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***Leptothorax caesari* sp.n. (Insecta: Hymenoptera: Formicidae), a granivore with apterous males**

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Abstract

Leptothorax caesari sp.n. from a very arid steppic region in the north-east of the Iberian Peninsula is described; this species is morphologically characterized by its big eyes, dark colour and mesopropodeal furrow in the workers; females are small in size and males are exceptional among the genus because they are apterous and ergatoid. Feeding habits are also unexpected: this species is the first granivorous *Leptothorax*.

Key words: Formicidae, Myrmicinae, *Leptothorax caesari*, new species, apterous male, granivory, Iberian Peninsula, Spain.

Zusammenfassung

Leptothorax caesari sp.n. wird aus einer sehr ariden Steppenregion im Nordwesten der Iberischen Halbinsel beschrieben. Morphologisch zeichnet sich diese Art durch große Augen, dunkle Farbe und eine Metanotalquerfurche der Arbeiterinnen aus. Die Königinnen sind klein. Die Männchen sind außergewöhnlich für diese Gattung, da sie flügellos und ergatoid sind. Auch die Ernährung ist ungewöhnlich: *Leptothorax caesari* sp.n. ist die erste granivore *Leptothorax*-Art.

Introduction

The abiotic and some biological aspects of the endoreic Sariñena lagoon have been studied (PEDROCCHI 1986). Among the ants collected there on May 10, 1980, a single worker with big eyes could not be identified. Its characteristics did not match any of the known *Leptothorax* MAYR, 1855 species. An attempt to collect more workers, also by night, failed. A general faunistic survey based on Barber traps (pitfalls) provided additional material and in 1985 we could find a full society. A second nest was partially recovered in 1987. Using all this material, this new species can now be properly described. Its morphology and feeding habits are extraordinary within the genus. Measurements (six workers, five females, five males; mean \pm standard deviation; minimum-maximum) and abbreviations follow BOLTON (1982).

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Leptothorax caesari sp.n.

Material examined: Holotype: worker, collected 11.V.1980, some 20 meters from the Sariñena lagoon, in a steppe with *Lygeum spartum* (L.), *Euphorbia sulcata* DE LENS, *Plantago albicans* L., Province of Huesca, Spain; leg. X. Espadaler (Coll. Espadaler). **Paratypes:** 5 workers from pitfall traps, same biotope, 10.II.1983, 24.II.1983, 7.IV.1983, 20.IV.1983, 16.VI.1983; 1 ♀ from pitfall trap, 14.IV.1983, leg. C. Pedrocchi; 18 workers, 1 ♀ from an excavated nest, 9.IV.1985, leg. X. Espadaler; 1 ♂ and 6 ♀♀ eclosed at the laboratory on VIII-1985; 14 workers, 1 ♀ from an excavated nest on 8.IX.1987; 6 ♀♀ eclosed in XI.1987; 15 ♂♂ eclosed in VIII.IX.1988. leg. X. Espadaler; 1 worker, 7.VI.1992, leg. X. Espadaler (Coll. Espadaler, 1 worker - Museum National d'Histoire Naturelle, Paris; 1 worker - Museum of Comparative Zoology, Harvard; 1 worker, 1 ♂ - Naturhistorisches Museum, Wien).

At the same site several nests of a yellow ant species, very similar to *Leptothorax laurae* EMERY, 1884, but with truncated pilosity were discovered; this material is waiting for a thorough comparative study with North African species to decide upon its taxonomic status.

Worker (Figs. 1 - 2): TL (total length) 2.26 ± 0.08 (2.20 - 2.40) mm. HL (head length) 0.57 ± 0.01 (0.57 - 0.60); HW (head width) 0.46 ± 0.01 (0.45 - 0.47); CI (cephalic index: $HW \times 100/HL$) 78.7 ± 1.0 (78.2 - 80.8); SL (scape length) 0.41 ± 0.01 (0.40 - 0.43); SI (scape index: $SL \times 100/HW$) 88.9 ± 1.7 (86.8 - 92.1); palp formula 5:3.

