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Occurrence of the Genus Microscolex (Oligochaeta, Acanthodrilidae) at Western Canary Islands

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Abstract. Two species of *Microscolex* are present in the western Canary Islands: *M. dubius* and *M. phosphoreus* (new record for Hierro). The latter belongs to the modern fauna of the Canaries and was recently introduced by man. Both species prefer to live at the basal altitude level, mainly in the highly anthropized band between 50 and 300 m a.s.l. The habitat range of *M. phosphoreus* is rather narrow and its principal nucleus of dispersion are tropical fruit plantations (papaya, avocados and bananas); however, *M. dubius* is more diversified, its range is wide, even reaching into the native *Pinus canariensis* and laurel forests at the montane level. Other data provide evidence that the greatest number of specimens and locations are on the northeast slopes of the Canaries, as reflected in the first distribution maps of each of the islands. The biogeographical affinities with Macaronesia are discussed, along with the probable links with Latin America as a long-standing (500 year-old) source for importing agricultural and ornamental plants into the Canaries.

Keywords. Earthworms, Acanthodrilidae, Canaries, habitats, chorology.

1. INTRODUCTION

The taxonomy and distribution of the Acanthodrilidae have been under study for a long time, Beddard (1895) and Michaelsen (1900) having compiled comprehensive information on these annelids in their magnificent scientific works. They are well known in Australasia, the Neoarctic and Neotropical regions, where they are spread over a wide range of both anthropized deforested habitats and those with abundant vegetation (e.g. tropical forests). The family is increasing in numbers and distribution area, as revealed by successive biogeographical records and descriptions of new taxa (Csuzdi & Szlávecz 2002; Fragosos 1988; Fragosos & Rec Fernandez 1994; Reynolds & Righi 1994; Zicsi & Csuzdi 1991).

In the Canary Islands, few acanthodrilids have been recorded in the literature to date. Kraepelin (1895) cites *Microscolex poulteni* (Beddard, 1892) as presumably from Tenerife but with no details. Michaelsen (1900) reports *Microscolex dubius* (Fletcher, 1887) and *Microscolex phosphoreus* (Dugès, 1837). Later, other authors merely copied them literally (Cognetti de Martiis 1906; Baldasseroni 1912). More recent data were obtained during direct field surveys performed by Bouché (1973) and Talavera (1992a), in particular those concerning the presence of *M. dubius* in banana plantations and laurel forest in Tenerife. In any case, the taxonomy, ecology and chorology of the genus *Microscolex* Rosa, 1887 in the Canary Islands have been insufficiently studied. Therefore, in order to update and increase the data we have sampled a total of 22 districts and reviewed more than 1550 specimens, producing original iconography and the first species distribution maps for each island (Tenerife, La Palma, Gomera and Hierro).

2. MATERIAL AND METHODS

Specimens were collected mainly by qualitative sampling along routes of up to one Kilometre in length, so as to include a wide range of habitats with the greatest possible species diversity. A geologist's hammer was used for digging and specimens were picked out manually. Less frequently, 0.04 % formalin was poured over surface areas of 100 x 50 cm, providing complementary data on specimen abundance. The collected earthworms were usually transported to the laboratory inside plastic bags along with one Kilogramm of earth (winter time). After washing to remove the remaining earth they were submerged in 70 % alcohol, introduced into glass test-tubes containing 10 % formalin and left for four days, then finally conserved in 75 % alcohol. On very warm days and to avoid possible over-drying and desiccation, the worms were prepared and conserved "in situ" following the same steps.

In Talavera (1990a) keys were used to identify species. To prepare the original iconography the specimens were placed on a sheet of cork at the bottom of a beaker half-full of 70 % alcohol and the dissection was carried out under a binocular lens using an unsheathed razor blade and entomological pins. The specimens examined came from my own collections made during the Doctoral Thesis (1980–1986), and from surveys carried out personally between 2000–2004, as part of research projects financed by the General Directorate of Universities of the Canary Government. A minimum of five station were sampled from each municipal district and montane localities (total 35), distributed as follows: 14 in Tenerife, ten La Palma, four Gomera and seven Hierro.

