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RAPID BIODIVERSITY ASSESSMENT, FAUNISTICS AND DESCRIPTION OF A NEW SPIDER SPECIES (ARANEAE) FROM DESERTAS ISLANDS AND MADEIRA (PORTUGAL)

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Abstract: The spider fauna of the Desertas Islands (Madeira) has been largely neglected until now, with only 11 species recorded. Both standardized and ad-hoc sampling was performed on organized expeditions to Desertas in the years 2011 and 2012. As expected for small, isolated islands, species richness estimates per sampled hectare are relatively low, ranging from 19 to 23 species. The updated local checklist now includes 57 species, of which 11 are thought to be new for science, including a new species of *Typhochrestus* Simon, 1884, endemic to the Madeira archipelago, here described. The previously unknown male of *Zimirina lepida* (Blackwall, 1859) is also described. The family Ochyroceratidae Fage, 1912 is recorded for the first time from a native habitat in Europe.
Key words: Arachnida, ecology, taxonomy, species richness estimates, checklist, new species, Macaronesia, Madeira, Desertas.

Evaluacion rápida de la biodiversidad, faunística y descripción de una especie nueva de araña (Araneae) de islas Desertas y Madeira (Portugal)
Resumen: El conocimiento actual de la araneofauna de las Islas Desertas (Madeira) se puede considerar como deficiente, con sólo 11 especies registradas. Con la finalidad de cubrir este vacío se efectuaron diversas expediciones durante 2011 y 2012, en las cuales se realizaron muestreos estandarizados y capturas manuales. Como era de esperar para islas pequeñas y aisladas, las estimas de la riqueza de especies por hectárea son relativamente bajas, oscilando entre 19 a 23 especies. La lista de especies local se ha incrementado hasta 57 especies, de las cuales 11 podrían ser nuevas para la ciencia, incluyendo una especie nueva de *Typhochrestus* Simon, 1884, endémica del archipiélago de Madeira, aquí descrita. También se describe el macho, hasta ahora desconocido, de *Zimirina lepida* (Blackwall, 1859). La familia Ochyroceratidae Fage, 1912 es citada por primera vez de un hábitat nativo en Europa.
Palabras clave: Arachnida, ecología, taxonomía, estimadores de riqueza de especies, especie nueva, Macaronesia, Madeira, Desertas.

Taxonomía /Taxonomy: *Typhochrestus madeirensis* Crespo **sp. nov.**

Introduction

The archipelago of Madeira is composed by the main islands of Madeira and Porto Santo plus the smaller Desertas Islands. The latter are 3 uninhabited small islets located 20 km Southeast of Madeira. Deserta Grande is the largest of these islands, with an area of 10km^2, followed by Bugio with 3 km^2 and Ilhéu Chão with 0.5 km^2 (Figure 1). The geological age of these islands is 5 M.y., similar to Madeira Island (Fernández-Palacios *et al*., 2011). The geomorphology is mostly rugged, with very steep slopes, ridges and peaks, except for the flat Ilhéu Chão. Their climate is temperate oceanic and the predominant habitats are rocky slopes and small arid flatlands, with sparse vegetation.

The Deserta Grande has en elongate form, with a maximum length of 11.7 km along a Northwest to Southeast angle and a maximum width of 1.9 km. Only two relatively flat areas exist, one in the extreme North, Vale da Castanheira (and West part of Pedregal), and one in the South, Planalto Sul. The island maximum altitude is 479 m, at Rocha do Barbusano. Additionally, two small flat areas are located at sea level, resulting from landslides, one of them, the Doca, being the main access point to the rest of the island. Bugio is an even steeper and rugged island, with very few and small flat areas, being the largest of these the Planalto Sul. It has a maximum length of 7.5 km and maximum width of 700 m. The highest summit reaches 388 m. Ilhéu Chão is a small plateau, rising 80 m above the sea level, and only 1.6 km long and with a maximum width of 500 m. In the North end, it reaches its maximum altitude of 89 m.

All islands are protected as part of the Natural Reserve of Desertas Islands, managed by the Natural Park of Madeira. They remain uninhabited, although attempts for colonization of Deserta Grande were made in the past. These historical events also include the introduction of goats (*Capra hircus* (L., 1758)) and rabbits (*Oryctolagus cuniculus* (L., 1758)), which since then caused a negative impact on the native flora and whole habitats of the Desertas. Besides invasive fauna, several exotic species of plants were also introduced in the territory, as is the case of *Ageratina adenophora* (Spreng.) R. M. King & H. Rob*, Nicotiana tabacum* L. or, more recently, the herb *Phalaris aquatica* L. The first two plant species were successfully eradicated by the Natural Park of Madeira, but the same does not hold true to the latter, which proliferates in Vale da Castanheira (Figure 2). The Natural Park of Madeira has been trying to eradicate *P. aquatica*, first with the use of wildfire (which burned throughout most of the valley) and latter with chemicals specific for plants of the family Poaceae. This species is responsible for a recent extreme reduction of the available habitat for *Hogna ingens* (Blackwall, 1857), and

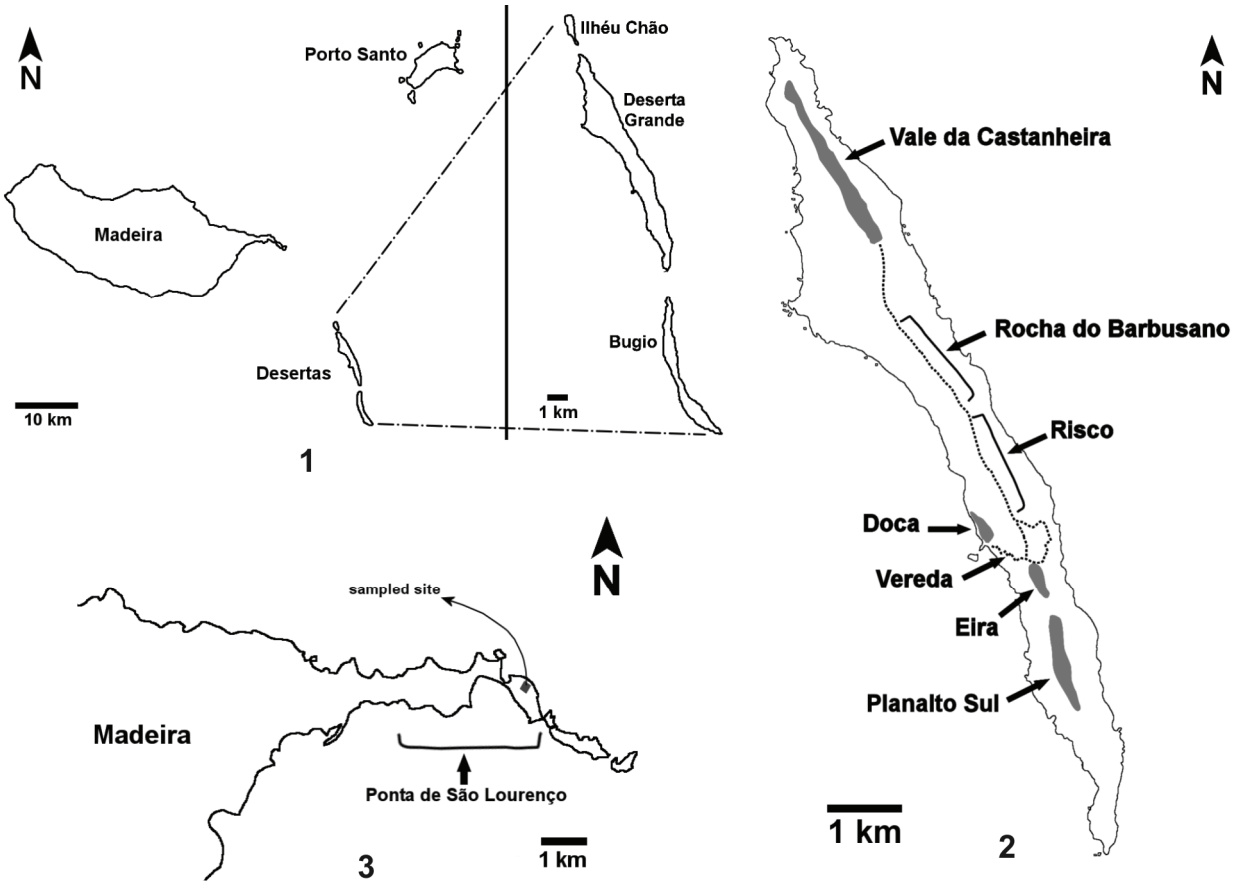

Fig. 1. Map of the Madeira archipelago, with the Desertas Islands enlarged. **Fig. 2.** Map with the sampled areas of Deserta Grande. **Fig. 3.** Map of the eastern side of Madeira Island.

endemic of Vale da Castanheira (Crespo *et al*., subm.). The study of this wolf spider species was one of the main reasons behind the recent expeditions to Deserta Grande.

