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Considerations about *Ocnerodrilus occidentalis* (Oligochaeta: Ocnerodrilidae) in the Canary Islands[1])

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Abstract. In this paper the results of a study of 350 Canarian specimens of *Ocnerodrilus occidentalis* are given. This species had been recorded for the islands of Tenerife and Gran Canaria, therefore its presence in La Gomera, Hierro, Fuerteventura and Lanzarote represents new records. The values of the edaphic factors analyzed indicate that the soils in which it lives are very humid, slightly alkaline and relatively poor in organic matter. The morphological characteristics which we have found corroborate the existence of some intervals of variability in the genital system, a fact which enables us to call into question the recordings of Canarian ocnerodrilids given by other authors. In addition, the paper discusses the circumstances which have favoured the introduction of *O. occidentalis* into the Canaries, as well as the geographical area of origin which, according to available evidence, could be the American continent.

Key words. Earthworms fauna, Ocnerodrilidae, Canary Islands.

Introduction

In order to gather as much information as possible on the Canarian ocnerodrilids, the author has carried out different samplings which resulted in the capture of abundant specimens of the species *Ocnerodrilus occidentalis* Eisen, 1878. It is a species first recorded for the Canaries by Cognetti (1906) who refers to it by the already synonymous name of *Ocnerodrilus calwoodi* (Michaelsen, 1900), although he includes only scant descriptive information.

For this reason our study is focused on obtaining data concerning the morphology and insular distribution of *O. occidentalis*. We include an analytical treatment of the soil samples and comments regarding the habitats where the species lives; the most unusual habitat are the plant communities of "Cardonal-Tabaibal" (*Euphorbia canariensis — Euphorbia obtusifolia*).

Material and Methods

The study material comprising 350 specimens collected in large parts of the thermo-canarian zone, mainly situated between the heights of 10—600 m, also occasionally up to 1400 m (south side of the Canaries). The specimens were collected between 1977—1989 from different biotopes and at different times of the year. The extraction was made by the formalin method and by hand sorting.

In addition, a random sampling of soil was carried out in order to measure humidity (HUM), pH in water (PHH), carbon (C), organic matter (MO), nitrogen (N) and relation C/N, in accordance with the techniques indicated by Talavera (1987).

A list of sites (Tab. 1) classified according to islands and together with these information regarding Universal Transverse Mercator (UTM) of 1 x 1 km, altitude (ALT), type of vegetation, number of specimens (EXX) and date are included.

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[1]) This paper was presented at the 9th Biennial of the Spanish Royal Society of Natural History, Spain, September 1989.

Table 1: Collecting sites (* communities of *Euphorbia canariensis* — *Euphorbia obtusifolia*).