These districts prospected (Fig. 1) are as follows: **1** Santa Cruz de Tenerife, **2** La Laguna, **3** Anaga, **4** El Rosario (Monte La Esperanza), **5** Acentejo, **6** Icod, **7** Daute, **8** Los

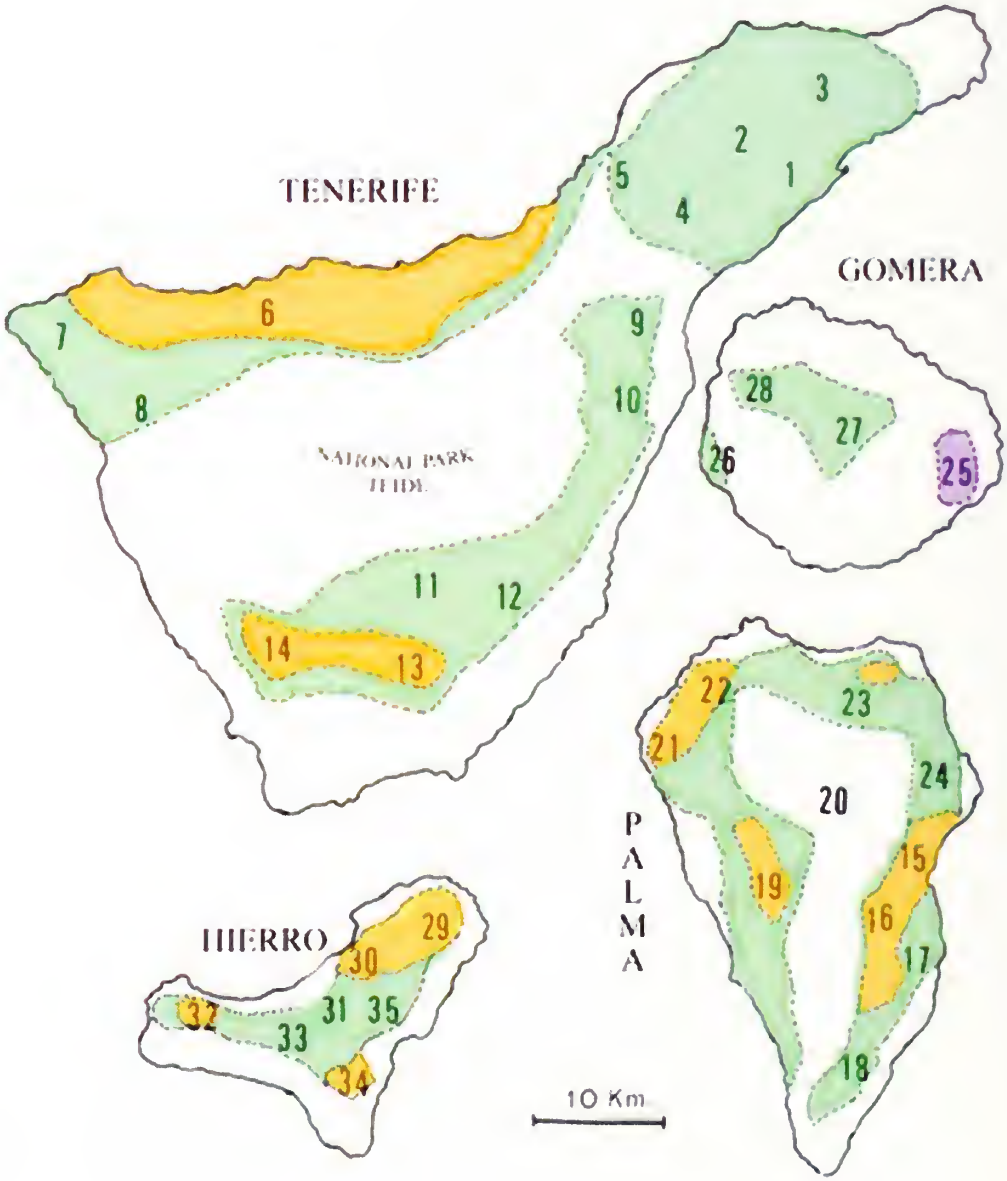

Fig. 1. Maps western Canary Islands showing of municipal district. Green, distribution of *Microcolex dubius*; Mallow, distribution of *Microscolex phosphoreus*; Orange, distribution of together species.