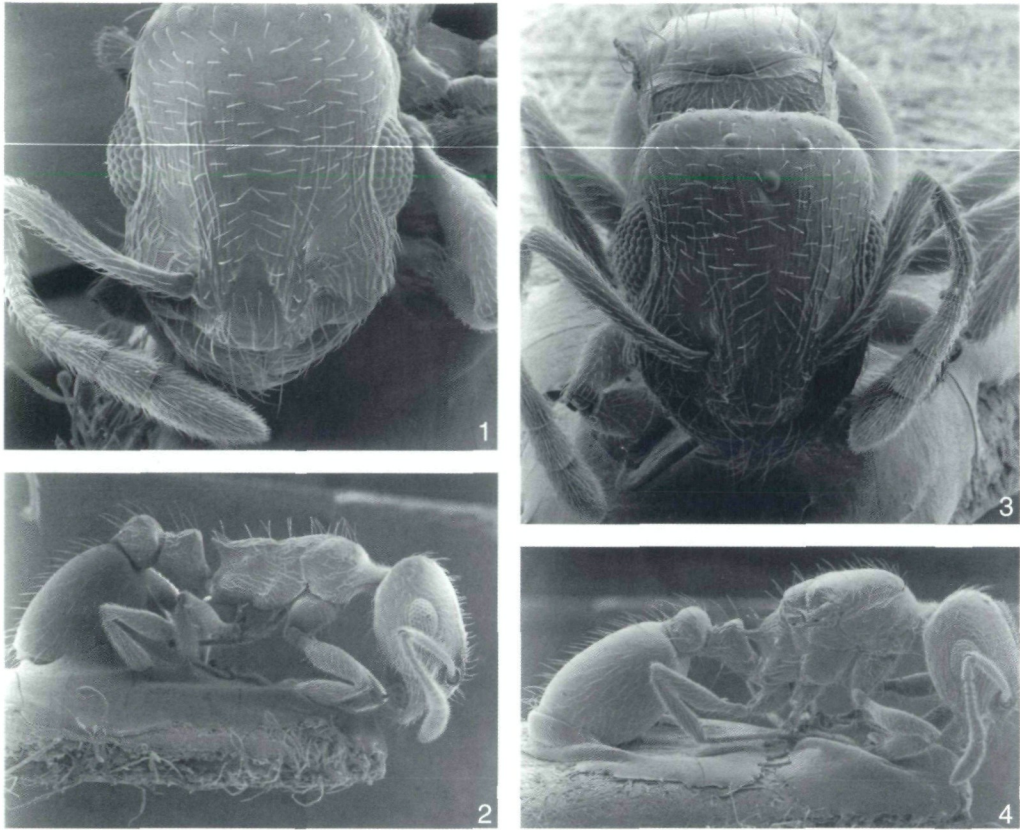
Head and gaster dark brown, thorax olivaceous brown; legs and antennae brownish yellow; pilosity as in Figs. 1 - 2, erect and finely pointed, with microscopic denticulations; some truncated, but similarly long hairs on the mesonotum and propodeum; head pilosity shorter and finer at the sides; mandibles, legs and antennae with short subdecumbent pilosity; eyes with micropilosity; mandibles with 5, sometimes eroded teeth, slightly striate, head somewhat rectangular, with parallel sides and rounded occipital corners; occiput variable, from slightly concave or straight to slightly convex; head smooth and shining with some longitudinal striae in the front and above the eyes and concentric striae in the antennal fossae; clypeus shining with some striae converging anteriorly; frontal triangle smooth and shining; eyes very well developed, with 55 - 70 ommatidia; EL (eye length) 0.16 ± 0.01 (0.15 - 0.17) mm; OI (ocular index: $EL \times 100/HW$) 35.3 ± 1.4 (33.3 - 36.8); scape not reaching occiput.