Sites	UTM	Alt (m)	Vegetation	Date	Exx
TENERIFE:					
1. Santa Cruz de Tenerife	CS7547	140	ornamental plants	3-1-1977	4
2. Barranco Fregenal	CS6026	360	deforested	6-6-1977	1
3. Valleseco	CS7951	20	grapevine	8-4-1978	9
4. Barranco Balayo	CS8655	20	avocado trees	8-4-1978	2
5. Los Silos	CS2238	100	lemon trees	4-1-1983	4
6. Jardín Botánico	CS4943	100	ornamental plants	4-7-1983	6
7. Barranco tabares	CS7352	400	herbaceus plants	6-11-1983	1
8. San Miguel	CS4009	620	ornamental plants	4-2-1985	1
9. El Peladero	CS7158	440	heath forest	20-4-1985	1
10. Güimar	CS6132	300	banana groves	8-6-1985	9
11. Fañabé	CS3009	180	banana groves	20-7-1985	8
12. Barranco del Bufadero	CS8052	40	cardonal-tabaibal*	19-9-1985	5
13. María Jimenez	CS7953	140	deforested	19-9-1985	7
14. Finca las Mesas	CS7452	540	herbaceus plants	20-9-1985	9
15. Garachico	CS2639	100	banana groves	17-8-1986	15
16. Barranco Dos Hermanos	CS7260	40	cardonal-tabaibal*	22-2-1988	2
17. Adeje	CS3011	280	banana groves	27-2-1988	2
18. San Andrés	CS8153	5	deforested	5-6-1988	10
19. Las Galletas	CS3700	30	banana groves	12-7-1988	8
20. Buenavista del Norte	CS1738	100	banana groves	15-7-1988	10
21. Bajamar	CS6859	10	banana groves	7-8-1988	9
22. Punta del Hidalgo	CS7160	100	herbaceus plants	7-8-1988	4
23. Barranco de Santos	CS7748	20	avocado trees	14-2-1989	6
GOMERA:					
24. Hermigua	BS8417	240	banana groves	15-8-1980	11
25. Cañadas Casas Blancas	BS8610	750	herbaceus plants	15-7-1985	2
26. Barranco La Guancha	BS8609	800	herbaceus plants	15-7-1985	11
27. Tanques de Sardina	BS8404	350	deforested	16-7-1985	4
28. Playa de Santiago	BS8403	160	banana groves	16-7-1985	11
29. Alajeró	BS7906	780	deforested	16-7-1985	2
30. Agulo	BS8419	200	banana groves	17-7-1985	5
31. El Rincón	BS8613	800	herbaceus plants	18-7-1985	1
32. San Sebastián de La Gomera	BS9208	20	avocado trees	18-7-1985	4
33. Embalse de Chejelipes	BS8711	240	herbaceus plants	18-7-1985	1
HIERRO:					
34. Hoya de Fileba	BR0471	1300	pine forest	24-6-1983	1
35. Los Mocanes	BR0374	120	banana groves	25-6-1983	19
GRAN CANARIA:					
36. El Toscón de la Vizcaina	DS5103	600	herbaceus plants	21-3-1978	3
37. San Bartolomé de Tirajana	DR4388	1100	herbaceus plants	8-6-1978	4
38. El Carrizal	DR5987	200	herbaceus plants	25-7-1978	14
39. Los Llanos	DR5996	120	banana groves	19-8-1978	12
40. Lomo del Galeón	DR3471	100	banana groves	14-8-1981	2
41. El Tablero	DR3972	100	tomatoes	16-8-1982	2
42. Embalse de Ayagaures	DR4080	400	deforested	18-8-1982	17
43. Presa de Chamoriscan	DR3877	300	avocado trees	18-8-1982	11
44. Presa de Chira	DR3787	910	deforested	9-8-1983	3
45. Morros de las Vacas	DR4287	1400	herbaceus plants	11-8-1983	3
46. Sardina del Sur	DR5281	200	herbaceus plants	16-8-1983	3
47. Puerto de Mogán	DR2577	40	avocado trees	17-8-1983	15
48. Tasarte	DR2589	500	canebrake	14-8-1985	2
49. Barranco de Azuaje	DS4308	500	canebrake	14-8-1985	1
50. Las Palmas de Gran Canaria	DS5711	10	ornamental plants	11-10-1987	10
FUERTEVENTURA:					
51. Gran Tarajal	ES9520	40	tomatoes	13-12-1984	2
52. Casas de Jorós	ES5904	60	alfalfa	16-12-1984	14
53. Casas las Pilas	ES5506	100	herbaceus plants	16-12-1984	12
LANZAROTE:					
54. Barranco del Estanque	FT4820	100	alfalfa	9-1-1981	9
55. Puerto del Carmen	FT2900	20	tomatoes	10-1-1981	3
56. Punta Mujeres	FT5024	30	ornamental plants	19-12-1984	3

Results and Discussion

Remarks

The most abundant material was collected in summer and decreased during the rest of the year (Tab. 1); July and August were the best months for finding sexually mature specimens, as was December although to a lesser extent. This is interesting since it could indicate that *Ocnerodrilus occidentalis* developes its external sexual features preferably when warm weather conditions prevail in the Canary Islands.

The specimens collected are not only small in size (18—35 mm, rarely more), but also present significant morphological analogy, except for the genital system. Thus, in the case of the clitellum, fifty-two of them have it beween segments 14—18 (Fig.