Silos, **9** Candelaria, **10** Güimar, **11** Chasna, **12** Abona, **13** Arona **14** Adeje, **15** Santa Cruz de La Palma, **16** Las Breñas, **17** Mazo, **18** Fuencaliente, **19** Valle de Aridane, **20** Taburiente, **21** Puntagorda, **22** Garafía (Cueva del Agua), **23** Barlovento (Las Cancelitas), **24** Puntallana, **25** San Sebastián, **26** Valle Gran Rey, **27** Hermigua (Cedro-Garajonay **28** Vallehermoso (Chorros de Epina), **29** Valverde, **30** Meseta de Nizdafe, **31** Frontera, **32** Dehesa **33** Julán, **34** El Pinar, **35** Tajace.

3. RESULTS

1550 earthworms assignable to *Microscolex dubius* and *Microscolex phosphoreus* were studied. Figs 1–3 show the main anatomical-morphological characters and the present range of distribution for each species.

Microscolex dubius (Fletcher, 1887)
Eudrilus dubius Fletcher, 1887
Microscolex dubius Rosa, 1890

Remarks. The morphological variability between the examined specimens is minor, except in the pigmentation (different tones of pinkish grey), and body length varying between 30–75 cm. Male pore and prostates tubular on 17. Genital papillae and spermathecae are generally absent, whereas small aracemose seminal vesicles nearly always appear in segments 11–12. A hydrophilic species tolerating high Na concentrations, it was found at humid sites rich in natural or artificial organic matter, and occasionally in soils with as little as 15.5 % relative humidity and 1.1 % organic matter (Buenavista, Tenerife).

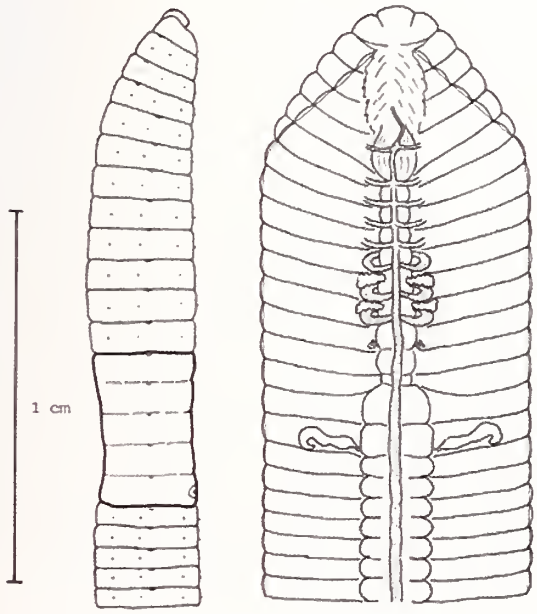

Fig. 2. *Microscolex dubius*. External morphology (lateral view); General dissection of the anterior region.

Habitat spectrum. It is common in anthropized biotopes in the basal belt below 300 m asl (gardens, parks, greenhouses, tropical fruit plantations), and also often found in the medium altitude zones (400–600m) occupied by traditional agriculture, and even in the native forests (Canary pine, and laurel forest). Nevertheless, it was not found in the high mountain zones where the extensive lava fields present a practically insurmountable natural barrier (Teide National Park, at altitudes over 2000 m). *M. dubius* has been found throughout the northwest of Tenerife, La Palma and Hierro, being less common on south-facing slopes, mainly in areas lying leeward of the trade-winds (Fig. 1). The presence of this species in Tenerife is note-worthy over deforested or tree-covered biotopes on northern slopes, whereas it diminishes gradually towards the south, which explains the smaller number of specimens found there, due to the dry gritty soil, as well as to the tremendous impact of urban expansion associated with tourism. This is repeated on the south slopes of La Palma, and Hierro, where the habitat range of *M. dubius* is restricted to valleys and ravines, gardens, and avocado, tomato and banana plantations. It also inhabits the deep gorges running through Garajonay National Park (Gomera), and remote areas of Taburiente National Park (La Palma), where it found underneath stones and rotting trunks together with *Dendrodrilus rubidus* and *Eisenia eiseni*.

