

Twenty-seven new records of associated ants with thirteen myrmecophilous lycaenid butterflies from Spain

(Lepidoptera, Lycaenidae; Hymenoptera, Formicidae)

by

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received 1.II.2011

Abstract: In this paper 27 new ant associations with larvae of Lycaenidae butterflies (13 species of Lycaenidae) are recorded. The Lycaenidae species referred to are: *Zizeeria knysna* (TRIMEN, 1862), *Laeosopis roboris* (ESPER, 1794), *Leptotes pirithous* (LINNAEUS, 1758), *Polyommatus albicans* (GERHARD, 1851), *Pseudophilotes abencerragus* (PIERRET, 1837), *Pseudophilotes panoptes* (HÜBNER, 1813), *Tomares ballus* (FABRICIUS, 1787), *Aricia morronensis* (RIBBE, 1910), *Glaucopsyche melanops* (BOISDUVAL, 1828), *Lampides boeticus* (LINNAEUS, 1758), *Polyommatus icarus* (ROTTEMBURG, 1775), *Agrodiaetus violetae* (GÓMEZ-BUSTILLO, EXPÓSITO & MARTÍNEZ, 1979) and *Satyrium esculi* (HÜBNER, 1804). For the first 6 Lycaenidae species mentioned, we have been able to identify for the first time ant species associated with their larvae. With regards to *Laeosopis roboris* (ESPER,) we have also found ant associations with larvae as well as with their pupae (presently there is very little information on pupal myrmecophily in Lycaenidae).

Resumen: En este trabajo se registran 27 nuevas asociaciones de hormigas con larvas de mariposas Lycaenidae (13 especies de Lycaenidae). Las especies Lycaenidae son: *Zizeeria knysna* (TRIMEN, 1862), *Laeosopis roboris* (ESPER, 1794), *Leptotes pirithous* (LINNAEUS, 1758), *Polyommatus albicans* (GERHARD, 1851), *Pseudophilotes abencerragus* (PIERRET, 1837), *Pseudophilotes panoptes* (HÜBNER, 1813), *Tomares ballus* (FABRICIUS, 1787), *Aricia morronensis* (RIBBE, 1910), *Glaucopsyche melanops* (BOISDUVAL, 1828), *Lampides boeticus* (LINNAEUS, 1758), *Polyommatus icarus* (ROTTEMBURG, 1775), *Agrodiaetus violetae* (GÓMEZ-BUSTILLO, EXPÓSITO & MARTÍNEZ, 1979) y *Satyrium esculi* (HÜBNER, 1804). Para las 6 primeras especies de Lycaenidae mencionadas, se identifican las primeras especies de hormigas asociadas con sus larvas. Con *Laeosopis roboris* (ESPER) se ha encontrado asociaciones de hormigas tanto con sus larvas como con sus pupas (existen muy pocos datos sobre mirmecofilia pupal en Lycaenidae)

Introduction: The Lycaenidae family comprises more than 5000 species worldwide. The larvae of the majority of their species (about 75%) are associate with ants. Myrmecophily is the term used to describe such association. The secretions of lycaenid immatures are partly nutritive, providing carbohydrates and amino acids, supplying an alternative food source for tending ants.

Most lycaenid species do not depend essentially on ant-attendance, such cases are termed facultative myrmecophiles. Most of these associations are mutualistic: caterpillars are attended and protected by ants while feeding on the host plant. These are less likely to be parasitized if they have ant attendants, in compensation, the ants obtain nutritive (sugar-rich honeydew) from the caterpillar they protect, throughout its larval life.

Myrmecophilous relationships of lycaenid caterpillars or pupae are essentially mediated via secretions of specialized exocrine glands. Several evolutionary adaptations enable these associations to be fruitful; these include small glands on the skin of the caterpillars called pore cupola organs. Lycaenid caterpillars of many species, except those of the Riodininae, have a glandular organ called dorsal nectary gland (also called Newcomer's gland) on the 7th abdominal segment that produces honey dew. An eversible organ called tentacular organ is present on the 8th abdominal segment (third segment of thorax in Riodinids) being cylindrical in shape and topped with a ring of spikes which expel chemical signals which are believed to be an important aid in their communication with the ants.

FIEDLER (2006) summarized the knowledge available at that time on ant association related to immature Palaearctic Lycaenidae, from multiple sources: books, journal articles, websites and personal communications from entomologists.