Alitrunk elongated, with mesopropodeal furrow; AL (alitrunk length, Weber's distance) 0.68 ± 0.02 (0.65 - 0.72) mm; PW (pronotum width) 0.33 ± 0.01 (0.30 - 0.35) mm; AL/PW 2.07 ± 0.05 (2.00 - 2.16); pronotum nearly completely smooth and shining; mesonotum and propodeum with some dorsal striae that turn to a reticulum at the sides; propodeal spines well developed; Buschinger's index: 1.56 ± 0.16 (1.37 - 1.87); petiole and post-petiole slightly reticulated laterally, nearly smooth dorsally; petiole with short peduncle, with the posterior face variable: straight to sinuous; petiole length/height 1.12 ± 0.03 (1.05 - 1.07); postpetiole trapezoidal when viewed from above; postpetiole width/length 1.34 ± 0.05 (1.28 - 1.42); gaster smooth and shining.

Female (queen) (Figs. 3 - 4): TL 2.9 ± 0.2 (2.5 - 3.1); HL 0.61 ± 0.02 (0.57 - 0.65); HW 0.49 ± 0.01 (0.46 - 0.52); CI 79.7 ± 1.1 (78.7 - 81.4); SL 0.43 ± 0.01 (0.40 - 0.44); SI 87.6 ± 2.0 (84.6 - 88.6).

Colour and pilosity as in workers; cephalic sculpture somewhat more pronounced; head with parallel sides; eyes with 65 - 70 ommatidia and 10 - 11 facets in the longest row; OI 37.0 ± 2.3 (36 - 40); ocelli poorly developed.

Pronotum visible from above; PW 0.40 ± 0.02 (0.37 - 0.45); AL 0.85 ± 0.03 (0.80 - 0.90); AL/PW 2.1 ± 0.06 (2.0 - 2.1); pronotum reticulated anteriorly, with some lateral striae;



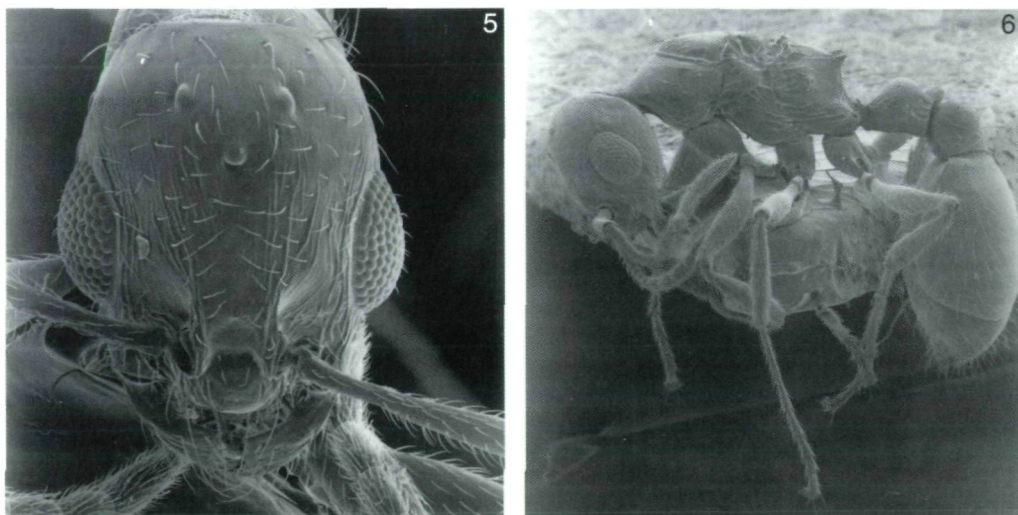
Figs. 1 - 4: *Leptothorax caesari* sp.n.: (1 - 2) worker (1) head in full face view, (2) body in profile, (3 - 4) female (3) head in full face view, (4) body profile.

mesonotum (scutum + scutellum) and mesopleurae smooth and shining; propodeum with dorsal reticulum and lateral striae; propodeal spines well developed; Buschinger's index: 1.87. Wings with radial cell open and as short as the pterostigma; discoidal cell open. Petiole and postpetiole as in workers; petiole length/height 1.1; postpetiole width/length 1.42. Gaster smooth and shining, less voluminous than in other *Leptothorax* queens.