The spider fauna of the Madeiran archipelago received some degree of attention by early scholars (Lowe, 1832; Blackwall, 1859, 1862; Johnson, 1863; Warburton, 1892; Bösenberg, 1895; Kulczynski, 1899, 1905; Schmitz, 1895; Bristowe, 1925; Schenkel, 1938; Denis, 1962, 1963, 1964). Later, a comprehensive work about Madeiran and Canarian spiders was performed by Wunderlich (1987, 1992, 1995, 2011, 2012). Since then, only small faunistical contributions were published with new spider records, focusing on Porto Santo (Crespo *et al*., 2009a). A checklist was compiled by Cardoso & Crespo (2008). In this checklist, only 11 spider species were cited so far for the Desertas. Such a low number mainly reflects a lack of surveys on these islands.

The main goals of this work are threefold: 1) estimate species richness for delimited areas in Deserta Grande using semi-quantitative, standardized sampling and compare them with a similar area in Madeira Island; 2) update the Desertas Islands checklist based on standardized and ad-hoc sampling and; 3) describe new species and taxonomic novelties.

Material and methods

Sampling methods. Standardized sampling was made using a modified version of the COBRA protocol (Cardoso, 2009). At Planalto Sul, Vale da Castanheira (Figure 2) and Ponta de São Lourenço (Figure 3), 1 ha (100 x 100 m) sampling plots were delimited and sampled for two weeks in April 2011. Two methods were used, each covering potentially different assemblages. Pitfall trapping, using 48 plastic cups with 33 cl capacity were left open for the entire two weeks. These were filled to two thirds of their capacity with a solution of monoethyleneglicol, and some drops of detergent to decrease surface tension. Each four contiguous traps were clumped in a single sample, resulting in 12 samples per site. Hand sampling at ground and low vegetation level, with either an entomological aspirator or forceps was also performed in one-hour samples at the middle of the two-week period. Twelve hand samples, four diurnal and eight nocturnal, were made per site (for more details on the protocol see Cardoso, 2009 and Cardoso *et al.*, 2009). The previous design of the COBRA protocol used net sweeping for sampling sites with no arboreal stratum, but in the present sites the vegetation was so scarce that even the herbaceous stratum was, in most of the areas, non existent, which rendered net sweeping a very poor sampling technique, initially tested but rapidly abandoned.

A site similar in both area and habitat was sampled in the eastern tip of Madeira Island, the Ponta de São Lourenço (Figure 3). This site was similarly covered by scarce xerophytic shrubs and herbs and completely devoid of trees.

Ad-hoc, non-standardized sampling was also performed covering most of Deserta Grande both in 2011 and 2012 (Figure 2). A small additional set of ad-hoc samples was collected from the Planalto Sul of Bugio Island in 2012.

Table I. Richness data from the COBRA protocols conducted in Deserta Grande and Madeira.

	Deserta Grande						Madeira		
	Vale da Castanheira			Planalto Sul			Ponta de São Lourenço		
	Ground search	Pitfall trapping	Total	Ground search	Pitfall trapping	Total	Ground search	Pitfall trapping	Total
Samples	12	12	24	12	12	24	12	12	24
Individuals	58	171	229	113	208	321	131	175	306
Individuals/sample	5	14	10	9	17	13	11	15	13
Species	10	12	16	15	12	20	17	12	21
Species/sample	1	1	1	1	1	1	1	1	1
Sampling intensity	5.8	14.25	14.31	7.53	17.33	16.05	7.71	14.58	14.57
Singletons	3 (30%)	4 (33%)	5 (31%)	2 (13%)	3 (25%)	2 (10%)	5 (29%)	4 (33%)	7 (33%)
Doubletons	1 (10%)	1 (8%)	1 (6%)	2 (13%)	3 (25%)	5 (25%)	3 (18%)	2 (17%)	3 (14%)
Estimates									
Chao1	12 ± 3	15 ± 4	21 ± 6	15 ± 1	13 ± 1	20 ± 1	20 ± 3	14 ± 3	26 ± 5
Chao2	11 ± 2	14 ± 3	19 ± 4	16 ± 1	13 ± 1	20 ± 1	22 ± 5	24 ± 3	30 ± 9
Jacknife1	13 ± 1	16 ± 2	21 ± 2	18 ± 1	15 ± 1	23 ± 2	23 ± 2	16 ± 2	29 ± 2
Jacknife2	14	17	24	18	15	20	26	17	34
Completeness	87%	80%	76%	98%	94%	99%	87%	86%	80%

Laboratorial methods. Specimens were analyzed through a Leica MZ9.5, a Leica MZ16 or a Nikon SMZ1000. Epigynes were cleared using methylsalicilate, after being dissected from the specimen with the help of needles and forceps. The vulvar structure of *Typhochrestus madeirensis* n. sp. was prepared in a slide and analyzed using a Leica ICC50 HD microscope.

All measurements are in mm and are given in the format "average (minimum – maximum)".

Most species nomenclature and their distributions are according to Platnick (2013).

Abreviatures

AME – Anterior median eyes
ALE – Anterior lateral eyes
PME – Posterior median eyes
PLE – Posterior lateral eyes
L Sp Ti – Proportional length of tibial spine relative to diameter of tibia
Tm (I, II, III or IV) – Metatarsal tricobothria of legs I, II, III or IV
MOQ – Median ocular quadrangle
SNM - Senckenberg Naturmuseum, Frankfurt, Germany
FMNH - Finnish Museum of Natural History, Helsinki, Finland

Statistical analysis. Species richness estimates per plot were done using non-parametric estimators, namely Chao1 (Chao, 1984), Chao2 (Chao, 1987), Jackknife1 (Burnham & Overton, 1978) and Jackknife2 (Burnham & Overton, 1979) (see also Colwell & Coddington, 1994 or Hortal *et al*., 2006). These indices are based on the number of observed species and the frequency of rare species, namely singletons (species for which a single individual was sampled), doubletons (species for which two individuals were sampled), uniques (species present in a single sample) and duplicates (species present in two samples). Even though they require high completeness to be effective, the richness per plot in small isolated islands is relatively low and the protocol used usually allows reliable estimates. Sampling intensity and completeness were computed as in Cardoso *et al.* (2008, 2009), the first being the ratio of specimens per species captured and the second the ratio between observed and estimated richness. Species accumulation curves and all calculations were computed with the software EstimateS version 8.20 (Colwell, 2006).

We also calculate the species area relationship for the entire Macaronesia using island area as independent and number of single island endemics as dependent variables (both log-transformed). This was done for both before and after accounting for the new species found in Desertas and Madeira. All data for this analysis was taken from the available checklists (Oromi *et al*., 2004; García *et al*., 2005; Cardoso & Crespo, 2008 & Cardoso *et al*., 2010).

Results

Standardized species sampling. Sixteen species were captured in Vale da Castanheira, 20 in Planalto Sul and 21 in Madeira (Table I).

For the plots of Vale da Castanheira (Deserta Grande) and Ponta de São Lourenço (Madeira), Chao1 and Chao2 estimators were recomputed using the Classic formula instead of the Bias-Corrected formula as recommended when the coefficient of variation is greater than 0.5 (Colwell, 2006). The behavior of richness estimators for both sites sampled in Deserta Grande differed (Figure 4). While the Planalto Sul sampling yielded asymptotic curves of estimators, reaching final values very close to the observed richness and with the singletons and doubletons curves crossing, the same did not occur for the curves of Vale da Castanheira, which did not show any signs of stabilizing and in which singletons kept rising and doubletons declining. Curves behaviors for the samples of Madeira were intermediate.

Estimated richness was around 20 in both sites of Deserta Grande and 30 in Madeira (Figure 4). Higher completeness values were obtained for Planalto Sul (Table I).

Ad-hoc species sampling, faunistics and taxonomy. Ad-hoc samples resulted in 57 species, of which 32 were not captured by the standardized sampling. 12 species are thought to be new to science, and of these, 11 are supposedly single island endemics (SIEs), significantly upgrading the current knowledge of Macaronesian endemics (Figure 5). Deserta Grande now appears as one of the islands in the whole Macaronesia with the greatest numbers of endemics relative to its area.

Family **Agelenidae** C.L. Koch, 1837 (2 species)

Tegenaria domestica (Clerck, 1757)

MATERIAL: Deserta Grande – 1 ♀, hand collecting, 19.IV.2011, in a dark shelter at the top of Vereda.

DISTRIBUTION: Cosmopolitan.

REMARKS: First record for the Desertas. It is probably an introduced species restricted to dark and disturbed habitats.

