

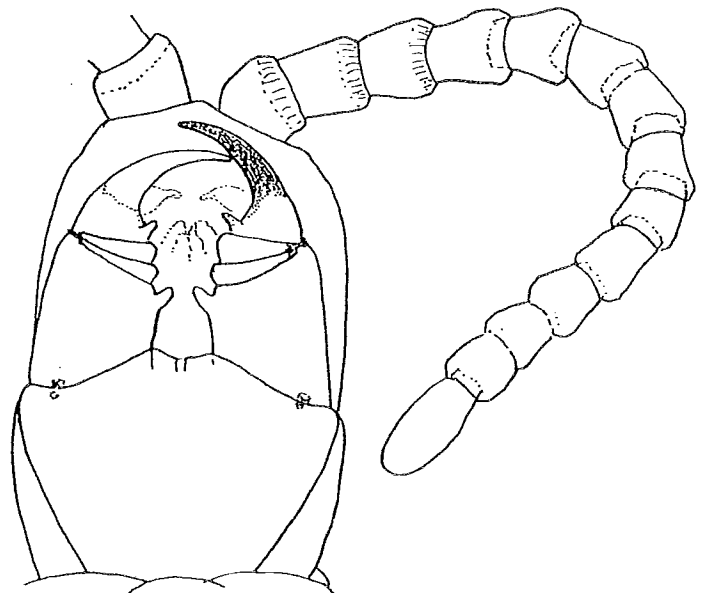
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BULLETIN **of the** **BRITISH** **MYRIAPOD** **GROUP**

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EDITORIAL

Volume 15 appears after a rather longer than planned gestation period and those who recall Desmond Kimes's European Invertebrate maps of various millipedes will be interested to see that this issue sees further evidence of his great activity. Here we have European maps of those 29 species of Julida (Nemasomatidae, Blaniulidae and Julidae) found in the British Isles.

In addition we have various descriptions and nomenclatural reports relating to several of our centipede species, *Brachyschendyla dentata*, *Geophilus proximus*, *Geophilus insculptus/oligopus* and *Cryptops hortensis* together with further comments from Dr Jeekel on Latin names of species and an account of *Arenophilus peregrinus* from Cornwall.

Wallace Arthur's activity at Sunderland University provides us with two accounts, one on Limited variation in segment number in *Brachygeophilus truncorum*, the other on Size selective predation by *Geophilus insculptus* on *Blaniulus guttulatus*. With so many recent papers in the Bulletin on species description or distribution the latter is account is most welcome.

Various discussions took place at the Annual Spring Meeting in Northumberland, one result of which is to "slim down" the Group's *Newsletter* and to include short accounts and reports of meetings, etc. in the Bulletin in future hence ensuring their more formal publication in this way. At various times the Bulletin has had a Miscellanea section for short reports and we anticipate its revival in this way.

Bulletin of the British Myriapod Group 15 (1999).

WHO IS THE AUTHORITY FOR *CRYPTOPS HORTENSIS*?

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Many years ago, exploring our institutional library in search of classical literature on Myriapoda in connection with my nomenclatorial investigations, I noticed a small-sized book by George Samouelle bearing a title composed of no less than 99 words (!) of which the first are: The Entomologist's Useful Compendium. It was published in 1819. Although many books with the word entomology in their title relate to insects in the current sense, this sympathetic little book had some interesting pages on Myriapoda, with an original approach although apparently largely based on the work of Leach.

In the synonymy of *Cryptops hortensis* Leach I was struck by the clear citation of "*Scolopendra hortensis*. Donovan's Br. Ins." Preceding the citations of four works by Leach. This seemed rather curious because in the entire international chilopod literature Donovan is never quoted and Leach is always credited with the authorship of *Cryptops hortensis*. Subsequent consultation of the various works by Leach gradually solved the mystery.

In his well-known Zoological Miscellany (1817), Leach cites in his synonymy only his earlier publications; Donovan is not even mentioned.

Earlier, in 1815, Leach only gives only one literature citation:

"*Scolopendra hortensis*. Leach, Mss. In Donovan's Brit. Ins."

This suggested simply the quotation of a Leach manuscript name in the work of Donovan, without nomenclatorial consequences.

When I finally could consult the original publication by Leach in Brewster (1814), a work not available in the Netherlands, the problem was clarified. There we had it, the revealing statement by Leach:

"*Cryptops hortensis*. Leach's MSS. *Scolopendra hortensis*, Donovan's *British Insects*, vol. XV. Where it was first figured and described from four specimens sent by Mr Leach, under that name to Mr Donovan."

The work of Donovan (1810), also a rare publication, confirmed this. Under *Scolopendra hortensis* he gives a short description and remarks:

"This centipede appears to be an undescribed species: it was discovered in some abundance, by Mr. W. Leach, in the gardens at Exeter."

At the conclusion of the supplementary remarks it is stated "...and for this reason it is submitted as a new insect."

It is perfectly clear that, although Leach may have collected the material, may have recognised it as an undescribed species, gave it a name and donated specimens to Donovan, the latter is the author who is responsible for publication of the description and drawing. He is consequently, in perfect accordance with the provisions of the International Code of Nomenclature, the author of *Scolopendra hortensis*.

Obviously, as appears from the subsequent citations by Leach, that writer preferred to credit himself as the discoverer and author of the species. On account of the authority of Leach as the father of myripodology in Britain nobody ever dared to contest his view. However, the conclusion is clear: the garden centipede should henceforth correctly be cited as *Cryptops hortensis* (Donovan, 1810).

The type-specimen(s) may still be in the Natural History Museum, London and a lectotype might be designated because of the possibility that *Cryptops parisi* Brolemann could be represented in the material. That is, however, for British colleagues to decide.

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SIZE-SELECTIVE PREDATION BY *GEOPHILUS INSCULPTUS* ON *BLANIULUS GUTTULATUS*

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INTRODUCTION

Little is known about the feeding habitats of geophilomorphs. The literature up to about 1980 was reviewed by Lewis (1981, chapter 10). In most cases, plant and decaying material seems to be taken only in cases of prolonged absence of any animal food. However, Gunn & Cherrett (1993), using an underground rhizotron observation chamber with 34 windows, allowing inspection of soil animals down to a depth of 70cm, observed geophilomorphs eating 'inanimate basal resources' such as detritus. The main dietary items of typical inland geophilomorphs appear to be small earthworms, enchytraeid worms and small/soft insect larvae, but there are no substantive data-sets to back up this claim.

There are a few reports of geophilomorphs feeding in groups, and consequently being able to attack quite large or 'difficult' prey items, including barnacles (Blower 1957), *Orchestia* (Lewis 1961), and earthworms up to 8 cm long (Poser 1988). However, individual foraging is probably the norm for most inland species, and here the size of a potential food item may be a major factor in whether it can be successfully attacked and consumed.

In nature, size and taxon are often confounded, making it hard to be certain of the effects of size *per se*. So we conducted an experiment in which different sized individuals of a single prey type - the snake millipede *Blaniulus guttulatus* (Fabricius) - were presented to *Geophilus insculptus* Attems.

SOURCE HABITATS

Our supply of *B. guttulatus* derived entirely from a single, dense population inhabiting a vegetable (potato) plot in a suburban garden in Ponteland, Northumberland (grid ref. NZ151703). Although the area of this plot was only about 7.5 m², it housed a *B. guttulatus* population of hundreds, probably thousands, with most being found in association with rotting potatoes. We brought a sample of 300 or so individuals to the laboratory and maintained them in culture as a source population for the experiment.

G. insculptus occurs in the same plot, but at a much lower density (numbers found to date in single figures). Consequently, we used other populations (various sites in Co. Durham) in order to obtain sufficient numbers of *G. insculptus* for our experiment. All *G. insculptus* individuals used were adult. No attempt was made to distinguish males

from females; the sex-ratio of the experimental predators no doubt reflected that prevailing in the source populations at the time of collection.

METHODS

The type of experimental chamber used was a sealed petri-dish containing moistened filter paper covered by a thin layer of soil/peat substrate. Twenty of these were set up (in two trials of 10, separated by about a month). Into each were placed 5 'large' *B. guttulatus*, 5 'small' *B. guttulatus* (modal sizes approximately 7.8 mm and 2.3 mm respectively, with variation of about ± 1 mm around each mode) and a single *G. insculptus*. The petri-dishes were maintained in the laboratory for 7 days, after which time the *B. guttulatus* remaining uneaten were counted. (The *G. insculptus* individuals used in the second trial were different to those used in the first, thus avoiding the problem of pseudoreplication.)

RESULTS

The results are shown in Table 1. Clearly, *G. insculptus* does not (can not?) consume the larger *B. guttulatus* individuals. In contrast, one or more smaller individuals were consumed in 14 out of the 20 replicates. This contrast is sufficiently clear that it hardly needs statistical analysis. However, it is perhaps worth noting that the probability of getting this result under a null hypothesis of 'both prey types equally acceptable' is 0.5 to the 13th power, or approximately 0.0001.

In the majority of cases where small individuals were consumed, some parts were left - typically the anterior and/or posterior ends. This is important because complete disappearance of *B. guttulatus* individuals would be an ambiguous result, given that our 'sealed' petri-dishes were not completely airtight, and small individuals might escape more readily than large ones through tiny gaps between base and lid.

DISCUSSION

Why is *G. insculptus* apparently unable to consume the larger (7-8 mm) *B. guttulatus* individuals? Three factors suggest themselves: diameter, hardness and speed, all of which increase with age/length. The maximum diameter of a large *B. guttulatus* is about 0.6 mm (Blower 1985), which is less than the tip-to-tip span of the forcipules of *G. insculptus* when fully opened (approx 1 mm). So it should be physically possible for the larger individuals to be attacked. Escape speed also seems unlikely to be a deterrent, given the manoeuvrability of *G. insculptus* and the limited size of the experimental chamber. So cuticular hardness may be the main factor involved, though further work would be needed to test this hypothesis. Also, there may be other factors that increase with length, for example quantity of defensive secretions, which could be examined in future studies.

TABLE 1

NUMBERS OF LARGE AND SMALL *BLANIULUS GUTTULATUS* CONSUMED BY *GEOPHILUS INSCULPTUS* OVER A 7-DAY PERIOD

| Trial | Replicate | Large specimens | | Small specimens | |
|-------|-----------|-----------------|-----------|-----------------|-----------|
| | | Eaten | Remaining | Eaten | Remaining |
| 1 | 1 | 0 | 5 | 1 | 4 |
| 1 | 2 | 0 | 5 | 1 | 4 |
| 1 | 3 | 0 | 5 | 2 | 3 |
| 1 | 4 | 0 | 5 | 1 | 4 |
| 1 | 5 | 0 | 5 | 3 | 2 |
| 1 | 6 | 0 | 5 | 1 | 4 |
| 1 | 7 | 0 | 5 | 0 | 5 |
| 1 | 8 | 0 | 5 | 2 | 3 |
| 1 | 9 | 0 | 5 | 0 | 5 |
| 1 | 10 | 0 | 5 | 1 | 4 |
| 2 | 11 | 0 | 5 | 1 | 4 |
| 2 | 12 | 0 | 5 | 2 | 3 |
| 2 | 13 | 0 | 5 | 1 | 4 |
| 2 | 14 | 0 | 5 | 0 | 5 |
| 2 | 15 | 0 | 5 | 0 | 5 |
| 2 | 16 | 0 | 5 | 1 | 4 |
| 2 | 17 | 0 | 5 | 2 | 3 |
| 2 | 18 | 0 | 5 | 1 | 4 |
| 2 | 19 | 0 | 5 | 0 | 5 |
| 2 | 20 | 0 | 5 | 0 | 5 |

On a broader note, the range of food items consumed by centipedes merits further investigation, not least because of the curious paradox that centipede morphology (including that of the forcipules) has remained virtually constant through vast periods of evolutionary time, over which the available 'prey community' has radically altered. The best evidence for this comes not from geophilomorphs, whose fossil record is poor, but from scolopendromorphs, where the beautifully preserved *Mazoscolopendra* (Carboniferous, ca 300 MY ago: see Mundel 1979) is morphologically very similar to its present-day descendants. Perhaps the resolution of this paradox is that while specialist predators must coevolve with their prey, generalist predators need not. But our current information on centipede feeding is too anecdotal to help much in establishing just how 'generalist' centipede species are; there is a clear need for more quantitative studies.

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**LIMITED VARIATION IN SEGMENT NUMBER IN POPULATIONS OF
BRACHYGEOPHILUS TRUNCORUM AND *GEOPHILUS INSCULPTUS* IN
NORTHUMBERLAND AND DURHAM**

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INTRODUCTION

A great deal of information has been compiled, over many years, on the extent of variation in the number of trunk segments in geophilomorph centipedes (see review by Minelli & Bortoletto 1988). However, most of this information relates simply to the overall variation within each species, either in a particular country or over the whole of the species' range (e.g. Eason 1964). Little is known about the way the intraspecific variation is geographically structured. Whether populations living in particular localities should exhibit the same range of variation as the species as a whole, or just a small subset of it, is in most cases not known. This is sometimes problematic from a species-identification viewpoint, and it restricts the usefulness of the currently available data in answering questions about evolutionary change in segmentation, despite the many potential advantages that geophilomorphs possess in this respect.

With regard to the amount of variation within a single local population, Misiocich (1978) argued that sufficient intensity of sampling might reveal *more* variation than thought to characterize the species as a whole, and gave three examples. But whether this is true of most species is not yet known. With regard to differences in segment number between populations living in different places, the best example of this is *Strigamia maritima* (Lewis 1962), though the cause of the differences observed is still obscure. There are also differences between populations within *Geophilus carpophagus* and *Pachymerium ferrugineum* (Eason 1979) which have been attributed respectively to (a) the environmental differences between natural and synanthropic sites (see also Keay 1994 on *Haplophilus subterraneus*) and (b) a possible effect of latitude - but whether these are the correct explanations is not yet clear.

To generate some new data on this problem, we sampled populations of two species, *Brachygeophilus truncorum* (Bergsöe & Meinert) and *Geophilus insculptus* Attems, at several localities in Northumberland and Durham, and examined the amount of variation within and between populations.

METHODS

Twelve sites (see Table 1) were sampled between August and November 1998. In each case, an area no bigger than 300 x 100 m was used, and a search was conducted for about 2-3 hours. Four types of microhabitat were examined - soil (top 20cm), leaf litter, the undersides of stones, and rotting wood (generally underneath the bark or underneath the piece of wood itself). All centipedes found were identified to species in the laboratory. Although *B. truncorum* and *G. insculptus* were generally the commonest geophilomorphs, other geophilomorph species, and several lithobiomorph species, were also collected - these data will be presented and analyzed in a separate paper.

Small juveniles in which sex could not be determined with certainty were omitted from the study. The remaining individuals were sexed and the number of leg-bearing, or trunk, segments was counted for each.

TABLE 1

SAMPLING SITES

| County | Locality | Grid ref. | <i>B. truncorum</i> | <i>G. insculptus</i> |
|----------------|---------------|------------|---------------------|----------------------|
| Northumberland | Harwood | NY 964 908 | + | - |
| Northumberland | Allen Banks | NY 799 634 | + | + |
| Northumberland | Allenheads | NY 824 434 | + | - |
| Northumberland | Darras Hall | NZ 151 703 | - | + |
| Northumberland | Gosforth Park | NZ 244 714 | - | + |
| Northumberland | Linden Hall | NZ 154 966 | - | + |
| Durham | Muggleswick | NZ 028 453 | + | - |
| Durham | Chopwell | NZ 133 578 | + | - |
| Durham | Thornley | NZ 179 603 | + | + |
| Durham | Hamsterley | NZ 067 298 | + | - |
| Durham | Sedgefield | NZ 346 257 | - | + |
| Durham | Redworth | NZ 229 234 | - | + |

The county name given correspond to Vice-Counties 66 and 67. The 'urban county' of Tyne & Wear is not utilized here. Also, none of the samples were from North Northumberland (Vice County 68).

RESULTS

Each species was found at a total of seven sites. Tables 2 and 3 show the results for the relevant sites for *B. truncorum* (74 individuals) and *G. insculptus* (45 individuals) respectively. These tables also show, for comparison, the range of segment numbers given by Eason (1964) as characteristic of these species. It is apparent that, for both species, the range of variation observed is somewhat less than (and slightly displaced from), the variation given by Eason (1964). This result is, in a sense, the opposite to what Misioc (1978) found.

The lack of variation is most pronounced in *B. truncorum*. Here, only a single male out of 27 has other than the 'normal' 37 segments, while only two females out of 47 have other than the 'normal' 45 segments. The majority of local populations show no within-sex variation at all, though they exhibit the expected sexual dimorphism. Although *G. insculptus* shows a little more variation in the males, it is still more restricted than might have been expected, with only one male lying outside the 47/49 segment categories.

TABLE 2

**NUMBER OF TRUNK SEGMENTS IN MALE AND FEMALE
BRACHYGEOPHILUS TRUNCORUM FROM SEVEN SAMPLING SITES IN
NORTHUMBERLAND AND DURHAM**

| Site | Males | | | | Females | | | |
|-------------|-------|----|----|----|---------|----|----|----|
| | 35 | 37 | 39 | 41 | 35 | 37 | 39 | 41 |
| Harwood | 0 | 4 | 0 | 0 | 0 | 0 | 10 | 0 |
| Muggleswick | 0 | 2 | 0 | 0 | 0 | 0 | 6 | 0 |
| Chopwell | 0 | 3 | 0 | 0 | 0 | 0 | 4 | 0 |
| Allen Banks | 0 | 6 | 0 | 0 | 0 | 0 | 2 | 0 |
| Allenheads | 1 | 1 | 0 | 0 | 0 | 1 | 5 | 0 |
| Thornley | 0 | 7 | 0 | 0 | 0 | 0 | 13 | 0 |
| Hamsterley | 0 | 3 | 0 | 0 | 0 | 1 | 5 | 0 |
| TOTAL | 1 | 26 | 0 | 0 | 0 | 2 | 45 | 0 |
| EASON | - | + | + | - | - | - | + | + |

TABLE 3

NUMBER OF TRUNK SEGMENTS IN MALE AND FEMALE *GEOPHILUS INSCULPTUS* FROM SEVEN SAMPLING SITES IN NORTHUMBERLAND AND DURHAM

| Site | Males | | | | | Females | | | | |
|---------------|-------|----|----|----|----|---------|----|----|----|----|
| | 45 | 47 | 49 | 51 | 53 | 45 | 47 | 49 | 51 | 53 |
| Sedgefield | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| Redworth Wood | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| Allen Banks | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| Thornley Wood | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Darras Hall | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 6 | 0 |
| Gosforth Park | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 5 | 0 |
| Linden Hall | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 5 | 1 |
| TOTAL | 0 | 5 | 15 | 1 | 0 | 0 | 0 | 0 | 23 | 1 |
| EASON | + | + | + | - | - | - | - | + | + | + |

DISCUSSION

Clearly, the data-set presented has its limitations: it involves only two species and only one region (NE England) ; also, the sample sizes from individual localities are relatively small. Nevertheless, it reveals that in at least some cases the amount of variation in segment number within and between local populations of a geophilomorph species can be very limited. How common this situation is, in comparison to Misiach's (1978) finding of considerable local variation, is not yet clear.

To some extent, different species may show different patterns. Nevertheless, the same species may show different patterns in different places. An example of this is *Geophilus carpophagus* where both males and females are almost constant in segment number in Danish populations (with 53 and 55 segments respectively: H. Enghoff, pers. comm.), while both sexes exhibit considerable variation in Britain (Eason 1979). Another example is *B. truncorum*, as this was one of the three species studied by Misiach.

Whatever the extent of variation within and between populations in each species, its cause is still unknown. Differences between individuals may be hereditary, as

suggested by Prunescu & Capuse (1972), in which case they may be subject to genetic drift and founder effects (Lewis 1962) and/or to natural selection. Alternatively, differences may be partly or wholly due to phenotypic plasticity (Eason 1979), as a result of the direct effects of environmental factors, such as temperature, an embryogenesis. Some apparent intraspecific variation may not even be that at all, but may be due to the presence of as-yet-unidentified cryptic species (Lewis 1985)

These questions are of considerable interest, but a concerted experimental approach is required if they are to be answered. Breeding experiments are necessary, and attempts to rear broods under different environmental conditions (e.g. different temperatures) to explore possible plasticity may also be informative. We are intending to conduct studies of this kind in the near future. However, the species examined in the present paper do not provide good material for such experiments, due to (a) the difficulty of obtaining large samples from individual localities, and (b) the difficulty of telling the sexes apart reliably in live specimens. To obviate these difficulties, our experiments will involve *Strigamia maritima*.

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FURTHER NOTES ON *BRACHYSCHENDYLA DENTATA* BROLEMANN & RIBAUT, 1911 (CHILOPODA, GEOPHILOMORPHA)

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INTRODUCTION

Brachyschendyla dentata was first described by Brolemann and Ribaut (1911) from a single female found at Saint B  at (Haute Garonne), central Pyrenees. Broleman (1930) also recorded it from a locality some 150 km north (Tarn). It was rediscovered nearly 40 years later in an urban site in southern England in 1968 (Barber & Eason, 1970) since when a series of records have been made from both English and other European sites. The present account includes drawings of specimens from Oxfordshire, England collected by S. Gregory during the course of a survey of that county when he made some dozen records (Gregory & Campbell, 1996).

DESCRIPTION

Length: 9 - 12 mm.

Number of trunk segments: 39 (only females are known).

Colour: whitish, somewhat translucent.

Head: slightly longer (1.1x) than broad (Figure 2).

Antennae: 3 - 4 times as long as breadth of head capsule and about one twelfth of body length. Articles about as broad as long.

Clypeus: typically with a pair of conspicuous post antennary setae, 6 irregularly arranged intermediate setae and a pair of minute prelabial setae (Figure 4) but the pattern differs from this in many specimens (Figure 3).

Labrum: with 15 teeth with projections on them not always visible (Figure 6). The differentiation between central pigmented and lateral pale sharp teeth is rather indefinite but one or more of those at either lateral extremity are feeble and rather inconspicuous.

Mandibles: with dentate and pectinate (fimbriate) lamellae (see Barber & Eason, 1970).

Maxillae: (Figure 5) First maxillae with femoral and coxal palps (lappets) but the latter especially are difficult to see in preparations (described as being seen by transparence through the coxosternite when viewed ventrally, Barber & Eason, *loc.cit.*) and are not shown in the present drawings. Second maxillae with simple spoon shaped claws without spines.

Forcipules: With a well developed medial tooth on the femoroid and a very prominent tooth at the base of the poison claw (Figure 1). The latter has a smooth concavity.

Anterior sternites: without pores, with faint reticulation and rather prominent anterior and posterior marginal setae (Figure 7).

Coxal pores of last legs: 2 + 2.

Last legs: Appear rather obviously swollen, the telopodite is about 1.5x as long as the penultimate, prefemur barely longer than trochanter when viewed ventrally, metatarsus very small, about one seventh the length of the tarsus and without armature (Figure 8).

Juveniles: 5 - 6.5 mm have been seen with relatively short and stout antennae, characteristics of forcipule less well developed, metatarsus of last leg one third the length of the tarsus and coxal pores 1 + 1.

Males are not known so presumably the species is parthenogenetic. This could account for its widespread distribution to urban / suburban sites.

DISTRIBUTION & ECOLOGY

The original British records were from two urban sites in Surrey and the species was subsequently found in a more rural location (although substantially human influenced) in the same area. Subsequently it was found twice in gardens, in a churchyard and in a private tip in Norfolk, an abandoned station garden in Plymouth, another Devon location (adjacent to buildings) and in formal gardens in London. As noted above, it has been found by Steve Gregory from 12 1km grid squares in Oxfordshire, from churchyards with sandy or calcareous friable soils (Gregory & Campbell, *loc.cit.*). More recently, it has been found in Dorset and in a churchyard in West Cornwall and in Edinburgh. Anecdotal evidence suggests that it is most likely to be found in winter, often during frosty weather.

The species has been recorded from a garden in Copenhagen (Enghoff, 1973) and from a park in Amsterdam (Jeekel, 1977) and Berg (1995) shows 5 10km grid square records from the Netherlands, two from the southern province of Limburg. This would suggest that it is likely to be found widely in synanthropic sites in western Europe.

Christian (1996) has the first mid-European record, this time not from an urban site but from *Quercus pubescens* woodland south-west of Leopoldsberg (Vienna region). He includes a photograph showing the characteristic appearance of the poison claws.

