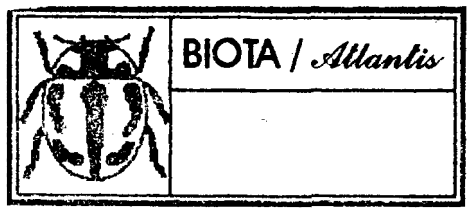
Revue Arachnologique, **11** (11), 1996 : 109-122.



Dysdera ratonensis Wunderlich, 1991 (Arachnida, Araneae) a troglomorphic species from La Palma, Canary Islands : description of the male and redescription of the female

by **M.A. ARNEDO** and C. **RIBERA***

Résumé

Les especes du genre ***Dysdera*** des îles Canaries nous offrent un intéressant problème biologique car elles sont le résultat d'un extraordinaire processus de colonisation et radiation dans toutes les îles de l'archipel. Pour inférer leurs relations phylogénétiques afin de reconstruire son processus évolutif, il est nécessaire de disposer de descriptions les plus completes possibles de toutes les espèces connues des Canaries.

Dysdera ratonensis est une des espèces du genre adaptée au milieu souterrain volcanique et la seule espèce de ***Dysderu*** cavemicole des Canaries connue en dehors de Ténérife. Cette espèce fut décrite à partir de restes : quelques céphalothorax de femelles, d'autres fragments et des exemplaires juvéniles. Dans ce travail, on présente la description du mâle, la redescription de la femelle et les relations phylogénétiques qu'elle présente avec les autres espèces du genre.

Abstract

Dysderu species from the Canaries represent a very interesting group of species. They have undergone an extraordinary radiation, the colonization and evolutionary processes of which remain uncertain. Exhaustive descriptions are required to recover their phylogenetic relationships, from which to infer evolutionary process.

Dysdera ratonensis is one of the few species of *Dysdera* that has become adapted to lava tubes, and the only one known outside Tenerife island. This species was described from fragmentary material, some female carapaces and juveniles. **A** detailed revision of this species is provided, and affinities as well as ecology are discussed.

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Introduction

The family Dysderidae is one of the spider groups with a larger number of troglomorphic species. Most of its genera have evolved cave-dwelling representatives; in fact, some of them are only known from cavemicolous species (RIBERA and JUBERTHIE, 1994). Their most outstanding features are the reduction or loss of the eyes, the elongation of the appendages and depigmentation. The presence of these characters and their different manifestation seem to be more or less correleted with both time and the degree of adaptation to the hypogean environment.

In genus *Dysdera*, up to 10 troglomorphic species have been described. These species could be found in two cavernicolous environments: caves from karstic areas, mainly distributed through the westem mediterranean region (Iberian peninsula and North Africa; RIBERA, 1983; RIBERA, FERRÁNDEZ and PÉREZ, 1986; and RIBERA, 1993) and lava tubes from volcanic areas, which have been found only in the Canary Islands to date (RIBERA, FERRÁNDEZ and BLASCO, 1985; RIBERA and BLASCO, 1986; and RIBERA and ARNEDO, 1994).

Troglomorphic *Dysdern* species from the Canaries represent a very interesting group of species. Apart from being the only known species of the family Dysderidae that have become adapted to a volcanic hypogean environment, they form part of an extraordinary radiation that *Dysdera* genus has undergone in the Canary Islands, the colonization and evolutionary processes of which remain uncertain (WUNDERLICH, 1986 and 1991). For these reasons, it is important to provide exhaustive descriptions, or redescriptions, of these species. Such descriptions should include not only the morphological characters necessary to recognize species but also those required to recover their phylogenetic relationships, from which to infer evolutionary processes.

Dysdern ratonensis Wunderlich, 1991, is the only known species of *Dysdera* adapted to lava tubes outside Tenerife island. It was found in a cave at the south-eastern part of La Palma, an island situated at the north-west of the Canarian Archipelago. This species was originally described from fragmentary material: some adult carapaces and juveniles. The only diagnostic characters of the species were their size and the ocular reduction. Male and female adults have recently become available through prospections of La Palma lava tubes.

Characters examined and terminology

Gross morphological features were investigated using a dissecting microscope. Scanning electron microscopy was used to study male genitalia and spinnerets of both sexes. Measurements were taken of carapace length and width (maximum and minimum width, in dorsal view), eye diameter and separation, chelicera length (lateral view), abdomen length (dorsal view), abdomen hairs length and leg segments (except for coxa and trochanter). Characters were coded for carapace shape and ornamentation, eye reduction, shape of the labium and its groove, sternum ornamentation, relative size of the chelicera and fang, location and size of the chelicera teeth, legs spination and relative length, shape of the abdomen hairs and male and female genital structures. For the first time, characters from spinneret external mor-

phology are used in Dysderidae taxonomy. Eventhough spinnerets usually lack species-diagnostic characters, they could be useful in establishing species-groups (PLATNICK et al., 1991).