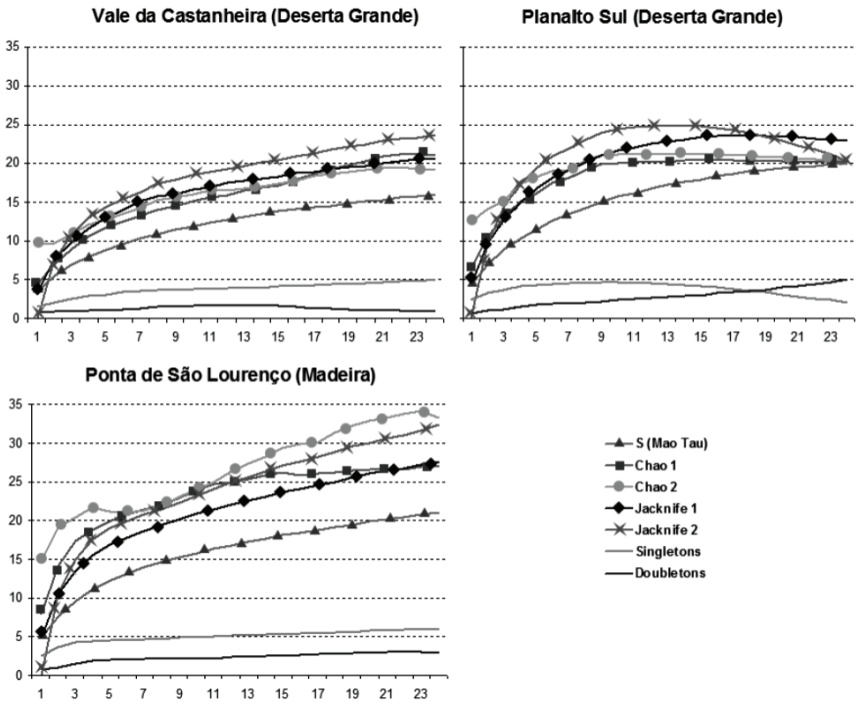

Fig. 4. Accumulation curves for the three sites sampled with a standardized protocol. Y axis = species; X axis = samples.

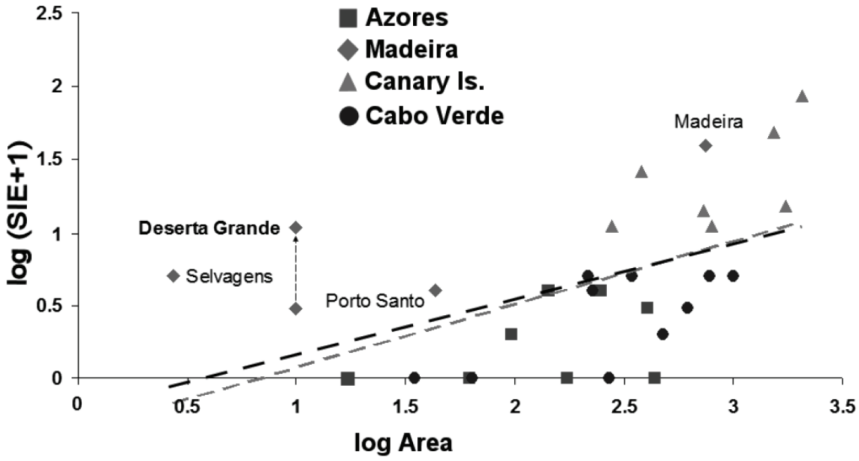

Fig. 5. Scatter plot with the relationship between the number of SIEs and the island area in the whole Macaronesia. Dashed lines represent the linear regression of both variables before (gray) and after (black) the present survey. The arrowed dashed line shows the position of Deserta Grande Island before and after the present survey.

Tegenaria pagana C.L. Koch, 1840
MATERIAL: Bugio – 1 ♂, hand collecting, 28.IV.2011, Planalto Sul.
DISTRIBUTION: Cosmopolitan.
REMARKS: First record for the Desertas. Possible juveniles were also spotted in Deserta Grande.

Family **Araneidae** Clerck, 1757 (2 species)

Mangora acalypha (Walckenaer, 1802)
MATERIAL: Deserta Grande – 1 ♀, net sweeping, 16.IV.2011, Doca.
DISTRIBUTION: Palearctic.
REMARKS: First record for the Desertas. It is not surprising since its presence has been recorded on most of the Macaronesian archipelagos.

Zygiella cf. minima Schmidt, 1968
MATERIAL: Deserta Grande – 1 ♂ and 4 ♀♀, hand collecting, 16.IV.2011, Gruta dos Roques de Castro.
DISTRIBUTION: Canary Islands.
REMARKS: First record for the Desertas and the Madeira archipelago.

Family **Dictynidae** O. Pickard-Cambridge, 1871 (2 species)

Lathys affinis (Blackwall, 1862)
MATERIAL: Deserta Grande – 13 ♀♀, 18.IV.2011, 11 ♀♀, 27.IV.2011, 3 ♂♂ and 11 ♀♀, 12.IV.2012, Planalto Sul; 4 ♀♀, 18.IV.2011, 1 ♀, 27.IV.2011, 3 ♀♀, 9.IV.2012, Eira; 1 ♀, 8.IV.2012, Vale da Castanheira; 1 ♂ and 1 ♀, 10.IV.2012, in the trail leading from Rocha do Barbusano to Risco. All specimens were collected by hand.
DISTRIBUTION: Madeira archipelago and Canary Islands.

Nigma puella (Simon, 1870)
MATERIAL: Deserta Grande – 1 ♂ and 10 ♀♀, hand collecting, 5.XII.2012, Doca.
DISTRIBUTION: Europe, Azores, Madeira, Canary Islands.
REMARKS: First record for the Desertas. Its presence was expected, due to its widespread distribution over the Macaronesian archipelagoes.

Family **Dysderidae** C.L. Koch, 1837 (1 species)

Four species of the genus *Dysdera* Latreille, 1804 were found in Deserta Grande by the authors in the field trips of 2011 and

2012. Two additional species were previously collected by the second author. These six species are all new to science and will be described in a forthcoming publication, regarding the phylogeny and biogeography of this group in the entire archipelago, adding material recently collected from the other islands. Two females were additionally captured in Bugio, but until further observations can be done, we will assign them to one of the species from Deserta Grande.

Dysdera crocata C.L. Koch, 1838
MATERIAL: Deserta Grande – 1 juvenile, 18.IV.2011, hand collecting, Doca.
DISTRIBUTION: Cosmopolitan.
REMARKS: The only specimen available was identified using DNA sequencing by Miquel Arnedo.

Family **Filistatidae** Ausserer, 1867 (1 species)

Pritha pallida (Kulczynski, 1897)
MATERIAL: Deserta Grande – 1 ♂ and 2 ♀♀, 27.IV.2011, hand collecting, Eira.
DISTRIBUTION: Mediterranean.
REMARKS: First record for the Desertas.

Family **Gnaphosidae** Pocock, 1898 (11 species)

Drassodes lutescens (C.L. Koch, 1839)
MATERIAL: Deserta Grande – 1 ♂, 18.IV.2011, 4 ♂♂ and 6 ♀♀, 27.IV.2011, hand collecting, 1 ♂ and 2 ♀♀, 27-IV-11.V.2011, pitfall trapping, Planalto Sul; 1 ♀, 19.IV.2011, hand collecting, Rocha do Barbusano; 1 ♂ and 1 ♀, 19.IV.2011, hand collecting, 1 ♂, 26.IV-10.V.2011, pitfall trapping, Vale da Castanheira.
DISTRIBUTION: Mediterranean to Pakistan.
REMARKS: First record for Desertas.

Haplodrassus dalmatensis (L. Koch, 1866)
MATERIAL: Deserta Grande – 5 ♂♂ and 3 ♀♀, 17.IV.2011, 13 ♂♂ and 14 ♀♀, 27.IV.2011, hand collecting, 32 ♂♂ and 10 ♀♀, 27.IV-11.V.2011, pitfall trapping, Planalto Sul; 1 ♂, 26.IV-10.V.2011, pitfall trapping, Vale da Castanheira. Madeira – 1 ♀, 2.V.2011, hand collecting, Ponta de São Lourenço.
DISTRIBUTION: Palearctic, Ethiopia

Micaria pallipes (Lucas, 1846)
MATERIAL: Madeira – 2 ♀♀, 2-17.V.2011, pitfall trapping, Ponta de São Lourenço.
DISTRIBUTION: Canary Islands to Central Asia.

Scotophaeus blackwalli (Thorell, 1871)
MATERIAL: Deserta Grande – 1 ♀, 28.IV.2011, hand collecting, Doca, inside a house.
DISTRIBUTION: Cosmopolitan.
REMARKS: First record for the Desertas. It was only found in the most disturbed area of the Deserta Grande.

Setaphis carmeli (O. Pickard-Cambridge, 1872)
MATERIAL: Deserta Grande – 1 ♂ and 3 ♀♀, 26.IV-10.V.2011, pitfall trapping, Vale da Castanheira. Madeira – 2 ♀♀, 2.V.2011, hand collecting, Ponta de São Lourenço.
DISTRIBUTION: Mediterranean.
REMARKS: First record for the Desertas and Madeira.