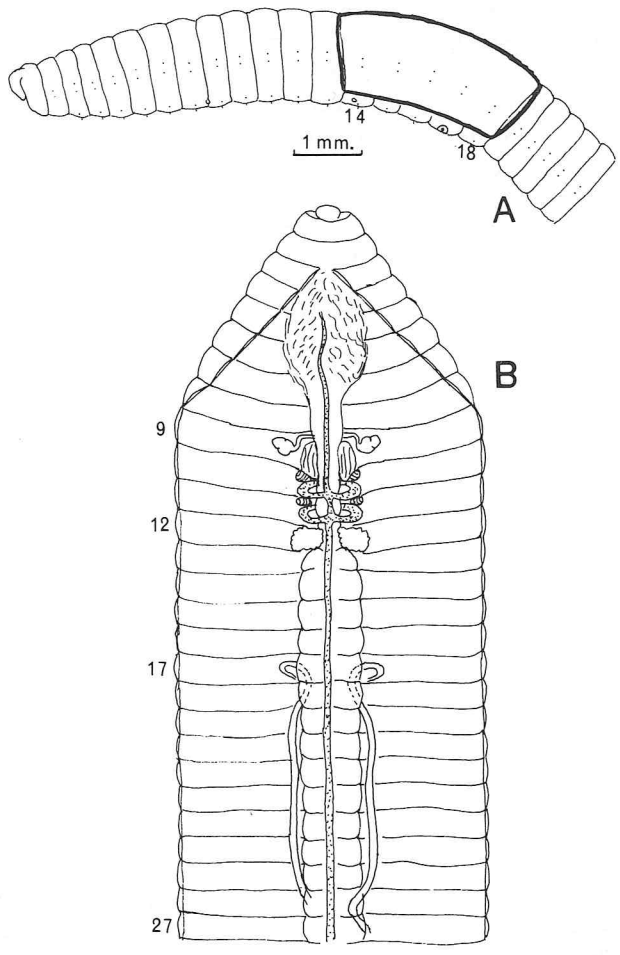

Fig. 1: External and internal morphology of *Ocnerodrilus occidentalis*. A = Lateral view; B = General dissection of the anterior region.

1A), thirty-three between 14—19, twenty-eight between 13—18, twenty-two between 13—19, forteen between 15—19, and only in seven specimens it is located between segments ½ 13—½ 19. Due note has been taken of this clear population variability and consequently the Canarian material attributed to *Ocnerodrilus calwoodi* by Talavera & Bacallado (1983). On the basis of the position of the clitellum, it is assigned here to *O. occidentalis* since there is no significant difference.

Most of the internal morphology of *O. occidentalis* was described by Díaz Cosín et al. (1980) and Gates (1942, 1973). Nevertheless, we have found Canarian specimens (Fig. 1B) with a pair of prostates taking up as many as 11 segments (from 17 to 27), as well as a pair of spermathecae adiverticulatae but with a long sinous peduncle. Together with the absence of seminal vesicles in some of the specimens (while in others these are to be found in segment 12), this is logical if we consider that this species shows a certain range of variability in the genital system.

With regard to the presence or absence of diverticula in the calciferous glands Gates (1982) mentions how important they are when it comes to distinguishing between *O. occidentalis* and *Ocnerodrilus simplex* Cognetti, 1904 (which shows diverticula). Precisely this latter species was recorded for Tenerife by Cognetti (1906), who unfortunately failed to include any reference to its morphology, thereby not clarifying the true identity of the material collected by Dr. Festa in 1895, which could well belong to *O. occidentalis*. In this respect, it is interesting to add that despite the numerous samplings taken by the author throughout the alleged collection site and adjacent zones, only specimens classifiable as *O. occidentalis* appeared.

Table 2: Analytical data from soil samples and minimum (Min), maximum (Max), mean ($\bar{x}$) and standard deviation ($\bar{u}$) values of the edaphic factors.

Samples	Sites	HUM	PHH	%C	MO	%N	C/N
1	(5)	—	8.40	2.10	3.60	0.17	12.35
2	(6)	23.10	7.30	2.31	3.98	0.32	7.22
3	(6)	23.82	7.00	1.30	2.24	0.30	4.33
4	(8)	27.15	7.80	1.80	3.10	0.15	12.00
5	(18)	22.49	7.66	3.06	5.26	0.22	13.90
6	(20)	39.15	6.60	3.83	6.61	0.26	14.73
7	(22)	27.28	8.10	1.72	2.97	0.13	13.23
8	(24)	10.62	5.70	1.68	2.90	0.10	16.80
9	(28)	23.15	5.70	7.70	12.60	0.62	11.77
10	(29)	21.00	6.40	6.30	10.80	0.58	10.86
11	(35)	18.30	7.61	4.00	6.88	0.24	16.66
12	(37)	20.98	8.42	3.65	6.28	0.19	19.21
13	(38)	21.53	8.00	0.10	0.20	0.01	10.00
14	(41)	26.81	7.90	2.20	3.70	0.20	11.00
15	(43)	59.62	7.70	6.06	10.45	0.51	11.88
16	(46)	24.10	9.00	1.50	2.60	0.17	8.82
	Min	10.62	5.70	0.10	0.20	0.01	4.33
	Max	59.62	9.00	7.70	12.60	0.58	19.21
	$\bar{x}$	25.94	7.46	3.08	5.26	0.26	12.17
	$\bar{u}$	11.05	0.95	2.07	3.47	0.17	3.71