For male and female genital structures, the terminology of DEELEMAN-REINHOLD (DEELEMAN-REINHOLD & DEELEMAN, 1988) was used, with the addition of several features peculiar to Canarian Dysdera. Spination was recorded for femur and tibia using numerical notation. In femora, the number of dorsal rows (parallel to the leg) and the number of spines for each row were registered, the rows were named according to their position close to the frontal margin or close to the back. In tibiae, the number of bands (perpendicular to the leg) both for the dorsal and ventral sides were recorded. Bands were named according to their arrangement with respect to the body axis (proximal or distal). For each band, there were three possible locations for the spines.: close to the frontal margin, close to the back, and in the middle, each position was separated by a point. The number of spines was recorded. If the number of spines between the two sides of the specimens were different, the left and the right number are registered, separating them with an hyphen (intraindividual variation). If different specimens were compared, an hyphen separates the minimum and the maximum number (intraspecific variation).

All characters were registered using DELTA package (DALLAWITZ, 1980 & 1993).

Dysdera ratonensis Wunderlich, 1991

(fig. 1-14)

Dysdera ratonensis WUNDERLICH, 1991: **306-307, fig. *99-100.***

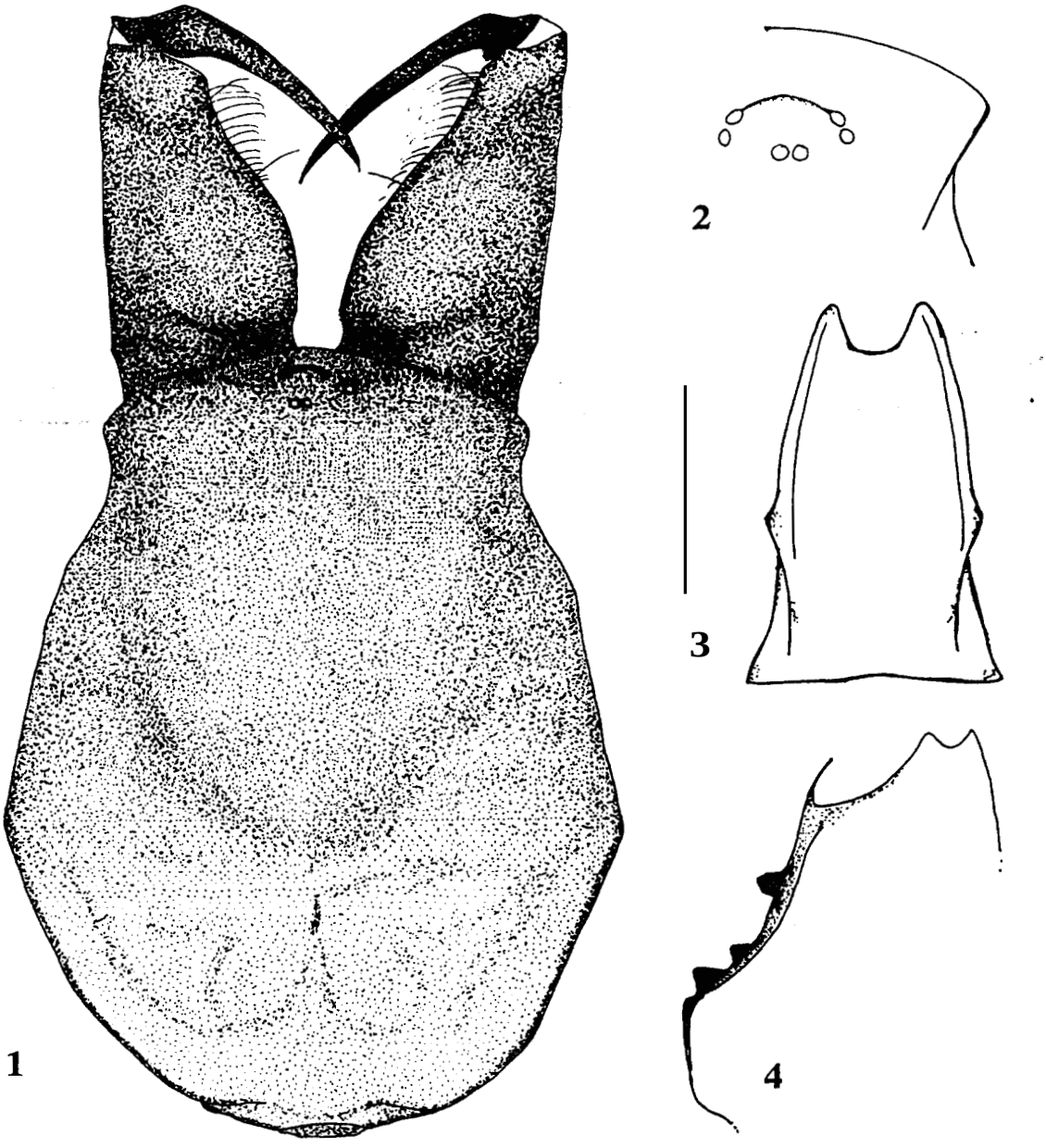
Material. *Type.* Holotype female (a cephalothorax and some legs), label states "*Dysdera* ratonensis Wunderlich, holotype female". Cueva del Ratón, La Palma; 17/8/86, J.L. Martin leg.; num. P-RA-36. Stored at University of La Laguna, Tenerife, Canary Islands. Examined.

