



A new social parasite in the ant genus *Ectatomma* F. Smith (Hymenoptera, Formicidae, Ectatomminae)

RODRIGO M. FEITOSA¹, RIVIANE R. HORA^{2,3}, JACQUES H. C. DELABIE^{4,5}, JORGE VALENZUELA⁶
& DOMINIQUE FRESNEAU²

¹Museu de Zoologia da Universidade de São Paulo, Av. Nazaré 481, 04263-000, Ipiranga, São Paulo, SP, Brazil.
E-mail: rfeitosa@usp.br

²Laboratoire d'Ethologie Expérimentale et Comparée (CNRS UMR 7153), Université Paris-Nord, 99, Avenue J. -B. Clément, 93430, Villetaneuse, France. E-mail: Dominique.Fresneau@leec.univ-paris13.fr

³Departamento de Biologia Geral, Universidade Federal de Viçosa, Av. P.H. Rolfs s/n, 36570-000, Viçosa, MG, Brazil.
E-mail: rivianer@hotmail.com

⁴Laboratório de Mirmecologia, Convênio UESC/CEPEC, Centro de Pesquisas do Cacau, C.P. 7, 45600-000, Itabuna, BA, Brazil.
E-mail: delabie@cepec.gov.br

⁵Departamento de Ciências Agrárias e Ambientais, Universidade Estadual de Santa Cruz, 45650-000, Ilhéus, BA, Brazil.

⁶Instituto de Ecología, A. C., Km 2.5, antigua carretera a Coatepec, A.P. 63, 91000, Xalapa, Veracruz, Mexico.
E-mail: jorge.valenzuela@inecol.edu.mx

Abstract

Ectatomma parasiticum Feitosa & Fresneau, a new ant species socially parasitic on *Ectatomma tuberculatum* (Olivier), is described from gynes discovered in Apazapan, state of Veracruz, Mexico, and reared in the laboratory. *Ectatomma parasiticum* is the first social parasite described in the Ectatomminae. This species can be distinguished from its host by morphological and behavioral features characteristic of theinquilines known in other ant subfamilies including reduced size, thickened petiole, and agonistic interactions with host species.

Key words: Ectatomminae, *Ectatomma tuberculatum*, Social parasitism, Taxonomy, Mexico

Introduction

The ant genus *Ectatomma* includes 14 relatively large species occurring predominantly in the Neotropical Region, with the widespread species *Ectatomma tuberculatum* (Olivier) also occurring in the Nearctic Region (Bolton *et al.* 2006; Fernández & Ospina 2003). These ants occur in a variety of warm habitats, and because they are often abundant and conspicuous, they figure prominently in ecological studies (Kugler & Brown 1982). Species of *Ectatomma* are generalized predators of a variety of small arthropods and earthworms in addition to collecting honeydew from homopterous insects and nectar from plant sources (e.g. Weber 1946; Wheeler 1986; Dejean & Lachaud 1992; Pie 2004).

Instances of social parasitism in ants have a patchy taxonomic and geographic occurrence, being well known among north temperate ants in the subfamilies Formicinae and Myrmicinae (Wilson 1971; Hölldobler & Wilson 1990). Hora *et al.* (2005) demonstrated the parasitic nature of microgynes found in colonies of a Mexican population of *E. tuberculatum*. These individuals concentrate their reproductive efforts almost exclusively on the production of sexual offspring, and they are genetically distinct and reproductively isolated from their hosts.

In the present paper we describe the microgyne from Hora *et al.* (2005) as a new species, *Ectatomma parasiticum* Feitosa & Fresneau, a social parasite. It is the fifteenth species described in the genus and represents the first case of social parasitism in the subfamily Ectatomminae.