Male (Figs. 5 - 6): Ergatoid, apterous. TL 2.4 ± 0.1 (2.3 - 2.7) mm. HL 0.51 ± 0.01 (0.49 - 0.52); HW 0.41 ± 0.01 (0.40 - 0.42); CI 81.4 ± 0.5 (81 - 82); SL 0.39 ± 0.01 (0.38 - 0.41); SI 95.2 ± 1.5 (93.7 - 96.8); EL 0.19 ± 0.01 (0.18 - 0.20).

Colour dark brown; body sculpture very similar to worker's sculpture; long hairs abundant on head, dorsal alitrunk, petiole, postpetiole and gaster; eyes with micropilosity, longer than in females and workers, with 12 - 13 ommatidia in its longest row; OI 46.1 ± 1.0 (45 - 46.8); ocelli small, of 0.025 mm; scape surpassing the occiput, as long as the first 9 articles of the funiculus; antennal club of four articles; mandibles with 1 apical tooth, 0 - 2 poorly developed median teeth and 1 basal tooth.

Thorax apterous, which is highly unusual within the genus; a scutum and a scutellum may be delimited, but tegulae absent; metanotum present and visible in lateral view as



Figs. 5 - 6: *Leptothorax caesari* sp.n., male, (5) head in full face view, (6) body profile.

a small upwell, separated from scutellum and propodeum; propodeal spines variable, from a smooth angle to a pair of well developed teeth; petiole node rounded; gaster smooth and shining; genitalia without any distinctive characteristic; subgenital plate with 30 - 35 setae (maximum length 0.1 mm); penicilli short, 1.6 times longer than wide, with 6 - 7 setae (maximum length 0.06 mm); paramera with 25 - 30 short setae (maximum length 0.05 mm); volsella with a short calx, with 13 - 15 short setae, digitus with 15 - 25 areolae with short setae and antrum poorly developed; sagitta with a very short ventral margin, with 8 - 10 spines; beccus sharply pointed; rictus elliptic to semicircular in shape.

Derivatio nominis: The species is named after a good friend, Dr. César Pedrocchi (Jaca, Huesca), who knows about the difficulties in getting the specimens.

Discussion

The closest relatives of *Leptothorax caesari* sp.n. are a group of North African species with big eyes: *Leptothorax laurae* EMERY, 1884 and its varieties (SANTSCHI 1915), *L. foreli* SANTSCHI, 1907, the Sudanese *L. megalops* HAMANN & KLEMM 1967; furthermore a Canarian species, *L. canescens* SANTSCHI, 1908, *L. finzii* MENOZZI, 1924 from Italy and *L. crepuscularis* TINAUT, 1994 from Southern Spain. Type material from all species except the last two has been examined.

Leptothorax laurae and its varieties are clear yellow, the propodeal spines are larger and finer (SANTSCHI 1915, figs. 6, 7); eyes are bigger (OI 39 - 40; 6 workers measured) and the petiole longer - or lower. Petiole length/height 1.12 ± 0.03 (1.17 - 1.37). The female of *L. laurae* is bigger (3.2 - 3.5 mm).

Leptothorax foreli is blackish and its propodeal spines and eyes are more developed (SANTSCHI 1907, fig. 7); the sexuals are unknown.

Leptothorax megalops, from Wadi Halfa (Sudan) is readily separated by its uniform yellow colour. In addition, it has the head completely striated; pilosity is truncated; head and

scape are longer (CI 70 in worker, CI 74 in female, SI 113 in worker, SI 105 in female); petiole is longer: petiole length/height 1.28 in worker, 1.25 in female. The female of *L. megalops* has normally developed ocelli.

The colour of *Leptothorax canescens*, from the Canary Islands, is clearly yellow in both, workers and females. Thoracic pilosity of females is truncated, the ocelli are well developed and the head, mesopleurae and mesonotum are striated. The petiole node is truncated and the scape is shorter (SI 91 in female; HL/SL 1.37 in female). The propodeal spines are longer. The Buschinger's index is 2.1.