Additional material exnmined. Cueva (cave) de los Palmeros (UTM 28R BS 2056), Fuencaliente, La Palma, Canary Islands ; 6/9/91 (R.G. Becerra leg.), 1 male [description], num. 2578/105, stored at University of Barcelona ; 26/10/94 (Arnedo, Ribera & Serra leg.), 1 female [redescription]; num. 2824/115, stored at University of Barcelona; 27/11/93 (R.G. Becerra leg.), 1 male; 17/8/86 (J.L. Martin) 1 juv.; Cueva del Ratón (UTM 38R BS 2252), Fuencaliente, La Palma, Canary Islands : July-August 1986 (J.L. Martin leg.) 2 prosoma and 3 juv.; Cueva del Salto del Tigalate (UTM 28R BS 2659), Fuencaliente, La Palma, Canary Islands : 7/8/94 (R.G. Becerra leg.) 1 male, 1/11/94 (Becerra and Arnedo leg.) 1 prosoma.

Diagnosis. It can be distinguished from the morphologically closest species by eye reduction (fig. 2), spination pattern, abdomen hairs shape and size, tip (fig. 11-12) and posterior apophyses (fig. 13) of the male copulatory bulbus and endogyne dorsal arch structures (fig. 7-8).

Description of the male.

Carapace 6.72 mm long, maximum width 5.27 mm, minimum width 3.5 mm. Carapace brownish orange coloured, frontally darker and becoming lighter backwards, covered with very small circular depressions, mainly distributed along the



Figures 1-4. —*Dysdera ratonensis*. **1,** carapace of the female, dorsal view. **2,** carapace frontal margin of the female, dorsal view. **3,** labium of the female, ventral view. **4,** teeth at the inner side of the left chelicera, ventral view.

lateral and backward borders. Carapace anterior margin wide (about 1/2 of its length), postocular lateral margins convergent in dorsal view; sharpened at point of dorsal maximum width; posterior edge slightly pointed backwards (fig. 1-2). *Eyes* markedly reduced (fig. 1-2); AME diameter 0.144 mm, PLE 0.177 mm, PME 0.072 mm, AME separation 0.396 mm, AME-PLE separation 0.072 mm, **PLE-PME** separation 0.18 mm, PME separation 0.1 mm. *Labium* trapezoid shaped with base wider than

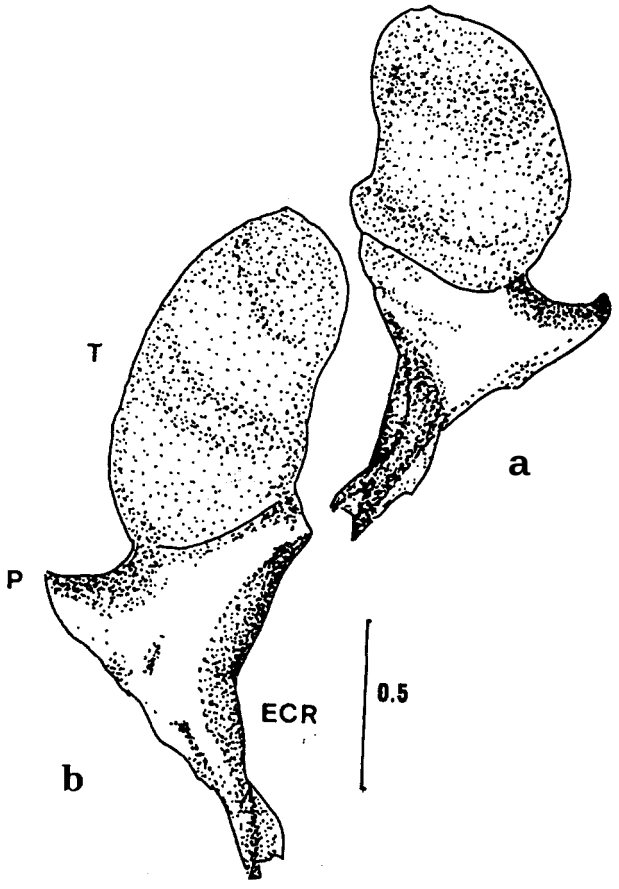


Figure 5. — *Dysdera ratonensis* **a, left copulatory bulbus, external view. b, right copulatory bulbus, interna1 view.** — T:**tegulum, ECR: embolus-conductor-radix. P : posterior apophysis.**

distal part, longer than wide at the base, with a semicircular groove at the tip (fig. 3). *Sternum* reddish orange-coloured, frontally darker and becoming lighter backwards, smooth, uniformely covered in slender black hairs.