SIMILAR SPECIES

Brachyschendyla dentata is easily distinguished from immatures of the common *Schendyla nemorensis* by both the appearance of the back legs with their very small terminal article and by the very distinct appearance of the forcipules. The latter also distinguish it from all other British schendylids.

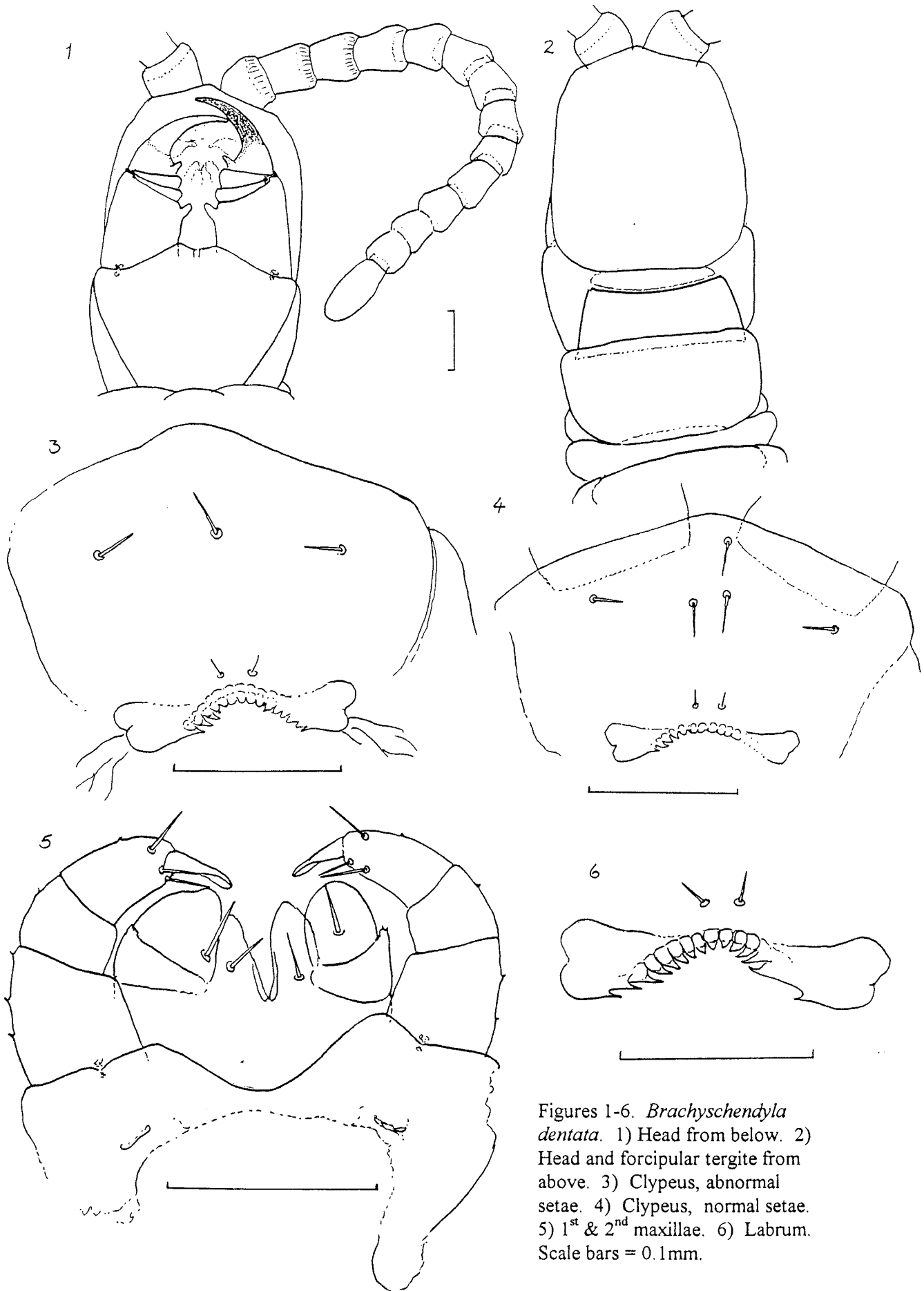
Brachyschendyla armata Brolemann, 1901 (as described in Brolemann, 1930) shows a very conspicuous tooth on the femoroid, more prominent than in *B. dentata* but its last legs are very different with the terminal articles of a more normal size. It is recorded from the littoral Mediterranean. *Brachyschendyla montana* (Attems), forms of which have been recorded in various parts of Europe seems to have a rather small protrusion on the femoroid. It lacks the characteristic last legs of *B. dentata* and bears a spine on the first maxillary claw.

ACKNOWLEDGEMENTS

Many thanks to Steve Gregory for allowing some of his Oxfordshire specimens to be examined and mounted.

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Figures 1-6. *Brachyschendyla dentata*. 1) Head from below. 2) Head and forcipular tergite from above. 3) Clypeus, abnormal setae. 4) Clypeus, normal setae. 5) 1st & 2nd maxillae. 6) Labrum. Scale bars = 0.1mm.

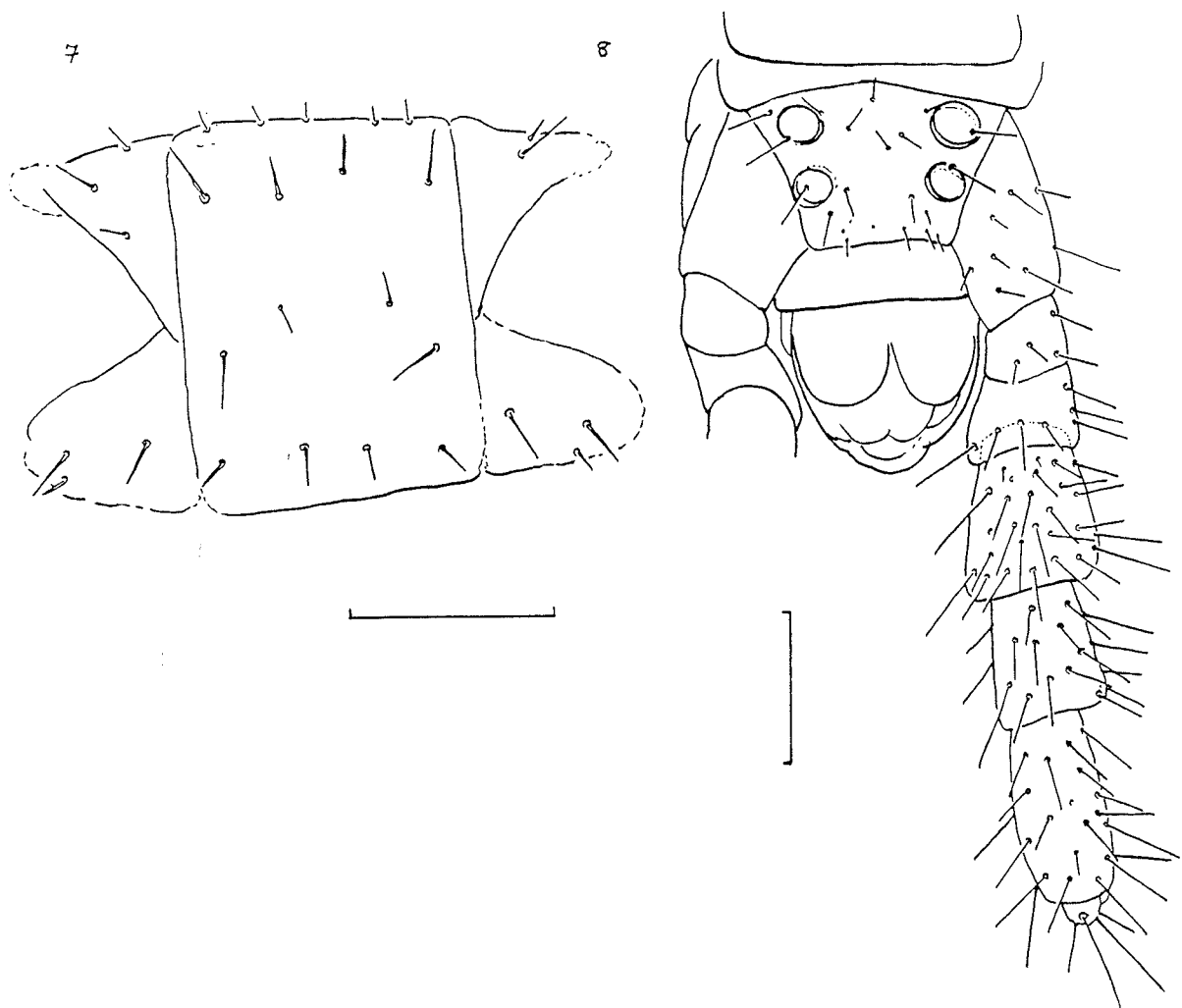


Figure 7-8. *Brachyschendyla dentata*. 7) Setae of the 3rd Segment. 8) Last leg bearing segment, female. Scale bars 0.1mm.

**A DESCRIPTION OF *GEOPHILUS PROXIMUS* C. L. KOCH, 1847
(CHILOPODA, GEOPHILOMORPHA)**

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Geophilus proximus C.L.Koch has only been recorded once with certainty in the British Isles; the drawings given here are from Norwegian specimens kindly provided by Bjarne Meidell and the description is based on these and on the literature, notably Brolemann (1930) and Kaczmarek (1979). Almost certainly all earlier records said to be of this species from Britain were of *Geophilus insculptus* Attems. Meidell (1969) distinguishes it from the latter species; Enghoff (1971) has drawings of the apices of the second maxillae and of the ventral aspect of the terminal segments as the chief distinguishing characteristics.

DESCRIPTION

Length: up to 40mm. According to Matic (1972) males are much shorter than females (25mm).

Trunk segments: 45-51 (males), 45-55 (females). The British specimen was a female of 49 leg pairs, the specimens examined here had 47-51 pairs. Only females appear to be found in Fennoscandia.

Colour: Pale yellowish with the head a little darker.

Head: Somewhat (about 1.2x) longer than broad (Figure 2).

Antennae: 2.5 times the length of the head (Figure 3).

Clypeus: With post-antennal, intermediate and posterior pairs of setae (Figure 10). The clypeal area seems somewhat variable between specimens but is distinct.

Labrum: Median portion is described as undivided (e.g. Brölemann, Fig. 239 & Kaczmarek, Fig. 63) but in the specimens examined it appears to be divided. Lateral portions with about 7 or so fimbriae which are wider at the base and show a sudden narrowing as seen in the most lateral ones in our drawing (Figure 11), a shape that might be described as "caudate". The labia in the three specimens dissected showed very much damaged fimbriae but this particular shape (illustrated in Brölemann's Figs. 239 & 240) seems characteristic.

Mandibles: (Figure 9)

Maxillae: First maxillae with coxal and femoral palps (lappets). Second maxillae with a distinct claw (Figure 8).

Forcipular tergite: Trapezoid but with sides slightly convex (Figure 2).

Poison claw: With a clear basal tooth (Figure 1).

Trunk: Pore areas diamond shaped, indistinct at their lateral angles (Figure 12). (In *G. insculptus* they are more spindle shaped). These pore areas seem to disappear at about the 17th trunk segment without dividing. Carpophagus structure present, fossa occupies about nine tenths of the breadth of the sternite when fully developed.

Last trunk segment: Coxal pores 8-10 along the edge of the metasternite (Figure 4). The latter has a much more rounded lateral-posterior borders than in *G. insculptus* (Figure 12) and unlike the latter species, there is no isolated pore towards the apex of the coxa.

Last legs: With distinct terminal claws

GEOGRAPHICAL DISTRIBUTION

This is a widespread European species but rare in Denmark (H. Enghoff, *pers. comm.*). Berg (1995) has 8 records from The Netherlands compared with 34 for *G. insculptus*. Meidell (1972) reports it from 50 localities in Norway, Palmen (1949) from more than a hundred in Eastern Fennoscandia and Kaczmarek (1980) lists it from 13 of the 23 biogeographical areas of Poland from which she has records. In Scandinavia, *G. insculptus* appears to be synanthropic (Enghoff, 1971, Meidell, 1969)

The single British record is from Unst, Shetland Islands (Barber, 1986). Its apparent parthenogenetic habit in Scandinavia would be expected to make for a ready spread into suitable habitats and the Shetlands were for a considerable period of their history under Norwegian rule.

ACKNOWLEDGEMENTS

Our thanks to Dr B. Meidell for providing us with the Norwegian specimens of this species.

TABLE 1.

COMPARISON OF *GEOPHILUS PROXIMUS* AND *GEOPHILUS INSCULPTUS*

| | <i>G. insculptus</i> | <i>G. proximus</i> |
|-------------------------------------|--|--|
| Clypeus: | Absent. | Distinct. |
| Labrum mid piece: | 7-9 well formed teeth. | Single tooth described, our specimens show 3 or 4. |
| Labrum fimbriae: | About 10 long fimbriae. | Fimbriae shorter & with distinct shape. |
| First maxillae: | No palps (lappets). | Coxal & femoral palps. |
| Second maxillae: | Small peg with hair like tubercle on apex. | Distinct, large claw. |
| Sternal pore areas: | Spindle shaped. | Triangular. |
| Metasternite of last trunk segment: | Rather straight edges laterally & posteriorly. | More distinctly rounded shape. |
| Coxal pores of last Legs: | Isolated pore towards apex of coxa. | No such isolated pore on coxa. |
| Occurrence: | Widespread British Species. | Single northern record. |

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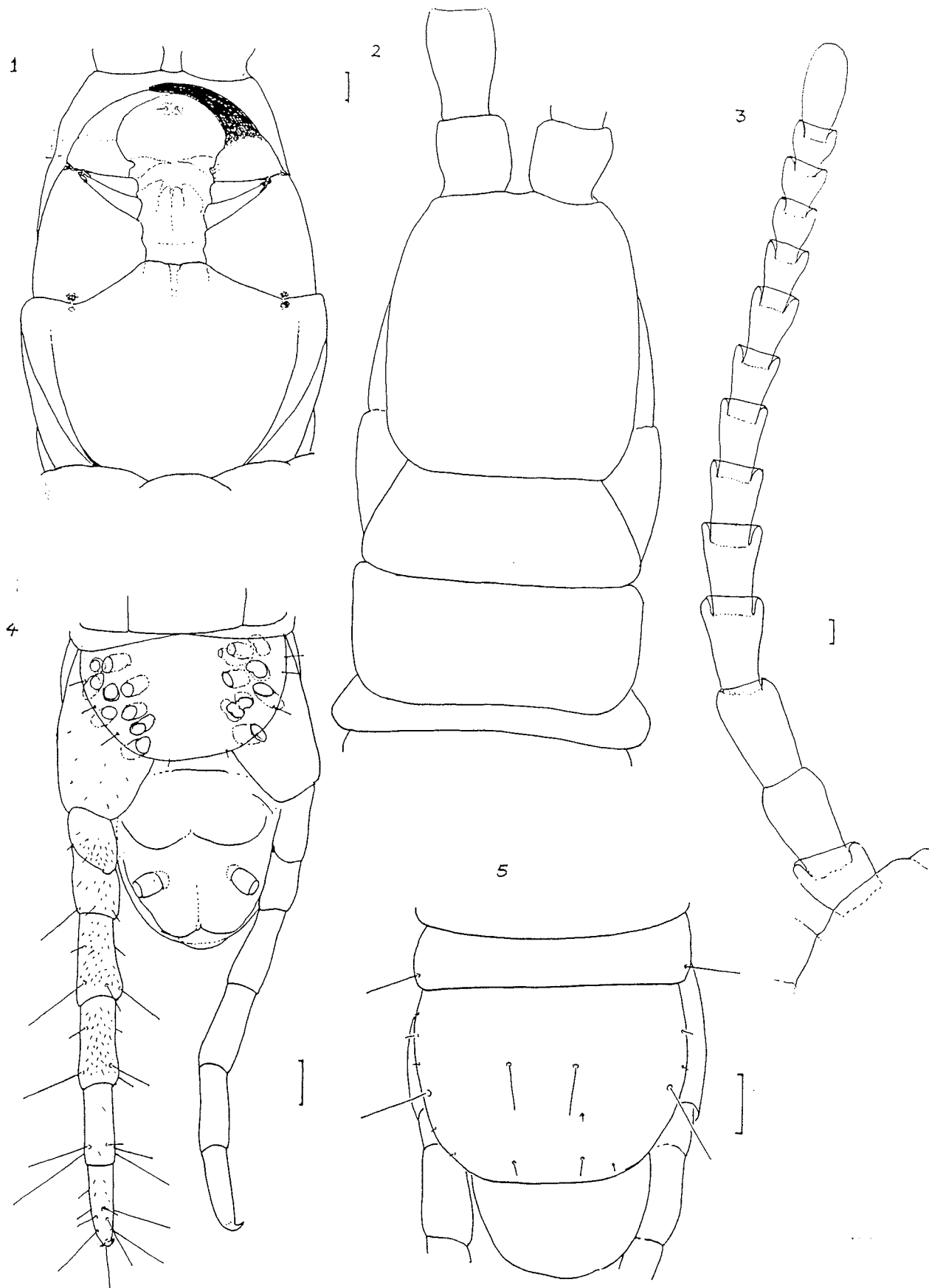
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Figures 1-5 *Geophilus proximus* 1) Head from below. 2) Head capsule from above.
3) Antenna. 4) Last leg pair, female. 5) Metatergite. Scale bars = 0.1mm

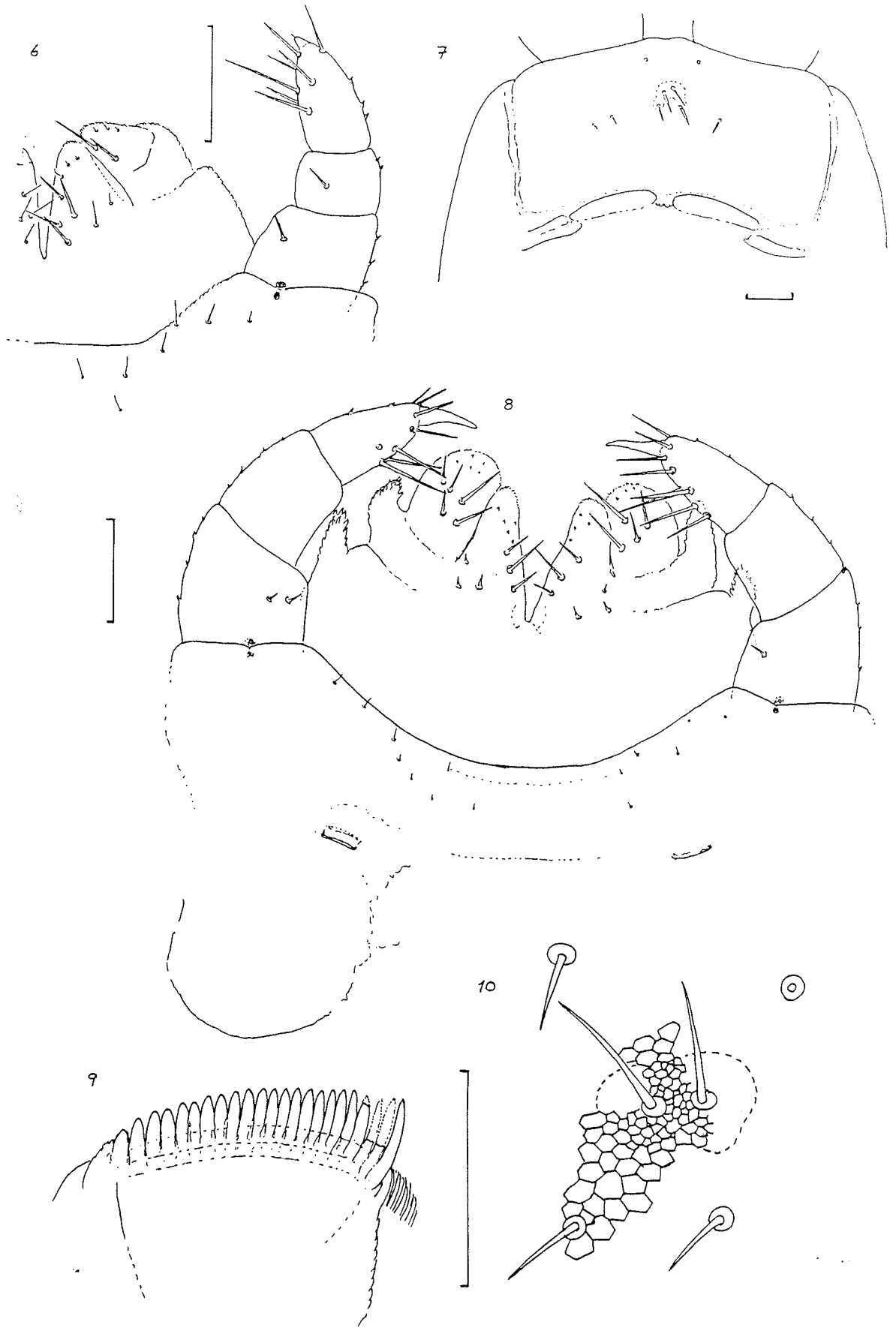
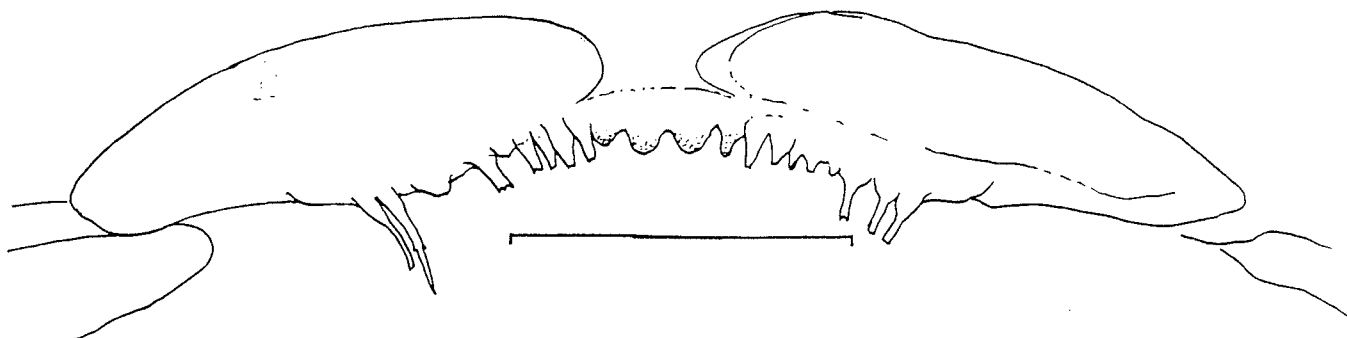
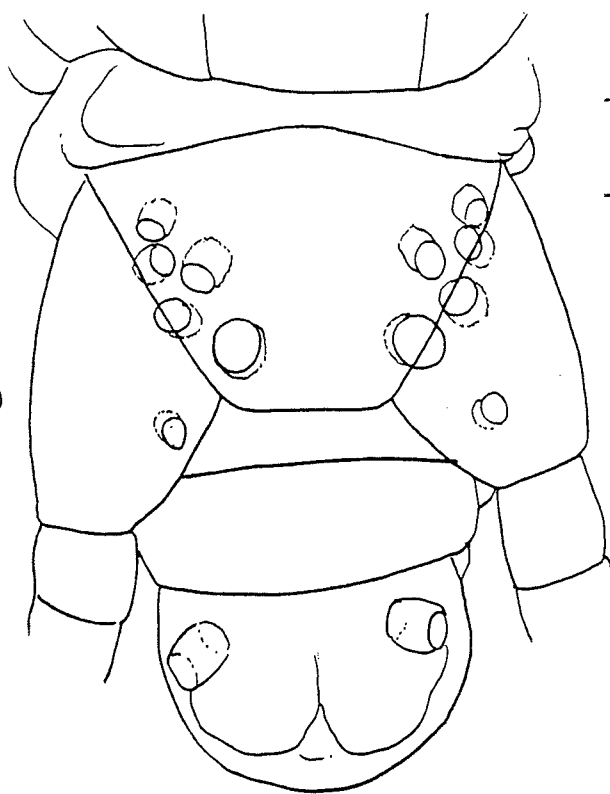


Figure 6 *Geophilus insculptus* 1st & 2nd Maxillae, note lack of lappets and the unusual peg like claws. Figures 7-10 *Geophilus proximus* 7) Clypeus, Clypeal area. 8) 1st & 2nd Maxillae, note lappets and the claws. 9) Mandible. 10) Clypeus, (clypeal area variable). Scale bars = 0.1mm

11



12



13

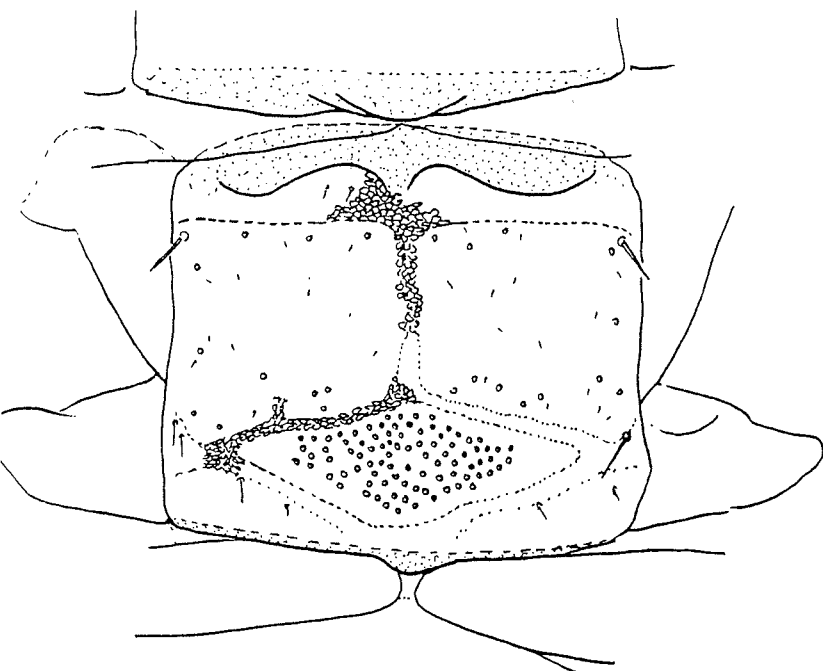


Figure 11 *Geophilus proximus* Labrum. The fimbriae are broken off in all three specimens that I examined. Figure 12 *Geophilus insculptus* Last leg pair, female, note the shape of the metatergite and the two isolated coxal pores. Scale bars all 0.1mm.