Ecology

On the basis of the data included in table 2, we may deduce that the species *occidentalis* lives in very humid soils, slightly alkaline, poor in organic matter, and moderately oxygenated (ratio C/N = 12.17). The soils were found in sunny but permanently humid zones, concentrated in specific spots as near dams, water canals and drip irrigation pipes. Humidity is striking, both because of the high values registered and because of its usefulness in detecting the preference of this species for soils with abundance of water throughout the year. As for water pH, although our values are similar to those noted by Díaz Cosín et al. (op. cit.) and Gates (op. cit.), they differ slightly from those obtained by Fragoso & Lavelle (1987), who found *O. occidentalis* in acidic soils in Chajul (México). On the other hand, the maximum values of organic matter in our soils are comparatively higher; this could be explained by the fact that the accumulation of vegetable remains (rotten leaves and branches) produced an enrichment of the surface of many of these soils.

With regard to ecological categories, the presence of vegetable remains in the content of the intestines of the specimens found under leaf litter in contrast to those specimens without such remains (they live between 1 and 3 cm beneath the surface) corroborates the fact that *O. occidentalis* is an epigeic species which shares in addition some characteristics of endogeic species.

Distribution

This species is unevenly distributed throughout the thermo-canarian zone (Fig. 2). The easy adaptation to different prevailing conditions explains its presence in nearly all the Canary Islands (except for La Palma), despite the marked climatological contrasts between them.

It is best represented on the southeast slopes of Tenerife and La Gomera, where it colonized gardens, tropical crops, plant communities of "Cardonal-Tabaibal" (*Euphorbia canariensis — Euphorbia obtusifolia*), and pastures situated in the low parts of ravines. On the contrary, there are fewer populations of *O. occidentalis* in Fuerteventura and Lanzarote; they are usually distributed throughout specific zones of the southern slope: the watercourses of ravines with plots where alfalfa and tomatoes are grown.

In the island of El Hierro the species has appeared only under the fallen pine needles of a residual forest of conifers (*Pinus radiata*); this unusual finding contrasts with that obtained in the coast zone of Los Mocanes, where banana groves and tropical pineapple are predominant. In Gran Canaria, far from being unusual, *O. occidentalis* extend along the north and northwest slopes (Barranco de Azuaje and Dorsal de Andújar), always below 600 m and coinciding approximately with the lower reaches of the fog zone. Its presence in the east slope is concentrated in the areas surrounding major coastal towns, whereas in the south it is not only widespread throughout the districts of Santa Lucia, San Bartolomé and Mogán but has also managed a wedge-like penetration in the valleys of Tirajana, Ayagaures and Chira, attaining heights of up to 1400 m. This fact could be taken as an indication of a process of colonization of new biotopes, favoured to a certain extent by the migrations of birds and human activities.