Trachyzelotes holosericeus (Simon, 1878)
MATERIAL: Bugio – 1 ♂ and 2 ♀♀, 28.IV.2012, hand collecting, Planalto Sul. Deserta Grande – 3 ♂♂, 19.IV.2011, 1 ♀, 23.IV.2011, 10 ♂♂ and 4 ♀♀, 25.IV.2011, hand collecting, 59 ♂♂ and 12 ♀♀, 26.IV-10.V.2011, pitfall trapping, Vale da Castanheira; 1 ♂, 27.IV-11.V.2011, pitfall trapping, Planalto Sul. Madeira – 2 ♂♂ and 1 ♀, 2.V.2011, hand collecting, 5 ♂♂ and 2 ♀♀, 2-17.V.2011, pitfall trapping, Ponta de São Lourenço.
DISTRIBUTION: Western Mediterranean.
REMARKS: First record for the Desertas.

Trachyzelotes lyonneti (Audouin, 1826)
MATERIAL: Bugio – 5 ♂♂ and 5 ♀♀, 28.VI.2012, hand collecting, Planalto Sul. Deserta Grande – 2 ♂♂, 16.IV.2011, hand collecting, Doca. Madeira – 1 ♂, 2-17.V.2011, pitfall trapping, Ponta de São Lourenço.
DISTRIBUTION: Mediterranean to Central Asia, USA, Brazil, Peru.

Zelotes aeneus (Simon, 1878)
MATERIAL: Bugio – 1 ♂, 28.VI.2012, hand collecting, Planalto Sul. Deserta Grande – 1 ♀, 19.IV.2012, hand collecting, Vale da Castanheira. Madeira – 1 ♀, 2-17.V.2011, pitfall trapping, Ponta de São Lourenço.
DISTRIBUTION: Europe, Madeira archipelago.
REMARKS: First record for the Desertas.

Zelotes civicus (Simon, 1878)
MATERIAL: Deserta Grande – 1 ♂, 19.IV.2012, hand collecting, Vale da Castanheira.
DISTRIBUTION: Europe, Madeira archipelago.
REMARKS: First record for the Desertas.

Zelotes semirufus (L. Koch, 1882)
MATERIAL: Bugio – 8 ♂♂ and 2 ♀♀, 28.VI.2012, hand collecting, Planalto Sul.
DISTRIBUTION: Mediterranean.
REMARKS: First record for the Desertas.

Zelotes tenuis (L. Koch, 1866)
MATERIAL: Bugio – 11 ♀♀, 28.VI.2012, Planalto Sul. Deserta Grande – 1 ♂, 7.IV.2011, Doca. All specimens collected by hand.
DISTRIBUTION: Mediterranean to Ukraine, USA.
REMARKS: First record for the Desertas.

Family **Hahniidae** Bertkau, 1878 (2 species)

Two different species of the genus *Hahnia* C.L. Koch, 1841 were collected from Deserta Grande, and these are thought to be new to science. Given that the authors possess additional new species from the Madeira archipelago we plan to describe them on a revisionary work of this genus at the regional scale.

Family **Linyphiidae** Blackwall, 1859 (9 species)

Agyneta canariensis Wunderlich, 1987
MATERIAL: Deserta Grande – 1 ♂ and 3 ♀♀, 16.IV.2011, hand collecting, Doca; 4 ♂♂ and 1 ♀, 27.IV-11.V.2011, pitfall trapping, Planalto Sul.
DISTRIBUTION: Canary Islands, Porto Santo.
REMARKS: First record for Desertas. This species was recently cited from Porto Santo Island (Wunderlich, 2011) and previously from the Selvagens (Crespo *et al*., 2009), thus it is not surprising that it was found in the Desertas.

Agyneta fuscipalpa (C.L. Koch, 1836)
MATERIAL: Deserta Grande – 27 ♂♂, 26.IV-10.V.2011, pitfall trapping, Vale da Castanheira; 2 ♂♂, 27.IV-11.V.2011, pitfall trapping, Planalto Sul. Madeira – 1 ♂, 2.V.2011, hand collecting, 19 ♂♂, 2-17.V.2011, pitfall trapping, Ponta de São Lourenço.
DISTRIBUTION: Palearctic.
REMARKS: First record for Desertas.

Centromerus phoceorum Simon, 1929
MATERIAL: Deserta Grande – 1 ♂, 26.IV-10.V.2011, pitfall trapping, Vale da Castanheira.
DISTRIBUTION: Iberian Peninsula, France, Algeria, Tunisia.
REMARKS: First record for the Desertas.

Diplocephalus graecus (O. Pickard-Cambridge, 1872)
MATERIAL: Deserta Grande – 1 ♂ and 2 ♀, 22.IV.2011, 1 ♂ and 2 ♀♀, 25.IV.2011, hand collecting, 24 ♂♂ and 5 ♀♀, 26.IV-10.V.2011, pitfall trapping, Vale da Castanheira; 1 ♂ and 3 ♀♀, 22.IV.2011, hand collecting, Vereda do Risco; 5 ♂♂ and 5 ♀♀, 27.IV.2011, hand collecting, 102 ♂♂ and 21 ♀♀, 27.IV-11.V.2011, pitfall trapping, Planalto Sul. Madeira – 1 ♂ and 8 ♀♀, 2.V.2011, hand collecting, 64 ♂♂ and 24 ♀♀, 2-17.V.2011, pitfall trapping, Ponta de São Lourenço.
DISTRIBUTION: Southern and Central Europe, North Africa.
REMARKS: First record for the Desertas and Madeira.

Microctenonyx subitaneus (O. Pickard.Cambridge, 1875)
MATERIAL: Deserta Grande – 3 ♀♀, 18.IV.2011, 1 ♀, 27.IV.2011, hand collecting, 12 ♂♂ and 5 ♀♀, 27.IV-11.V.2011, pitfall trapping, Planalto Sul; 1 ♀, 19.IV.2011, hand collecting, Vale da Castanheira; 1 ♀, 8.IV.2012, hand collecting, Vale da Castanheira; 1 ♀, 9.IV.2012, hand collecting, Eira. Madeira – 1 ♂ and 1 ♀, 2.V.2011, hand collecting, 3 ♂♂ and 5 ♀♀, 2-17.V.2011, pitfall trapping, Ponta de São Lourenço.
DISTRIBUTION: Holarctic (elsewhere, introduced).
REMARKS: First record for Desertas.

Ostearius melanopygius (O. Pickard-Cambridge, 1879)
MATERIAL: Deserta Grande – 4 ♀♀, 18.IV.2011, 1 ♀, 27.IV.2011, hand collecting, 8 ♂♂ and 3 ♀♀, 27.IV-11.V.2011, pitfall trapping, Planalto Sul.
DISTRIBUTION: Cosmopolitan.
REMARKS: First record for Desertas.

Tenuiphantes tenuis (Blackwall, 1852)
MATERIAL: Deserta Grande – 2 ♂♂ and 4 ♀♀, 20.IV.2011, hand collecting, Rocha do Barbusano; 1 ♀, 25.IV.2011, hand collecting, Vale da Castanheira.
DISTRIBUTION: Europe, North Africa, Iran, Afghanistan (elsewhere, introduced).
REMARKS: First record for Desertas.

Tiso vagans (Blackwall, 1834)
MATERIAL: Deserta Grande – 2 ♀♀, 20.IV.2011, hand collecting, Rocha do Barbusano.
DISTRIBUTION: Europe, Russia.
REMARKS: First record for Desertas.

***Typhochrestus madeirensis* Crespo sp. nov.** (Figure 6-11)

MATERIAL: Madeira – Holotype ♂ (misidentified as *T. acoreensis* Wunderlich, 1992, see Cardoso & Crespo, 2008: 284), 24.V-7.VI.2006, pitfall trapping, Pico do Areeiro, Mário Boieiro & Carlos Aguiar leg., deposited at SNM.

Deserta Grande – Paratypes: 1 ♂, 27.IV-11.V.2011, pitfall trapping, 1 ♀, 12.IV.2012, hand collecting, Planalto Sul, deposited at FMNH; 2 ♀♀, 13.IV.2012, hand collecting, Planalto Sul,deposited at SNM.

ETYMOLOGY: The species name refers to the archipelago where it was found.

DIAGNOSIS: This species can be diagnosed from all other species of *Typhochrestus* in the male by the shape of the prosoma and by the spatulate shape of the tip of the embolus and in the females by the shape of the copulatory ducts.

DESCRIPTION.
Male: Total length 1.3 (1.2 – 1.4). Prosoma 0.7 (0.6 – 0.7) long, 0.5 (0.5) wide. Male cephalic lobe elevated as usual for the genus, with excavated postocular sulci, the lobe being short and long (Fig. 6A). Clypeus height about 7 times the diameter of AME. Anterior row of eyes slightly recurved. Posterior row straight. AME separated from ALE by the twice the diameter of the latter. AME separated by half their diameter. PME separated from AME roughly 3 times the diameter of the former. PLE touching ALE. PME separated by their diameter. PME separated from PLE by 4 times the diameter of the former. Coloration of prosoma and legs yellowish to brown. Chelicerae with 16 stridulating ridges, with 4 promarginal and 3 retromarginal teeth. Opisthosoma black. Legs with spination typical of the genus, with 2 dorsal spines on tibiae I, II and III and 1 on IV. L Sp Ti I–II = 0.3; L Sp Ti III–IV = 0.2. Tm IV absent. Position of TmI 0.42. Measurements of legs in Table II.