GEOPHILUS INSCULPTUS OR GEOPHILUS OLIGOPUS ?

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In his 1990 paper (Eason, 1990), Ted Eason suggested that the correct name for the species known to us at the time as *Geophilus insculptus* Attems was in fact *Geophilus oligopus* Attems. Since it was clear from Attems' drawing in his original description that he was looking at *Geophilus proximus* C.L.Koch when he drew what he labelled *G. insculptus*. The species drawn with the peg-like claw on the second maxillae being *G. oligopus*. This derived from the paper by Koren (1986) where *G. oligopus* (Attems, 1895) was shown as synonymous with *G. insculptus* Attems in the sense used in "Centipedes of the British Isles" (Eason, 1964). The *G. oligopus* of Attems "wurde womöglich an Hand eines juvenilen Tieres (39 Beinpa.) von nur einem Fundpunkt" i.e. a juvenile specimen with only 39 pairs of legs found in one locality (Obersteiermark) (Koren, *loc.cit.*).

According to Koren's account, the species *G. insculptus* of Attems becomes synonymous with *G. proximus* of C.L.Koch, 1847 and Latzel, 1880 and on this basis (Eason, 1990) would be correctly known by that name. The fact that the Attems' *G. oligopus* specimen had only 39 trunk segments, well outside the normal range for *G. insculptus* sensu Eason, 1964 is, in itself, of note.

Christian (1996) examined type specimens of various *Geophilus* species to clarify the status of these. Attems' account showed a claw structure on the second maxillae in his drawing of *G. insculptus* as indicated above but in the text this characteristic was not mentioned. On the basis of this arose further confusion!

Geophilus oligopus would appear to be a different species to *G. insculptus* with a much smaller number of leg pairs and has been recorded in recent years from Austria, North Italy, Slovenia and Bosnia. There are also differences in the appearance of the maxillae (Christian, *loc. cit.*) but both species have a peg rather than a claw on the second maxillae. From his table of characteristics the following is taken:

| Species | Leg pairs | Coxal pores | Claw on last leg | Pretarsus of 2 nd maxillae | Sternal pores | Carpophagus structure |
|----------------------|------------|-------------|------------------|---------------------------------------|---------------|-----------------------|
| <i>G. insculptus</i> | (43-)49-53 | 4-7+1 v | + | conical | + | + |
| <i>G. oligopus</i> | 37(-39) | 2-5 v | + | conical | + | + |

G. minimus Verhoeff, 1929 and *G. pauropus* Attems, 1927 are shown to be junior synonyms of *G. oligopus*.

In a recent paper, Foddai & Minelli (1999) give various characteristics of several species of *Geophilus*. In this the two species are very similar except:

| Species | Leg pairs | Length (mm) | Length, antennae: cephalic shield | Cephalic shield breadth: length | Telopodite of 1 st max. | Sterna with pore fields |
|----------------------|-----------|-------------|-----------------------------------|---------------------------------|------------------------------------|-------------------------|
| <i>G. insculptus</i> | 43-47 | 25-30 | 3.1 | 0.92 | 2 articles | I to penultimate |
| <i>G. oligopus</i> | 37-39 | 12 | 3.4 | 0.88 | 1 article | II to mid body |

In his cladistic analysis, *G. oligopus* comes closest to the new troglomorphic *G. persephones* which also has a conical tubercle on the second maxillae, followed by *G. insculptus*.

Geophilus proximus has been recorded once from Britain and is distinguished by the normal claw on the second maxillae. It is described elsewhere in this volume.

ACKNOWLEDGEMENT

My thanks to Dr Erhard Christian for his comments on the status of *Geophilus insculptus*.

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**ARENOPHILUS PEREGRINUS JONES, 1989 IN CORNWALL: A
CENTIPEDE NEW TO MAINLAND BRITAIN**

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Examination of specimens collected the 1998 BMG field meeting in Cornwall by S.J.G. revealed a small geophilomorph which did not seem to key out easily. It was sent to R.E.J. who promptly named it as *Arenophilus peregrinus*, a species previously only known from the Isles of Scilly. This is the first recorded occurrence of the species on mainland Britain. Like all that have been found to date it was a female.

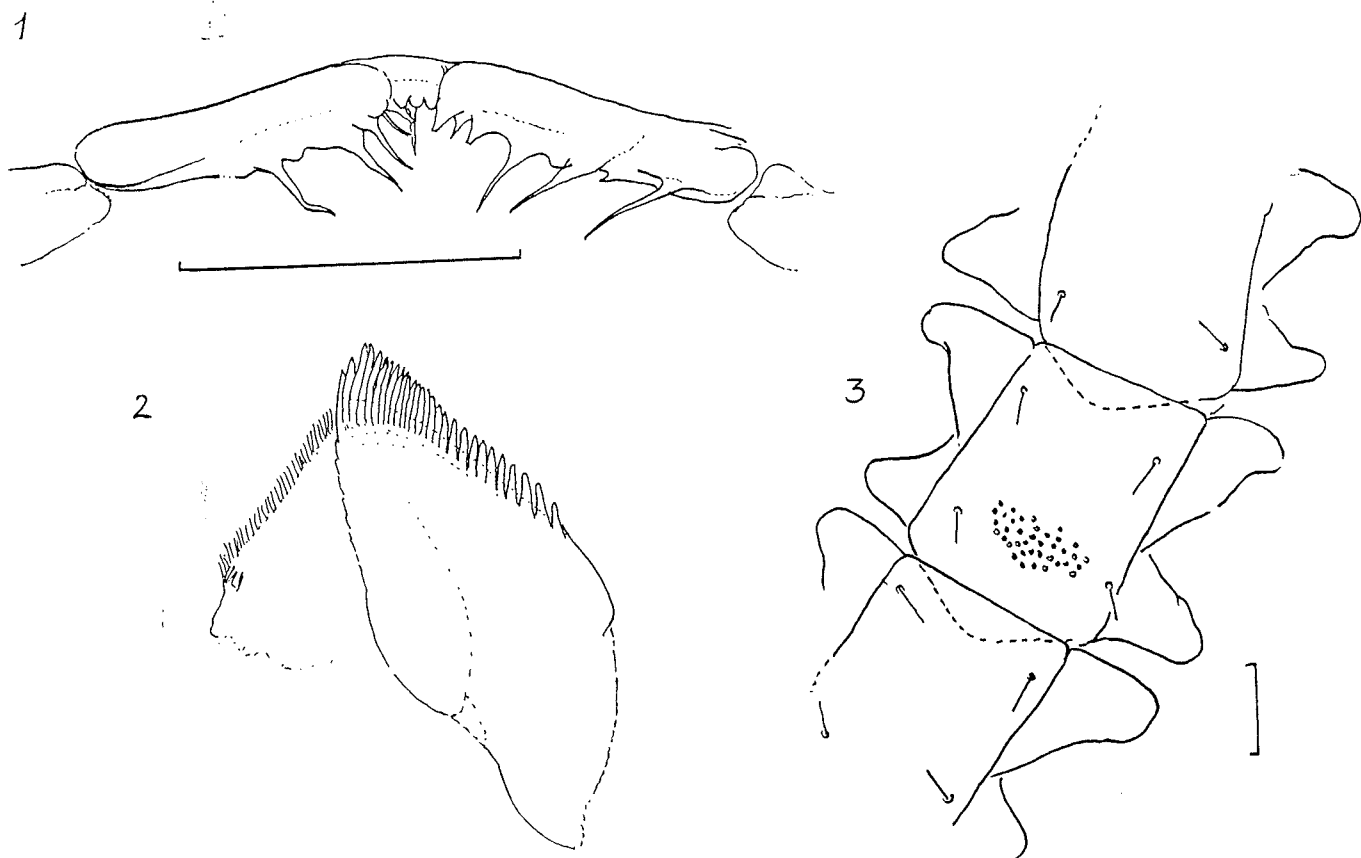
The specimen was collected at Lamorna Cove (10/45-24-, VC1, 17.4.1998). It was found under a small stone at the base of a rocky sea cliff, well above the high water mark. Vegetation was very sparse with a few tufts of *Festuca* sp. and sea thrift (*Armeria maritima*). The terrain was such that it was hard work to find anything at all, mostly it was solid rock. An hour's searching revealed four centipede species: *A. peregrinus*, *Geophilus carpophagus*, *Haplophilus subterraneus* and a few *Lithobius melanops*. The millipede *Cylindroiulus latestriatus* was the most commonly encountered myriapod.

Arenophilus was first recorded on the Isles of Scilly and presumably is an example of a man assisted colonist. It has now been found on the mainland but of course it may have colonised the mainland first and the Isles of Scilly afterwards. It is possible that *A. peregrinus* will occur at other sites in the south west but, like many small geophilomorphs, it may prove to be rather elusive.

While R.E.J. was dissecting the specimen he was able to draw several parts that were not shown in the original paper. These were the labrum, the mandibles and the way that the sternites tuck underneath each other.

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Figures 1-3 *Arenophilus peregrinus* 1) Labrum. 2) Mandible. 3) Segment 6. Scale bars = 0.1mm.

THE LATIN NAMES OF BRITISH CENTIPEDES: COMMENTS AND SUGGESTIONS

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INTRODUCTION

By producing the following lines I am afraid that I am labelling myself as a Dutch uncle with regard to Mr. Slawson's list (Slawson, 1998). Surely, tracing the meaning of scientific names is not at all as easy as one might think. Even to one with a thorough education in classical languages. Not having passed a classical training myself, having to work with only a few standard dictionaries and a little practical experience, I feel hardly qualified to solve the linguistic mysteries which previous authors sometimes have created. However, with the advantage of the access to a very complete library on myriapods, I feel sufficiently confident to enter the limelight without stage fright. Maybe the following list may help to correct a few obvious errors and offer some alternative solutions in a few ambiguous matters.

Chaetochelyne – From the Greek chaite: mane, and chelyne: lip. Obviously referring to the fringes along the lateral parts of the labrum.

Chalandea – This genus was dedicated by Brolemann (1909a: 330) to Mr Jules Chalande, of Toulouse, France, who published over 20 papers on myriapods between 1885 and 1911.

coleoprata – Possibly this is merely derived from the Greek koleopteros for beetle-like insects: with wings covered by a shield. In *Scutigera c.* seven larger tergites hide the reduced dorsal sclerites of the other segments.

Cryptops – From Greek krypto: hide and ops: eye.

Dicellogophilus – The ending -philus in this and other geophilomorph genera appears to be used not for its literal meaning: friend, but rather to rhyme with *Geophilus*. With the use of such an identical suffix in new generic names authors intended to indicate similarity or taxonomic relationship to a previously named genus.

duboscqui – Brolemann (1896:116) based this species name on the name of a friend, Mr O. Duboscq, of Grenoble, France, author of several important papers on myriapods around the end of the nineteenth century.

electricus – Although it is tempting to associate this name with electricity in the modern sense, the Greek elektron actually means amber.

fucorum – This species name is based on the Latin name *Fucus* (seaweed). Therefore: of the seaweeds.

Haplogophilus – see *Dicellogophilus*.

Lamyctes – Perhaps this is based on the Greek mykter: snout or trunk, and the Greek prefix la: strengthening the meaning of the following word. But this explanation does not add much descriptive sense to the word.

melanops – Greek melas: black and ops: eye.

microps – Greek mikros: small and ops: eye.

monoeci – The name, written originally with a capital M (Brolemann, 1904:7), might allude to the type locality of the taxon, Monaco.

Nesoporogaster – Greek nesos: island. The type species of this genus was originally described from the Mediterranean island of Ibiza.

oblongocribellata – Latin cribellum: small sieve.

osquidatum – the stem of this species name, which was written originally with a capital O, is likely to be of geographical origin. Brolemann (1909b: 209) based the species on material from the western Pyrenees. The only geographical name, which I could trace in this area, showing resemblance is the “Col d’Osquich” or “Osquish” on the road between Larceveau and Mauleon-Licharre in the French Department Pyrenees-Atlantiques. Brolemann gave only a few specified localities and otherwise indicated relative abundance in general: “de ci, de là”. So maybe the “Col” was one of these localities.

parisi – *Cryptops p.* was not named after the capital of France as one is apt to believe. Actually, the species name refers to Mr P. Paris, of Dijon, France, the collector of the type specimen: “C’est a lui qu’est dédiée cette nouvelle espèce française.” (Brolemann, 1929: 12).

peyerimhoffi – Dedicated to Mr P. de Peyerimhoff, a French coleopterist.

pusillifrater – This name was originally proposed for a subspecies of *Geophilus pusillus*. The name was obviously coined to emphasize a “brotherly” relationship.

Schendyla – Maybe from the Greek schendyle: “a tool of ship carpenters and blacksmiths, perhaps a pair of tongs”.

seurati – The taxon bearing this name was dedicated to Prof. L. Seurat.

Strigamia – Gray, who introduced this name, did not give an explanation of its derivation. Although it looks like a Latin or Greek word I have not been able to trace it in available dictionaries. Perhaps this is just an example of a well sounding combination of letters. (The same explanation might hold for the diplopod genus name *Stosatea* Gray).

Tygarrup – This name is composed of the generic name *Arrup* with the prefix *Tyg-* added. It does seem neither of classical origin nor based on a modern personal or geographical name. My guess is that Chamberlin, who, I have been told, was also an expert on American Indian languages and actually introduced many an Indian name in the nomenclature of chilopods and diplopods, adopted this from an Indian dialect. A meaning is not given.

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THE CONTINENTAL DISTRIBUTION OF BRITISH AND IRISH MILLIPEDES

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INTRODUCTION

The distribution on the Continent of the millipede species that occur in Britain and Ireland is becoming better known than it was even a few years ago. Well-worked countries include those in Scandinavia, Germany, the Benelux countries, Switzerland, Austria, Slovenia and Italy (especially northern Italy). The fauna of France is rather well-known, but, as it is such a large country there are extensive areas, particularly in the centre, north and west where there is a shortage of distributional data. In Spain and Portugal, with the exception of Catalunya and the Pyrenees, there are not enough data to work out the limits of the geographical ranges of most species. It is certain that more, as yet unknown, species will be found in Spain and Portugal. Most European countries have a reasonably comprehensive list of species and all countries have been studied, sometimes in an intensive manner locally: other than in the countries previously mentioned their records are generally patchy.

Distributional patterns are an intriguing field of study because the Continental distributions are of markedly different types. In many instances it would be virtually impossible to predict these distributions from those mapped in these islands, even for common species. On the other hand, viewed from the Continent, most of the species in Britain and Ireland are distributed in a fairly predictable way. As suggested by Barber & Jones (1996), there remain some species whose presence in these islands is best explained by chance introduction. I intend to review the evidence for each species, at the same time presenting a map of its presently known geographical range. This first paper will deal with the order Julida, about half the fauna; a subsequent paper will treat all the other orders.

ORIGIN OF THE BRITISH AND IRISH FAUNA

First, I would like to outline some general considerations which relate to the arguments made by Barber & Jones (1996). Most, if not all of the species in Britain and Ireland are pioneer species that have spread north since the last glaciation: many of these have quite extensive geographical ranges in Europe. This is quite different from the situation in and south of the Alpine mountains, where most species have small ranges. Whereas species found in Britain often occur in Scandinavia, species found in Spain almost never occur in Greece, and very few of them occur in Italy. Southern Europe houses between one and two thousand mainly regional or point endemics. The distributional data are not yet sufficiently worked out to permit a precise estimation.

Suffice it to say that, in Europe, there are about one hundred species commonly found north of the Alpine mountains (Pyrenees, Alps, Carpathians), plus some others that are marginal to these mountains (peri-Alpine species), and about 1500 known species in and south of these mountains. This latter figure is subject to some taxonomical revision, which will tend to reduce the number of species, and some new discoveries which will surely be made to augment it. I am aware of a number of recently found species waiting to be described at the moment.

The effect of the formation of the English and Irish Channels after the last glaciation is interesting, leaving a number of possibilities with respect to the origin of our present fauna.

1. It is possible that species survived the last period of glaciation on the fringe of what is now these islands, if only in the South/West. According to Huntley & Birks (1983) tree species survived the Devensian in Ireland (the Atlantic was not frozen over) and the possibility of survival of millipedes cannot be ruled out - they survived on nunataks in the icefields of the continental mountains, and in caves. From our present knowledge we can say that, if this happened, it should have only involved a few of the hardest species that occur in northern regions today.
2. Species will certainly have moved north and north-west from the still attached "Continent" during the climatic improvement that took place after the last glaciation and before Ireland and then Britain were cut off by sea-water.
3. Since the climate further improved for a while after the formation of the English Channel, species which would have arrived later may have drifted across or been transported by human agency (introduced) onto these islands and now appear to be naturally distributed; this applies especially to those which appear to be confined to southern areas. Theoretically they should be present in northern France and/or the Benelux countries.
4. Other species which may not occur in northern France or the Benelux countries, but which nevertheless find the Atlantic environment favourable, may have been introduced, and either exist in previously vacant ecological niches or compete successfully with an impoverished local fauna. Looking at their maps of distribution these species are on the face of it quite apparent introductions. But it is not all that simple because there are species on mainland Europe which occur in the mountains further south and occur in disjunct patches much further north. For instance the chordeumatid *Ceratosphys amoena* occurs in the Pyrenees and in Belgium and has not yet been found in between. The centipede *Lithobius microps exarmatus* occurs in the Pyrenees, Wales and the Belgian Ardennes and has not to my knowledge been recorded elsewhere either. Are these native relics which had a wider distribution when it was colder? There are several other examples of this phenomenon in the myriapod fauna of Western Europe.

It is likely that some species so far unrecorded do actually occur and will be found in Britain or Ireland. There are several species with continental distributions that resemble those of species which occur here, and which are possible candidates.

An important step that is required in order to further elucidate these possibilities is the accumulation of data on the fauna of the northern and western regions of the Continent. As already indicated, the best worked parts of France are the South and East; the North and West have received little attention, together with much of the Centre. This matter is being rectified, but in a large country of almost 550,000km² the task with respect to 10km mapping is immense. The list of species is more complete than the distribution maps; nearly 300 species have been recorded (Geoffroy, 1996). Given the gaps that occur in Northern Spain and Portugal as well, distribution limits of Atlantic species are often unclear. Most of the north-west corner of Germany is very poorly known too. Thus, my comments on European distributions of British and Irish species have to be tempered with some uncertainty about a number of them, particularly those confined to the Atlantic zone.

The maps will speak for themselves, some are much more complete than others.

CLIMATIC ZONES OF EUROPE

From a biogeographical standpoint we know that climatic factors are of paramount importance in determining millipede distribution. At our latitudes, minimum winter temperatures, humidity and rainfall may be especially significant parameters. Minimum summer temperatures may be significant too, as well as maximum summer temperatures, especially in the southern half of Europe, where they may exceed 40 C. These are factors that limit distribution on a continental scale. In discussing geographical range of whole species we do not need to discuss locally important ecological factors, such as humus type, unless they are limited on a regional scale by these major climatic considerations.

Britain and Ireland are in the Atlantic Zone (see Figure 1). Subject to local variation, with respect to the Continent the summers are relatively cool and the winters are relatively mild. However, in the West of France and the North-west of Spain it is similarly oceanic and generally warmer than in Britain; in Norway it is cooler. These are very evident facts, they are also very significant. Whereas the temperature declines from south to north in summertime, it tends to decline from west to east in winter when eastern France is much colder than the West. Whilst in Britain and Ireland we may see a SW-NE gradient of sorts (e.g. see Hill, 1991), in France there is a big difference in the fauna of the Atlantic zone and that of the East. Most Atlantic species do not occur in Alsace, not even in the eastern half of France south of the Atlantic zone, according to present evidence. Central Spain is colder than the coastal regions in winter, hotter in summer and dryer during both. All these factors restrict Atlantic species. However, we do also have Central, Alpine and Mediterranean species in Britain and Ireland.

TYPES OF MILLIPEDE DISTRIBUTION

There are strict Atlantic species, which do not occur outside the zone shown on Figure 1, many of which do not get as far north as Britain. There is a second group which is basically Atlantic, but which extends to different degrees into the Central and Baltic

zones and/or into the Mediterranean zone. These species may reach as far as Southern Finland/Russia near the North and Baltic seas, or as far as North-east Spain/North-west Italy in the Mediterranean Basin. Those that reach the Eastern zone are generally synanthropic there.

Unsurprisingly, many British and Irish species are Atlantic in distribution. Yet there is another large group which extends north-west from Central Europe; these species reach the North Sea coast but not the west or south coasts of France. They appear to withstand colder temperatures in winter than the Atlantic species: they may not be suited to high summer temperatures - some of them are mainly confined to montane areas in the more continental part of their range. They may extend to Ireland and they may be commoner in the north and east of Britain e.g. *Craspedosoma rawlinsi*, *Melogona voigti*: our species extend into southern Scandinavia (the Baltic zone) as well. From the European perspective, many central species do not reach either Britain or Scandinavia, nor even the North German Plain. They are strictly central species. Those that do reach our shores should probably be referred to as Central/NW species, but I will refer to them as central species with regard to Britain and Ireland.

Apart from these three noticeable groups of millipedes there are other types of distribution, including the pan-European species found more or less throughout the Continent. There are very few of these, in marked contrast to the case of more mobile groups of animals, e.g. insects.

There are those already referred to which occur in the Alps and/or Pyrenees and then much further north. These are not the zoological equivalent of Arctic/Alpine plants, since there are no Arctic, or Boreal millipedes. Millipedes are almost non-existent in the northern half of Scandinavia.

There are, of course, some maritime myriapods. While some have maritime tendencies, e.g. *Cylindroiulus latestriatus*, *Brachyiulus pusillus*, entirely littoral species are very few.

British species which have not yet been found in France or Belgium are particularly hard to explain, with the exception of species which clearly have their origin in the Mediterranean zone and may be introductions: these may eventually be found in France as well.

Summarising, I shall refer to the following categories:

1. **Atlantic.** Used strictly for species confined to the zone.
2. **Extended Atlantic.** Used for species stretching further east into other zones.
3. **Central.** Species extending NW towards Britain and Ireland and N towards Scandinavia from the Alps.
4. **Pan-European.** Species found almost everywhere in Europe.
5. **Alpine.** In our case species occurring in the Alps and/or Pyrenees, not yet found in lowland France or the Benelux Countries and found in Britain/Ireland. Distributions are disjunct.
6. **Littoral.** Maritime species.
7. **Introduced.** Used where this seems to be reasonably certain.

Most of our species fall fairly easily into one of these categories. The origins of some, however, remain highly debatable.

EUROPEAN DISTRIBUTION OF BRITISH AND IRISH SPECIES

The species listed in this section are numbered to correspond with the numbers on their maps of distribution.