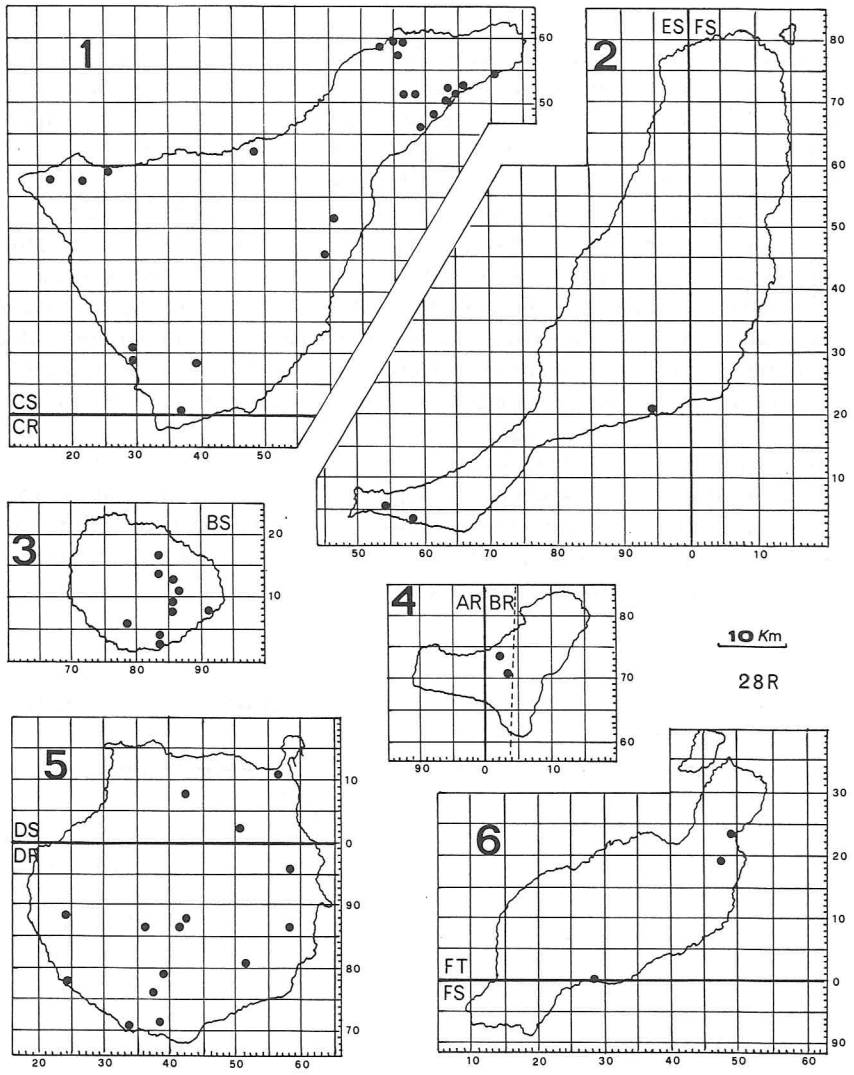

Fig. 2: Distribution of *Ocnerodrilus occidentalis* in the Canary Islands. Tenerife (1); Gomera (3); Hierro (4); Gran Canaria (5); Fuerteventura (2); Lanzarote (6).

The notable presence of ocnerodrilids in the metropolitan areas — Santa Cruz de Tenerife, Las Palmas de Gran Canaria and San Sebastián de La Gomera — which centuries ago were most important in terms of port activity and trade with the American continent, suggests that such areas were among the ideal centers in which the initial populations of *O. occidentalis* successfully established themselves hundreds of years ago. The process of spreading towards new habitats occurred by means of passive or unintended transportation, presumably associated with the extensive

net of water canals and the vertical migrations of Canarian sedentary birds. These migrations are short and they mark differences of altitude and by consequence of habitats; the sudden occurrence of the species in zones periodically visited by birds is extremely significant.

Zusammenfassung

Dieser Beitrag berichtet über die Ergebnisse einer Untersuchung an 350 kanarischen Exemplaren von *Ocnerodrilus occidentalis*. Die genannte Art war zuvor auf den Inseln Teneriffa und Gran Canaria erwähnt worden, während ihr Vorkommen auf La Gomera, Hierro, Fuerteventura und Lanzarote neu zu registrieren ist. Edaphische Untersuchungen haben ergeben, daß die Art in sehr feuchten, leicht alkalischen Böden vorkommt, die relativ arm an organischer Substanz sind. Die beobachteten morphologischen Kennzeichen bestätigen das Vorkommen einer gewissen Variabilitätsspanne des Genitalapparats, was die von anderen Autoren gemachten Beschreibungen von kanarischen Ocnerodriliden in Frage stellt. Weiterhin werden die Umstände diskutiert, die eine Einbürgerung von *O. occidentalis* auf den Kanarischen Inseln begünstigt haben könnten, sowie deren geographischer Herkunftsbereich, der aller Wahrscheinlichkeit nach der amerikanische Kontinent zu sein scheint.

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