Material and methods

The species described in the present study was obtained while collecting colonies of *E. tuberculatum* during fieldwork in Apazapan, in the state of Veracruz, Mexico (19°19'38"N; 96°43'21"W) from September 1999 to July 2000. The parasitic gynes were promptly distinguished by eye on the basis of their reduced size compared to *E. tuberculatum* gynes. Colonies were reared in laboratory and new parasitic specimens were produced (about 65 gynes from eight different colonies). Depository collections are referred to by the following acronyms:

CPDC	Centro de Pesquisas do Cacau, Itabuna, Bahia, Brazil.
INEC	Instituto de Ecologia, Xalapa, Veracruz, Mexico.
LACM	Los Angeles County Museum of Natural History, Los Angeles, California, USA.
MZSP	Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil.
UNCB	Museo de Historia Natural del Instituto de Ciencias Naturales, Bogotá, Colombia.
USNM	National Museum of Natural History; Smithsonian Institution, Washington, DC, USA.

Scanning Electron Microscope (SEM) images of *Ectatomma parasiticum* were made at MZSP with a LEO 440[®] microscope. The specimen was previously cleaned in acetone, critical-point dried in a Balzer (Bal-Tec[®] CPD 030), and coated with gold (Bal-Tec[®] SCD 050). Measurements were obtained with a micrometric reticule and using the scale of the SEM. All measurements are given in mm and the abbreviations used are:

HL	head length; the maximum measurable length of head capsule excluding mandibles, measured in full-face view, in a straight line from the mid-point of the anterior clypeal margin to the mid-point of the vertexal margin.
HW	head width; the maximum width of the head capsule measured in full-face view, excluding the compound eyes.
SL	antennal scape length; the chord length of the antennal scape, excluding the basal condyle and its peduncle.
EL	eye length; the maximum measurable length of eyes in profile.
PW	pronotal width; in dorsal view, the maximum width of the pronotum.
WL	mesosoma length (Weber's length); the diagonal length of mesosoma in profile, from the mid-point of the anterior pronotal declivity to the posterior basal angle of the metapleuron.
PTL	petiole length; in dorsal view, the maximum length of the petiole.
PTW	petiole width; in dorsal view, the maximum width of the petiole.
CI	cephalic index. $HW \times 100/HL$.
SI	scape index. $SL \times 100/HW$.
OI	optical index. $EL \times 100/HW$.
PTI	petiolar index. $PTL \times 100/PTW$.

Results

Ectatomma parasiticum Feitosa & Fresneau, sp. nov.

Figures 1, 2

Holotype gyne. MEXICO: Apazapan, Veracruz, 19°19'38"N 96°43'21"W, ix.1999, D. Fresneau col. [INEC].

Paratypes. same data as holotype (1 gyne) [CPDC]; (1 gyne) [UNCB]; (1 gyne) [INEC]; vii.2000, D. Fresneau & R. Hora cols. (1 gyne) [LACM]; (2 gynes) [MZSP]; (1 gyne) [USNM].

Diagnosis. Size relatively small (WL approximately 3.80 mm); clypeus and frontal area without sculpture; antennal scapes longer than the maximum head width (SI > 108); petiole relatively thick in lateral view.

Gyne description. Holotype (paratypes): HL 2.10 (2.06–2.16); HW 1.85 (1.73–1.88); SL 2.04 (1.92–2.06); EL 0.51 (0.50–0.58); PW 1.69 (1.62–1.77); WL 3.88 (3.65–4.04); PTL 0.79 (0.78–0.88); PTW 0.92 (0.92–1.07); CI 88.07 (84.11–88.89); SI 110.42 (108.57–113.04); OI 27.50 (27.50–31.25); PTI 85 (82.14–85.71). Color yellowish brown to dark reddish brown, including appendages. Mandibles finely and densely striate, with sparse piligerous punctures; clypeus, genae, and frontal area predominantly smooth, but opaque; dorsal surface of head densely and coarsely reticulated, except for the areas of antennal articulations, which are finely punctate; ventral surface of head with sparse longitudinal striae; antennal scapes finely and longitudinally striate. Mesosoma with variously oriented costulae, from sparse and transverse on dorsum of pronotum and propodeum to dense and subconcentric on the dorsum of scutum and scutellum; forecoxae with dense, fine, regular transverse striation; legs mostly smooth and shining. Lateral and posterior faces of petiolar node with sparse, short, longitudinal costulae; sculpture of gaster consisting of arched, transverse costulae, becoming gradually finer from first to terminal segment.