Order JULIDA

Family NEMASOMATIDAE

1. *Thalassiosobates littoralis* (Silvestri, 1903.)

While we may certainly regard this species as littoral, there is not enough known about its distribution to fully explain its presence in Britain. The British records, together with another from the west coast of Sweden, constitute the Atlantic/North Sea data. All other existing records emanate from the western part of the Mediterranean Basin, as far east as the Adriatic Sea. The dearth of records from the western coasts of continental Europe may be entirely due to a lack of collecting. On the other hand it may not, it is too early to say. The Atlantic coast has been largely neglected by myriapodologists. There is also the question of substrate to consider; the records indicate that shingle or rocky coasts are important habitats whereas there are long stretches of coast without these features. Some sandy or muddy coasts have been examined, but these were mainly along the North Sea. At present we are left with a huge gap between the Mediterranean records and the others. It would be useful to know how this specialised species is dispersed in the normal course of events. As it has been introduced into the USA (Enghoff, 1987), is this the way that it spread to the several sites in Britain?

2. *Nemasoma varicorne* C. L. Koch, 1847.

Enghoff (1976, 1994) provides a map of distribution which shows that a bisexual form occupies Central Europe and that a parthenogenetic form exists in the peripheral areas which include Britain, Ireland and southern parts of Scandinavia. It is in fact a species of Mediterranean origin (Enghoff, 1976), although, as far as we know, it occurs only sporadically in that zone today, and occupies a rather central position. Aided doubtless by its parthenogenesis, it has managed to colonise a large part of Europe, into the Atlantic, Baltic and Eastern zones.

My map shows some blank areas in regions where *N. varicorne* is common. This is because, for instance, the important reference work for Germany by Schubart (1934) does not give localities for this species, containing just a list of regions. In the past authors often had this approach to common species. I have only placed dots on my maps when I had a precise locality to refer to. But I shall indicate such anomalies in the text of future atlases. *Nemasoma varicorne* probably occurs in all regions of Central Europe. My experience is that it is patchy, I have looked under the dead bark of countless trees without finding it, I found it much more frequently in England than I do on the Continent.

Family BLANIULIDAE

3. *Proteroiulus fuscus* Am Stein, 1857.

Maps showing the distribution of *P. fuscus* have been published by Enghoff (1978) and Kime (1990). It is another parthenogenetic species, with a more extensive northern distribution than *N. varicorne*, occurring in Iceland, northern Finland and further east in Russia. *P. fuscus* is one of the most abundant millipedes in Europe between 48°N and the Arctic Circle. It might also be regarded technically as a central species, however, it is less common in Central Europe, where it is largely confined to forests in the mountains. For instance, Pedroli-Christen (1993) gives only nine stations for the whole of Switzerland, a rather well-recorded country. Like *N. varicorne* it is unrecorded from Iberia and most of France; it is also unrecorded from the Balkans. Yet it is a pioneering species and has reached Madeira, the Azores, North America and South Africa. There is an isolated record from a mountain in Sicily. Under-bark temperatures may be significant, it appears to be absent from hot areas. It may have moved both north and upwards since the ice age. My impression is once again that this animal is far more abundant in Britain than in Northern France, Belgium, Luxemburg or West Germany. On a visit to Finland it was the species that I found the most.

4. *Choneiulus palmatus* (Nemec, 1895)

Blaniulids associate so much with human activity that it is sometimes difficult to fully discern their range in natural habitats. The genus *Choneiulus* is centred on the western half of the Mediterranean zone, *C. palmatus* being its only representative north of the Alpine mountains. It appears to have an extended Atlantic distribution; most references from the north and east of its range are synanthropic. It has reached Madeira, the Azores and North America. Data from SW France suggest that it is not a central species, even though there are many records from some central regions. In Switzerland it is found in the warmer valleys, consistent with an Atlantic species. In Western Europe, too, it occurs in deciduous forests, where it may be found in the soil, leaf litter or under bark. This might be a natural habitat.

5. *Nopoiulus kochii* (Gervais, 1847)

I have some reservations about its type of distribution. It occurs in all central countries, but is also reported from western parts of France. It has been found often in SE Europe, as far afield as Greece and Turkey, and down the Italian peninsula to Sicily. It occurs in the Caucasus and extends towards the Ural Mountains in Russia. Unfortunately there has been some taxonomic confusion concerning this species. Other species of the genus occur in the Mediterranean Basin. *N. kochii* is the pioneering species, having been recorded from New Zealand, North and South America in addition to much of Europe. It might eventually be found anywhere in Europe.

6. *Blaniulus guttulatus* (Fabricius, 1798)

There are about ten species of *Blaniulus* occurring mainly in the western Mediterranean area, reminiscent of *Choneiulus*. The pioneering and strongly synanthropic *B. guttulatus* has a large extended Atlantic distribution at least. Some authors have said that it occurs throughout Europe, though this does not appear to be the case. Records from southern Europe are extremely scarce. It is clearly yet another pioneer and might turn up almost anywhere. It has an extensive distribution outside Europe, especially in Canada, the United States of America and Atlantic Islands. If synanthropic records are ignored it is found in woodland on calcareous soils in

Western Europe, and, like *C. palmatus*, might be native to woodland in the Atlantic zone. It is also regularly found in caves. Several species of *Blaniulus* are troglobionts.

7. *Archiboreoiulus pallidus* (Brade-Birks, 1920)

Much less frequently recorded on the Continent than the preceding blaniulids, *A. pallidus* is found in similar base-rich situations to *B. guttulatus* and *C. palmatus*, mostly in NW Europe, where, again, it is found in forests as well as in association with man. Once more, an extended Atlantic distribution is implicated. It extends to Finland and Russia as a synanthrope. The species has been found in Canada. A significant proportion of continental records are from soil samples and caves; in Hungary it is known only as a cavernicole.

8. *Boreoiulus tenuis* (Bigler, 1913)

This is yet another species found in base-rich soils and occurring in forest in the north of the Atlantic zone as well as synanthropically. The map suggests that it is a central species.

Family JULIDAE

9. *Ommatoiulus sabulosus* (Linnaeus, 1758)

The well-known and much-studied *O. sabulosus* is one of the most widely distributed European millipedes. It occurs in all the climatic zones and is as entitled to be called pan-European as any other millipede. It has not been found in Greece, a number of major Mediterranean islands and much of Iberia, where many more species of the genus are present. In fact, in Spain, there are at least thirty recorded species of *Ommatoiulus* and much uncertainty about distributional limits. My map is not complete, particularly to the south and east of the Baltic Sea. It reaches the Eastern zone in Russia and the Ukraine. It is eurytopic and has an altitudinal range of nearly 3000m, even though it is particularly associated with warm habitats and sandy areas. Its distribution nevertheless appears spatially patchy and populations fluctuate considerably with the passage of time.

10. *Tachypodoiulus niger* (Leach, 1815)

This animal has an extended Atlantic distribution, shown clearly on the map. It is eurytopic and generally very common throughout its range, reaching maximum population densities in woodland, especially on limestone. It is very scarce on peaty soils, being rare or absent from the polders in Belgium and Holland. Although we may regard it as thermophile it is absent from the Bavarian plain and from low ground in the south of France (Mauriès, pers. comm.). Yet it is common further south but higher up in the Pyrenees and extends into the northern mountains of Spain where its limits of distribution remain to be worked out. Gaps in the map in the northern half of France are attributable to a lack of collecting.

11. *Cylindroiulus londinensis* (Leach, 1815)

C. londinensis has an Atlantic distribution. On the Continent there are correct records only from west and central parts of France and from some northern parts of Spain. All the references to this species from other Continental countries actually relate to *C. caeruleocinctus*, with which it was either confused or thought to be conspecific. Most of the true data are from woodland, frequently oakwoods on calcareous soils, but there are others from litter in woods on well-drained acidic soils. Some of these woods were

fairly open or scrubby. Demange (1981) states that it reaches 2000m in France, above the tree line. On the map in Kime (1990) the dots for southern France and Spain were accidentally printed one square too far to the south: with the possible exception of the southernmost dot this was of little consequence but has been rectified here. It may well occur in NW Spain, the area is practically unstudied.

12. *Cylindroiulus caeruleocinctus* (Wood, 1864)

I have identified several thousand individuals of this species, mainly as a result of pitfall trapping in Belgium and Luxemburg, where it is abundant in open habitats, principally grassland. But it may be equally common in cultivated ground, parks, orchards and gardens, showing pioneering and synanthropic tendencies. On the Continent SE of Britain it is one of the most abundant species as far as the Jura mountains and the western calcareous Alps in Switzerland. In Britain it has been linked with calcareous soils, e.g. by Blower (1985). The same is true on the Continent, e.g. by Pedrolí-Christen (1993) and Haacker (1968), who described it as a synanthropic species of fields and gardens on hard alkaline soil. However, I have also found it in acidic woodland on greensand in Surrey, Hampshire and Sussex and suggested that this might reflect its tolerance of dry environments. SE England is relatively dry, differing in some respects from the rest of Britain. In Belgium and Luxemburg the woods are full of chordeumatids; I have not found *C. caeruleocinctus* in continental woodland. In SE England chordeumatids are rare, one of its particular features, probably connected with well-drained sandy or calcareous substrates and the low rainfall. Rainfall figures are higher in Belgium.

The distribution type of *C. caeruleocinctus* is presumably extended Atlantic. Doubts may arise because it has an unusually large distribution for one of this kind, extending through Poland into Russia in synanthropic situations. But then it has also colonised the eastern regions of North America. Doubts might also arise because of the paucity of records from the Atlantic part of France. But the amount of collecting in open sites has been minimal here; I have found it in the Atlantic zone in soil samples taken from fields in agricultural areas on chalk.

13. *Cylindroiulus vulnerarius* (Berlese, 1888)

This is one of the 42 species of *Cylindroiulus* found on the Italian list (Foddai *et al.*, 1995) over half of which are endemics. There are numerous records north of the Alps now, substantially in biotopes associated with human activity in or near cities; I have precise data on more localities from Belgium and the Netherlands (Berg, 1995) than from Italy. In view of the large gap on the map between occurrences in Italy and those in France, the Low Countries, Sweden and Britain it is most likely to have been introduced everywhere outside Italy.

14. *Cylindroiulus salicivorus*

C. salicivorus is listed as an Italian endemic species with a cis-Alpine distribution. Its recent discovery in Scotland is the only known occurrence elsewhere. It must have been introduced.

15. *Cylindroiulus punctatus* (Leach, 1815)

We know that *C. punctatus* is extremely common in NW Europe. It has an extended Atlantic distribution. It does not penetrate into areas that are regularly cold in the

winter and, presumably for this reason, is absent from high ground within its range. Like *T. niger* it is widely reported from the Pyrenees and possibly occurs throughout the northern Spanish mountains. The gaps on the map in northern France and Spain are as usual due to lack of collection. On the occasions when I have looked for it in the north of France I have usually found it. But further south in Aquitaine I think that it is considerably more scarce; I have examined large numbers of logs and not very often uncovered it despite noting the usual occurrence of centipedes. It might be useful to do some work on log temperatures: Haacker (1968), in his experiments, found that the species survived between -6 C and 43 C, with a range of preference between 2 C and 36 C, and an optimum of 18-26 C. In Aquitaine the temperature regularly exceeds 30 C in spring and summer, sometimes reaching 40 C. For instance, last summer (1998) the shade temperature reached 41 C in August. Whatever the reason, it is much less rewarding looking under bark in the southern half of France than in Britain.

16. *C. latestriatus* (Curtis, 1845)

This has an extended Atlantic distribution as well, in one way more confined and in another way exaggerated. *C. latestriatus* is well-known as a coastal species, common in dunes and sandy areas. At the same time, it is one of the World's most spectacular pioneering species. It has colonised a wide range of habitats associated with human activity, especially horticultural establishments, gardens and greenhouses. In such places it has reached Finland, Russia, the Ukraine and Hungary. Another feature of this species is its occurrence on the coasts of Portugal, the Azores, the Canary Islands; it has spread to North, Central and South America. It occurs in the remotest part of the Pacific, on Easter Island, and even in the Antarctic (see Blower, 1985). Few British and Irish species have been recorded from Portugal, which is still poorly worked like most of Spain. The Atlantic zone in Iberia should be rich in species; most unfortunately we still do not adequately know this fauna.

This much travelled species, and also the next species, illustrates well the connection between European millipedes and the old colonies of the western European empires.

17. *C. britannicus* (Verhoeff, 1891)

The distribution of this British and Irish millipede is difficult to explain. It has not been found at all in Spain, France or Belgium, but it does occur on Portuguese territory, including the Azores and Madeira. The records from Holland and Germany eastwards are supposedly or quite certainly synanthropic. It might have spread from Britain to Canada, the USA and New Zealand. Where was it during the Devensian glaciation? The genus *Cylindroiulus* is firmly based around the Western Mediterranean basin. Is this an Iberian species? A Lusitanian species? There are two records from Portugal and none from Spain. The only places where it certainly occurs "wild" are Britain and Ireland! Did it survive here? In "wild" stations it is strictly Atlantic. It might of course still be found in France. It is remarkable that there is so far absolutely no trace of it there. We cannot assume that it reached Britain through France.

18. *Cylindroiulus parisiorum* (Broelemann & Verhoeff, 1896)

This species is about as enigmatic as the last. Common features are that there are more records from Britain than from any other country and that it is synanthropic in the east on the Continent. There are no reports of it from Ireland, Iberia or the west of France. Paris is as far west as it has been found on the Continent. From the distributional

evidence it entirely conforms to a central species. Pedroli-Christen (1993) has found it wild in Switzerland, as I have in Belgian woodland. The odd thing is that there are few records from Central Europe. It is, of course, fairly easily overlooked, and has occasionally been confused with or regarded as *C. truncorum*. More data of both species from France would help to clarify the distributional situation. *C. parisiorum* should have spread to Britain from the Continent.

19. *Cylindroiulus truncorum* (Silvestri, 1896)

Yet another difficult *Cylindroiulus*! According to present data, it occurs neither in Italy nor in Iberia, but in North Africa, from where Schubart (1934) suggested that it was introduced into northern Europe. This seems to be the best explanation. It is becoming locally common in N European countries. In Belgium it is discovered regularly and some infestations of property have been reported. It too, has been introduced into N & S America.

20. *Allaiulus nitidus* (Verhoeff, 1891)

This is a central species; it is quite clear from its distributional range which in this instance fortunately lies mainly in well-explored areas. It should therefore occur more in N and E Britain than in the south-west and Ireland, as appears to be the case. An interesting feature of British distributions is that central species missing from western parts of France nevertheless arrive in Cornwall. If *A. nitidus* is not common in Britain it is probably because it is at the limits of its range. It is found in mull humus in deciduous woodland and burrows during adverse periods.

21. *Enantiulus armatus* (Ribaut, 1909)

E. armatus is a strictly Atlantic species, known outside England only from the western half of France, and there not yet from the north. The allopatric *E. nanus* is a central species on the Continent, occurring in Denmark, Sweden, Germany, Holland, Belgium, NE France and further east. It might turn up one day, most likely in E England or Scotland. It looks like a small *A. nitidus* or a pale juline, the male has very distinctive gonopods, easily distinguishable from those of *E. armatus*.

22. *Haplopodoiulus spathifer* (Brolemann, 1897)

In view of its links with the Royal Botanic Gardens *Haplopodoiulus spathifer* is almost certainly an introduction. It is a strict Atlantic species, occurring in the western half of the Pyrenees and neighbouring Spanish mountains. The limits of its distribution in Spain are not yet known. This year I have found it in the Landes, a hundred kilometres north of the Pyrenees. The absence of records between Sussex and the Landes might be due to either its absence or a lack of collecting. If, in France, it is more or less limited to the Pyrenees, it might be regarded as an Alpine as well as an Atlantic species.

N.B. The map shown in Figure 1, based on one published by the European Environment Agency (1995), does not include a Pyrenean zone. These are Alpine mountains and I would include a Pyrenean Alpine zone, which in fact houses a large number of endemic species. It is the case that the Alps proper and the Pyrenees house almost entirely different millipede faunas.

23. *Julus scandinavicus* Latzel, 1884.

This is quite definitely a central species, as the map shows. In Britain, its relative scarcity in South-east England might be connected with the few records in France other than those in the extreme NE and East, where it is very common. I have both received and collected a lot of data on this animal since its distribution was published in the 1990 atlas. It is a very common central European species. The 1990 map showed one dot in France west of Calais. I have re-examined the material from this site in Normandy, which was published in the BMG Bulletin No. 4 (R. D. Kime, J. G. E. Lewis, S. J. Lewis, 1987). There should and might have been a male, but I have discovered that the reference tube contains entirely black female jules as well as the other species that were recorded. On dissection I found vulvae resembling those of *Leptoiulus belgicus*. The record, which is entirely my own responsibility, must be considered highly doubtful, preferably null and void! I was prompted to re-examine this material, not because of its geographical location, but chiefly as a result of finding several specimens of all-black *L. belgicus* both in Belgium and in France. Recently I found a male *L. belgicus* in the Dordogne which had a marbled brown and cream coloration and no dorsal stripe. Although the gonopods were strikingly reminiscent of *L. belgicus* I sent it to Dr. Mauriès in Paris for him to reassure me that it was not a new species. I add all this as a cautionary note to all collectors. According to Jeekel (1973) *J. scandinavicus* has been introduced into the USA.

24. *Ophiulus pilosus* (Newport, 1842)

We come to one of the most remarkable European distributions known. It is difficult to understand the biogeographical history of this species. The genus (+/- 20 spp) is based in Italy and so we may begin from there. *O. pilosus* is common in N Italy and neighbouring alpine regions; it has also been found high up in mountains along the Italian peninsula to the south. The simplest view to take is that all the other patches of distribution are consistent with introductions. Outside Europe it has been introduced into N. America and New Zealand, where I collected it myself on a visit, suggesting that it is not rare there. If it has been able to colonise quite extensive areas in the New World it will have been able to do the same in Europe.

The present data do not support the view that *O. pilosus* moved north into Britain, Ireland and Scandinavia in the normal course of expansion. There are gaps in the distribution between Bavaria and Czechoslovakia on the one hand and NE Germany and Denmark on the other. There are almost no records at all from W Germany, none from Belgium and only a small patch in France in the Pas-de-Calais and the Somme departments near the coast where the population densities were locally high. Did these go over from England on the ferries?! There is no immediately obvious reason for these small patches of *O. pilosus* other than recent introduction. To the east and south-east of this French patch I have collected for years without finding any *O. pilosus*. Compared with other areas it is phenomenally common in Ireland and Britain. Did it survive the ice age or has there been a massive spread following introductions? It is a tough pioneering species. Some detailed genetic studies of its different populations might shed some light on the situation, and it would be helpful to include closely related species occurring chiefly in Italy, as well as the alpine variety *major* quoted in Blower (1985) which was described as a species by Bigler in 1913 - *Ophiulus major*.

25. *Leptoiulus belgicus* (Latzel, 1884)

This has a classical extended Atlantic distribution with a marked SW orientation in Britain. East of the Atlantic zone it is confined to warmer areas, extending almost across Germany and just reaching Austria. It is mainly found at low altitude, is locally common and very patchy in distribution. It has a pronounced activity period in the autumn in Belgium.

26. *Leptoiulus kervillei* (Brolemann, 1896)

L. kervillei has a strict Atlantic distribution, extending as far as the southern tip of the Netherlands. It favours silty basic soils: it is very common on these in Belgium. In France it has proved to be common on similar soils in Eastern Normandy and the Perigord and it probably occurs from the Pyrenees to Belgium in all such areas. It is usually found in woodland on mulls. *L. kervillei* has not yet been found in either Germany or Spain, although it reaches the western side of the Moselle valley in Luxemburg.

27. *Metaiulus pratensis* Blower & Rolfe, 1956.

On the basis of the few existing records this has a strict Atlantic distribution as well. Originally found in heavy clay soils in SE England, it was subsequently found in SW France, where three sub-species were described from caves in Aquitaine. The typical form was then found further north by Dick Jones in farmland in the Vienne and by myself in the Dordogne. This still leaves something of a gap between the Vienne and Sussex. However, it may very likely be found in NW France and SW England. It is quite difficult to locate of course.

28. *Brachyiulus pusillus* (Leach, 1815)

The several species of this genus are mainly located in the Mediterranean zone, especially in the Balkans. The two species that spread north of the Alpine mountains are *B. bagnalli* in the east and *B. pusillus* mainly, but not by any means only, in the west. Unfortunately these two species have sometimes been confused. *B. pusillus* is a pioneering species; Hoffman (1979) infers that it has been widely spread by commerce. It occurs in territory around the Atlantic Ocean (USA, Argentina, South Africa) as well as many of the oceanic islands. I found it in forest on Tenerife. Although it has been described as a littoral species by some authors, it clearly frequently occurs as a synanthrope a long way from the sea, although regularly associated with water in wet pastures, as well as arable land and gardens. Its distribution in Europe is obviously quite widespread and not easy to interpret without knowledge of the Mediterranean origin of the genus.

29. *Unciger foetidus* (C. L. Koch, 1838)

This is a central - even east-central - animal which has extended northwards as far as Norway and NW to Britain. Looking at its distribution it is quite logical that it should be found in East Anglia. At the same time it is synanthropic in the northern parts of its range and almost certainly introduced into Norway and Britain. Enghoff (1974) thinks that it may have been introduced even into Denmark. It was recorded from the Netherlands but the record is not substantiated according to Berg (1995). To the SE on the Continent it is more and more found in forest: the other species of the genus occur in E Europe. Its E-central orientation is similar to that of *Melogona voigti*, rather than the W-central orientation of *A. nitidus* or *J. scandinavus*.

CONCLUDING REMARKS

Generalising, it is possible to say that among the orders of millipedes found in Britain and Ireland the Julida are the most able to live in adverse habitats. A lot of them have thus extended their geographical ranges beyond where they originally existed, often aided by human activity. Several European species have moved into the colder northern and eastern areas following the retreat of the ice. Some are almost or entirely synanthropic in these regions. They are good pioneering species. There has also been a major movement of species into and across the Atlantic and even further afield following the development of colonies by European maritime powers. It is noteworthy that there has not been a corresponding movement from the New World into Europe. The British and Irish fauna is mainly of European Atlantic origin (pushing north and east or not), of Central European origin pushing north-west or southern (Mediterranean) origin and introduced.

Considering distributions within Britain and Ireland, I am struck by the fact that while some of the central species are commoner in the East and North others, e.g. *J. scandinavius*, appear to be common all the way to Cornwall, whereas they are missing from NW France. However, this brings me back to the point that much of the Atlantic zone in France and Spain is seriously under-explored. To better understand and clarify our own biogeography we need more expeditions to these areas.