Chorology. TENERIFE: Santa Cruz–La Laguna metropolitan area; above Las Mercedes laurel forest and La Esperanza pine forest; north-northwest slopes from the towns of Acentejo to Icod, Daute and Santiago del Teide; south to southwest slopes from the Malpais of Candelaría-Valle de Güimar, to Chasna, Abona and Adeje. LA PALMA: Metropolitan area of Santa Cruz, rural center of Mazo, and Las Breñas; northwest districts between the disperse evergreen laurel forest of Cueva del Agua and conifers around Puntagorda; northeast districts from the antropized zones of Puntallana to the undisturbed laurel forest of Cancelitas; villages of Valle Aridane, and dispersed pine forest in the southern district of Fuencaliente. GOMERA: Woodlands on the central plateau of El Cedro; agricultural areas on the northwest slopes (Vallehermoso and Valle Gran Rey. HIERRO: Metropolitan area of Valverde; deforested soils on north slopes between Nizdafe; El Pinar (Barranco de la Vieja, 28RBR0667)); wide forested bands in Las Dehesas, Julán, and Tajace.

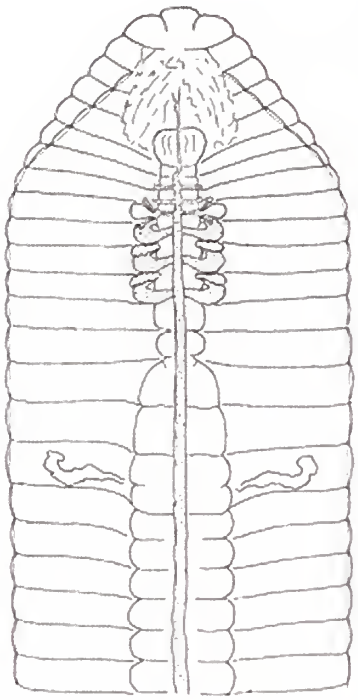

Fig. 3. *Microscolex phosphoreus*. External morphology (lateral view); General dissection of the anterior region.

Microscolex phosphoreus (Dugès, 1837)
Lumbricus phosphorens Dugès, 1837
Microscolex phosphoreus Bouché, 1972

Remarks. The body length between two and 5.5 cm (average 3.4) is evidence that the Canary island specimens are smaller than those described from continental areas. In addition, it differs from *M. dubius* in its smaller size, genital papillae in segment 11, penial chaetae present in 17, and a pair of diverticulate pyriform (pear-shaped) spermathecae in segment 9. *M. phosphoreus* is recorded for the first time from Hierro.

Habitat spectrum. We consider *M. phosphoreus* a species indicative of agricultural activity, whose pattern of habitats is tropical fruit crops by drip-feed irrigation and cultivated areas subject to the use of fertilizers. It was occasionally found in gardens with exotic plants and deforested sites up to 1500 m, sharing ecological niches with *M. dubius*. This species has a fragmentary distribution clearly related to human action; it is present on all the western Canary Islands, Gomera contributes the least number of specimens whereas Tenerife the greatest number, mainly in the northern zone in banana and avocado plantations. It is quite scarce in the South, where it arrived accidentally in soil transported from the northern slope to improve the ground used for tropical fruit and tomatoes. In La Palma, *M. phosphoreus* is noteworthy in some horticultural areas near the port and a few rural towns and villages in the basal belt, where produce for export is grown by irrigation. On the other hand, this species prefers the pineapple, banana and avocado plantations at the northeastern end of Hierro, whereas its presence on Gomera is restricted to the bay of San Sebastián and its suburbs, which suggests recent colonization and incipient populations of *M. phosphoreus* with little capacity to expand towards other sites.