Pilosity cream-colored. Body covered by relatively sparse, long, suberect hairs; antennal scapes and legs with short, suberect hairs; antennal funiculi and tarsi covered by fine appressed pubescence.

Head subrectangular, with weakly convex lateral borders and vertexal margin straight; masticatory margins of mandibles multidenticate and with a large apical tooth; clypeus strongly convex anteriorly; frontal lobes reduced; scapes in repose fairly surpassing the posterolateral margins of vertex; funicular segments gradually thickened distally; compound eyes placed near the posterolateral portions of head; ocelli present and reduced in size.

Pronotum with a distinct median eminence directed forward and a conspicuous pair of dorsolateral (humeral) projections; scutum large and rounded; notauli almost indistinct among sculpturation; parapsidial lines feebly visible and subparallel; scutoscutellar sulcus deeply impressed; scutellum relatively narrow and strongly convex, in lateral view; dorsal face of propodeum meeting the declivous face in a pair of reduced, blunt teeth; propodeal spiracle elliptical. Wing venation fully developed. Forewing with a weakly colored stigma; longitudinal veins Sc+R, SR, M, Cu, and A present; SR extending distally beyond stigma, forming 1R and 2R cells; cross vein 1r vestigial, not forming the 2R cell; M and Cu also extend distally as tubular veins for most of their length; A not extending beyond the junction with Cu; C, R, Cu, 1M, 1Cu, and SR cells closed. Hind wing with Sc+R extending beyond point where they connect to M, which continues as a tubular vein as much as Sc+R and then extends as spectral vein to wing distal border; basally M+Cu extending as a tubular vein beyond junction with Anal vein, which continues shortly beyond this point; seven submedian hamuli present.

Petiole ventrally carinate; in lateral view, petiolar node thick and subtriangular; anterior slope nearly concave and posterior slope slightly convex. Sternite of first gastral segment with a distinct anterior projection.

Worker. Unknown (but see comments bellow).

Male. Unknown.

Etymology. The specific epithet is a reference to the parasitic nature of this species.