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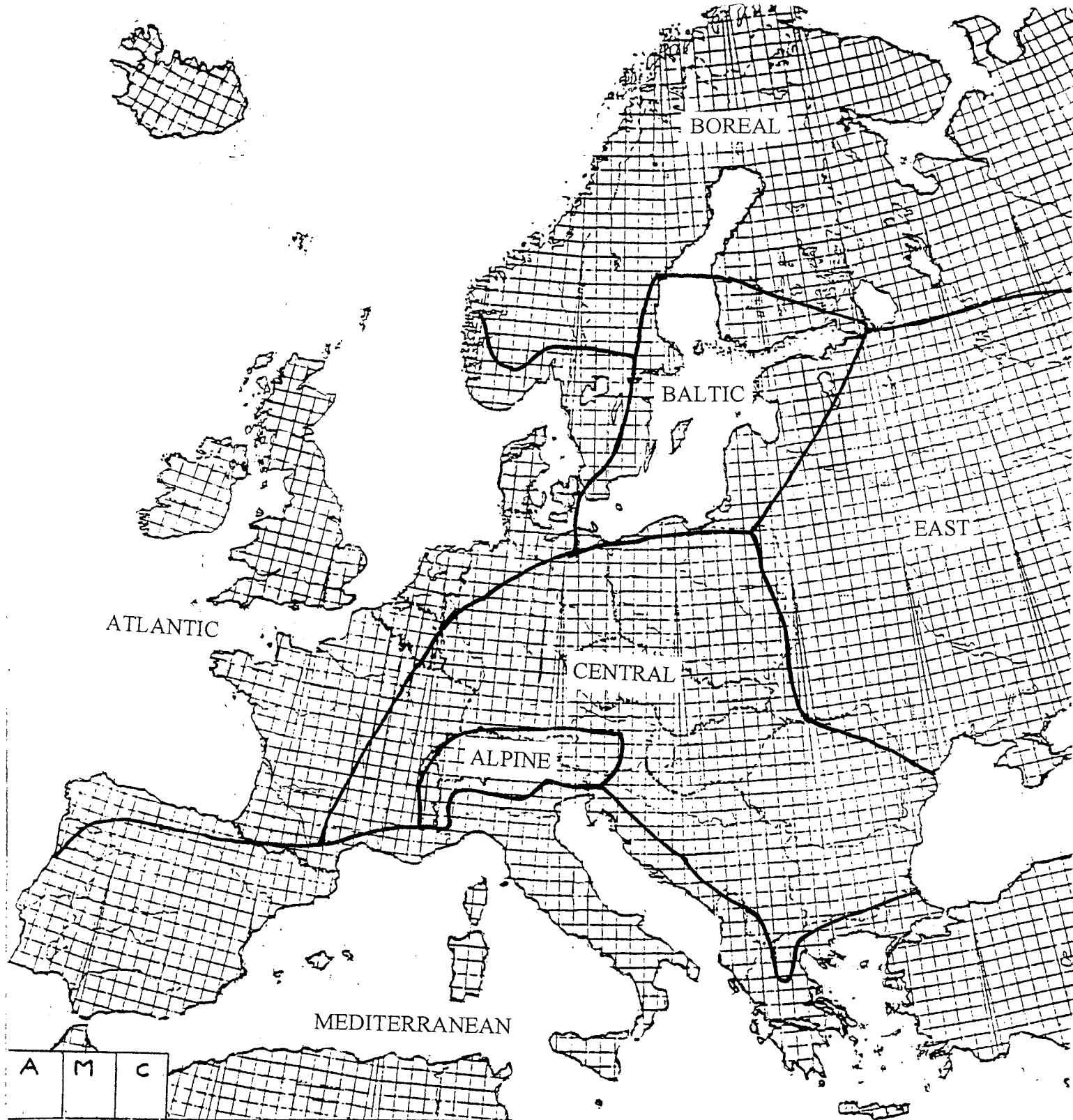


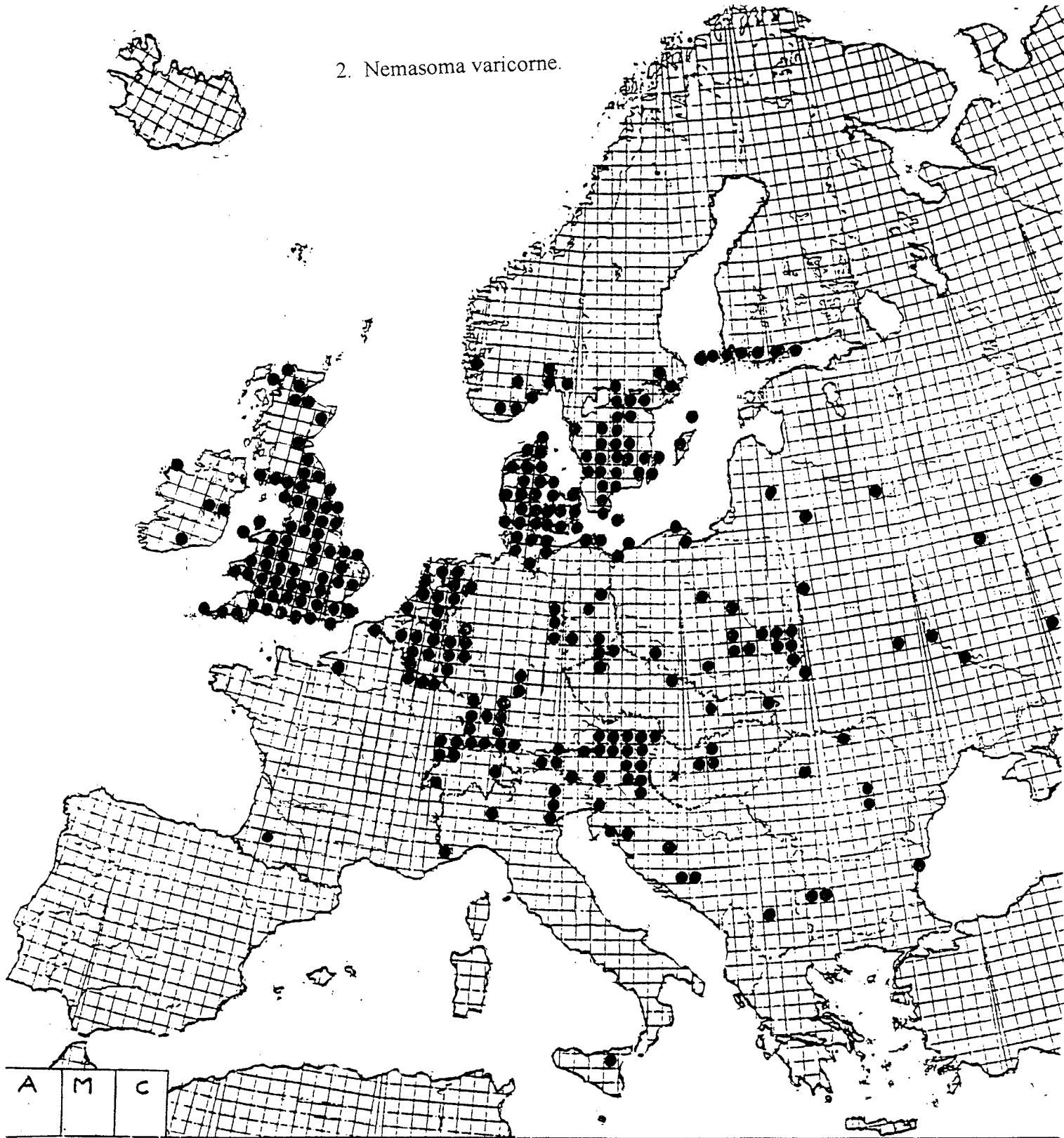
Figure 1. European map showing geographic zones.

In the following maps the boxes A, M and C indicate the presence of species in the Azores, Madeira and the Canary Islands if a dot is situated in them.

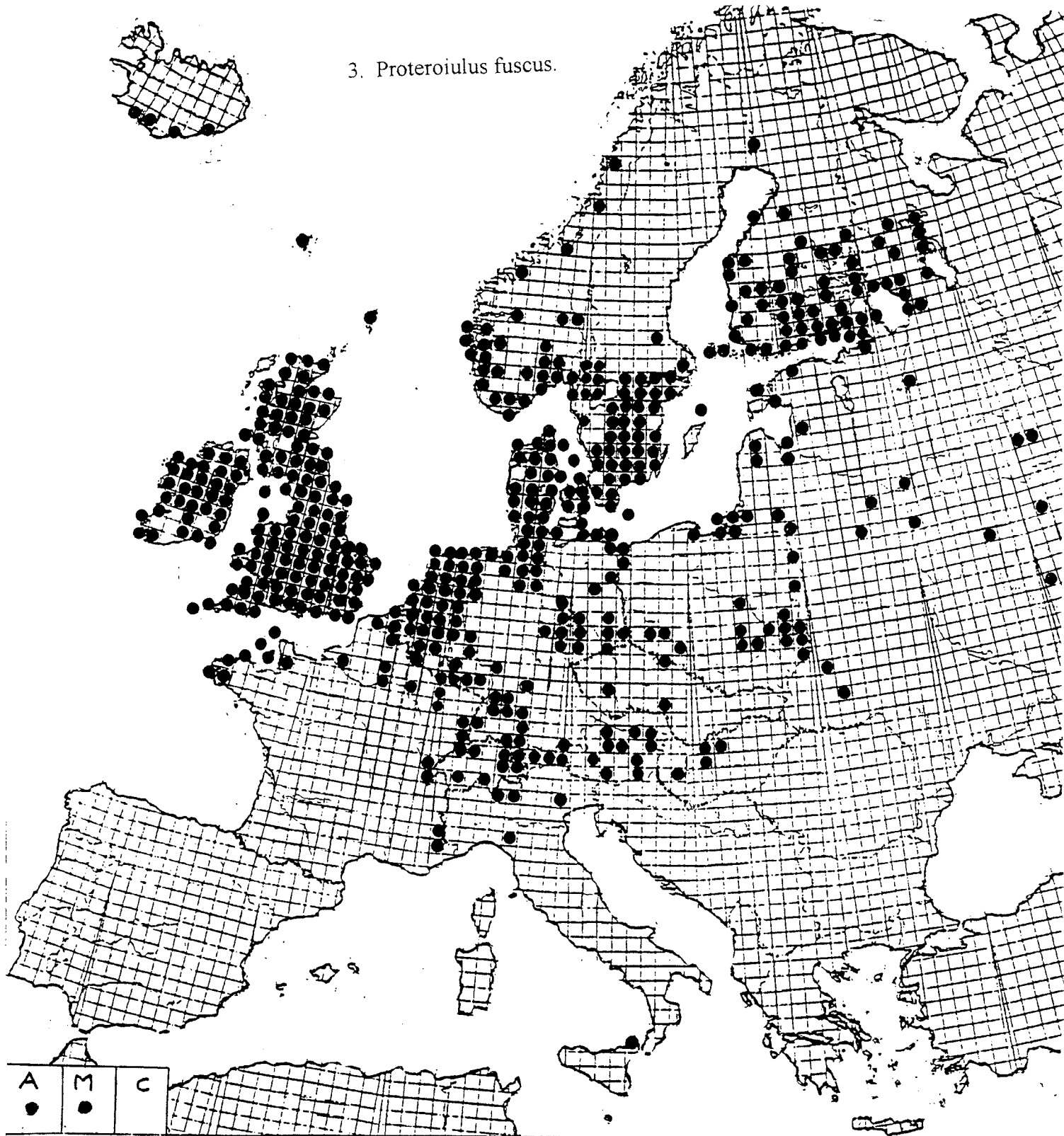
1. *Thalassisobates littoralis*.



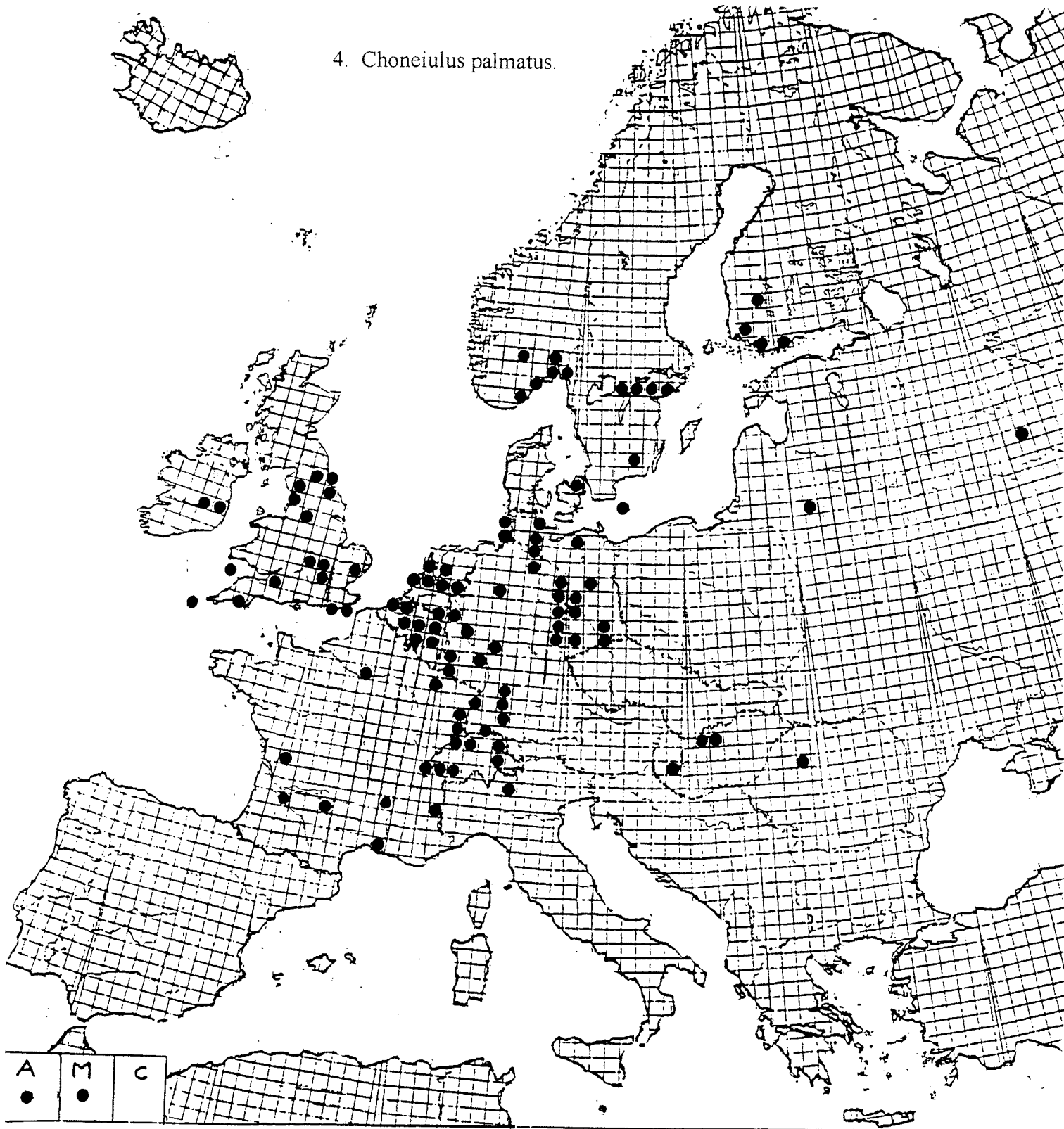
2. *Nemasoma varicorne*.



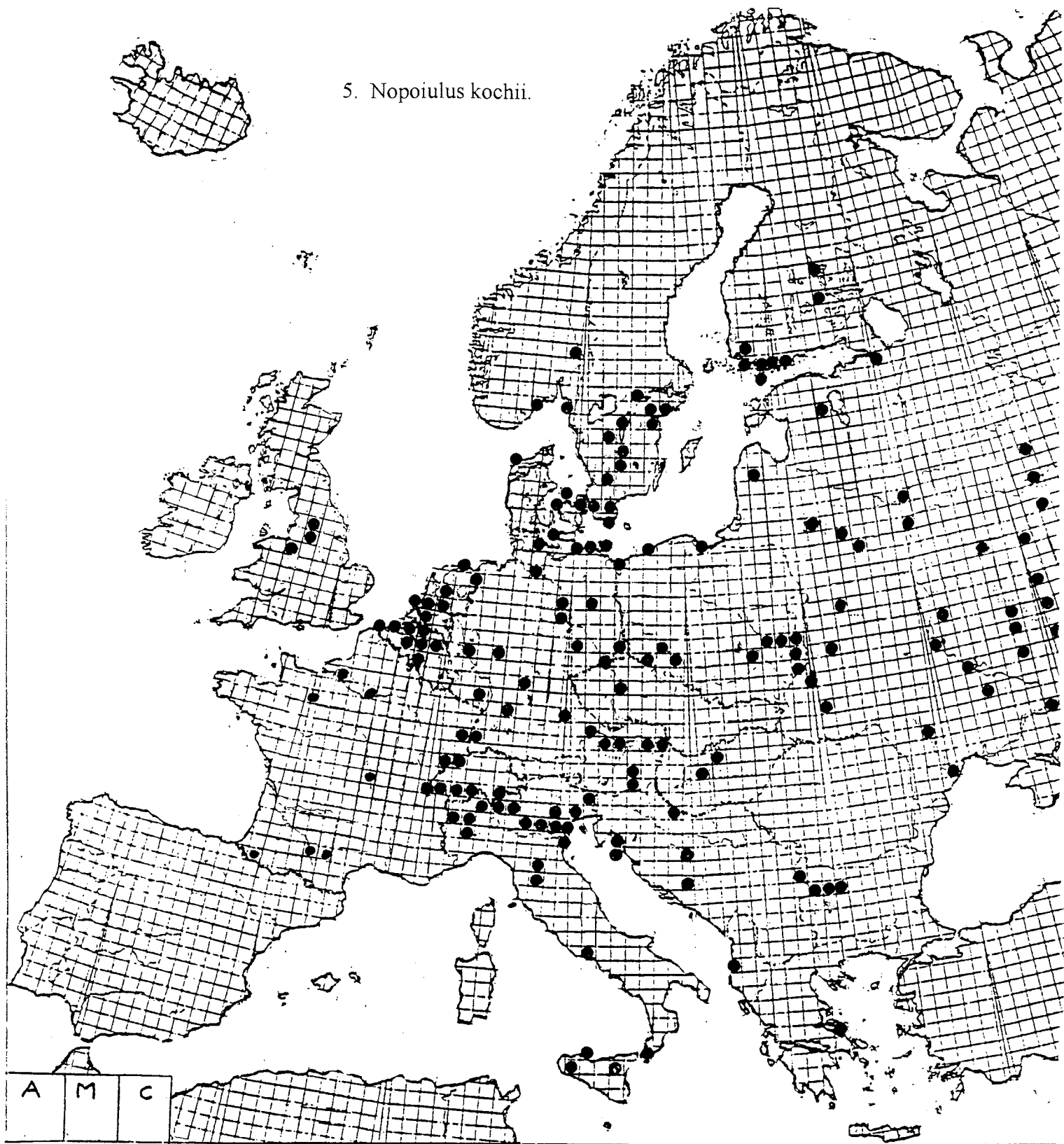
3. *Proteroiulus fuscus*.



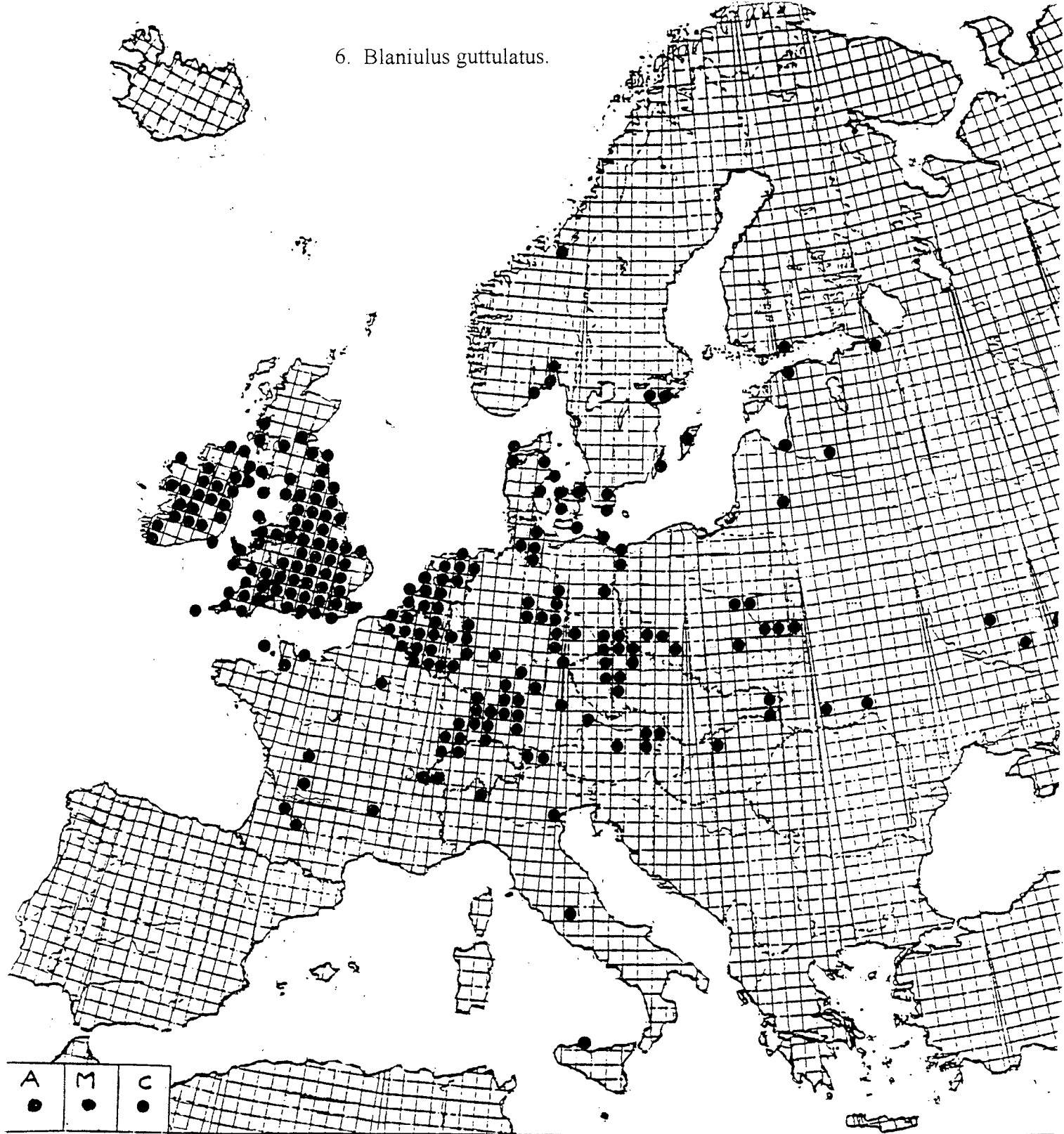
4. *Choneiulus palmatus*.



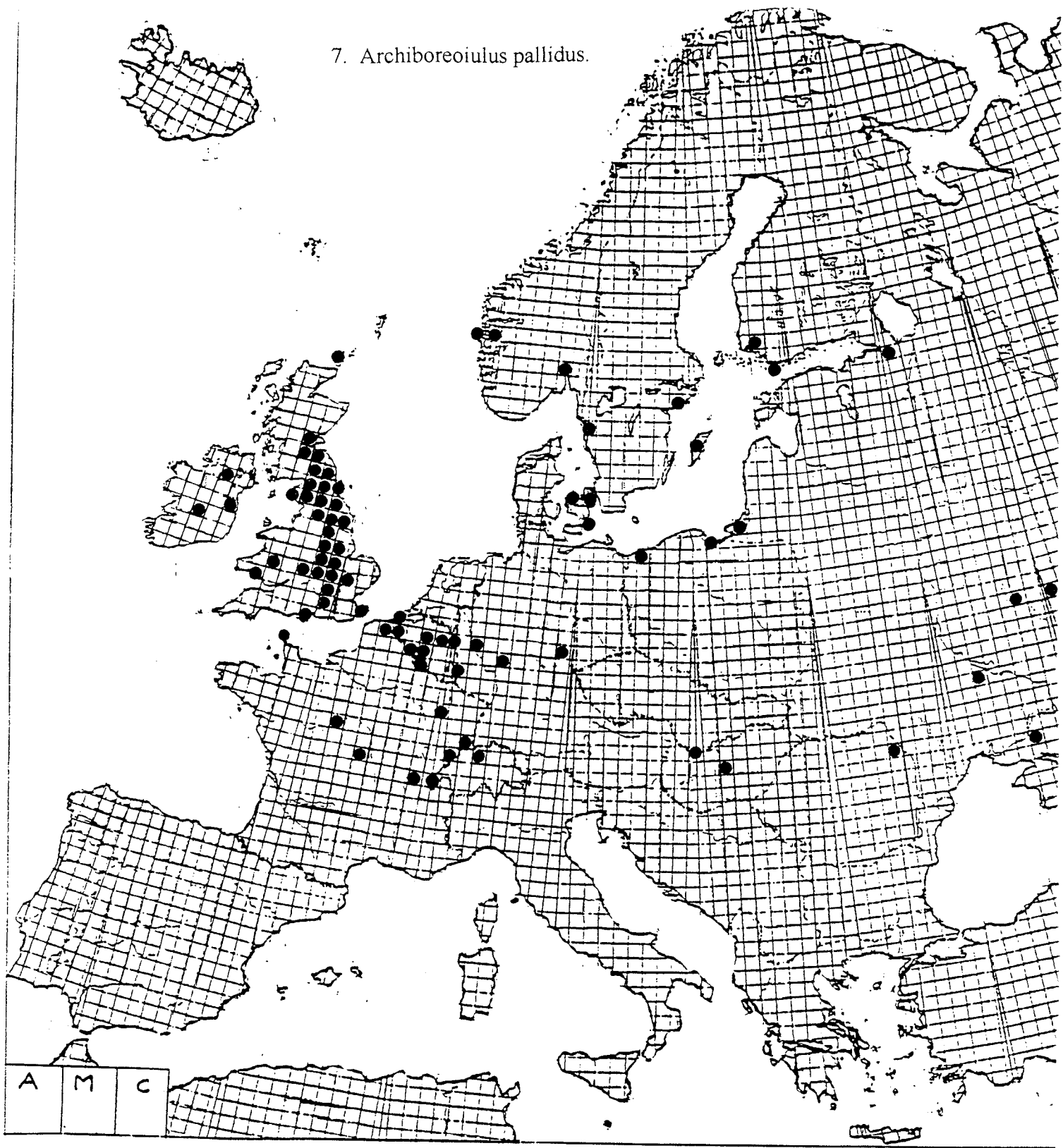
5. *Nopoiulus kochii*.



