Aegeritella (Deuteromycetes) on *Formica* (Hymenoptera, Formicidae) in Spain

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Abstract. Aegeritella *(Deuteromycetes) on* Formica *(Hymenoptera, Formicidae) in Spain*

Aegeritella tuberculata Bał. & Wiś. is reported on *Formica rufa* L. and *F. rufibarbis* Latr. from north Spain, next to the Atlantic coast. The last species is a new host for the fungus. Bulbils are more abundant at the rear part of the body. The degree of infestation is inversely related with ant size. This could be due either to a more effective auto-grooming in bigger ants or to an enhanced secretion of metapleural glands. The distribution reasons of *Aegeritella* in Spain are discussed.

Key words: *Aegeritella*, ants, epizoic fungi, *Formica*, Spain.

Resumen. Aegeritella *(Deuteromycetes) sobre Formica (Hymenoptera, Formicidae) en España*

Se comentan dos muestras de hormigas (*Formica rufa* y *Formica rufibarbis*) con bulbilos del hongo epizoico *Aegeritella tuberculata* Bał. & Wiś. procedentes del norte de España, junto a la costa atlántica. *F. rufibarbis* es un huésped nuevo para el hongo. Los bulbilos tienen una distribución sesgada, siendo más abundantes hacia la parte posterior del cuerpo. El grado de infestación está relacionado inversamente con el tamaño de la hormiga. Esto puede ser debido tanto a una mayor efectividad en la auto-limpieza en las hormigas mayores o a un aumento de la secreción de las glándulas metapleurales. Se discuten posibles razones para la distribución actualmente conocida del hongo en España.

Palabras clave: *Aegeritella*, hormigas, hongos epizoicos, *Formica*, Spain.

Introduction

Five species of *Aegeritella* —a rather enigmatic fungus— are known, all of them growing on the cuticular surface of worker ants. The majority of samples are from European origin, although this is probably another unfortunate example of

the highly biased distribution of taxonomists (Gaston & May, 1992). Fungi appear as small dark protuberances (=bulbils) looking like dirt on the ants. Its form is usually a dome, rounded in perimeter and up to 400 μm diameter. The relationship between the fungi and the ants is not clear. Some authors suggest a reduced activity level and life duration of the affected ants (Chérix 1982; Wiśniewski & Buschinger, 1982) although this has not been definitely proven. Here we report its finding in north Spain, on two ant species that are new hosts for the fungi.

Methods

Field samples were taken as part of an extensive general faunal survey program located in the Biosphere Reserve of Muniellos (Asturias, NW Spain). Bulbils were prepared in polivinil lactofenol and studied at magnifications up to 1000x. Voucher specimens of ants with the fungi are deposited at the Museum of Zoology (Barcelona) and at the Faculty of Biology of the Oviedo University. Analyses were run under Statistica 5.0 software.

Results

1) *Aegeritella* on *Formica rufa* (L.)

Aegeritella tuberculata Bał. & Wiś. is reported for the first time from *F. rufa* in Spain. Two samples collected at the same spot in different dates contained infested ants. The bulbils lacked any kind of hyphal elements and showed, instead, the typical bourgeoning of cells. Aleuriophores were also lacking. Data for both samples: twenty-two out of 37 (59 %) ants had bulbils on the body surface. Ants had a mean ±s.e. of 7.4 ± 1.1 bulbils (range 1-19). The distribution of bulbils is strongly biased ($\chi^2_{1\ d.f.} = 79.2$; $P < 0.001$) (Table 1, Fig. 1): the head is virtually devoid of bulbils and the gaster is heavily affected. The bigger surface of the gaster is probably not to be called for as an explanation because the legs —all similar in size— show the same skewed trend (($\chi^2_{1\ d.f} = 40.9$; $P < 0.001$). Sample data: (UTM 29 T 68828 476699) Transect Tablizas River; Muniellos (Asturias, Spain); 16 August 2001; 3 October 2001; S. Monteserín leg.

Table 1. Infestation of *Aegeritella* Bał. & Wiœ. on *Formica rufa* (L.) (n= 22 workers) and *F. rufibarbis* Fabr. (n= 6 workers) from Muniellos, Asturias. Entries are bulbils. A majority of bulbils are in midline of thorax, base and midline of gaster.

Species	*Formica rufa*						*Formica rufibarbis*					
	Head	Thorax	Gaster	1st leg	2nd leg	3rd leg	Head	Thorax	Gaster	1st leg	2nd leg	3rd leg
Mean	0.04	1.54	3.54	0.27	0.27	1.72	0	1.83	1	0.16	0.49	1.66
Minimum	0	0	1	0	0	0	0	0	0	0	0	0
Maximum	1	4	6	2	2	6	0	3	4	1	2	3