Chelicerae 3.15 mm long : about 1/3 of the length of the carapace in dorsal view; fang longer than the groove of the chelicerae ; basal segment dorsally scarcely covered with piligerous small black grains, mainly on the basal and inner sides. Chelicera inner margin arrnoured with three teeth and a lamina at the base; distal tooth as large as basal one and larger than medial one, trapezoid, located at the centre of the groove ; basal tooth close to the basal lamina; medial tooth close to the basal one (fig. 4). Forward ***legs and pedipnlp*** dark orange-coloured and backward legs yellow. Leg and pedipalp lengths of male described above ; relative length : I>II>IV>111.

	femur	patella	tibia	metatarsus	tarsus	total
Pedipalp	3.15	1.82	1.47		1.68	8.12
1	6.23	4.06	6.09	5.53	1.05	22.96
2	5.74	3.57	5.74	5.25	1.05	21.35
3	4.55	2.52	3.36	4.13	0.91	15.47
4	5.95	3.22	4.83	5.67	1.19	20.86

Spination. Palp, leg 1, and leg 2 spineless ; leg 3 and leg 4 spinated. Fe3d one row, 1-1 ; pa3 spineless ; tb3d arranged in three bands, proximal 0.0.1, medial-proximal 1.2.1, distal 1.0.1 ; tb3v arranged in two bands, proximal 1.2.1, distal 1.0.0; with two terminal spines. Fe4d two rows, forward 1-0, backward 3-4; pa4 spineless; tb4d arrandeg in four bands, proximal 1.0. 1, medial-proximal 1.1.1-0, medial-dista1 0-3.1-0.0, distal 1.0. 1 ; tb4v arranged in four bands, proximal 1.2-0.1, niedial-proximal 0.0.1, medial-dista1 1.1.0, distal 1-0.0-1.1-2, with two terminal spines.

Abdomen 6.65 mm long ; whitish, cylindrical. Abdomen dorsal hair of the male 0.018-0.054 mm long, straight, nail-shaped, medium-sized ; uniformly and scarcely distributed.

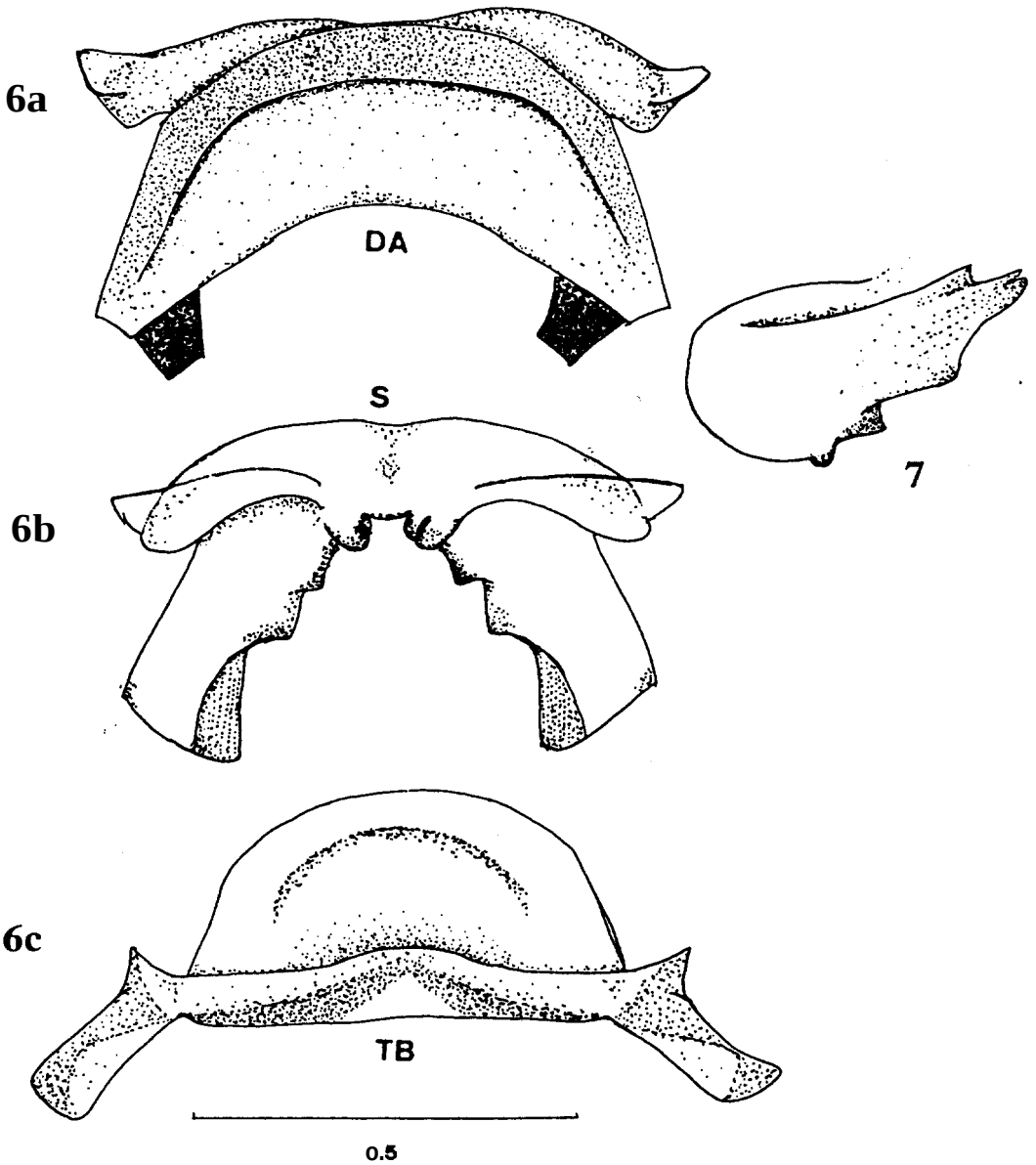
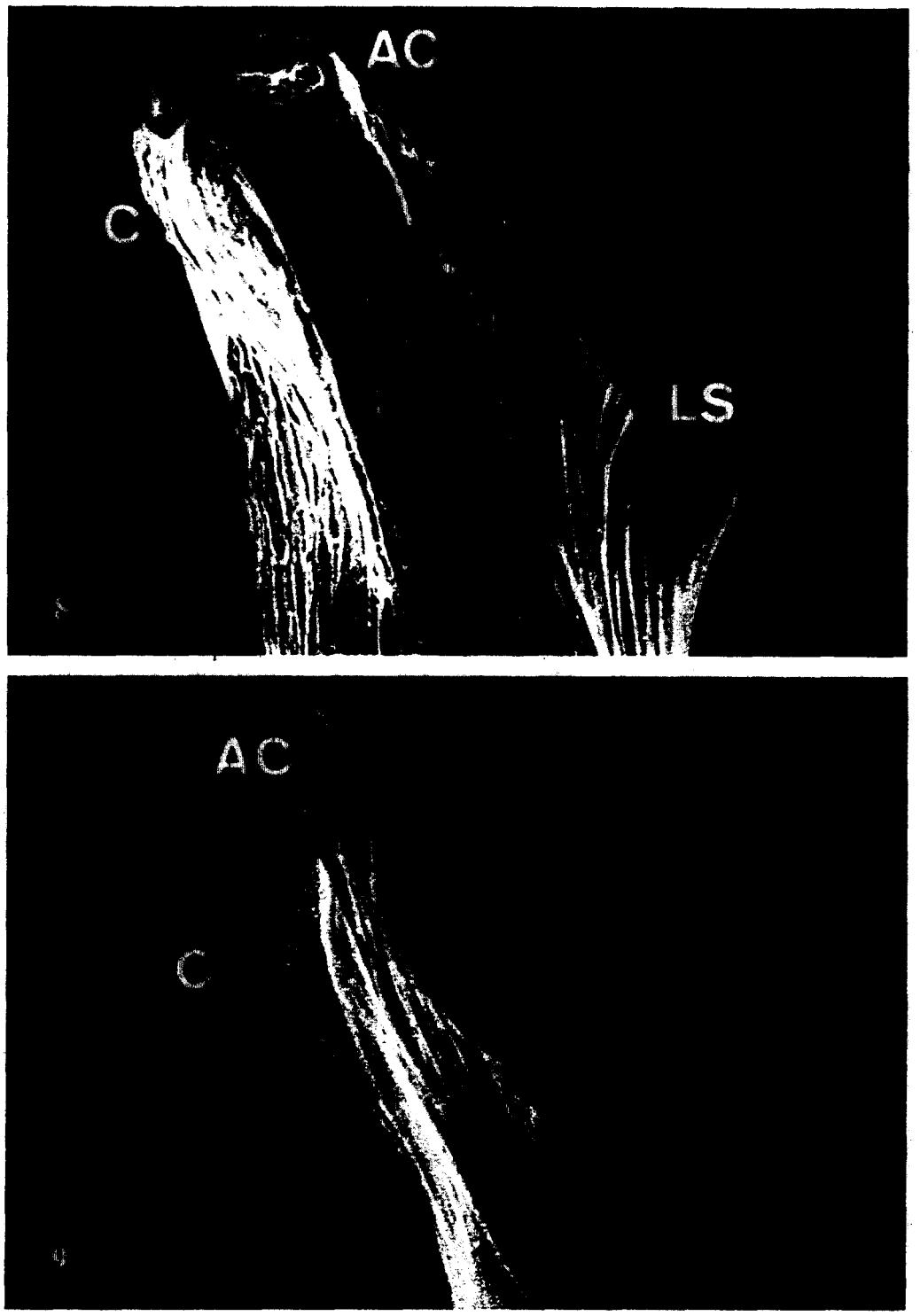