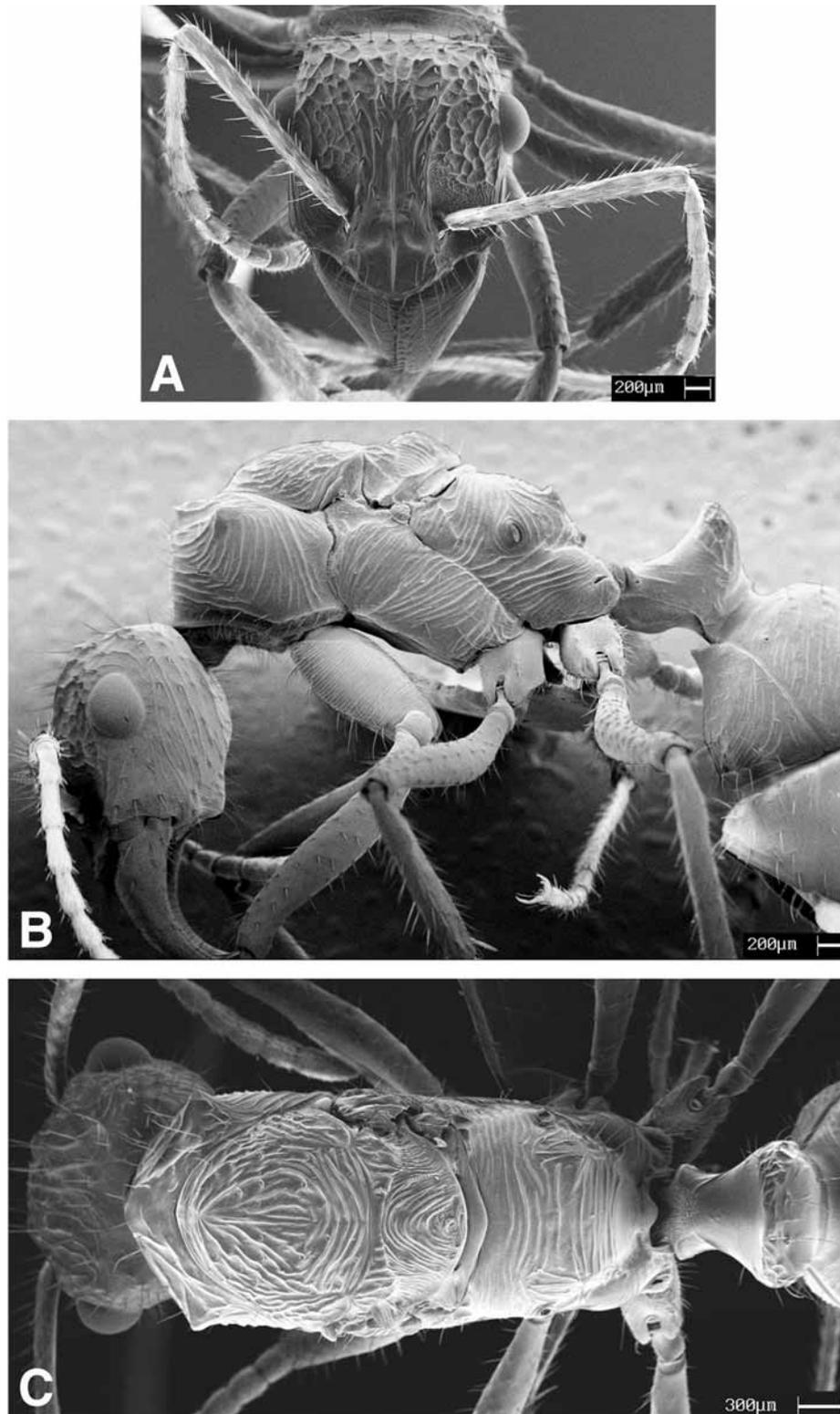


FIGURE 1. Paratype gyne of *Ectatomma parasiticum*: A, head in full face view; B, lateral view; C, dorsal view.

Comments. Gynes of the socially parasitic *Ectatomma parasiticum* can be distinguished from the gynes of its host species, *E. tuberculatum*, by the following features: sparser sculpture on the body; smaller size (Fig. 2), with WL approximately 3.80 mm (around 5.40 mm in *E. tuberculatum*); clypeus and frontal area devoid of any sculpture (usually longitudinally striate in *E. tuberculatum*); antennal scapes longer than the maximum head width, with $SI > 108$ (< 99 in *E. tuberculatum*); propodeal spines reduced to minute teeth; and petiole

thicker in lateral view (flattened anteroposteriorly in *E. tuberculatum*). The reduced size and wider petiole of *E. parasiticum* are also characteristic of the inquiline syndrome in other ant species (Wilson 1984; Radchenko & Elmes 2003).

Males produced by parasitized colonies were of a uniform morphology and indistinguishable from males of *E. tuberculatum*. Thus it remains unknown if males of *E. parasiticum* are lacking, present but not yet observed, or observed but indistinguishable from *E. tuberculatum*. According to Hora *et al.* (2005), one of the 10 colonies of *E. parasiticum* reared in laboratory produced four small "workers." However, these workers presented a developed spermatheca and six to 10 ovarioles, in contrast to typical workers of *E. tuberculatum* which lack the spermatheca and possess only one to four ovarioles (Fénerón & Billen 1996; Hora *et al.* 2001). The presence of developed reproductive structures in these specimens suggests that they are possibly intermediate (intercaste?) reproductive forms of *E. parasiticum* and not true workers.

