and North American. Considering the anal plate and the styli *ramosus* must be placed in the imme-

diate vicinity of *lambertoni* Remy from Madagascar, but the general structure of these organs in the species mentioned above appear in various parts of the world in a great many species, so also in this respect there is no possibility to connect *ramosus* with any particular species.

10. *Allopauropus (D.) subminutus* Remy

Madeira: Serra de Água, Powerstation, 600 m a.s., under stone on grassy ground, 1 ad. 9 (♀), 23.IV., (Loc. 120).

A. subminutus is known from Europe and North Africa.

11. *Allopauropus (D.) vulgaris* (Hansen)

Madeira: Funchal, Ribeiro Seco, in ravine under stone at a damp rock, 1 ad. 9 (♀), 19.IV., (Loc. 111).

A. vulgaris is known from Europe, North Africa, São Miguel in the Azores, Madagascar, Réunion and North America.

DISCUSSION

The collection listed above comprises 11 species, without exception belonging to the widespread genus *Allopauropus*. Five of them are new. From the Madeiran localities, 5 in number, Dr. Brinck and Dr. Dahl gathered 16 specimens comprising no less than 10 species, 4 of which are new. The Azorean material only amounts to two specimens which, however, constitute a new species.

The two Madeiran localities Ribeiro Seco and Terreiro da Luta together were inhabited by 5 of the previously known species reported above, viz. *aristatus, cuenoti, graecilis, millotianus* and *vulgaris*. The former three and the latter are very widely distributed: Europe, North America, North Africa and Madagascar and/or Réunion, whereas the fifth species, *millotianus*, was unknown outside Corsica and Réunion. It is evident, however, that all the species, already known to be distributed outside the Azores and Madeira, are very widespread.

According to information by letter from Dr. P. Remy, who has recently examined another collection of Pauropoda from these islands (Soc. Sci. Nancy, Bull., 1961, in press), their pauropod fauna is very closely related to that of Europe and North Africa. His list of species comprises subcosmopolites only: 4 from São Miguel in the Azorean group, *viz. Stylo-*

pauropus (*S.*) *brito* Remy, *Allopauropus* (*D.*) *helveticus* (Hansen) var. *obtusicornis* Remy, *A.* (*D.*) *vulgaris* (Hansen) and *Polypauropus duboscqui* Remy var. *inflasetus* Remy, and finally from the main island of Madeira. *A.* (*D.*) *gracilis* (Hansen) *f. typica*. Since these species as well as 4 more species from Dr. Brinck's and Dr. Dahl's collections were recorded from Europe and North Africa, this type of distribution is fairly well represented. The species have presumably spread from these areas to the actual islands. So it seems that the pauropod fauna of these islands contain a high number of cosmopolites and subcosmopolites, this also on account of the fact that there are very few spots which are not heavily influenced by human action.

As seen above we now know 10 species in all from Madeira, and 5 from the Azores, 6 respectively 4 of which are widely distributed outside the islands.

The high proportion of subcosmopolites in the two collections might indicate that the new species described above, or at least some of them, are more or or less widespread. Consequently, it is possible that one or more of them may be discovered on the Iberian peninsula when its pauropod fauna is studied. Though the Pauropoda are fairly well known in North Africa, thanks to papers especially by Remy, it is not unlikely that at least some of the new species also may occur in that area. On the other hand there are reasons which indicate true endemism, as the new species *A. brincki*, *dahli*, *laurinus* and *ramosus* were not found together with the subcosmopolites mentioned above. In Dr. Brinck's and Dr. Dahl's collection the latter widespread species, with one exception, were all from Ribeiro Seco and Terreiro da Luta. According to Dr. Brinck these two localities are greatly affected by man, especially the former. The new species were found together with the subcosmopolites in one case only namely at Terreiro da Luta, where *alicundus* occurs together with *gracilis* var. *sabaudianus* and *millotianus*.

The North African Pauropoda are mainly of Palearctic origin, but there are some related to the pauropod fauna of the Ethiopian region. The latter is poorly known and it might be that some of the new species have their close relatives south of the Palearctic area. But we need much more material from the islands in question and from south-western Europe, before we can form an idea of the extent of the influence of the Palearctic and the Ethiopian faunas respectively.