Figure 6-7 — *Dysdera ratonensis.* 6a, endogyne, dorsal arch **(DA)** and spermatheca, dorsal view. 6b, ventral view. **6c,** transverse bar (TB), dorsal view. — **7,** endogyne dorsal arch, lateral view.

Bulbus with the tegulum as long as the **ECR** (embolus-conductor-radix complex), bent forming an angle about 130 degrees (fig. 5-6); ECR tip truncated in frontal view (fig. 11). Crest *(c)* present, well developed, located close to the tip of the embolus, its upper part folded, without any groove at the base. Crest tip straightened in lateral view, its distal point projected and pointed (fig. 12). Additional crest **(AC)** present (fig. 11). Lateral sheet (LS) extended, with margin divergent from the embolus, not continuous (small step present), with the tip perpendicularly projected **(fig.** 11). Supplementary lateral sheet at the inner side (SLS) absent. Posterior apophysis **(P)** triangle-like in lateral view, distally not projected; small crest-like struc-



Figures 8 & 9. — *Dysdera ratonensis*.scanning electron photographs. **8,** right bulbus ECR, anterior view (scale x400). C: crest. **AC:** additional crest, LS: lateral sheet. **9,** right bulbus ECR, externa1 view (scale x160). C: crest, **AC:** additional crest.

tures along the external side (fig. 13); small apophyses at the internal base of the ECR in posterior view.