Up to now, the occurrence of this species is restricted to Apazapan, state of Veracruz, Mexico. However, its host, *E. tuberculatum*, is widely distributed in the Neotropics, from Mexico to northern Argentina. We expect that the excavation and detailed examination of *E. tuberculatum* colonies in different localities could reveal new populations of *E. parasiticum*.

A detailed behavioral and genetic study on the interaction between *E. tuberculatum* and *E. parasiticum* (so far undescribed and treated as "microgynes") was conducted by Hora *et al.* (2005). Gynes and workers of *E. tuberculatum* and gynes of *E. parasiticum* were sequenced for the *cyt b* region and the results showed two haplotypes. The haplotypes differed in seven variable sites, with a nucleotide sequence difference of 0.93%. They clearly discriminate *E. parasiticum* from the group composed of workers and gynes of *E. tuberculatum*. According to the findings of Hora *et al.* (*op. cit.*), *E. parasiticum* is a genetically distinct social parasite producing of almost exclusively sexual offspring. The co-occurrence of *E. parasiticum* and *E. tuberculatum* in the field (nine mixed colonies found) suggests that the parasite usurps established colonies of the host, but does not kill the resident gynes. Agonistic interactions were also observed, exclusively from workers and gynes of *E. tuberculatum* against the parasites.

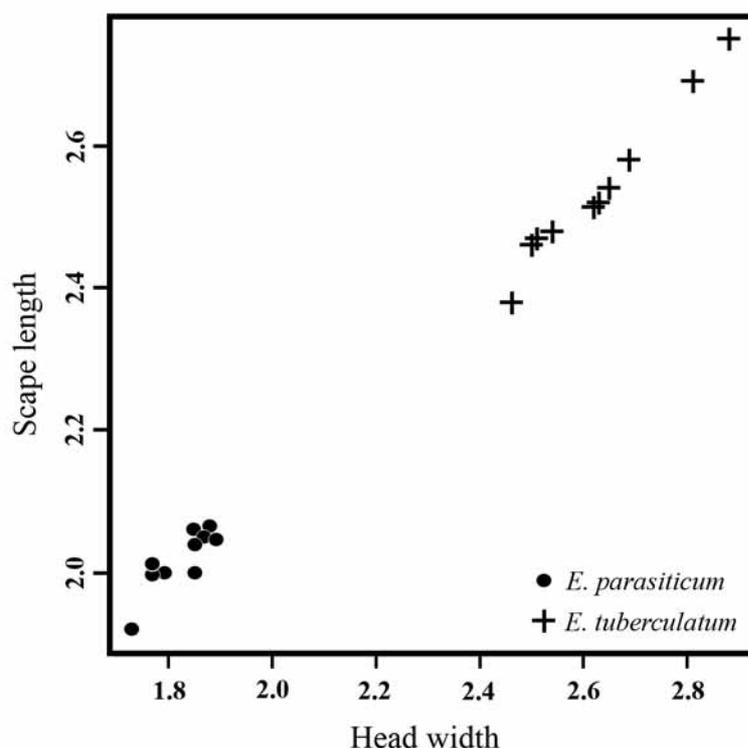


FIGURE 2. Morphometric scatterplot of head width by scape length, differentiating gynes of *Ectatomma parasiticum* and *E. tuberculatum*. Measurements are in mm.

Microgynes are also found in *Ectatomma ruidum*; however, this is a truly gyne-polymorphic species, and the offspring of both microgynes and normal gynes consist of workers, males, and both microgynes and normal gynes. It was therefore suggested that the two gyne morphs in *E. ruidum* represent alternative phenotypes adapted to different ways of dispersal and colony founding. *Ectatomma ruidum* microgynes are thought to disperse and to found new colonies solitarily, while the macrogynes are a stationary morph (Lachaud *et al.* 1999).

The study of Hora *et al.* (2005) and the present paper raise the possibility of the occurrence of similar undescribed social parasites within other basal ant lineages.