Chorology. TENERIFE: Parks in Santa Cruz; Botanical Garden above Puerto de la Cruz; anthropized biotopes on the north slopes (from La Victoria of Acentejo to Los Silos), and south to southeast (Arona - Adeje).LA PALMA: Around the port of Santa Cruz de la Palma; vegetable gardens in Las Breñas districts; and fragmentedly in the Valle Aridane area; Barlovento (northeast); Garafía, (northwest). GOMERA: Metropolitan area of San Sebastián. HIERRO: cultivated plots with non-native crops in Valverde; adjacent hamlets with farming tradition; Dehesa (northwest); southeast of El Pinar (Barranco de la Vieja, 28RBR0667).

4. DISCUSSION AND CONCLUSIONS

This new contribution, as did the earlier study (Talavera 1990b, 1992b), adds to the knowledge of these earthworms widely distributed over tropical America and Africa. The family Acanthodrilidae Claus, 1880, is made up of more than twenty genera (Sims 1980), of which *Microscolex* has been able to reach the western Canary Islands but with unequal success, the seaports being the main entry point of *M. dubius* and *M. phosphoreus*. This latter species was introduced by man in recent times, perhaps from the 18th century on, as a result of the increase in foreign trade and imports of exotic plants from the Caribbean colonies and Latin America. However the colonizing process of M. *dubius* may have begun in more remote times, as shown by its presence deep within the native forests in the Canaries. In any case, both peregrine species initially used empty niches free of predators and native parasites, which favoured the installation of pioneer individuals in a short period of time. This hypothesis is in agreement with Gates (1972) for European lumbricids transported to America by man. Fig. 1 reveals some differences at the chorological level, for example that *M. dubius* is more abundant than *M. phosphorens*. In fact, the latter is restricted to tropical fruit plantation parks and gardens with exotic plants imported from America.

The habitat spectrum of *M. dubius* is wider, it was even found in the native *Pinus canariensis* and evergreen laurel forests, where it may constitute independent populations, or otherwise occasionally share its ecological niche with epigeous lumbricids or the endogeous species *Al-*

lolobophora chlorotica Savigny, 1826 belonging to the ancient fauna of the Canaries. Indeed, no indications of interspecific competition among them were detected, which concords with what ABBOT (1982) reported for Western Australia. We suggest three reasons why *M. dubius* has prospered more than *M. phosphoreus*: ecological plasticity, mode of transportation, and the colonization period; since *M. dubius* has been able to adapt to a greater diversity of habitats, use other dispersion routes besides the merely human one, and its colonization process began long ago, as testified by finding it in montane zones with difficult access. All this is compatible with the possible advantage that would be provided by parthenogenesis in recently colonized sites, where the probability of finding a mate is less.

KRAEPELIN (1895) in his naturalist study cites *Microscolex poulteni* Beddard, without mentioning number of specimens, locality, or which island. However, all the collected indications and data lead us to remove it from the present Canary Islands catalogue of valid species, as well as from any list of species 'to be confirmed' or considered as extinct, simply because it did not exist nor has it been introduced into the Canary Islands. We suspect that the researcher K. Kraepelin, inexpert in earthworm taxonomy performed an imprecise identification, perhaps due to the similarity between *M. poulteni* and *M. dubius*. Besides this, it is unlikely that this latter peregrine species could have been passed by unnoticed, since it is the only acanthodrilid with a wide distribution in the Canary Islands. In general the *Microscolex* genus is scarcely represented in the Atlantic islands, which contrasts with its wide continental presence. In particular, when comparing our results with those obtained in Madeira (TALAVERA 1996), the same is confirmed (only two species: *M. dubius* and *M. phosphoreus*), showing similarities between the habitat preferences and distribution range of both. The colonization process in the Canaries and Madeira probably followed the same pattern, mainly as regarding the role of human activity and the routes along which these acanthodrilids became dispersed over the basal and montane belts, where we consider that the easy altitudinal movements of bird flight were one of the possible modes of transport of cocoons-larvae (adhered to legs or plumage). This hypothesis is supported by other authors, among them TERHIVUO (1988) suggested it as a pathway in the colonization of oceanic islands.

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