Anterior lateral ***spinnerets*** (ALS) with 7 piriform gland spigots. Rest of characters as in female.

Redescription of the female.

All characters as in male, except :

Carapace 6.16 mm long, maximum width 5.32 mm, minimum width 3.64 mm. *Eyes* markedly reduced ; AME diameter 0.171 mm, PLE 0.162 mm, PME 0.126 mm, AME separation 0.432 mm, AME-PLE separation 0.036 mm, PLE-PME separation 0.162 mm, PME separation 0.054 mm.

Chelicerae 3.08 mm long ; about 1/3 of the length of the carapace in dorsal view, basal tooth the largest and distal one bigger than medium one. ***Leg and pedipalp*** lengths of female described above ; relative length 1>IV>II>III.

	femur	patella	tibia	metatarsus	tarsus	total
Pedipalp	**2.80**	1.40	1.54		2.10	7.84
1	6.30	4.20	5.60	5.25	1.05	22.40
2	5.32	3.64	5.18	4.97	0.84	19.95
3	4.55	2.59	3.50	4.34	0.84	15.82
4	5.81	3.15	4.48	5.81	1.05	20.30

Spination. Palp, leg 1, leg 2 spinneless; leg 3, leg 4 spinated. Fe3d one row, 2 ; pa3 spineless ; tb3d arranged in four bands, proximal 1.0.1, medial-proximal 1.2.1, medial-dista1 1-0, distal 1-2.0.1, tb3v arranged in two bands, proximal 1.2.1, distal 1.0.0, with two terminal spines. Fe4d two rows, forward 1, backward 5 ; pa4 spineless ; tb4d arranged in four bands, proximal 0.0-1.2, medial-proximal 1.1.0-1, medial-dista1 0.2-0.1-0, distal 1.0.1, tb4v arranged in four bands, proximal 1.4-3.1, medial-proximal 0.0.1-2, medial-dista1 0-1.1.0, distal 1.0.1, with two terminal spines.

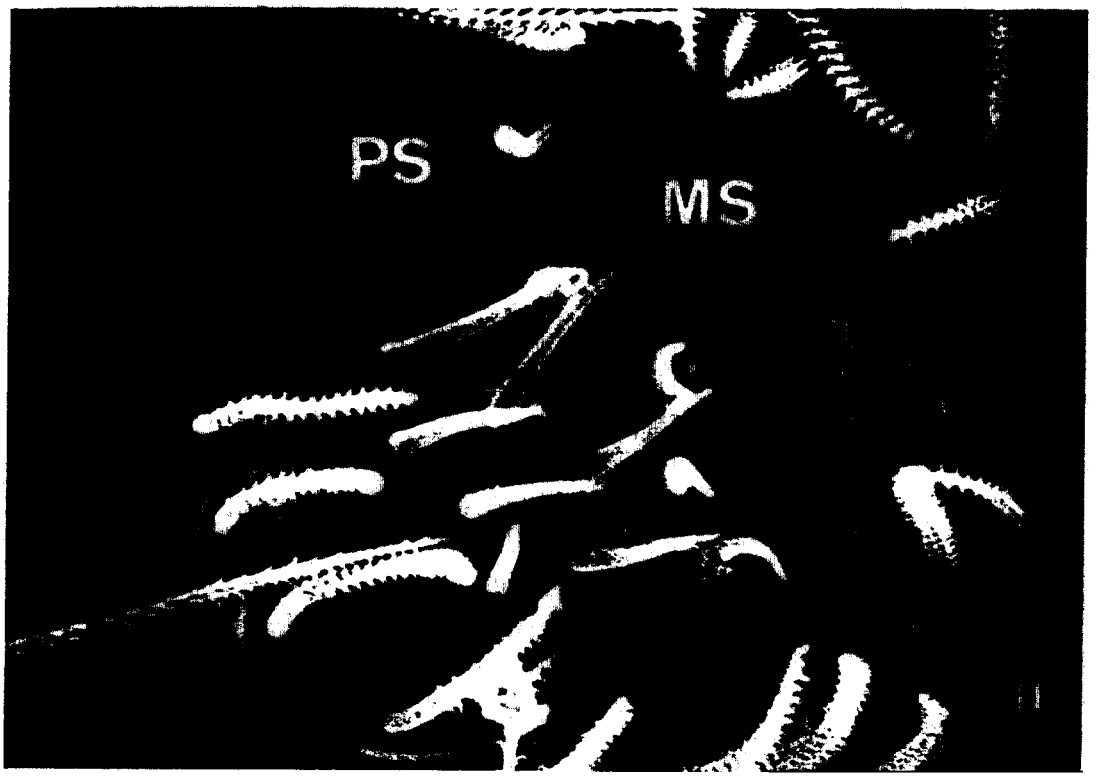
Abdomen 7.7 mm long, whitish, cylindrical. Abdomen dorsal hair of the female 0.018-0.032 mm long.

Endogyne dorsal arch (DA) frontally rounded in dorsal view, wider than long, margins bent upwards. Endogyne ventral region sclerotized, inner projections present, poorly developed; small additional projection present near spermatheca attachement. Spermatheca arms as long as DA, curved, with the ends projected forwards; middle enlargement absent ; attachment to the DA truncated. Transverse bar arms straight from the middle point but bent towards the end.