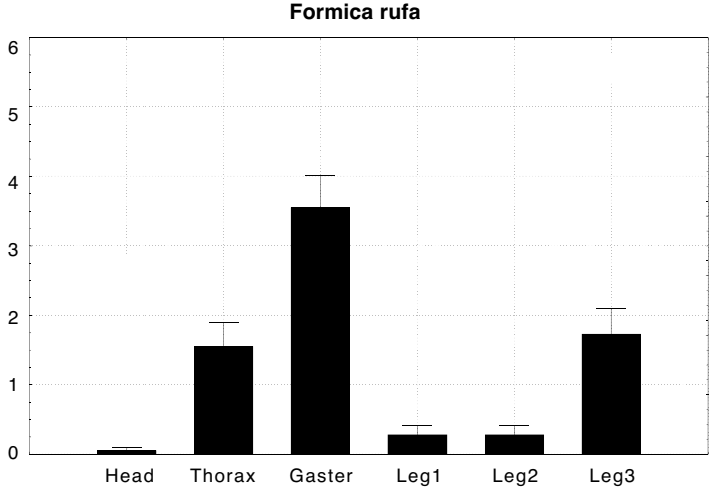

Figure 1. Mean (± s.e.) number of bulbils of *Aegeritella* on different body parts of *Formica rufa* from Muniellos, Asturias, Spain.

2) *Aegeritella* on *Formica rufibarbis* Fabr.

A. tuberculata was also the species involved. *F. rufibarbis* is a new host for the species. In this case, unicellular aleuriophores were present. Six out of eight ants were infested. Ants had a mean ± s.e. of 4.6 ± 0.9 bulbils (range 3-8). Bulbils tended to show the distal trend although not so markedly (Table 1). This is probably to be ascribed to the lesser infestation level and small sample size. Sample data: (UTM 29 T 68568 476816) Tojal Connio; Muniellos (Asturias, Spain); 18 March 2002; S. Monteserín leg.

Discussion

On those few instances in which the distribution of bulbils over the body has been quantified there is a general trend in the tendency of the bulbils to be more abundant at the rear of the body. This is the case in three other fungus-ant pairs: *Aegeritella tuberculata* on *Lasius grandis* (Espadaler & Oromí, 1997), on *Lasius umbratus* (Espadaler & Suñer, 1989) and *Formica pressilabris* (Espadaler & Wiśniewski, 1987) but is not clear why. It is well known the obsessive cleaning behaviour of the ants by autogrooming (Wilson, 1971). The head, with the sensible parts (eyes, antennae and mouthparts) is to be kept the most clean as possible and a behavioural component by using the strigil of the forelegs is probably in action. This would result in a better cleansing of the head. In addition, some of the grooming movements involving legs and gaster, such as L3-gaster, present in Dolichoderinae, Ponerinae, Myrmicinae and Pseudomyrmecinae, seem to

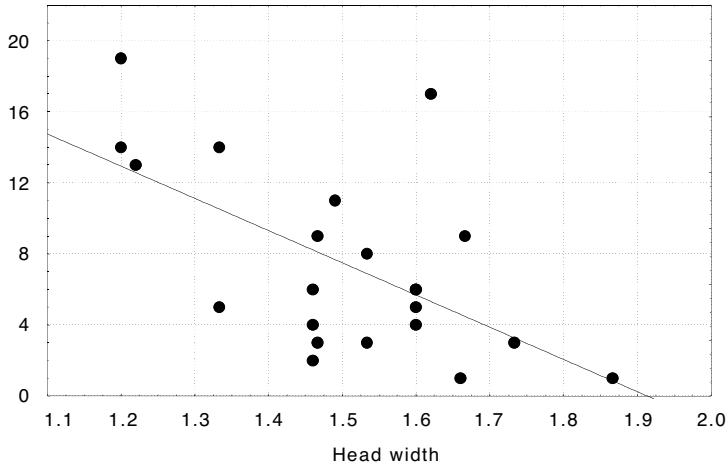

Figure 2. Correlation between ant size (head width; *Formica rufa*) and the number of bulbils over the body. Total bulbils = 34.6 – 18.1*head width (mm).

have been lost in Formicinae species, that lack also L3-L3 grooming (Farish, 1972). Nothing in the cleaning apparatus appears functionally distinct in the Formicinae as compared with other subfamilies (Francoeur & Loiselle, 1988). The total number of bulbils is inversely related to ant size (Fig.2), with smaller ants having more bulbils than bigger ants ($r^2 = 0.35$; $P = < 0.01$), perhaps indicating that bigger ants, a) clean themselves more effectively and/or b) produce more antibiotic substances as metapleural glands have proportionatelly more cells in bigger individuals (Schoeters & Billen, 1993; Bot *et al*. 2001).

Aegeritella species seem to have effectively broken the proven sanitary function of the metapleural gland secretion (Maschwitz et al., 1970, Beattie et al., 1986; Hölldobler & Engel-Siegel, 1985; Veal et al., 1992; but see Currie et al., 1999 for an extraordinary exception). Alternatively, perhaps, as the affected ants do not seem to suffer in any degree, the metapleural secretions are indeed effective and the fungi remain in an arrested state. No experimental laboratory work has been intended with *Aegeritella* and thus, its true nature (epizoic or parasitic) remains speculative.

With the present cases of *F. rufa* and *F. rufibarbis* six *Aegeritella* samples have been found in Spain; all come from the northern part of the peninsula, and the ant hosts were in habitats belonging in the Eurosiberian climatic zone of the Iberian Peninsula (Pyrenees, Atlantic coast and few more southern spots). No data are known from Mediterranean habitats. It remains to be seen if this limited distribution is explained, again, by the biased geographical location of entomologists or has to do with precise climatic, humid conditions needed for a proper development of the fungus.

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