Results: The new ant associations (Table 1) were recorded (facultative myrmecophiles) in Cordoba and Granada provinces, Andalusia Region, S. Spain. Besides these previous new records, and of the plants where the ants were found on (host plants of the lycaenids referred to), we also indicate the ant species previously known to play a role in these associations:

	<i>Zizee. knysna</i>	<i>Toma. ballus</i>	<i>Laeoso. roboris</i>	<i>Aricia morronensis</i>	<i>Glauco. melanops</i>	<i>Leptotes pirithous</i>	<i>Lampi. boeticus</i>	<i>Polyo. albicans</i>	<i>Polyo. icarus</i>	<i>Agro. violetae</i>	<i>Pseudo. abencerragus</i>	<i>Pseudo. panoptes</i>	<i>Satyrium esculi</i>
<i>Camponotus foreli</i>											X		
<i>Camponotus lateralis</i>							X						
<i>Camponotus piceus</i>												X	
<i>Crematogaster auberti</i>		X			X	X						X	
<i>Crematogaster scutellaris</i>							X						
<i>Crematogaster sordidula</i>		X											
<i>Formica subrufa</i>		X			X					X			X
<i>Lasius grandis</i>		X	X	X								X	X
<i>Pheidole pallidula</i>	X												
<i>Plagiolepis pygmaea</i>						X	X	X					
<i>Plagiolepis schmitzii</i>					X		X						
<i>Tapinoma nigerrimum</i>		X						X	X				

Table 1: New records of associated ants with myrmecophilous lycaenid butterflies.

1. *Zizeeria knysna* (TRIMEN): No ant species had been identified so far. In SCHURIAN (1994) *Pheidole* genus had been recorded to be associated in Gran Canaria island (were several species of this genus exist). We have recorded (fig. 1) *Pheidole pallidula* (on *Tribulus terrestris* plant).
2. *Tomares ballus* (FABRICIUS): Regardless of the fact of their frequent ant association, its surprising that up till now only *Plagiolepis pygmaea* had been registered. Our records show 5 new associated ant species (on *Erophaca baetica* plant), being these as follows: *Crematogaster auberti*, *Crematogaster sordidula*, *Formica subrufa*, *Lasius grandis* (fig. 2) and *Tapinoma nigerrimum* (fig. 3).
3. *Laeosopis roboris* (ESPER): So far no ant species has been indentified for this Iberian and SE France endemic lycaenid. Only a short reference was made with regards to its relationship with the genus *Lasius*. We have registered *Lasius grandis* (on *Fraxinus angustifolia*), species which we have noticed to be associated with both their larvae and pupa (fig. 4). According to FIEDLER (1988), reliable field data on pupal myrmecophily is very much scarce.
4. *Aricia morronensis* (RIBBE): Up till now the following species had been recorded for this endemic Iberian lycaenid: *Crematogaster auberti*, *Tapinoma erraticum* and *Lasius niger*. We have recorded a new one, this being *Lasius grandis* (on *Erodium cheilanthis* plant).
5. *Glaucopsyche melanops* (BOISDUVAL): According to bibliography, 4 ant species are presently, all belonging to genus *Camponotus* [*Camponotus foreli* (figs. 5, 6), *C. cruentatus*, *C. micans* and *C. sylvaticus*]. We have recorded for this lycaenid 3 new ant species of 3 different genera *Crematogaster auberti*, *Formica subrufa* (fig. 7) and *Plagiolepis schmitzi* (all on *Genista hirsuta*).
6. *Leptotes pirithous* (LINNAEUS): No ant species had been identified previously; only genus *Lasius* was referred to as having association with this taxa. We have recognized 2 species: *Crematogaster auberti* and *Plagiolepis pygmaea*, both on *Erophaca baetica* plant.
7. *Lampides boeticus* (LINNAEUS): According to FIEDLER (2006), 8 ant species are known to be in association with this lycaenid (*Camponotus compresus*, *C. cruentatus*, *C. sylvaticus*, *C. foreli*, *Paratrechina clandestina*, *Anoplolepis gracilipes*, *Tapinoma melanocephalum*, *Linepithema humile*) and two unidentified species belonging to *Lasius* and *Plagiolepis* genus. We have identified 4 new species for this taxon, these were found on the plants *Erophaca baetica* and *Colutea hispanica*, these being as follows: *Camponotus lateralis*, *Crematogaster scutellaris*, *Plagiolepis pygmaea* and *P. schmitzii*.
8. *Polyommatus albicans* (GERHARD): Besides the genus *Tapinoma*, no ant species have been recorded for this taxon. We have registered the following: *Tapinoma nigerrimum* (fig. 8) and *Plagiolepis pygmaea* (on *Hippocrepis* sp. plant).
9. *Polyommatus icarus* (ROTTEMBURG): 9 ant species are known to be in association with this lycaenid (*Lasius niger*, *L. alienus*, *Myrmica sabuleti*, *M. lobicornis*, *M. tenuispina*, *Formica subrufa*, *F. subpilosa*, *F. rufibarbis* and *Pagiolepis pygmaea*). We have recorded a new associated ant species: *Tapinoma nigerrimum* (on *Medicago sativa* plant).
10. *Agrodiaetus violetae* (GÓMEZ-BUSTILLO, EXPÓSITO & MARTÍNEZ): The second author of the current article recorded the first 4 ant species known to be associated to this Iberian endemic lycaenid (*Camponotus cruentatus*, *C. piceus*, *Plagiolepis pygmaea* and *Crematogaster sordidula*), cited in LAFRANCHIS et al. (2007). Note: in the previous reference “*Agrodiaetus fabressei subbaeticus*” is referred to as being pending of a molecular study in order to determine its final taxonomic status. The recent work of VILA et al. (2010) determined that this taxon is a subspecies of *A. violetae* (GÓMEZ-BUSTILLO, EXPÓSITO & MARTÍNEZ): *A. violetae subbaeticus* GIL-T. & GIL-UCEDA (2005). We have registered a new associated ant species for this lycaenid (fig. 9): *Formica subrufa* (on the plant *Onobrychis argentea*).
11. *Pseudophilotes abencerragus* (PIERRET): Associated ant species were unknown so far, we have registered the first one: *Camponotus foreli* (on *Cleonia lusitanica* plant).
12. *Pseudophilotes panoptes* (HÜBNER): Besides the genus *Camponotus*, no ant species have been recorded for this endemic Iberian lycaenid. We have registered 3 associated ant species: *Camponotus piceus*, *Crematogaster auberti* y *Lasius grandis* (on *Thymus* sp.).
13. *Satyrrium esculi* (HÜBNER): Until now, only *Camponotus cruentatus* has been recorded for this lycaenid. We have registered 2 new associated ant species (on *Quercus ilex*): *Formica subrufa* and *Lasius grandis* (fig. 10).