Anterior lateral ***spinnerets*** (ALS) with a piriform gland spigot in a polar position ; remaining piriform gland spigots more external than major ampulate gland spigot ; 11 piriform gland spigots ; presence of an ostiole-like structure below major ampulate gland spigot ; posterior medial spinnerets (PMS) and posterior lateral spinnerets (PLS) with a great number of aciniform gland spigots, with a narrow base (about 15 µm).

Variation. Total variation in chaetotaxia (female and males from different populations together) :

	Proximal	medial-proximal	medial-dista1	distal
Tibia 3 dorsal	0-1.0.1	1.2.1	0-1	1-2.0.1
Tibia 4 dorsal	0-2.0-1.1-2	0-1.0-1.0-1	0-3.0-1.0-2	1.0.1
Tibia 3 ventral	1.2.1			0-1.0.0-1
Tibia 4 ventral	1.1-4.0-1	0.0-1.1-2	0-1.0-1.0	0-1.0-1.1-2



Figures 10-11. — *Dysdera ratonensis*, scanning electron microphotographs. 10, right bulbus, posterior apophysis, internal view (scale x255) 11. anterior lateral spinnerets (ALS) of the female (scale x680). MS : major ampullate gland spigot, PS : polar piriform gland spigots.

Figures 12-13. — *Dysdera ratonensis*, scanning electron rnicrophotographs. **12,** posterior median spinnerets **(PMS)** of the fernale (scale x510). **13.** posterior lateral spinnerets **(PLS)** of the fernale (scale x5 10). **AS** : aciniform gland spigot.

	row number	spines number
Femur **3** dorsal	**1**	1-2
Femur **4** dorsal	2	0-1/3-6

Specimen from Salto del Tigalate Cave shows a slight reduction in size and chaetotaxia, but a greater relative length of its chelicerae (about 1/2 of the carapace length). Its colour is paler.

Distribution. Endemic species from La Palma, Canary Islands. Known only from caves, around the village of Fuencaliente at the **SE** of the island.

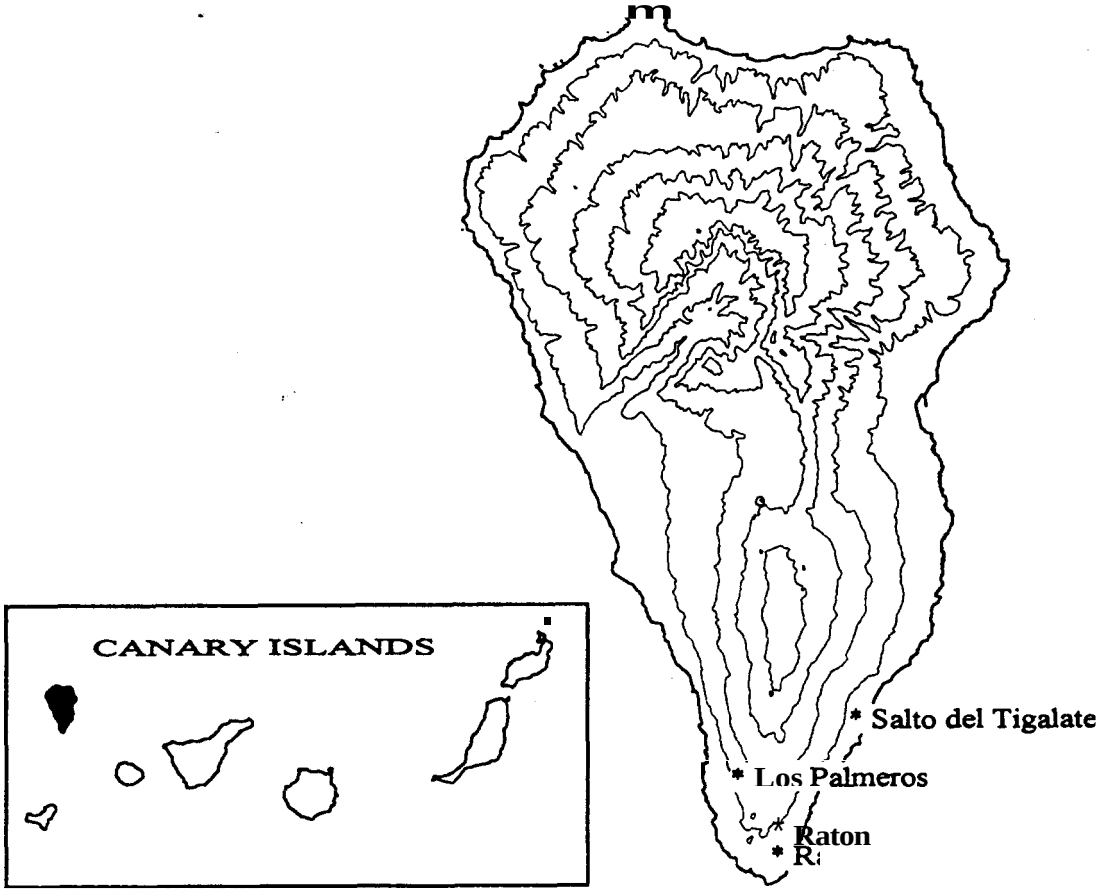


Figure 14. — Distribution of the **lava** tubes where *Dysdera ratonensis* was collected.