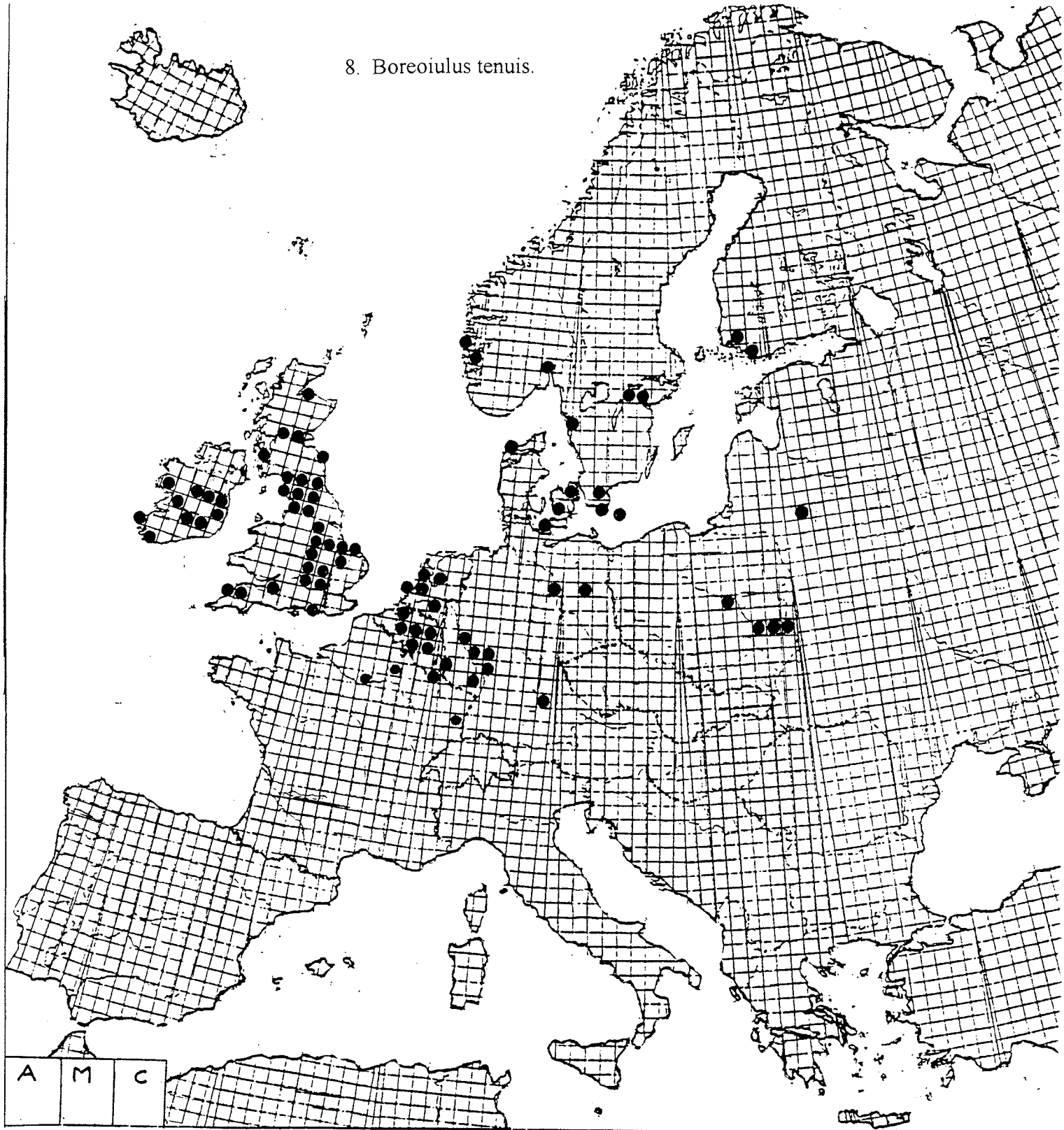
6. *Blaniulus guttulatus*.



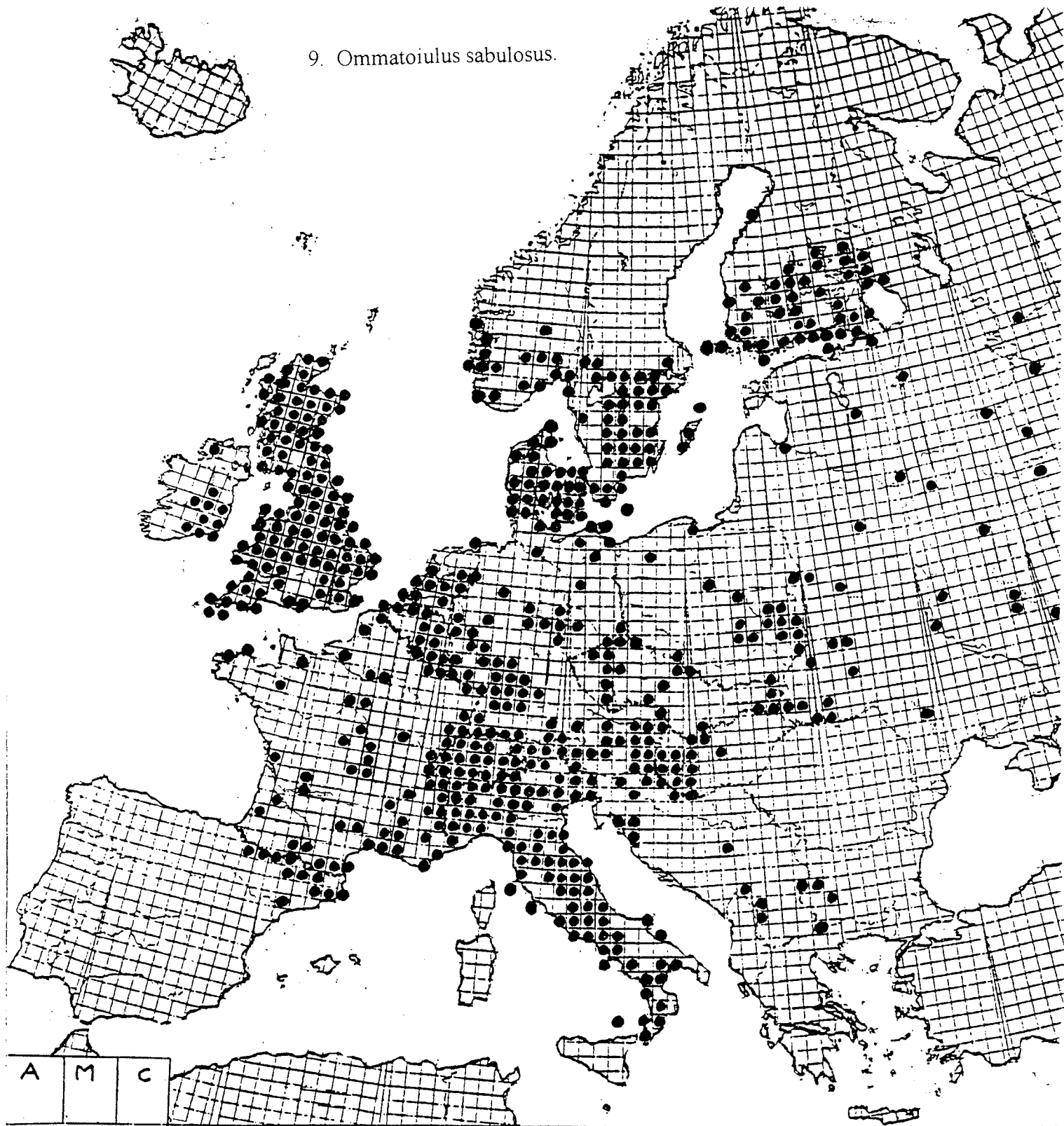
7. *Archiboreoiulus pallidus*.



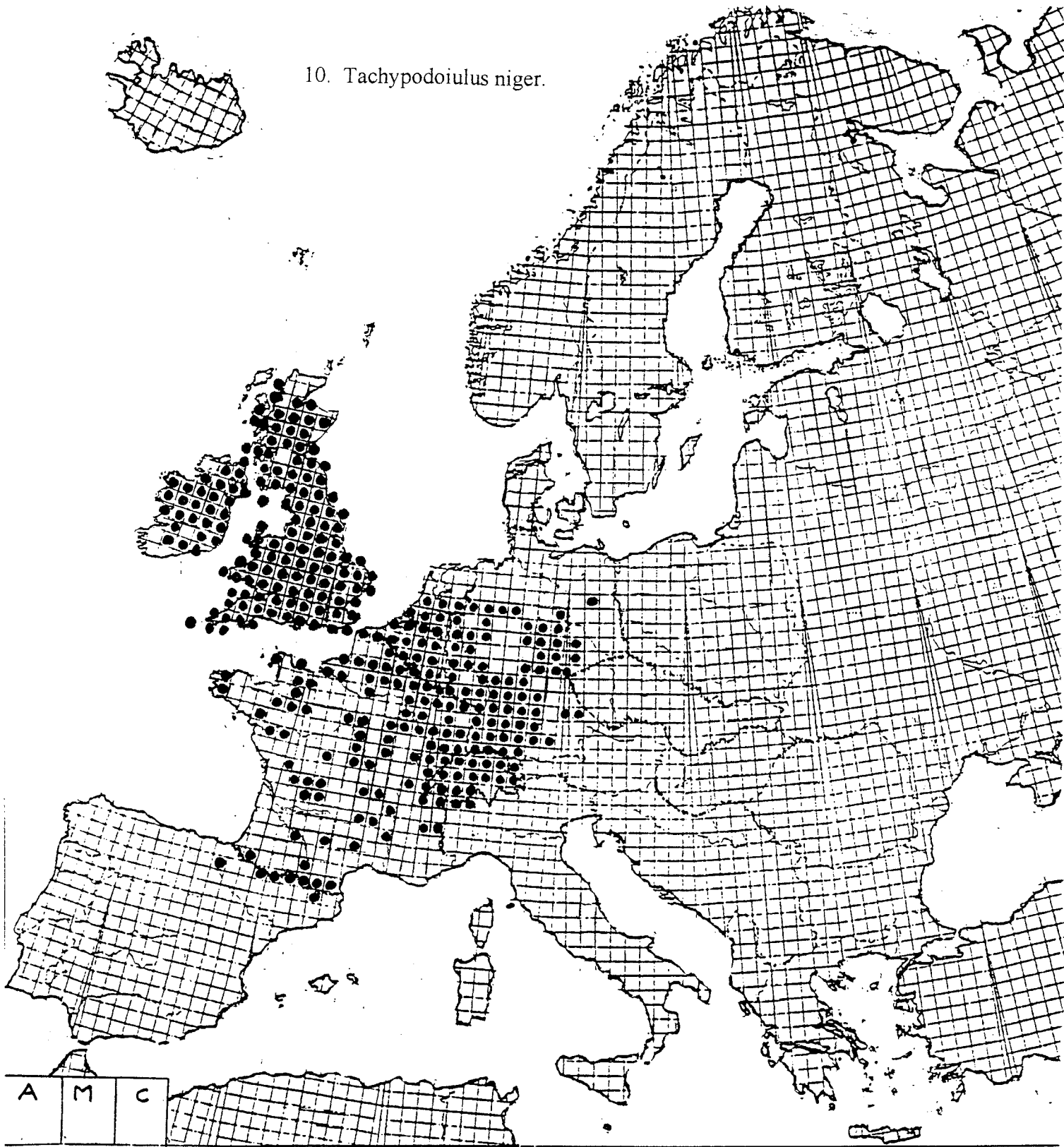
8. *Boreoiulus tenuis*.



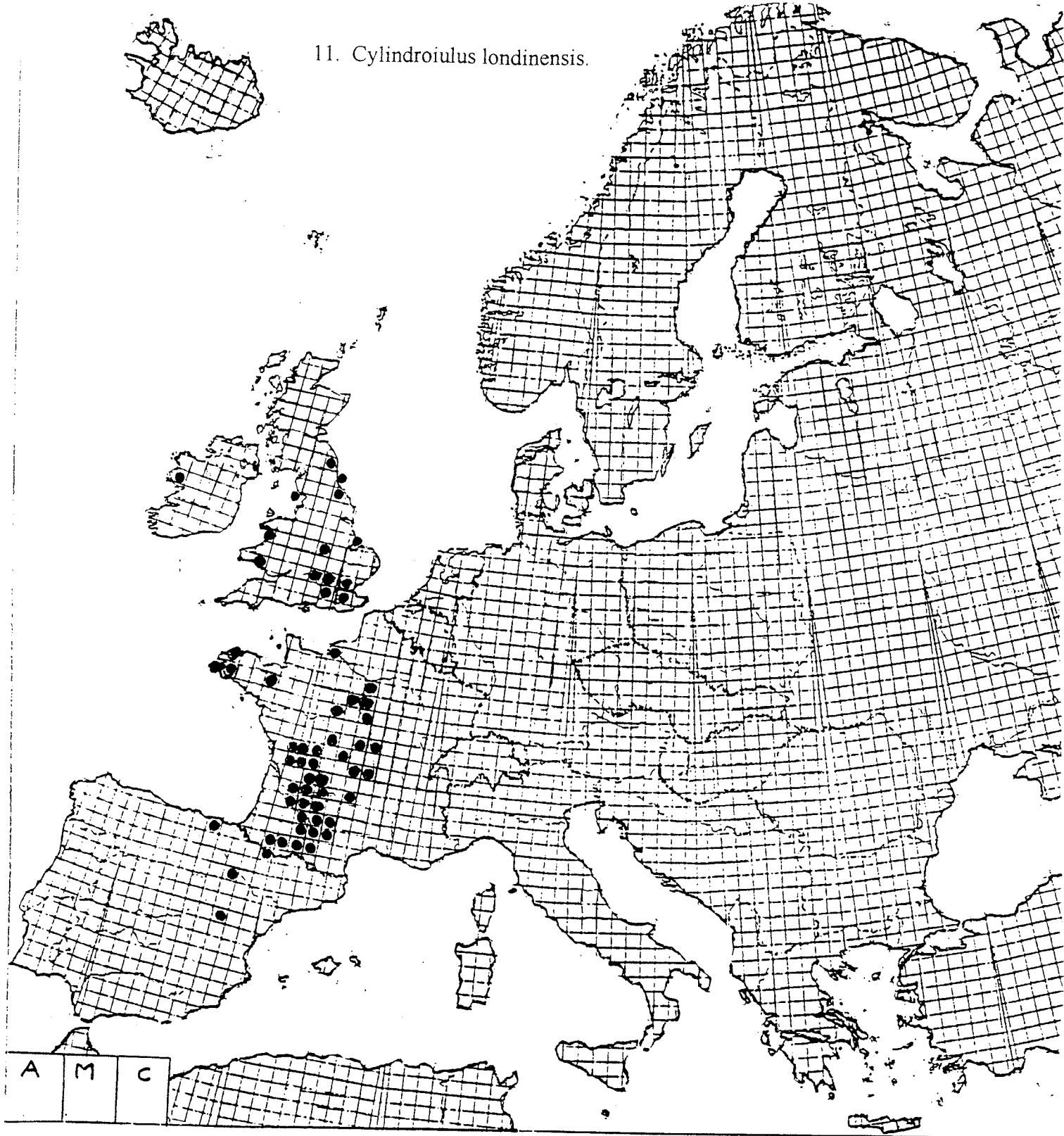
9. *Ommatoiulus sabulosus*.



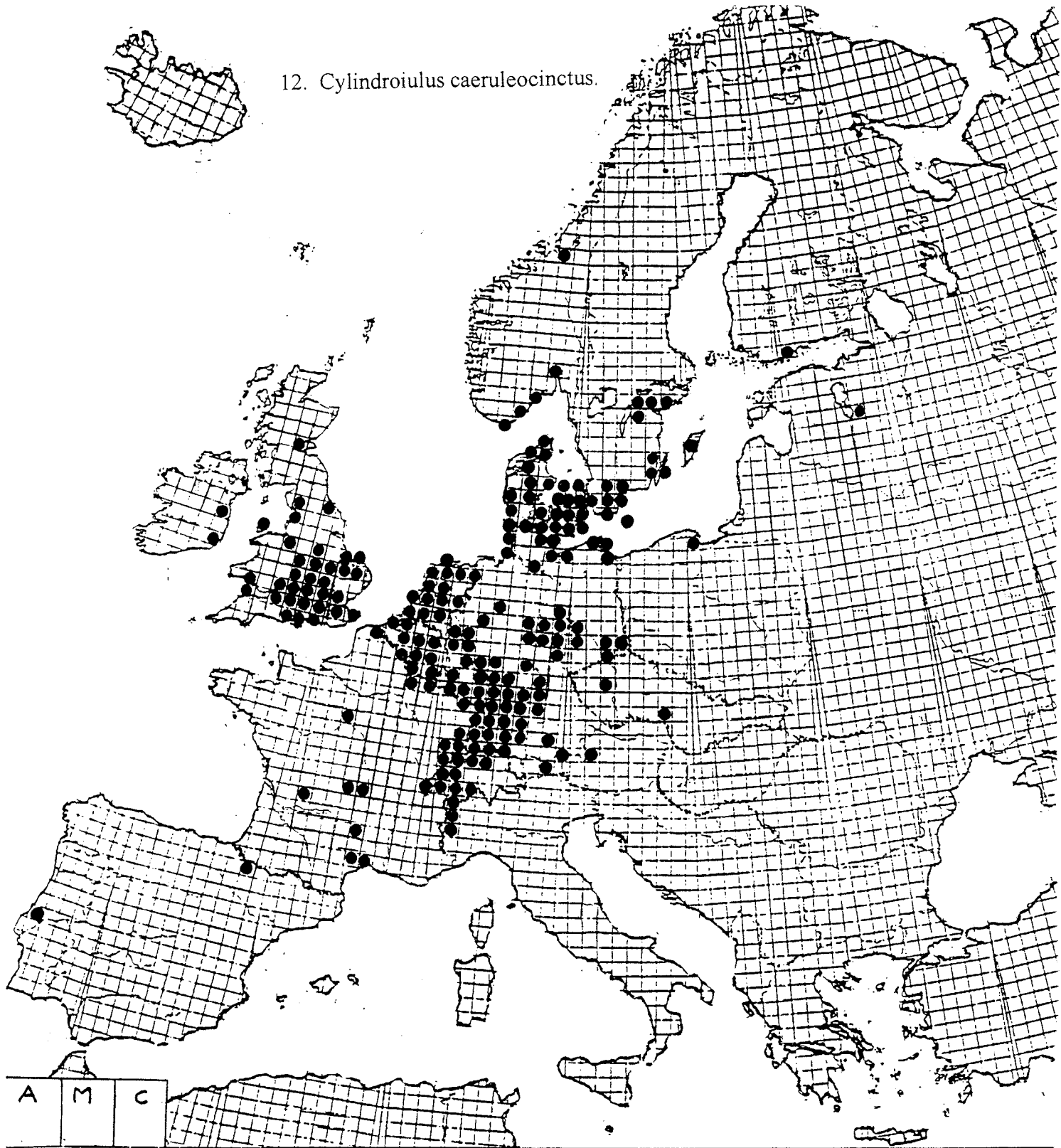
10. *Tachypodoiulus niger*.



11. *Cylindroiulus londinensis*.

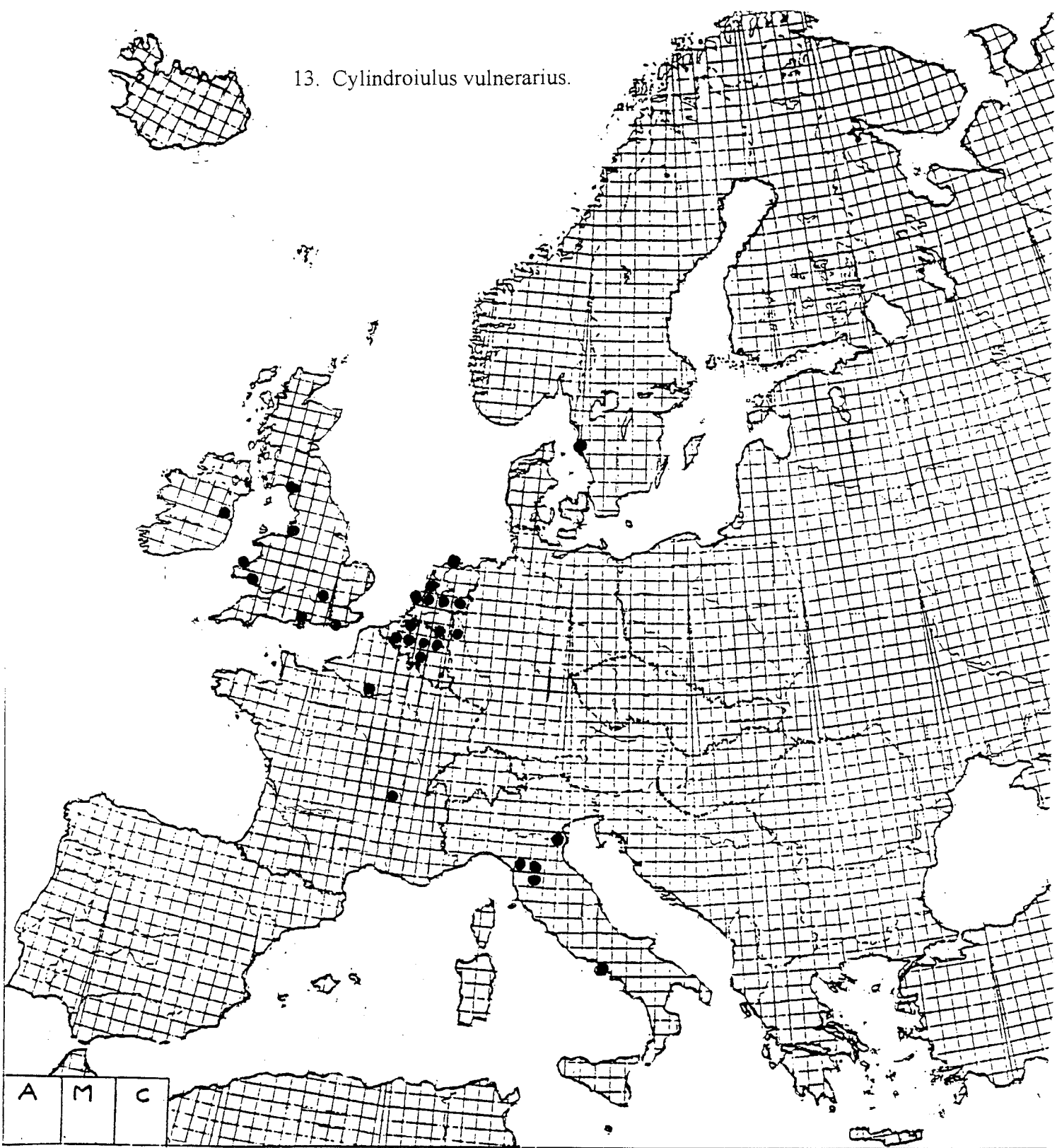


12. *Cylindroiulus caeruleocinctus*.