Male palp (Figs. 6B – D). Tibia with an apophysis typical of all Macaronesian *Typhochrestus,* with 3 subequal dorsal teeth. Paracymbium simple, without apophyses or hairs. Embolar apophysis corkscrew in shape, pointing dorsally and retrolaterally. Embolus coiled about 1.5 times, shortening at the final third until it widens at its tip, conferring it a spatulate shape.

Female. Total length 1.3 (1.3 – 1.4). Prosoma 0.6 (0.6) long, 0.4 (0.4) wide. Clypeus not protruding. Clypeal height 6 times the diameter of AME. Anterior row of eyes recurved. Posterior row straight. AME separated from ALE by 1.5 times the diameter of the former. AME separated by their diameter. PME separated from AME by 1.5 times the diameter of the former. PLE touching ALE. PME separated by their diameter. PME separated from PLE by the diameter of the former. Coloration of legs yellow, with trochanters, endites and coxae suffused with black. Sternum and labium black. Prosoma brown, suffused with black. Chelicerae with 8 small stridulating ridges, with 5 promarginal and retromarginal teeth. Opisthosoma black.

Tibial spination as in male but spines longer, L Sp Ti I–IV= 1.1. Position of TmI: 0.4. Measurements of legs in Table III.

Epigyne (Fig. 6E - F). Epigynal openings surrounded by a rounded plaque. Vulva very similar to that of *T. hesperius* Thaler, 1984 but inner branches of anterior copulatory ducts smaller than outer branches.

ECOLOGY: This species apparently dwells in open undisturbed spaces in the Madeira archipelago. The site in Madeira is a high altitude open habitat. Four females were captured under stones in Deserta Grande.

PHENOLOGY: Adults of both sexes were collected in April and May. This should not be regarded as precise information due to the absence of sampling outside of the referred months.

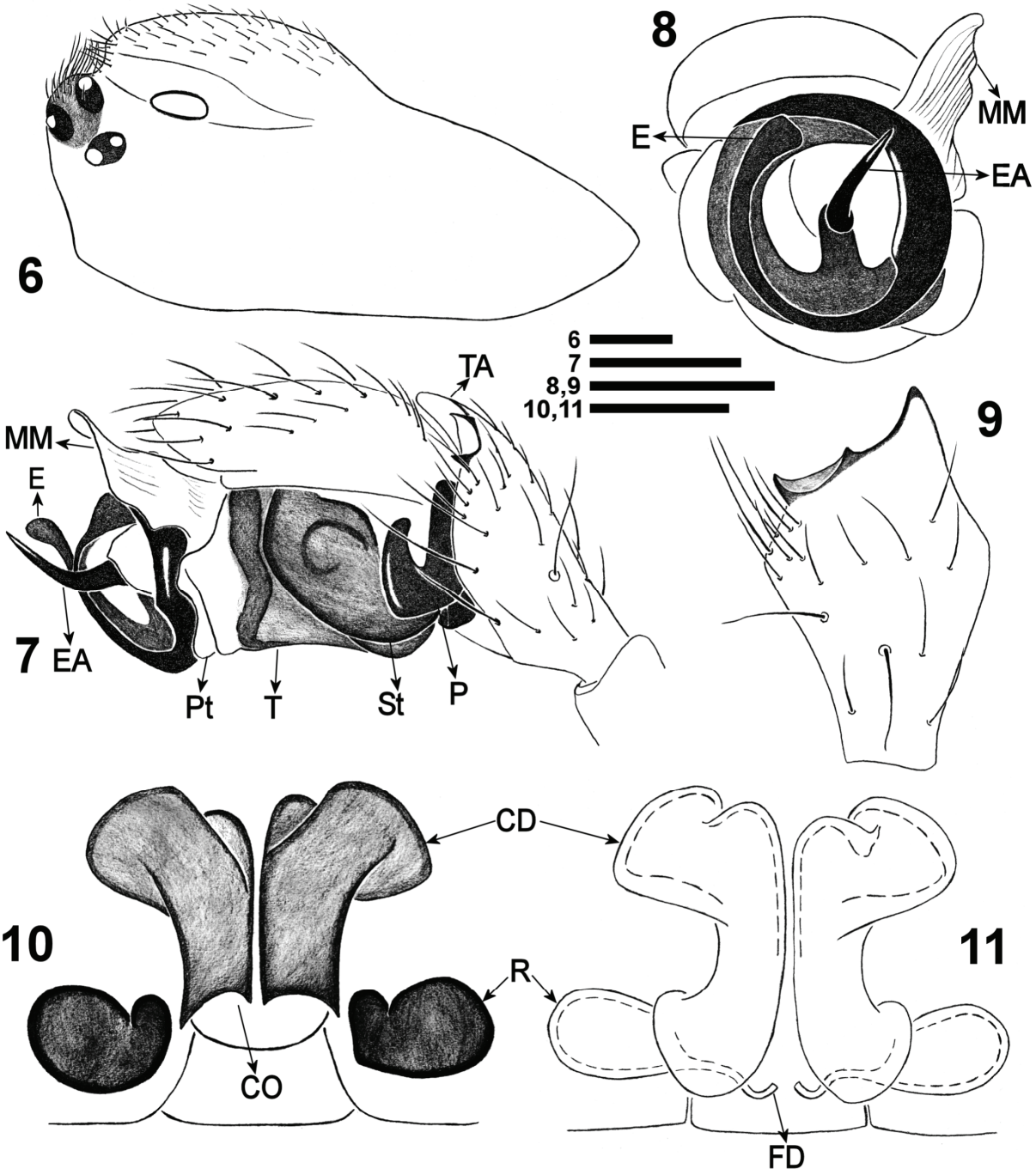

Fig. 6-11. *Typhochrestus madeirensis* n.sp.: male from Madeira, **6**. prossoma; **7**. retrolateral aspect of left pedipalp; **8**. frontal aspect of left pedipalp; **9**. dorsal aspect of tibia. Scale bars = 0.1 mm. Female from Deserta Grande, **10**. ventral aspect of vulva; **11**. dorsal aspect of vulva. Scale bars = 0.05 mm. TA – Tibial apophysis; E – Embolus; P – Paracymbium; T – Tegulum; St – Subtegulum; Pt – Protegulum; EA – Embolar apophysis; MM – median membrane; CO – Copulatory openings; CD – Copulatory ducts; R – Receptacula; FD – Fertilization ducts.

Table II. Leg measurements for male *Typhochrestus madeirensis* n. sp.

	Femur	Patella	Tibia	Metatarsus	Tarsus	Total
Leg I	0.5 (0.4 – 0.5)	0.2 (0.2)	0.4 (0.4)	0.3 (0.3)	0.3 (0.2 – 0.3)	1.6 (1.5 – 1.7)
Leg II	0.4 (0.4)	0.2 (0.1 – 0.2)	0.4 (0.3 – 0.4)	0.3 (0.3)	0.2 (0.2)	1.4 (1.3 – 1.5)
Leg III	0.3 (0.3)	0.2 (0.1 – 0.2)	0.3 (0.3)	0.3 (0.2 – 0.3)	0.2 (0.2)	1.3 (1.2 – 1.3)
Leg IV	0.5 (0.5)	0.2 (0.1 – 0.2)	0.5 (0.4 – 0.5)	0.3 (0.3)	0.2 (0.2)	1.7 (1.6 – 1.7)

Table III. Leg measurements for female *Typhochrestus madeirensis* n. sp.

	Femur	Patella	Tibia	Metatarsus	Tarsus	Total
Leg I	0.4 (0.4)	0.1 (0.1 – 0.2)	0.3 (0.3)	0.3 (0.2 – 0.3)	0.2 (0.2 – 0.3)	1.3 (1.3 – 1.4)
Leg II	0.4 (0.4)	0.1 (0.1)	0.3 (0.3)	0.2 (0.2 – 0.3)	0.2 (0.2)	1.2 (1.2 – 1.3)
Leg III	0.3 (0.3)	0.1 (0.1)	0.2 (0.2)	0.2 (0.2)	0.2 (0.2)	1.1 (1.1)
Leg IV	0.4 (0.4 – 0.5)	0.1 (0.1 – 0.2)	0.4 (0.4)	0.3 (0.3 – 0.4)	0.2 (0.2)	1.5 (1.4 – 1.6)

DISTRIBUTION: The archipelago of Madeira. Known from the islands of Madeira and Deserta Grande.