Relationships

From the external morphology point of view, the closest relative to *Dysdera rntonensis* is *Dysdera curvisetae* Wunderlich, 1987, a poorly known species (only one specimen, male) from north Tenerife (San Marcos). Both species share a similar carapace shape and omamentation, *D. ratonensis* being slightly more robust than *D. curvisetae*. They have a common spination pattern, although a reduction in the number of spines occurs in *D. curvisetae*. Differences between their copulatory bulbus are reduced to the tip of the **ECR,** pointed in *D. curvisetae* and truncated in *D.*

ratonensis, and the shape of the crest, straight in lateral view in *D. ratonensis* and stepped in *D. curvisetae*. Other characters that separates these species are size and shape of the hairs of the abdomen and granulation of the chelicerae.

The only known specimen of *D. cuwisetae* was found in a little cave. Nevertheless, it does not display any troglomorphic character, except a certain degree of appendage elongation if compared with another epigean species of *Dysdera.*

Dysdern clnvisetne Wunderlich, 1991, from El Hierro island (the southwesternmost island of the Archipelago, at the south of La Palma), is another species, morphologically close to *D. ratonensis.* **A** common pattern in carapace shape and ornamentation, male genitalia and spination was observed between them. Nevertheless, these two species differ in severa1 characters, especially frontal shape of the carapace (margins divergent in *D. clnvisetae),* length of the hairs of the abdomen (much longer in *D. clnvisetne),* spine number and unusual distribution (*D. clavisetae* has a greater number of spines and generally presents an atypical spine at the ventral side of the patella **4)** and, finally, some genitalic divergences (*D. clavisetae* possesses a tegulum smaller than ECR, parallel LS, a different DA shape and lack of **DA** inner projections).

Four species of *Dysdera* have been described from La Palma to date, apart from *D. ratonensis,* the cosmopolitan *D. crocotn* C.L. Koch, 1839, and *D. palmensis* Schmidt, 1982, a synonymy of the forrner. Two of those species, *D. insulana* Simon, 1883, and *D. nesiotes* Simon, 1907, have not been collected in La Palma since their description. Moreover, their type material seems to have been lost. Therefore, comparison has only been done with the two remaining species, *D. rugichelis* Simon, 1907, and *D. calderensis* Wunderlich, 1987. While *D. ratonensis* differs strongly from *D. rugichelis, D. calderensis* shares a similar structure, shape and disposition of the male and female genitalia, although the rest of its morphological features are very different.

Finally, there are other species distributed through the western islands (La Palma, El Hierro, La Gomera and Tenerife) that, despite differing strongly in morphological features of the body, have a joint pattern in male genitalia.

Owing to the large number of character states shared, both *D. curvisetae* and *D. clavisetne* are candidates for the sister-species of *D. ratonensis,* and together with the former species could be a monophyletic group. Nevertheless a cladistic analysis (mainly polarity assessment of their shared character states) of these species, and also other Canarian and continental *Dysdera,* is required to infer their true phylogenetic relationship with regard to *D. ratonensis.*

Ecology

Little is known about the ecology of this species. Most of the specimens were collected using pit-falls. Only juveniles and one adult male were seen alive before collection. They were walking along the floor of the lava tubés, the juveniles on a sandy spot and the male between small stones. *Dysdera* are wandering spiders that catch their preys, mainly arthropods, in the forward legs and the chelicerae. Some indivuals had been found that appeared to have been eaten, probably by another spider or a carabid beetle.

If compared with the other cave-dwelling *Dysdera* from the Canaries, *D. ratonensis* (together with *D. labrndaensis* Wunderlich, 1991 and *D. chioensis* Wunderlich, 1991), seems to be the least troglomorphic species (i.e. eyes are reduced but not lost, there is no reduction in the pigmentation and appendages are elongated but not become slender). This could be explained by a short time of adaptation to the hypogean environment, which could be coupled with the relative modemity of the lava tubes in La Palma (some hundred thousands of years for the most ancient caves ; MARTIN, 1992).

Finally, although the troglomorphic *Dysdera* in Canaries have always been collected in lava tubes, it is suggested (RIBERA & ARNEDO, 1994) that the adaptation to caves occurs, in most of cases, in the MSS (*Milieu Souterrain Superficiel*, mesocavernous shallow stratum ; OROMI, MEDINA and TEJEDOR, 1986; MEDINA, 1991) arid that this is the true habitat where most of these species live (HOWARTH, 1981a, 1981b, 1983, 1986). This hypothesis may explain how *D. rntonensis* could be found in the Cueva del Ratón lava tube which was forrned during the eruption of the San Antonio vulcan in the year 1677 AD.

Acknowledgements

We would like to thank Dr. P. OROMI (University of La Laguna, Canary Islands) for his support in our research expeditions to the Canary Islands and his helpful comments, and R. GARCIA BECERRA (Felo) who very kindly made available some of the specimens studied. This research was supported from DGICYT PB93-0811, Project 2192-PGC 94A Generalitat de Catalunya and by an FI grant from the Catalan Govemment to M.A. ARNEDO.

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