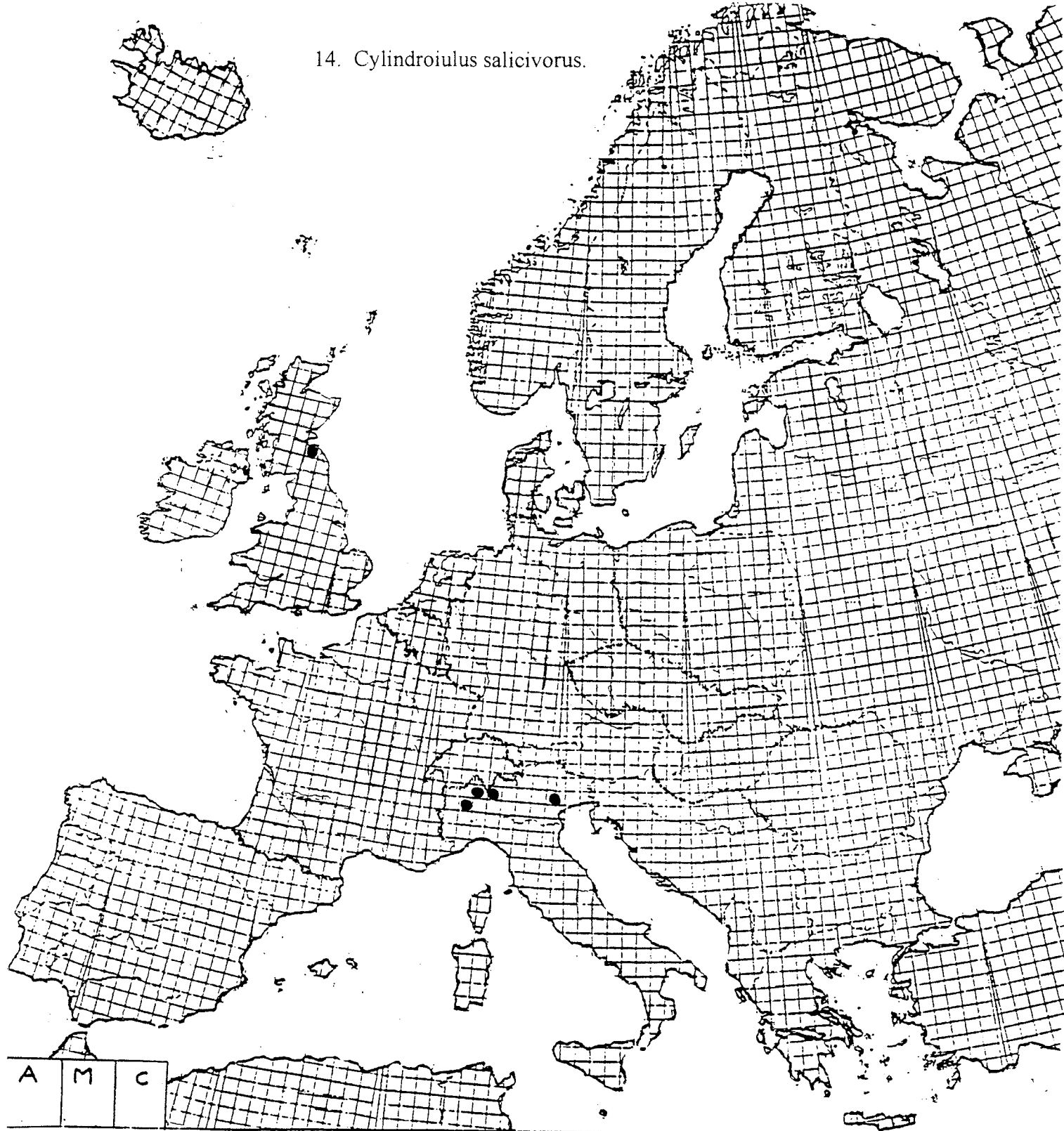


I have not yet located several regional records from Poland and some from other parts of East Europe.

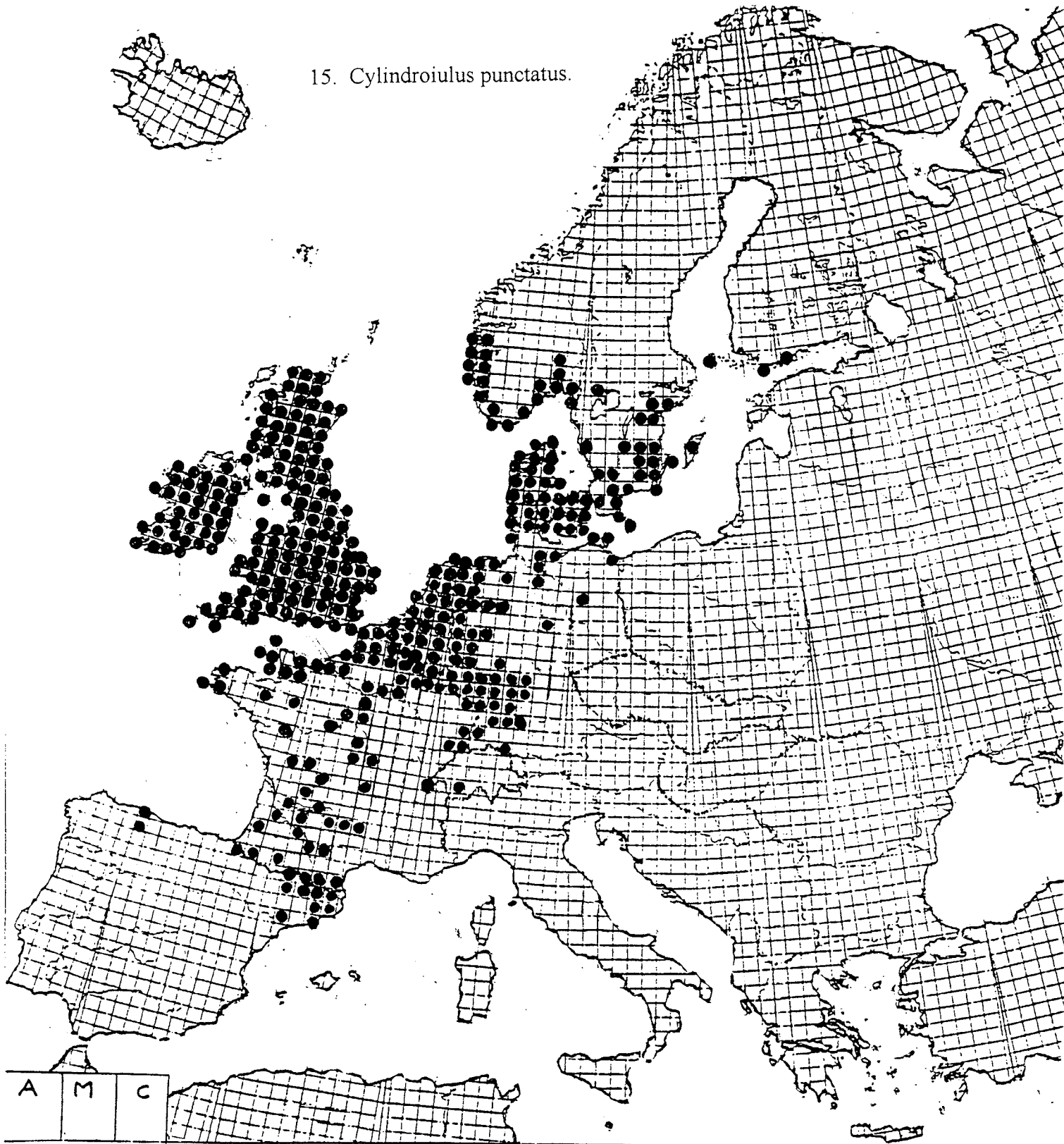
13. *Cylindroiulus vulnerarius*.



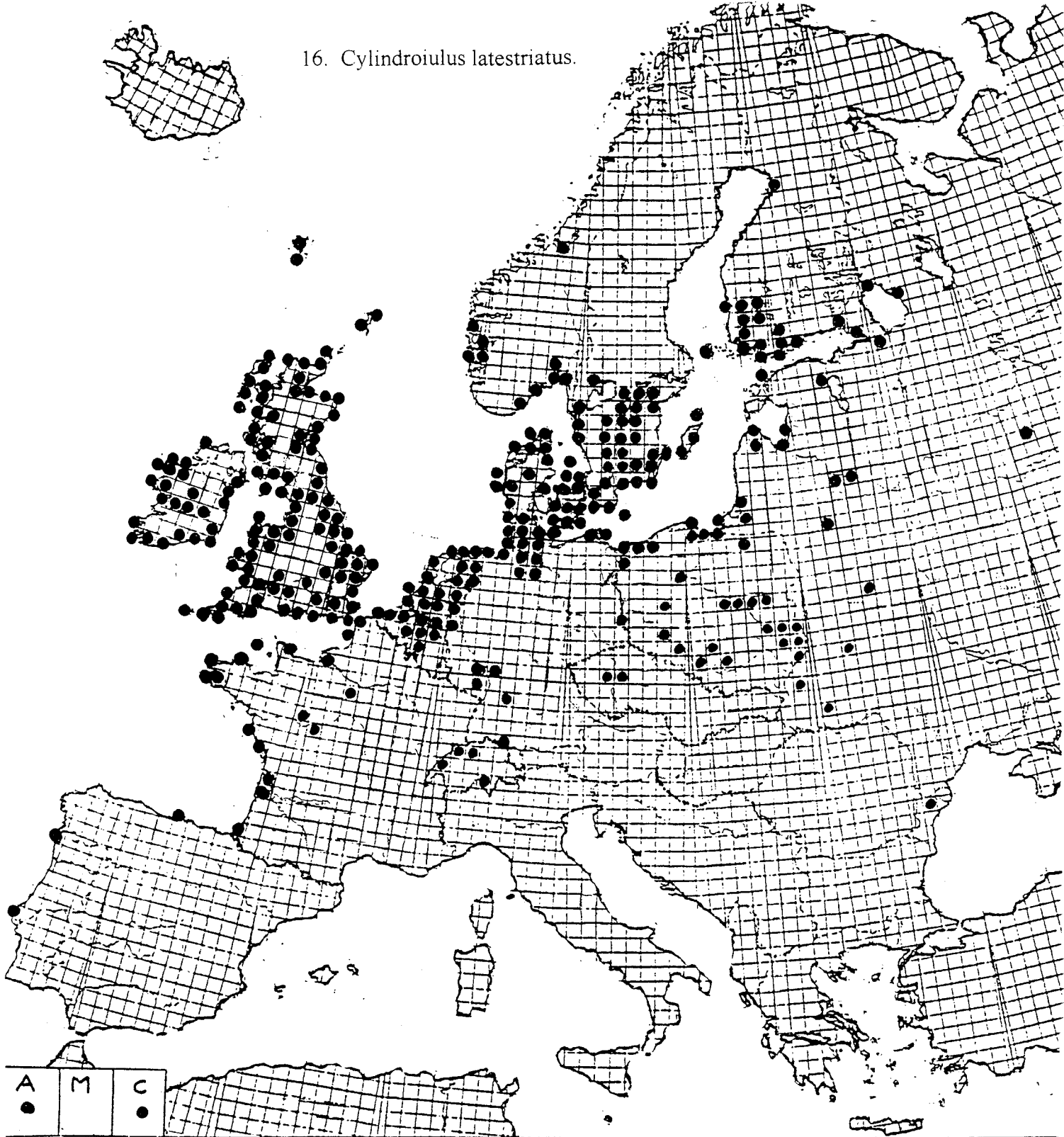
14. *Cylindroiulus salicivorus*.



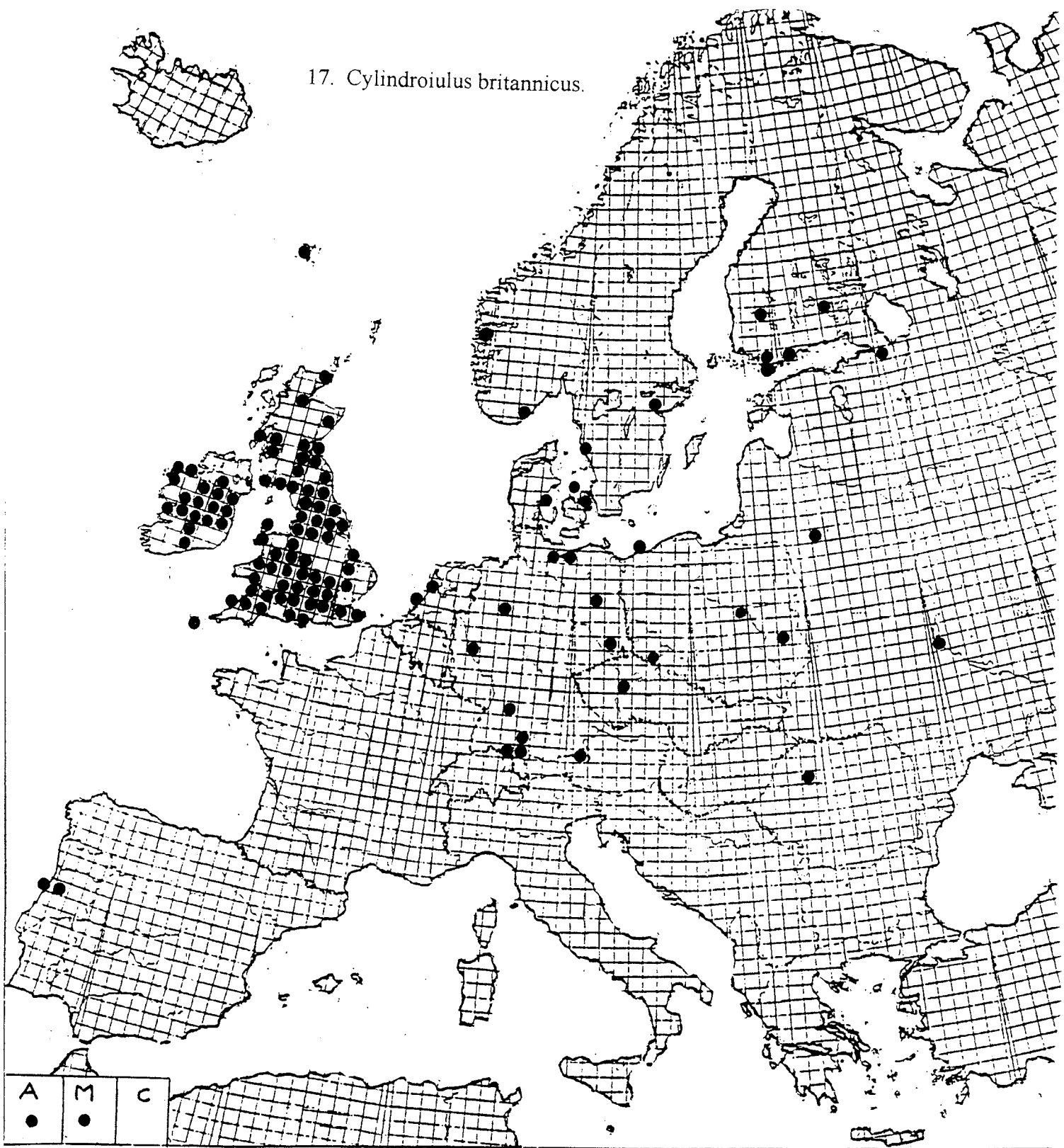
15. *Cylindroiulus punctatus*.



16. *Cylindroiulus latestriatus*.



17. *Cylindroiulus britannicus*.



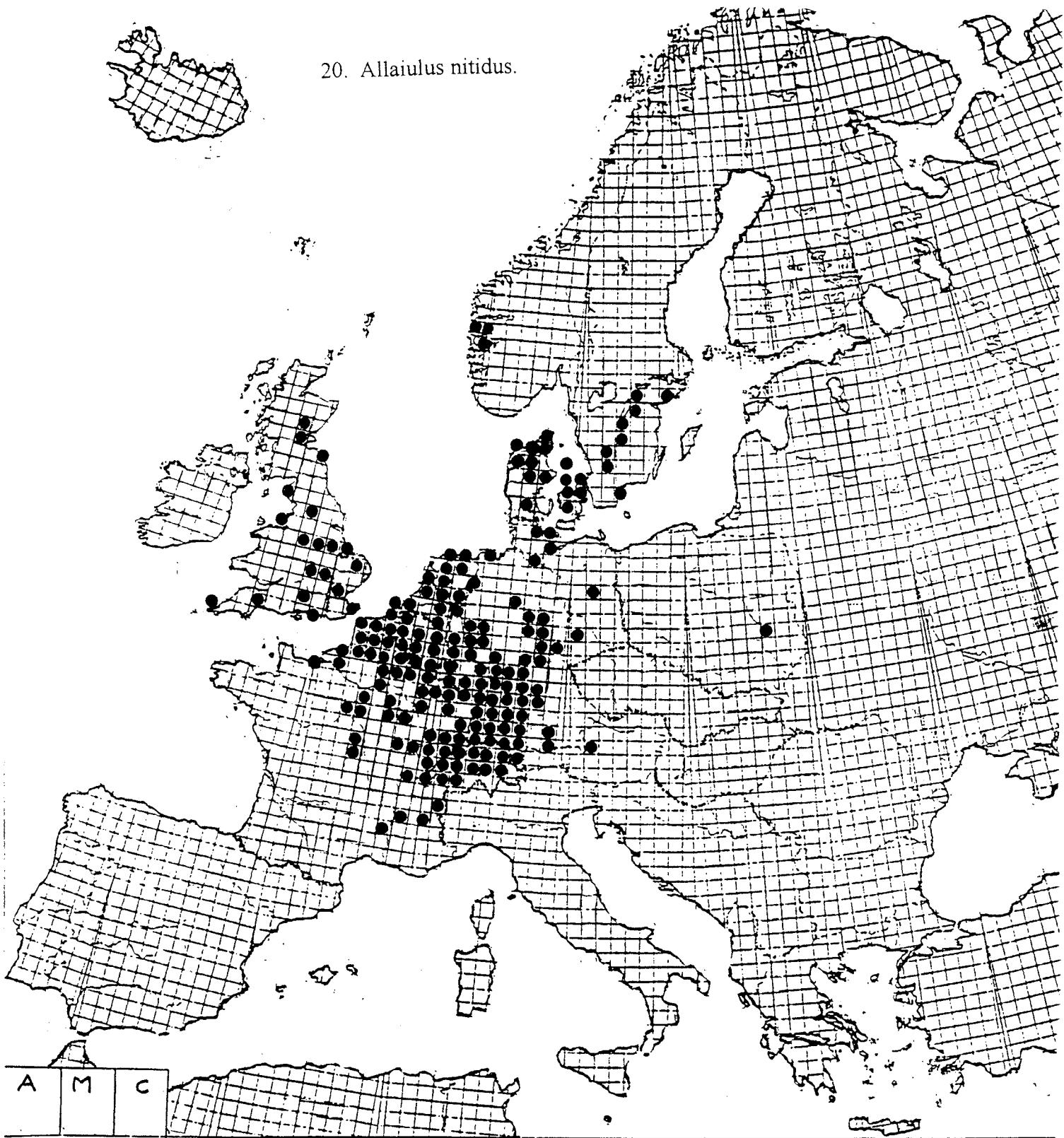
18. *Cylindroiulus parisiorum*.



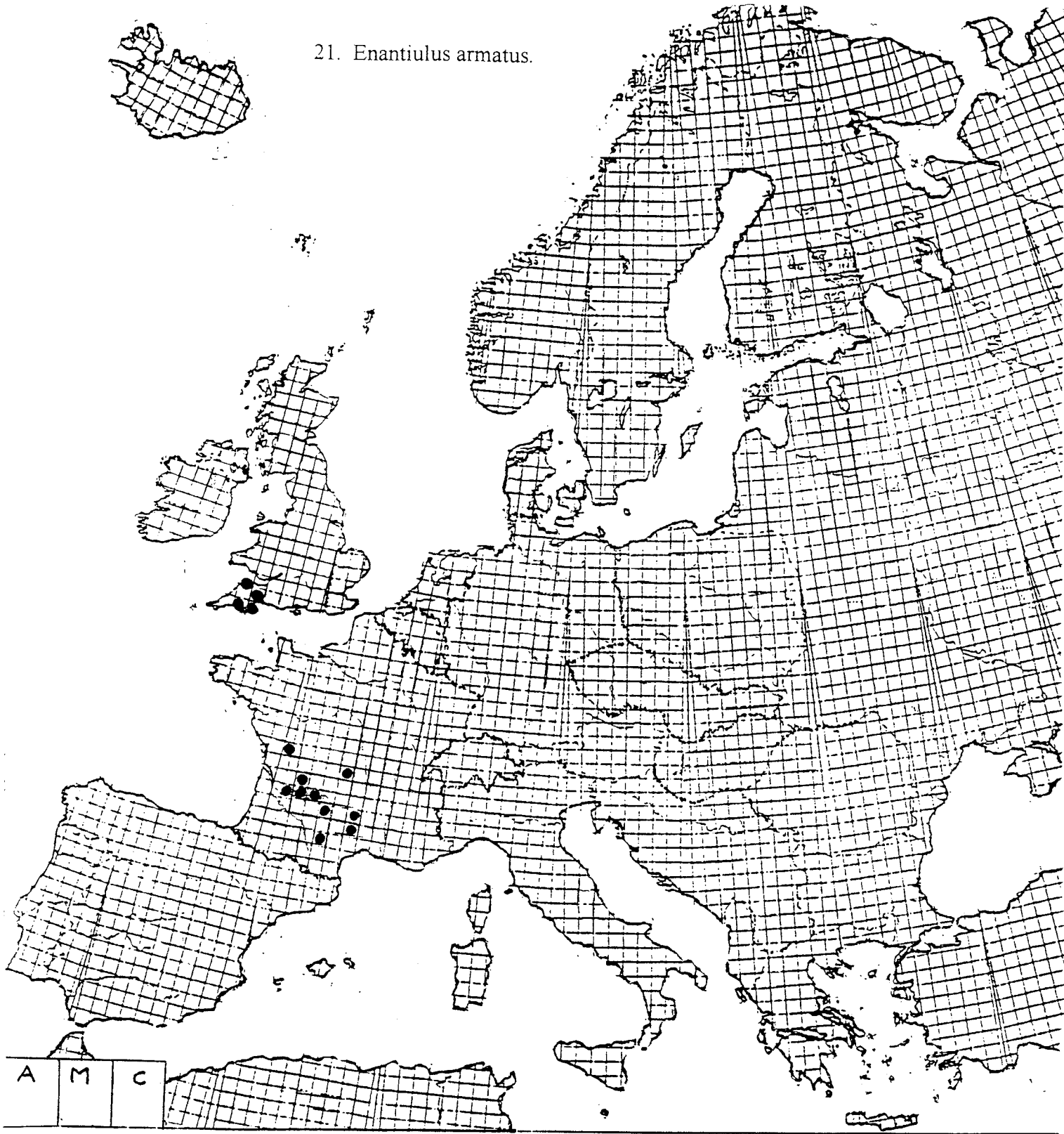
19. *Cylindroiulus truncorum*.



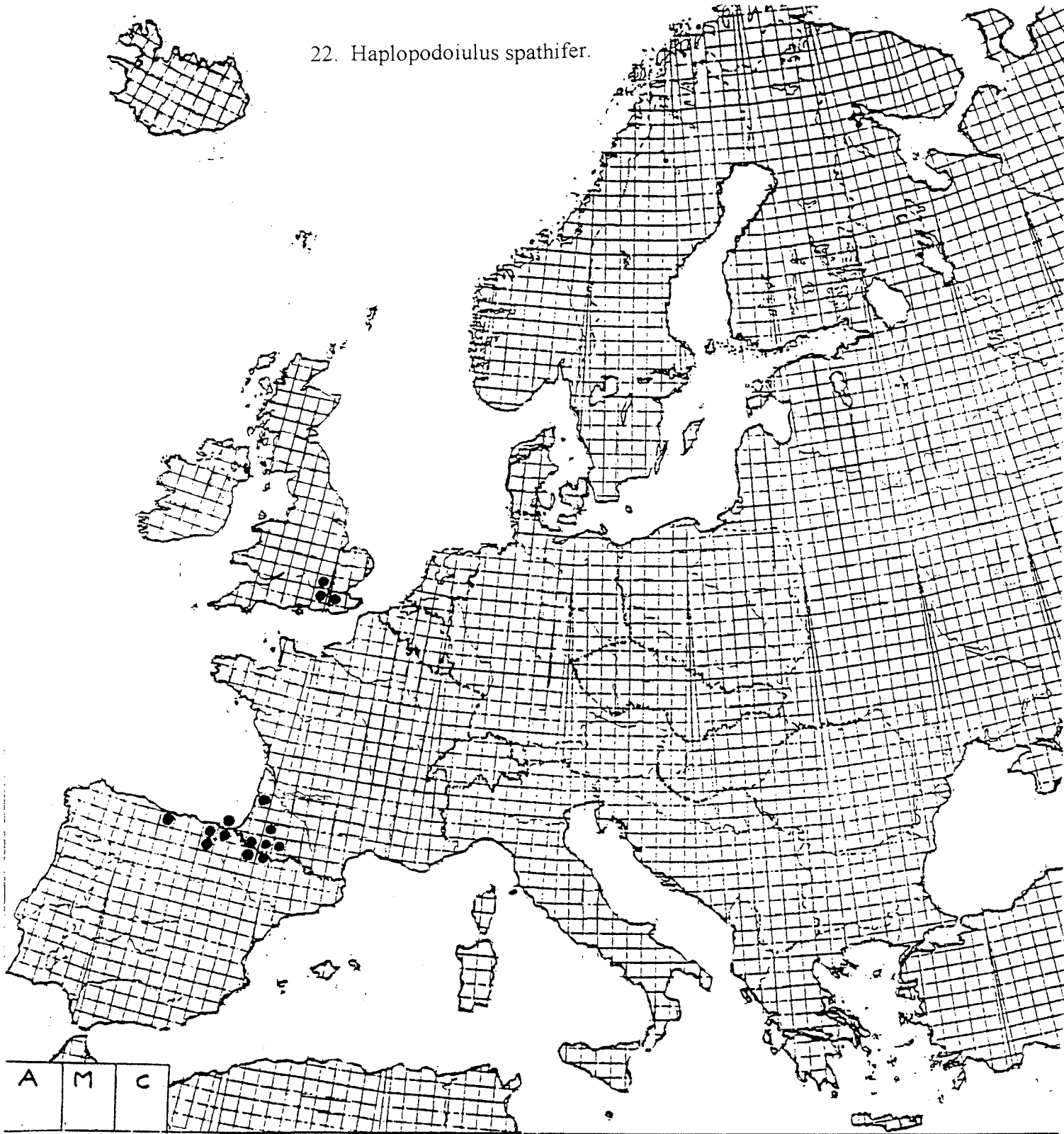
20. *Allaiulus nitidus*.