Acknowledgements: We would like to express our sincere thanks to Dr. JOAQUIN REYES LÓPEZ (Department of Ecology, University of Córdoba, Spain) who identified the ants and Mr. RAFAEL ESTÉVEZ RODRÍGUEZ (Vigo, Pontevedra, Spain) for his valuable help in translating the text of this paper.

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Fig. 1: Caterpillar of *Zizeeria knysna* (TRIMEN, 1862) with the ant *Pheidole pallidula*.
 Fig. 2: Caterpillar of *Tomares ballus* (FABRICIUS, 1787) with the ant *Lasius grandis*.
 Fig. 3: Caterpillar of *Tomares ballus* (FABRICIUS, 1787) with the ant *Tapinoma nigerrimum*.
 Fig. 4: Pupae of *Laeosopsis roboris* (ESPER, 1794) with ants *Lasius grandis*.
 Fig. 5: Caterpillar of *Glaucopsyche melanops* (BOISDUVAL, 1828) with the ant *Camponotus foreli*.
 Fig. 6: Caterpillar of *Glaucopsyche melanops* (BOISDUVAL, 1828) with the ant *Camponotus foreli*.
 Fig. 7: Caterpillar of *Glaucopsyche melanops* (BOISDUVAL, 1828) with the ant *Formica subrufa*.



Fig. 8: Caterpillar of *Polyommatus albicans* (GERHARD, 1851) with the ant *Tapinoma nigerrimum*.
Fig. 9: Caterpillar of *Agrodiaetus violetae* (GÓMEZ-BUSTILLO, EXPÓSITO & MARTÍNEZ, 1979) with the ant *Formica subrufa*.
Fig. 10: Caterpillar of *Satyrrium esculi* (HÜBNER, 1804) with the ant *Lasius grandis*.

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Digitale Literatur/Digital Literature

Zeitschrift/Journal: [Atalanta](#)

Jahr/Year: 2011

Band/Volume: [42](#)

Autor(en)/Author(s): Gil-T. Felipe, Obregon-Romero Rafael

Artikel/Article: [Twenty-seven new records of associated ants with thirteen myrmecophilous lycaenid butterflies from Spain 139-142](#)