Family **Liocranidae** Simon, 1897 (1 species)

Mesiotelus grancanariensis Wunderlich, 1992
MATERIAL: Deserta Grande – 1 ♂, 8.IV.2012, 1 ♂, 19.IV.2012, Vale da Castanheira; 1 ♀, 12.IV.2012, Planalto Sul. All specimens collected by hand.
REMARKS: First record for Desertas.
DISTRIBUTION: This species was initially thought to be endemic to the Canary Islands, but it was recently found in the Portuguese mainland (Wunderlich, 2011).

Family **Lycosidae** Sundevall, 1833 (3 species)

Hogna heeri (Thorell, 1875)
MATERIAL: Bugio – 1 ♂ and 1 ♀, 3.XII.2012, hand collecting, Planalto Sul.
DISTRIBUTION: Madeira Island and Bugio.
REMARKS: Thought to be an endemic restricted to Madeira Island, it was now found in Bugio. Interestingly, adult specimens of *H. heeri* were not found with adults of the closely related species, *Hogna insularum* (Kulczynski, 1899). The cohabitation of two similar species of the same genus in such a small island like Bugio could explain the appearance of adults of *H. heeri* solely in Winter and those of *H. insularum* in Spring.

Hogna ingens (Blackwall, 1857)
DISTRIBUTION: This species is restricted to the Vale da Castanheira, the valley in the North of Deserta Grande.
REMARKS: The authors have not collected new material of this remarkable endemic species, given that this was readily identifiable in the field.

Hogna insularum (Kulczynski, 1899)
MATERIAL: Bugio – 4 ♂♂ and 4 ♀♀, 28.VI.2012, hand collecting, Planalto Sul. Deserta Grande – 1 ♀, 17.IV.2011, hand collecting, Eira; 1 ♂, 23.IV.2011, 15 ♀♀, 25.IV.2011, hand collecting, 1 ♂, 26.IV-10.V.2011, pitfall trapping, Vale da Castanheira. Madeira – 1 ♂ and 4 ♀♀, 2.V.2011, hand collecting, 4 ♂♂ and 5 ♀♀, 2-17.V.2011, pitfall trapping, Vale da Castanheira.
DISTRIBUTION: Madeira archipelago.

Family **Nesticidae** Simon, 1894 (1 species)

Eidmanella pallida (Emerton, 1875)
MATERIAL: Deserta Grande – 1 ♂, 17.IV.2011, 1 ♀, 21.IV.2011, hand collecting, Doca.
DISTRIBUTION: Cosmopolitan.
REMARKS: First record for Desertas.

Family **Ochyroceratidae** Fage, 1912 (1 species)

Undetermined species
MATERIAL: Deserta Grande – 6 ♀♀, 7.IV.2012, Doca; 2 ♀♀, 13.IV.2012, Planalto Sul. All specimens collected by hand.
REMARKS: These specimens were initially thought to be oonopids because they carry their eggs with their chelicerae. A detailed observation in the laboratory revealed them to be members of the Ochyroceratidae, with all specimens being females and showing the opening of the copulatory ducts in a position situated laterally and posteriorly of the epigastric sulcus, from which a slightly sclerotized arch runs. Further observations should reveal the identity of these specimens. This is the first record of the family in a native habitat in Europe (see also Kielhorn, 2008).

Family **Oecobiidae** Blackwall, 1862 (1 species)

Oecobius similis Kulczynski, 1909
MATERIAL: Deserta Grande – 4 ♀♀, 16.IV.2011, 2 ♂♂ and 2 ♀♀, 18.IV.2011, hand collecting, Doca; 1 ♂ and 2 ♀♀, 17.IV.2011, Eira; 13 ♂♂ and 3 ♀♀, 25.IV.2011, hand collecting, 15 ♂♂ and 1 ♀, 26.IV-10.V.2011, pitfall trapping, Vale da Castanheira; 5 ♂♂ and 5 ♀♀, 27.IV.2011, hand collecting, Planalto Sul. Madeira – 16 ♂♂ and 33 ♀♀, 2.V.2011, hand collecting, 29 ♂♂ and 3 ♀♀, 2-17.V.2011, pitfall trapping, Ponta de São Lourenço.
DISTRIBUTION: Madeira, Canary Islands, Azores, St. Helena.
REMARKS: First record for Desertas.

Family **Oonopidae** Simon, 1890 (3 species)

Gamasomorpha insularis Simon, 1907
MATERIAL: Madeira – 1 ♂, 2.V.2011, hand collecting, 2 ♂♂, 2-17.V.2011, pitfall trapping, Ponta de São Lourenço.
DISTRIBUTION: Madeira, Bioko, São Tomé, St. Helena, Mauritius, Yemen, Seychelles.

Oonops cf. *pulcher* Templeton, 1835
MATERIAL: Deserta Grande – 2 ♂♂, 16.IV.2011, 2 ♂♂ and 1 ♀, 7.IV.2012, Doca. Madeira – 6 ♂♂ and 8 ♀♀, 2.V.2011, Ponta de São Lourenço. All specimens were collected by hand.
DISTRIBUTION: Europe to Ukraine, North Africa, Tasmania.
REMARKS: First record for the Desertas and Madeira. This identification is not certain as the observation of the structures of the tip of the bulbus were not clear.

Opopaea concolor (Blackwall, 1859)
MATERIAL: Deserta Grande – 5 ♂♂ and 2 ♀♀, 7.IV.2012, hand collecting, Doca.
DISTRIBUTION: Pantropical.
REMARKS: First record for the Desertas. It was only found in the most disturbed area of the island.

Orchestina sp.
MATERIAL: Deserta Grande – 1 ♀, 16.IV.2011, 1 ♀, 17.IV.2011, Doca; 2 ♀♀, 17.IV.2011, 3 ♀♀, 9.IV.2012, Eira; 1 ♀, 18.IV.2011, 1 ♂ and 4 ♀♀, 27.IV.2011, 3 ♀♀, 12.IV.2012, 1 ♂ and 3 ♀♀, 13.IV.2012, Planalto Sul. All specimens were collected by hand.
REMARKS: These specimens are a new species, which will be described in an upcoming revisionary work on the genus *Orchestina* in the Macaronesian and Mediterranean region.

Family **Philodromidae** Thorell, 1870 (1 species)

Thanatus vulgaris Simon, 1870
MATERIAL: Deserta Grande – 1 ♀, 17.IV.2011, hand collecting, Eira; 1 ♀, 27.IV.2011, hand collecting, 1 ♂, 27.IV-11.V.2011, pitfall trapping, Planalto Sul. Madeira – 3 ♀♀, 2.V.2011, hand collecting, Ponta de São Lourenço.
DISTRIBUTION: Palearctic.
REMARKS: First record for Desertas.

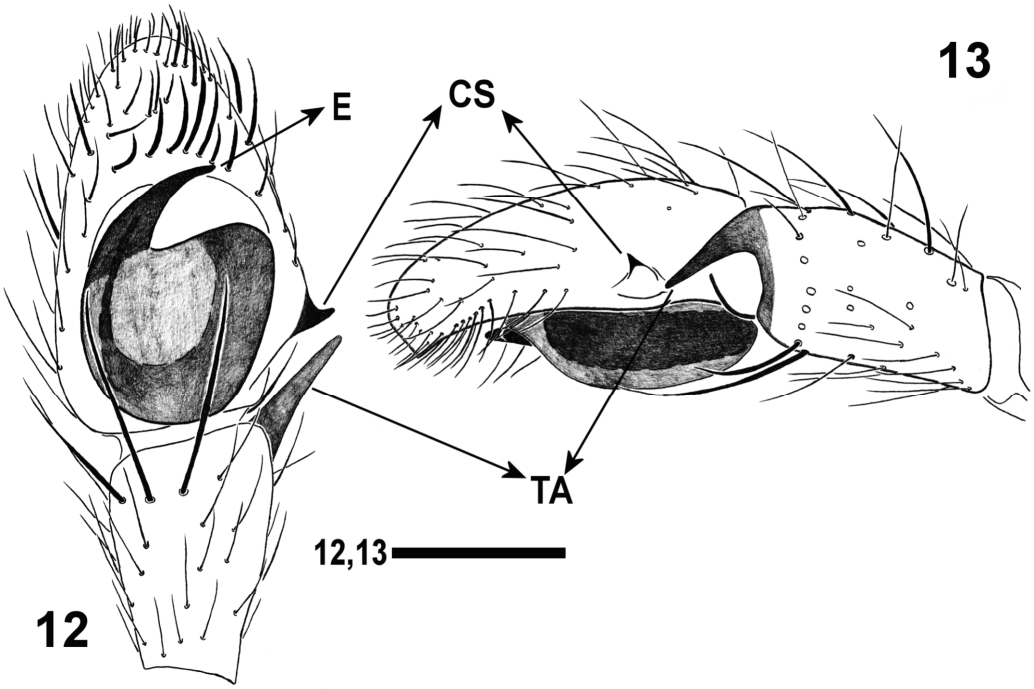

Fig. 12-13. *Zimirina lepida* (Blackwall, 1859): male from Deserta Grande, **12**. ventral aspect of left pedipalp; **13** . retrolateral aspect of male pedipalp. Scale bar = 0.1 mm. TA – Tibial apophysis; CS – Cymbial spur; E – Embolus. **Fig. 14.** *Zimirina lepida* (Blackwall, 1859): female in Deserta Grande. Note the erect ventral setae in close contact with the ground. © Pedro Cardoso, 2011.