Acknowledgements

The authors would like to thank Alex Wild, Alexander Radchenko, Riita Savolainen, and Jack Longino for the critical reading and the invaluable comments on the manuscript. Lara M. Guimarães took the SEM images. Rogério Rosa da Silva kindly prepared the morphometric scatterplot. We also acknowledge M. Favila, L. Quiroz (INEC, Mexico), C. Rojas, A. Wolf, and K. Wolf for the technical support during fieldwork. RRH received financial support from FAPEMIG and CAPES, Brazil, Project CAPES/COFECUB no. 244/98-II. RMF and JHCD acknowledge the research grant received from FAPESP and CNPq, respectively. This work was partially supported by BRI (Université Paris-Noird, France).

References

- Bolton, B., Alpert, G., Ward, P.S., Naskrecki, P. (2006) *Bolton's Catalogue of Ants of the World: 1758–2005*. Harvard University Press, Cambridge, Massachusetts, USA, CD-ROM.
- Dejean, A. & Lachaud, J.-P. (1992) Growth-related changes in predation behavior in incipient colonies of the ponerine ant *Ectatomma tuberculatum* (Olivier). *Insectes Sociaux*, 39, 129–143.
- Fénerón, R. & Billen, J. (1996) Ovarian cycle in *Ectatomma tuberculatum* workers (Formicidae, Ponerinae). *Journal of Invertebrate Reproduction and Development*, 29, 79–85.
- Fernández, F. & Ospina, M. (2003) Sinopsis de las hormigas de la región Neotropical. In: Fernández, F. (Ed), *Introducción a las Hormigas de la Región Neotropical*. Instituto de Investigación de Recursos Biológicos Alexander von Humboldt, Bogotá, Colombia, pp.49–64.
- Hölldobler, B. & Wilson, E.O. (1990) *The Ants*. Harvard University Press, Cambridge, Massachusetts, USA, 732 pp.
- Hora, R.R., Doums, C., Poteaux, C., Fénerón, R., Valenzuela, J., Heinze, J. & Fresneau, D. (2005) Small queens in the ant *Ectatomma tuberculatum*: a new case of social parasitism. *Behavioral Ecology and Sociobiology*, 59, 285–292.
- Hora, R.R., Fénerón, R., Valenzuela, J., Favila, M. E. & Fresneau, D. (2001) Queen-size dimorphism in the ant *Ectatomma tuberculatum* (Hymenoptera: Formicidae: Ponerinae). *Sociobiology*, 38, 407–420.
- Kugler, C. & Brown, W.L. (1982) Revisionary and other studies on the ant genus *Ectatomma*, including the descriptions of two new species. *Search: Agriculture*, 24, 1–7.
- Lachaud, J.-P., Cadena, A., Schatz, B., Pérez-Lachaud, G. & Ibarra-Núñez, G. (1999) Queen dimorphism and reproductive capacity in the ponerine ant, *Ectatomma ruidum* Roger. *Oecologia*, 120, 515–523.
- Pie, M.R. (2004) Foraging ecology and behaviour of the ponerine ant *Ectatomma opaciventre* Roger in a Brazilian savannah. *Journal of Natural History*, 38, 717–729.
- Radchenko A.G. & Elmes G.W. (2003) A taxonomic revision of the socially parasitic *Myrmica* ants (Hymenoptera: Formicidae) of the Palearctic Region, *Annales Zoologici*, 53, 217–243.
- Weber, N.A. (1946) Two common ponerine ants of possible economic significance, *Ectatomma tuberculatum* (Olivier) and *E. ruidum* Roger. *Proceedings of the Entomological Society of Washington*, 48, 1–16.
- Wheeler, D.E. (1986) *Ectatomma tuberculatum* foraging biology and association with *Crematogaster* (Hymenoptera, Formicidae). *Annals of the Entomological Society America*, 79, 300–303.
- Wilson, E.O. (1971) *The Insect Societies*. Harvard University Press, Cambridge, Massachusetts, USA, 548 pp.
- Wilson, E.O. (1984) Tropical social parasites in the ant genus *Pheidole*, with an analysis of the anatomical parasitic syndrome. *Insectes Sociaux*, 31, 316–334.