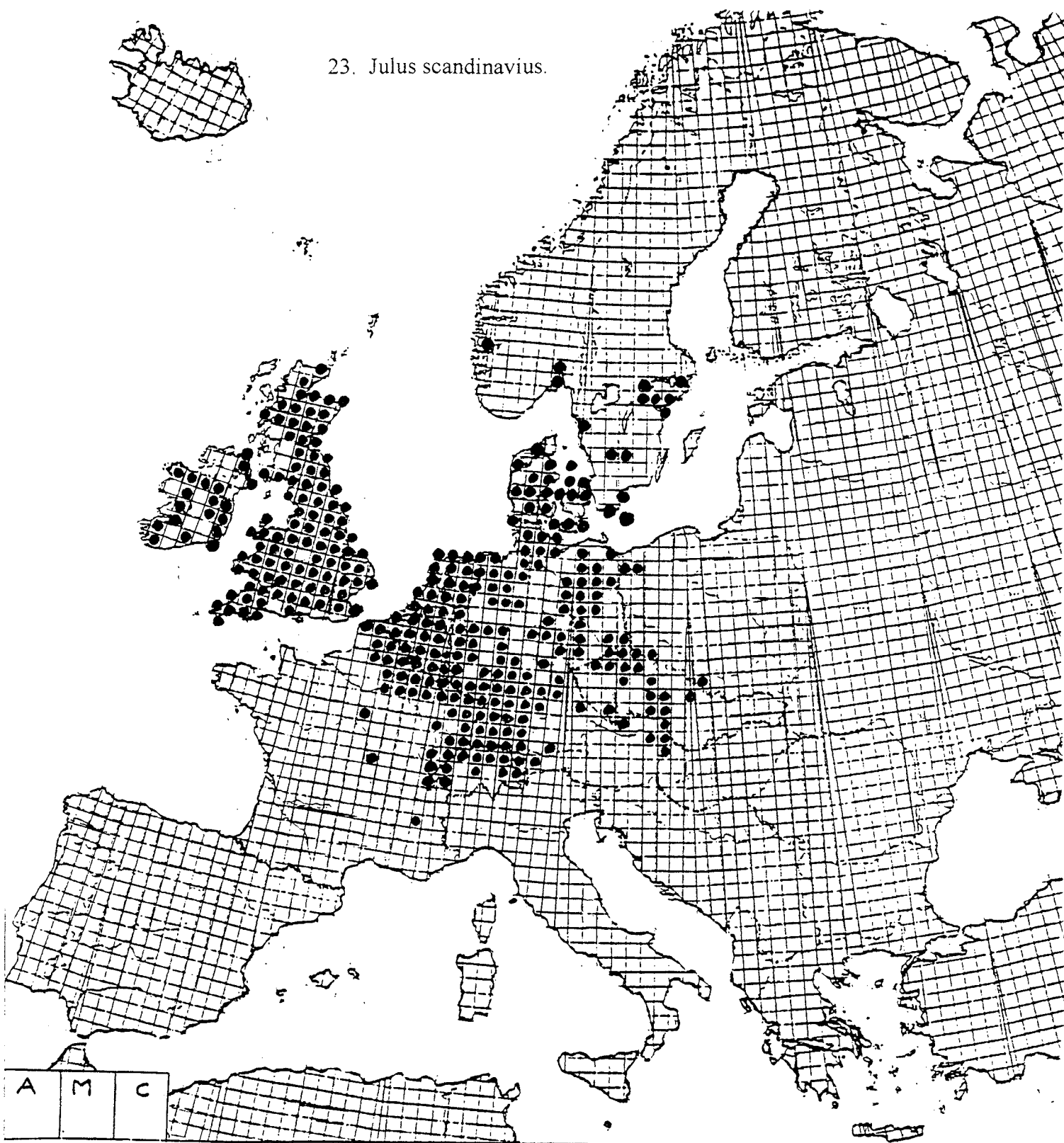
21. *Enantiulus armatus*.



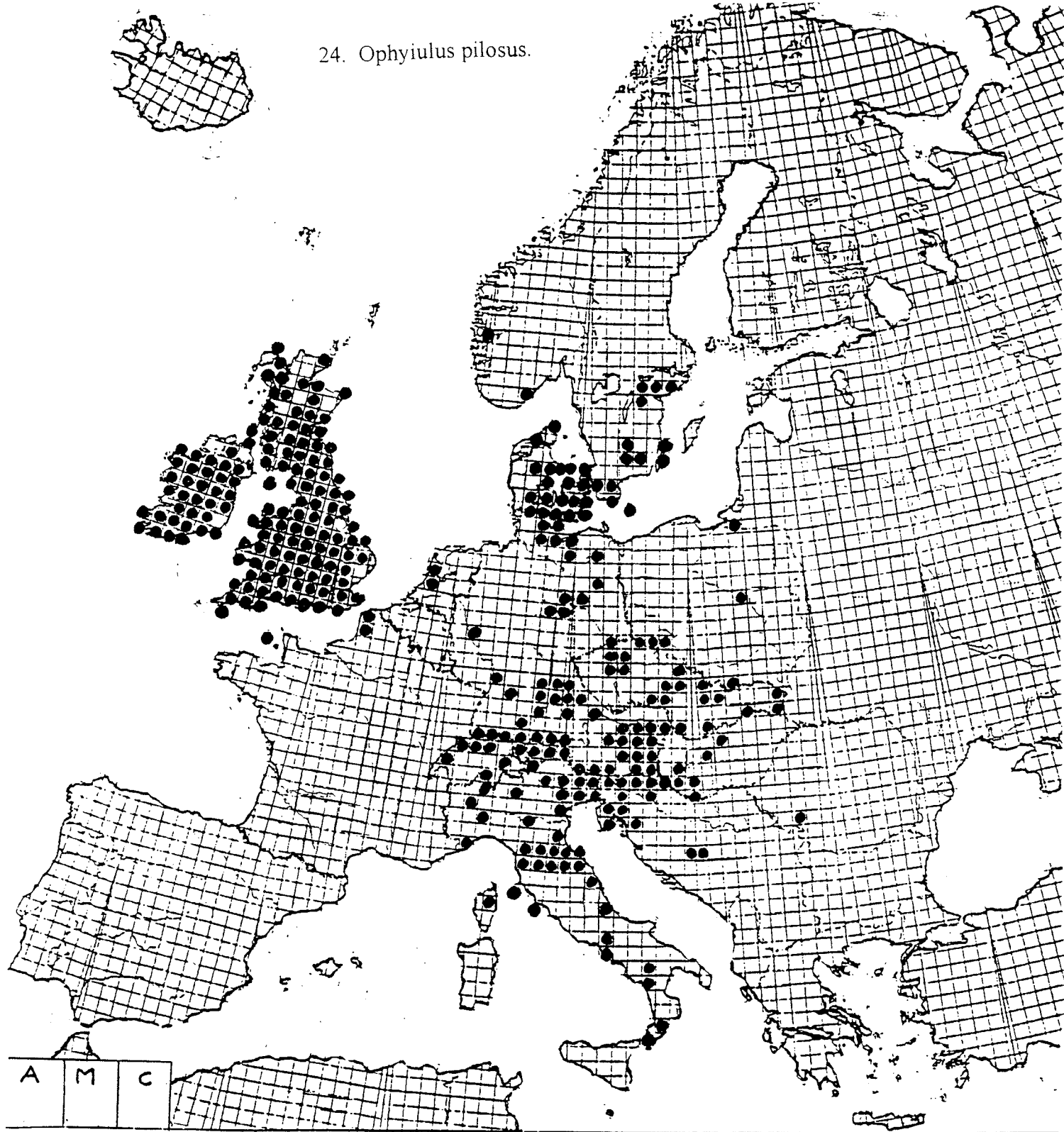
22. *Haplopodoiulus spathifer*.



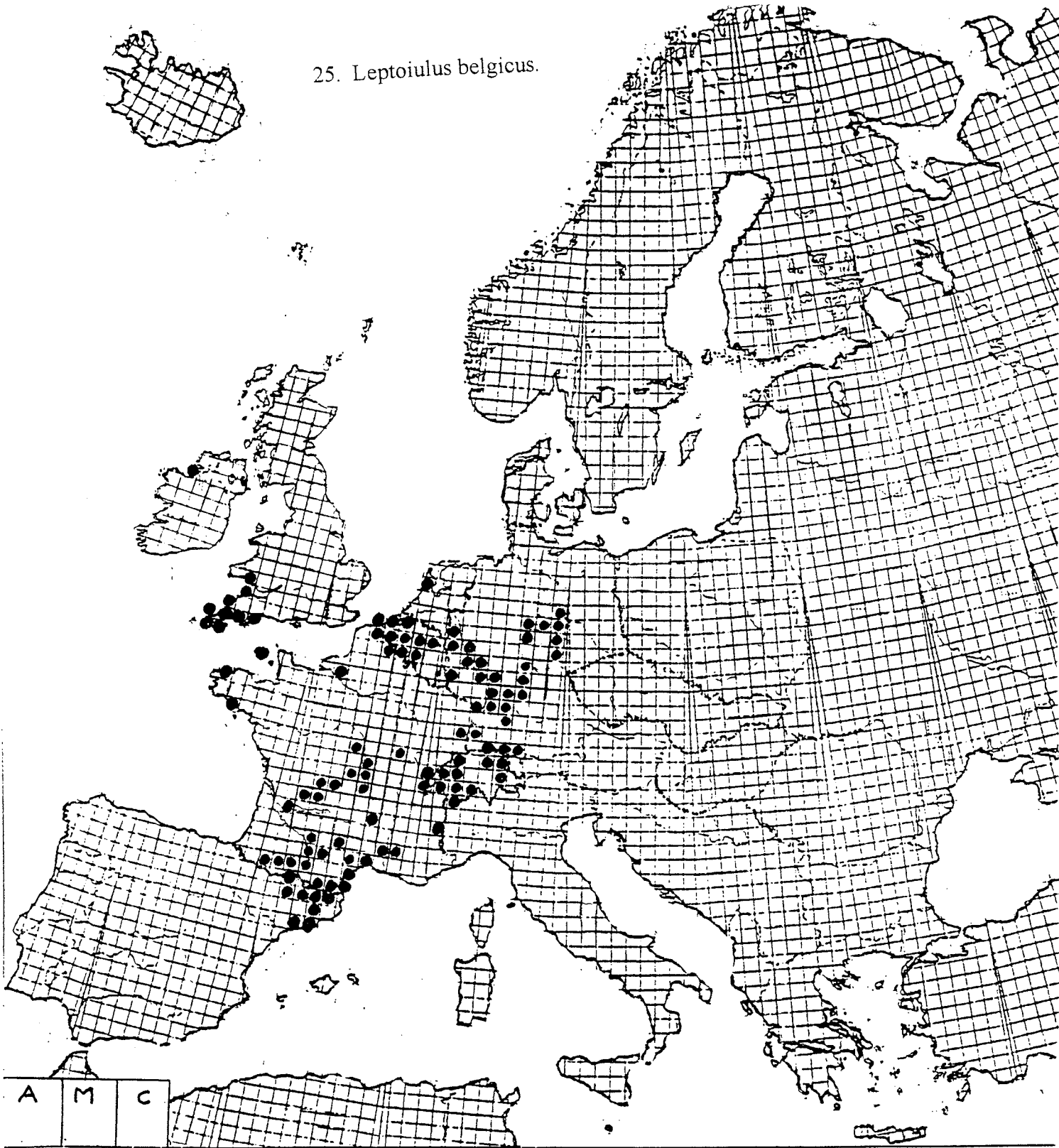
23. *Julus scandinavus*.



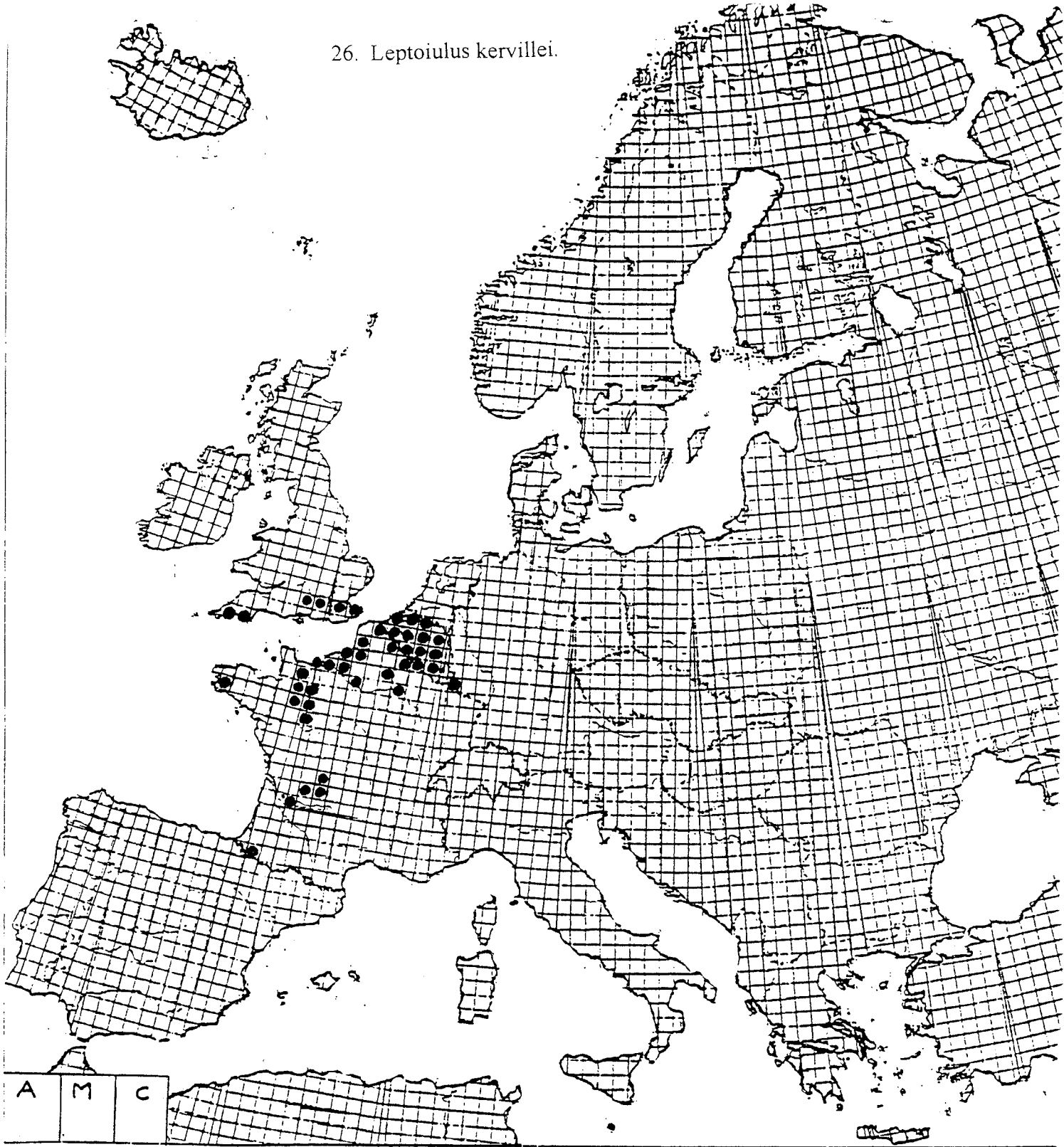
24. *Ophiulus pilosus*.



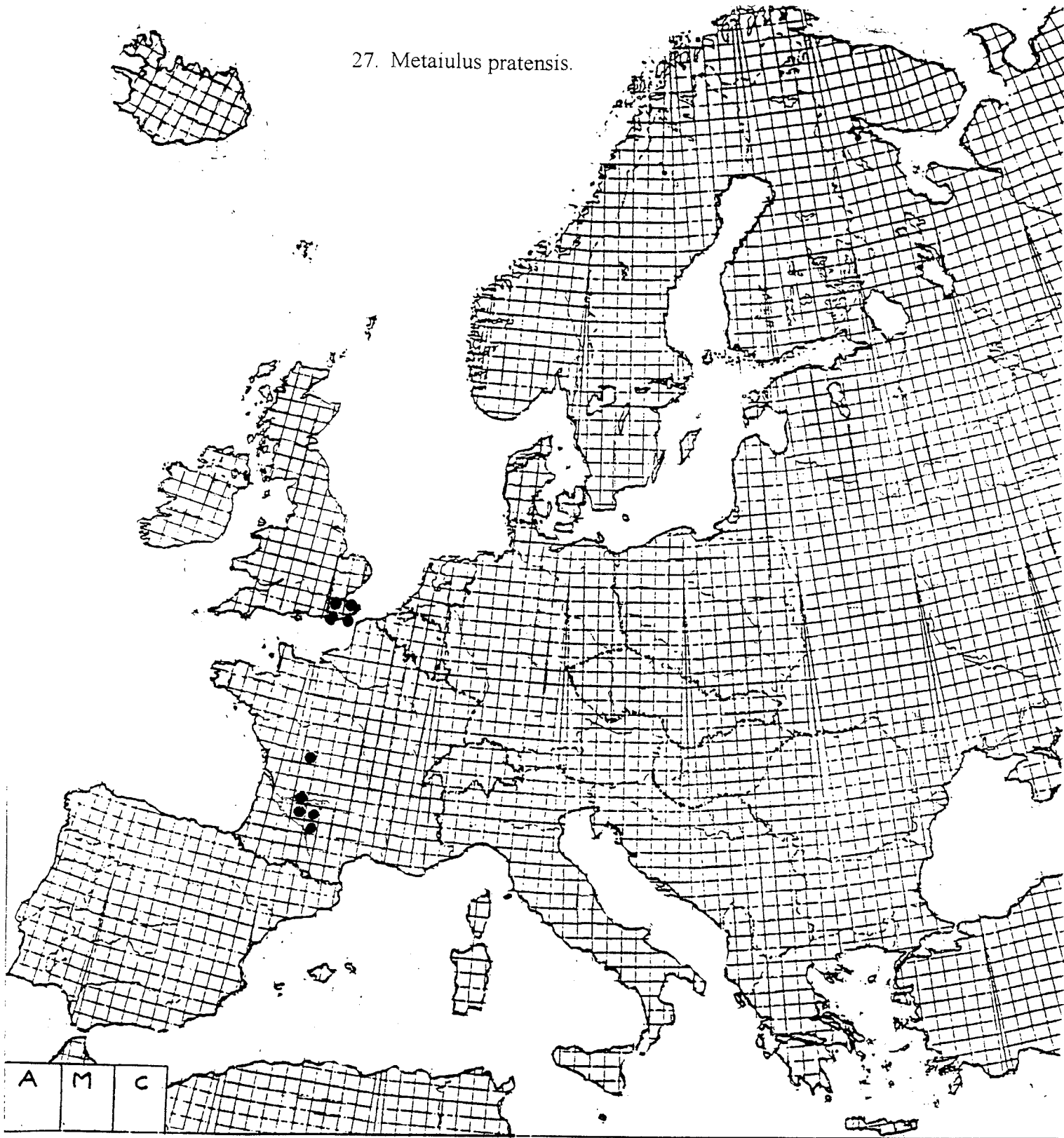
25. *Leptoiulus belgicus*.



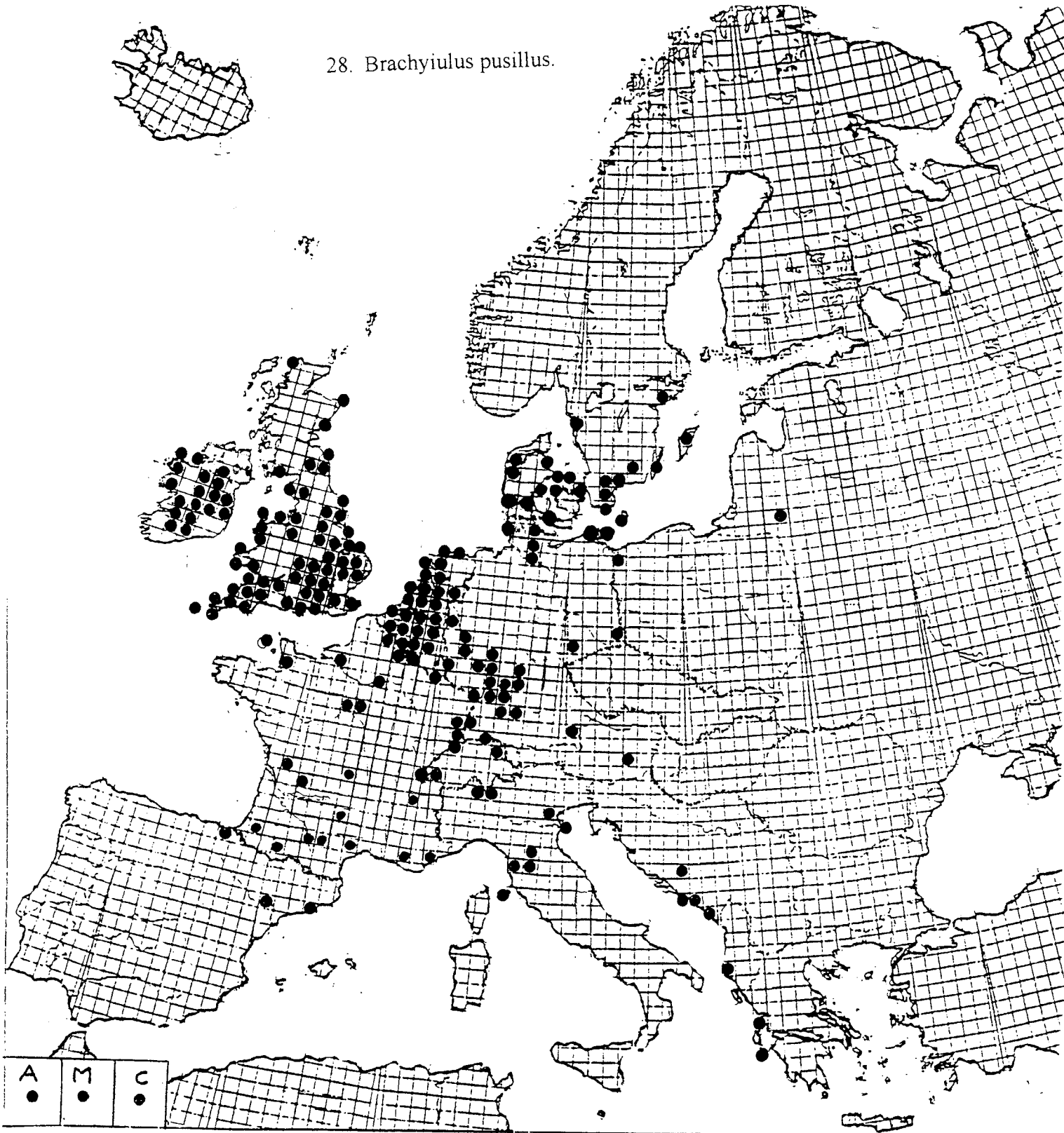
26. *Leptoiulus kervillei*.



27. *Metaiulus pratensis*.



28. *Brachyiulus pusillus*.



29. *Unciger foetidus*.