Family **Pholcidae** C.L. Koch, 1850 (1 species)

Pholcus phalangioides (Fuesslin, 1775)
MATERIAL: Deserta Grande – 1 ♂ and 1 ♀, 18.IV.2011, hand collecting, Doca (in a house).
DISTRIBUTION: Cosmopolitan.
REMARKS: First record for Desertas. It is probably restricted to sheltered disturbed habitats.

Family **Prodidomidae** Simon, 1884 (1 species)

Zimirina lepida (Blackwall, 1859) (Fig. 12-14)
MATERIAL: Deserta Grande – 1 ♀, 16.IV.2011, 3 ♂♂ and 1 ♀, 17.IV.2011, 1 ♂, 7.IV.2012, Doca. Madeira – 14 ♂♂ and 13 ♀♀, 2.V.2011, Ponta de São Lourenço. All specimens were collected by hand.
DISTRIBUTION: Madeira and Selvagens.
REMARKS: First record for Desertas. After identifying this species from the Selvagens (Crespo *et al*., 2009b) from where the undescribed male was found, some females were caught from Porto Santo (Crespo *et al*., 2009a). These were, however, slightly different from the Selvagens specimens, and the authors waited until further material was collected. After observing the males, a striking resemblance to *Z. spinicymbia* Wunderlich, 1992, endemic from Gran Canaria in the Canary Islands was found. The type material of the latter species was checked and found to be slightly different from the material caught in the Madeira archipelago, given the differences in the tibial apophysis, cymbial spur and cymbial pilosity.

The material collected from Desertas, in addition to material from Madeira containing both males and females and 2 males from Porto Santo, lead us to conclude that *Z. lepida* occupies the entire archipelagoes of Madeira and Selvagens. The male of *Z. lepida* is here described for the first time.

Table IV. Leg measurements for male *Zimirina lepida*.

	Femur	Patella	Tibia	Metatarsus	Tarsus	Total
Leg I	0.9 (0.8 – 1.1)	0.6 (0.5 – 0.7)	0.7 (0.7 – 0.9)	0.7 (0.6 – 0.8)	0.5 (0.4 – 0.5)	3.4 (3.0 – 4.1)
Leg II	0.8 (0.7 – 1.0)	0.5 (0.4 – 0.6)	0.7 (0.6 – 0.9)	0.6 (0.5 – 0.7)	0.4 (0.4 – 0.5)	3.0 (2.7 – 3.7)
Leg III	0.7 (0.6 – 0.8)	0.4 (0.4 – 0.4)	0.5 (0.5 – 0.6)	0.5 (0.5 – 0.5)	0.4 (0.4 – 0.4)	2.5 (2.3 – 2.7)
Leg IV	1.1 (1.0 – 1.2)	0.5 (0.5 – 0.6)	0.9 (0.8 – 1.1)	0.8 (0.7 – 0.9)	0.6 (0.5 – 0.7)	3.9 (3.5 – 4.4)

DESCRIPTION.
Prosoma 1.2 (1.1 – 1.4) long, 0.9 (0.8 – 1.1) wide. Total length 2.5 (2.2 – 2.9). Eyes: Typical prodidomid arrangement, with the posterior row very procurved and the anterior row slightly recurved, from above. PME rectangular, whitish, PLE quadrangular, light, ALE oval, whitish, AME rounded, dark. MOQ longer than wide and wider at the back than at the front, from behind. AME separated by roughly their radius, nearly touching ALE. ALE nearly touching PLE. PLE nearly touching PME. PME separated by roughly their radius in male. Carapace orange, oval, with widest point between coxae II and III and posteriorly invaginated, fovea absent. Clypeal height at AME roughly their diameter. Sternum pale orange, oval, widest between coxae II and III, protruding between coxa IV, with clusters of stiff setae nested between the coxae. Labium roughly as wide as long, with its anterior margin more or less rounded, each endite converging roughly to a third of labium width. Chelicerae: without teeth, with a relatively long fang, slightly projecting forwards. Opisthosoma: male with a gray opisthossoma, sometimes suffused with red (mostly depending on the preservation of the specimen), strong bristles scattered through most of the ventral opisthossoma. Legs: yellow, tarsal claws with no teeth in their ventral surface, claw tufts present; see leg sizes in Table IV; 1 dorsal spine in femurs I and II, 2 dorsal spines in femur III and IV; tibiae and metatarsi I and II without spines, tibiae and metatarsi III and IV with very variable spination.

Male palp (Figs. 12-13): Retrolateral tibial apophysis relatively simple, oblique, with its tip reaching the proximities of the cymbial spur in retrolateral and in ventral view. Cymbial spur well developed, sharply pointed. Embolus a simple curved process. Hairs at the tip of cymbium thick, but not lanceolate.

ECOLOGY: The species was found only in the most disturbed area of Deserta Grande, which raises the question of it being a native species to the island that prefers low altitude areas or an introduction from surrounding islands. It was always found under stones, in arid habitats. *Z. lepida* was captured from similar habitats in Porto Santo Island (Crespo *et al*., 2009a), Ilhéu de Cima, Madeira Island and Selvagem Grande (Crespo *et al*., 2009b), and it was never found in the humid habitats of Madeira Island, such as laurel forest.

BEHAVIOR: In the field, *Z. lepida* moved very fast in short periods, interspaced with periods of slow moving and perhaps sensing the vicinities for tactile or chemical stimuli. The authors noticed that in these moments the strong hairs present in the opisthosoma of this spider were erected, touching the ground (Figure 14).

Family **Salticidae** Blackwall, 1841 (2 species)

Chalcoscirtus sublestus (Blackwall, 1867)
MATERIAL: Deserta Grande – 3 ♀♀, 17.IV.2011, hand collecting, Doca; 1 ♀, 19.IV.2011, 1 ♀, 23.IV.2011, hand collecting, 1 ♂ and 1 ♀, 26.IV-10.V.2011, pitfall trapping, Vale da Castanheira; 14 ♀♀, 27.IV.2011, 2 ♀♀, 12.IV.2012, hand collecting, 1 ♂ and 1 ♀, 27.IV-11.V.2011, pitfall trapping, Planalto Sul. Madeira – 7 ♀♀, 2.V.2011, hand collecting, 1 ♀, 2-17.V.2011, pitfall trapping, Ponta de São Lourenço.
DISTRIBUTION: Madeira and Canary Islands.
REMARKS: First record for Desertas.

Macaroeris desertensis Wunderlich, 1992
MATERIAL: Deserta Grande – 1 ♂, 16.IV.2011, Doca; 1 ♀, 18.IV.2011, 1 ♀, 12.IV.2012, Planalto Sul; 1 ♀, 19.IV.2011, 2 ♀♀, 25.IV.2011, Vale da Castanheira; 1 ♀, 10.IV.2012, trail leading from Rocha do Barbusano to Risco. All specimens were collected by hand.
DISTRIBUTION: the archipelago of Madeira.
REMARKS: This species builds its cocoons mostly on the abundant bush-like lichens covering many rocks.

Family **Segestriidae** Simon, 1893 (1 species)

Ariadna maderiana Warburton, 1892
MATERIAL: Deserta Grande – 1 ♀, 16.IV.2011, Doca; 1 ♂ and 2 ♀♀, 17.IV.2011, Eira; 1 ♂ and 1 ♀, 18.IV.2011, 9 ♀♀, 27.IV.2011, Planalto Sul; 1 ♂ and 4 ♀♀, 25.IV.2011, Vale da Castanheira. Madeira – 2 ♀♀, 2.V.2011, Ponta de São Lourenço. All specimens were collected by hand.
DISTRIBUTION: Madeira and Selvagens.

Family **Sicariidae** Keyserling, 1880 (1 species)

Loxosceles cf. *rufescens* (Dufour, 1820)
MATERIAL: Deserta Grande – 1 ♂ and 4 ♀♀, 19.IV.2012, hand collecting, Vale da Castanheira.
DISTRIBUTION: Cosmopolitan.
REMARKS: These specimens appear slightly different in size and color to the typical form present in anthropic habitats, but for now we will attribute this provisional identification to the material.

Family **Theridiidae** Sundevall, 1833 (4 species)

Enoplognatha diversa (Blackwall, 1859)
MATERIAL: Deserta Grande – 2 ♀♀, 17.IV.2011, Eira; 1 ♂ and 2 ♀♀, 18.IV.2011, 1 ♂ and 3 ♀♀, 27.IV.2011, Planalto Sul; 1 ♂, 25.IV.2011, Vale da Castanheira. Madeira – 1 ♀, 2.V.2011, Ponta de São Lourenço. All specimens were collected by hand.
DISTRIBUTION: Madeira, Canary Islands, Spain, Morocco to Greece.