Leptothorax finzii, known only from the type material from Emilia (Italy), is clear yellow, its pilosity is very long (MENOZZI 1925, fig. 2), the scape reaches the occiput. The mesonotum of the female is striated laterally. The size is bigger: 3 - 3.5 mm in workers, 3.5 - 4 mm in females. Females have black ocelli. Males have shorter scapes, as long as the first five articles of the funiculus, and are normally winged.

Leptothorax crepuscularis has a very developed body sculpture in both, workers and females, which differentiates it from *L. caesari* sp.n. Its colour is slightly darkened yellow. There is no mesopropodeal furrow. The propodeal spines are longer and finer. Males have scape not reaching the occiput and a normally developed thorax; they are winged.

The uniqueness of males of *L. caesari* among the genus is sufficient to characterize this species. Apterous males are known in several ant genera: free living species of *Hypoponera* SANTSCHI, *Cardiocondyla* EMERY, and *Technomyrmex* MAYR or from social parasites or guest-ants as some *Crematogaster* LUND, *Formicoxenus* MAYR, some *Pheidole* WESTWOOD, and *Anergates* FOREL (HÖLLDOBLER & WILSON 1990, HEINZE & TSUJI 1995). It is interesting to note that *Cardiocondyla*, *Formicoxenus* and *Leptothorax* belong to the tribe Formicoxenini (BOLTON 1994). The genus *Leptothorax* is on the verge of being split into several genera but in my opinion such a step would be premature since new species, like *L. caesari* sp.n. or the recently described *L. mirabilis* from Morocco (ESPADALER & CAGNIANT 1997), or the biologically unknown *L. nigrinus* group, may break down any systematic arrangement. In effect, *L. caesari* has characteristics found in *Formicoxenus* and other *Leptothorax* species (unpubl. obs.) and not in *Leptothorax* (s.str.) (FRANCOEUR, LOISELLE & BUSCHINGER 1985): eyes with micropilosity in workers, females and males, maxillary palps shorter than stipes and ergatoid males with long scape. A prospect for the future may well be a minimum of six genera among what is now encompassed by the single name *Leptothorax*.

Biological observations

In April 1985, at noon, a single foraging worker was found; a dead small spider and a crushed *Pheidole pallidula* (NYLANDER) worker ant were offered to that worker but were rejected (found but not taken). Just for fun, seeds of *Cerastium* sp. (Caryophyllaceae) were scattered in front of it and it was a big surprise to see the worker taking a seed and beginning to move rapidly; half an hour later, it reached the nest, a simple hole (diameter 2 mm); the excavation (15 cm deep) provided a queen, 18 workers, some larvae and many seeds in a granary. To our knowledge this is the first example of a granivorous *Leptothorax*. Since it is a single case it must be taken with caution since it is known that ants can change their feeding habits in different biotopes (BENOIS & al. 1978, DU MERLE & al. 1978; MARSH 1985). This small society was fed with seeds and artificial diet after

BHATKAR & WHITCOMB (1970). During the first week in August 1985 seven females eclosed and lost their wings within two days, without being fertilized; a single male eclosed the last week in August and was preserved in alcohol since I judged it anomalous because of aptery. Seeds had been consumed. In mid September there were 14 larvae, 15 workers and eight dealated queens and the nest was hibernated. In 1986 the society did not produce any new output and was preserved. The nest excavated on 8-IX-1987 produced also some females in September 1987 and 12 apterous males in August-September 1988. The queen/worker thorax volume ratio has been related to nest founding behaviour (STILLE 1996). For *L. caesari* sp.n. this ratio is a small 3.09 ($n = 5$ workers, 5 females from same nest), more similar to dependent founding (ratio 1.9 - 2.7) than to independent founding (ratio 5.1 - 9.1) Formicoxenini. The rapid lose of wings in females and aptery of males indicates intranidal mating (HEINZE & TSUJI 1995).

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