Steatoda grossa (C.L. Koch, 1838)
MATERIAL: Deserta Grande – 1 ♀, 16.IV.2011, Gruta dos Roques de Castro; 1 ♀, 18.IV.2011, Doca; 1 ♀, 19.IV.2011, Vereda. Madeira – 1 ♀, 2.V.2011, Ponta de São Lourenço. All specimens were collected by hand.
DISTRIBUTION: Cosmopolitan.
REMARKS: First record for Desertas.

Theridion hannoniae Denis, 1944
MATERIAL: Madeira – 1 ♀, 2.V.2011, hand collecting, Ponta de São Lourenço.

DISTRIBUTION: Europe and Mediterranean, Madeira and Canary Islands.

Theridula aelleni (Hubert, 1970)
MATERIAL: Deserta Grande – 1 ♀, 17.IV.2011, Eira; 3 ♂♂ and 2 ♀♀, 27.IV.2011, Planalto Sul. All specimens were collected by hand.
DISTRIBUTION: Spain, Tunisia.
REMARKS: First record for Desertas.

Family **Thomisidae** Sundevall, 1833 (2 species)

Xysticus grohi (Wunderlich, 1992)
MATERIAL: Deserta Grande – 1 ♀, 28.IV.2011, hand collecting, Vereda.
DISTRIBUTION: Only known from Desertas.
REMARKS: The single specimen of this single island endemic species was caught by the second author in a very steep slope. In flatter sites, where the sampling effort was greater, the species *X. nubilus* was present instead.

Xysticus nubilus Simon, 1875
MATERIAL: Deserta Grande – 1 ♀, 22.IV.2011, 1 ♀, 23.IV.2011, 2 ♀♀, 25.IV.2011, 1 ♀, 8.IV.2012, 1 ♂ and 1 ♀, 19.IV.2012, hand collecting, 8 ♀♀, 26.IV-10.V.2011, pitfall trapping, Vale da Castanheira; 1 ♀, 27.IV-11.V.2011, pitfall trapping, Planalto Sul. Madeira – 1 ♀, 2-17.V.2011, pitfall trapping, Ponta de São Lourenço.
DISTRIBUTION: Mediterranean, Macaronesia.
REMARKS: First record for Desertas.

Discussion

The data obtained by standardized sampling revealed a number of interesting phenomena. First, the lack of an asymptote and a large proportion of singletons in Vale da Castanheira might reflect an unstable community composed of early colonizers of disturbed habitats, as only 2.5 years had gone by after a large wildfire that spread over most of the valley and a few months after chemical treatments were made to fight *Phalaris aquatica* in the sampled plot. Total abundance of spiders was also smaller in Vale da Castanheira than in Planalto Sul, which might be an abnormal situation given that Planalto Sul is a more exposed and barren site, with less vegetation than Vale da Castanheira. It would be interesting to repeat the protocols in the same sites in the future and compare the data, to understand how the community shapes itself after the recent interventions by the Natural Park of Madeira in the attempt to eradicate *Phalaris aquatica* from Vale da Castanheira. Second, even though similar in habitat type, the plot in Madeira Island (São Lourenço), presented higher observed and estimated richness than both plots at Deserta Grande. This might suggest an important contribution of the regional pool, larger in Madeira, to the local diversity of each plot. The importance of regional pools to local diversity is well known (Ricklefs, 1987; Srivastava, 1999; Borges & Brown, 2004) and it seems reflected in our data.

Until recently, only 11 spider species were known from Desertas (Cardoso & Crespo, 2008). This number increases to 57 with the current work. Although many of the novel species are widely distributed, often preferring disturbed habitats, we also add 11 new species for science, 10 of which endemic to Desertas and 1 to Desertas and Madeira. Five Macaronesian endemics were also detected, previously unknown from

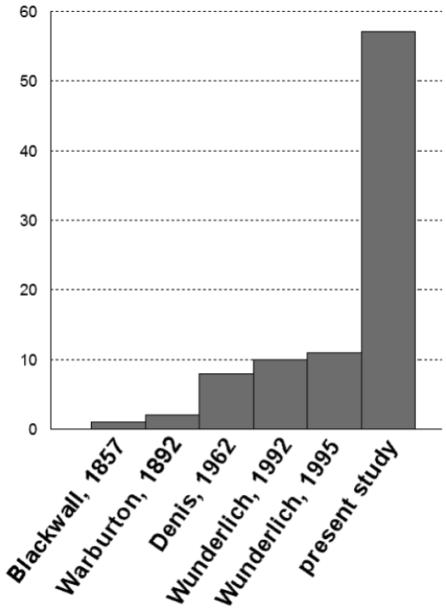

Fig. 15. Cumulative citations of spider species for the Desertas.

Desertas. This is a big step towards resolving the Linnean and Wallacean shortfalls (see Cardoso *et al*., 2011) still prevalent in this region (Figure 15), which was undoubtedly one of the less sampled in the whole Macaronesian region (Figure 5). In addition to the faunistical contribution to Desertas, the list of species known from Madeira Island is increased by 3.

The strange appearance of an unknown species of Ochyroceratidae is reported, if we consider the tropical distribution of the family. Other species were collected with wide and tropical distributions, such as *Opopaea concolor* and *Gamasomorpha insularis*. It would be easy to think of the ochyroceratid as a recent introduction to Deserta Grande but besides the samples collected at Doca, the most disturbed site in the island, the authors have also found it in the South Plateau, a site subject to a very small degree of disturbance, with reduced probability of introduction of exotic species.

Many of the new species belong to genera which speciated in the Macaronesian or Madeiran archipelagos and thus demand generic revisions at least at regional level, in the cases where only limited information is available (*Hahnia* spp, *Dysdera* spp., *Orchestina* sp.). Interestingly, nearly all cases of new species were found in the high altitude areas of Deserta Grande, while common widespread and mostly exotic species were found at the most disturbed, low-altitude site, the Doca, where all visitors arrive. The only way for invasive species to colonize the rest of the island would be overcoming a steep, 400 m high cliff to the top of the island, and at least for now this seems to be an obstacle to most species. We stress that in this area we found *D. crocata*, known as an invasive species throughout the Macaronesian archipelagos, this being a recent introduction thought to have occurred after the storms of February 2010 brought large quantities of driftwood to Deserta Grande from Madeira Island. We now fear that *D. crocata,* being a cosmopolitan and aggressive species, can eventually reach the top of the island and outcompete its endemic congenerics and lead to their extinction. This is thought to be the case in the Azorean archipelago where *D. crocata* is present in all the islands even inside native forests, possibly having driven endemic species to extinction in recent decades (Cardoso *et al*., 2010).

The number of supposed SIEs of the Deserta Grande now reaches 21% of the known spider community, surpassing the values for Porto Santo (5%) and the Selvagens (9%), the most similar islands for which comparable data can be drawn, although now with a large difference in terms of sampling effort. This presence of a greater number of SIEs can certainly be attributed to the rugged geomorphology, which rendered this island inappropriate to human colonization, which several authors have related to extinction waves and homogenization of biota in groups ranging from spiders (Cardoso *et al.*, 2010), birds (Vitousek, 1988), land snails (Solem, 1990) and even plants (Cronk, 1989).

Although precise estimates are impossible with the available data, it is certain that more than 60 species occur in Deserta Grande. Juveniles belonging to additional genera (such as *Argiope*) were collected and could lead to higher species numbers in the future, even if all these are thought to be exotics.

Many of the undescribed new species have highly restricted distribution ranges, such as one of the *Hahnia* species, captured solely in a small erosion cave, and most of the new *Dysdera*, found in very small numbers. Even *Hogna ingens*, a species known to science since 1857, and restricted to the North end of Deserta Grande (Vale da Castanheira), was never assessed for extinction risk according to the IUCN criteria (IUCN, 2001) neither is it protected by regional, national or international law (e.g. Habitats Directive, Council of the European Communities, 1992). Its habitat is currently degraded by invasive species, namely *Phalaris aquatica*, and suffered recent interventions by the Madeira Natural Park. The authors address this issue in another publication. In addition, feral goats (*Capra hircus*) have long been established in the Desertas, like other invasive species, and the efforts to their eradication proved to be unsuccessful. They currently proliferate and have irreversibly altered the local flora. We can only guess if this change of the native flora is the cause for the low numbers of *Dysdera* specimens, which could have specialized in different kinds of prey, possibly endemic insects that were somehow dependent on the native flora. Restoration of native habitats in Desertas is biased towards the protection of some taxa, like birds (such as *Pterodroma deserta*) or mammals (*Monachus monachus*), and conservation projects on such iconic fauna usually disregard other fauna. Future projects should be made to monitor the spiders and other terrestrial invertebrates of the Desertas, in view of the possibility of additional new species being found and the high extinction risk for many of the already known (but still undescribed) species.

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