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THE GENUS *Attaphila* WHEELER, 1900 (BLATTARIA: POLYPHAGIDAE) IN ARGENTINA

El género Attaphila Wheeler, 1900 (Blattaria: Polyphagidae) en Argentina

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Abstract. The genus *Attaphila* in Argentina is reviewed. One species with two subspecies are recorded from Argentina: *Attaphila bergi bergi* which is associated to the fungus garden inside the nests of *Acromyrmex lundii* (Hymenoptera: Formicidae) and distributed in the provinces of Entre Ríos and Buenos Aires, and *Attaphila bergi minor*, associated to *Acromyrmex lobicornis* and *A. silvestrii* and distributed in the provinces of Catamarca, Córdoba and San Luis. A complete account of *Attaphila* from Argentina is provided, including geographic distributions recorded in literature, new records for the country, and data of phoresy on ants.

Key words. Cockroaches, systematic, myrmecophily, distribution, Argentina.

Resumen. Se revisa el género *Attaphila* en Argentina. Una especie con dos subespecies están registradas en Argentina: *Attaphila bergi bergi* que está asociada al jardín de hongos dentro de los nidos de *Acromyrmex lundii* (Hymenoptera: Formicidae) y distribuida en las provincias de Entre Ríos y Buenos Aires, y *Attaphila bergi minor*, asociada a *Acromyrmex lobicornis* y *A. silvestrii* y distribuidos en las provincias de Catamarca, Córdoba y San Luis. Se proporciona un recuento completo de *Attaphila* de Argentina que incluye las distribuciones geográficas registradas en la literatura, nuevos registros para el país y datos de foresía con hormigas.

Palabras clave. Cucarachas, sistemática, mirmecofilia, distribución, Argentina.

INTRODUCTION

The genus *Attaphila* Wheeler, 1900 is represented by small cockroaches with myrmecophilous habits. They live in nests of leaf-cutter ants of the genus *Acromyrmex* and *Atta* (Hymenoptera: Formicidae). These small cockroaches may feed on the same fungus the ants grow (Wheeler, 1900). The genus has six recognized species distributed in the American continent: *A. aptera* Bolívar, 1905 (Colombia; Suriname); *A. bergi* Bolívar, 1901 (Argentina, Uruguay); *A. flava* Gurney, 1937 (Belize); *A. fungicola* Wheeler, 1900 (United States; Trinidad and Tobago; Colombia); *A. schuppi* Bolívar, 1905 (Brazil); *A. sexdentis* Bolívar, 1905 (Brazil) (Gurney, 1937; Rodríguez *et al.*, 2013). Their association with leaf-cutter ants was known when the genus and first species were described at the beginning of the twentieth century. *Attaphila bergi*, the second species being described in the genus (and dedicated to Carlos Berg), lives in the nests of four ant species: *Acromyrmex hispidus* Santschi, 1925 (Uruguay); *A. lobicornis* Emery, 1888 (Argentina; Uruguay); *A. lundi* (Guérin-Méneville, 1838) (Argentina; Uruguay), and *A. silvestrii* Emery, 1905 (Argentina) (Table 1).

In 1916 Bruch described *A. bergi* var. *minor* from San Luis (Argentina) which was first listed as a variety by Gurney (1937) but later included as a synonym of *A. bergi* by Princis (1963), a taxonomic status maintained by Crespo *et al.* (2010). However, there has never been a thorough taxonomic review of the species in this genus in the country.

The bibliography on *A. bergi* lacks important information about this species: The type locality was not provided in the original description and it is currently unknown (Bolívar, 1901); the location of a supposed holotype mentioned in the Argentine Cockroach Catalog (Crespo *et*

al., 2010) is unknown; and the (dubious) synonymy of var. *minor* (Princis, 1963) was never re-examined. In order to clarify some of these information gaps we provide a complete account of *Attaphila* from Argentina, its geographical distribution, new records, and data of phoresy on Attini ants during the nuptial flights.

MATERIALS AND METHODS

Localities, data of specimens, number and sex of specimens, collectors, and repository collections when they were stated in previous works are detailed in the text. Based on the loan records of the Museo Argentino de Ciencias Naturales “Bernardino Rivadavia”, Ciudad Autónoma de Buenos Aires, Argentina, the localities, collectors and numbers of specimens loaned to H. Bohn (München, Germany) are included in the material examined as “loaned”. The specimens are deposited in the Arthropod Collection of the Fundación de Historia Natural Félix de Azara, Ciudad Autónoma de Buenos Aires, Argentina.

Collections mentioned in the text

CFA-Ar: Colección de artrópodos de la Fundación de Historia Natural Félix de Azara, Ciudad Autónoma de Buenos Aires, Argentina.

CFCU: Colección de la Facultad de Ciencias de la Universidad de la República, Montevideo, Uruguay.

MACN: Museo Argentino de Ciencias Naturales “Bernardino Rivadavia”, Ciudad Autónoma de Buenos Aires, Argentina.

MNCN: Museo Nacional de Ciencias Naturales, Madrid, Spain.

Abbreviations of Argentinian provinces used in map: BA, Buenos Aires; Ca, Catamarca; Cb, Córdoba; Ch, Chaco; Co, Corrientes; ER, Entre Ríos; Fo, Formosa; Ju, Jujuy; LP, La Pampa; LR, La Rioja; Me, Mendoza; Mi, Misiones; Ne, Neuquén; RN, Río Negro; Sa, Salta; SF, Santa Fe; SE, Santiago del Estero; SL, San Luis; SJ, San Juan; Tu, Tucumán.

RESULTS

Complete account of the distribution and natural history of *Attaphila* from Argentina

Subfamily Attaphilinae Genus *Attaphila* Wheeler, 1900

Attaphila bergi bergi Bolívar, 1901

Figures 1-3

Synonymy. *Attaphila bergi* Bolívar, 1901: 331-336 (description; host; distribution; natural history); Bolívar, 1905: 134-135 (host; distribution; natural history; reference); Wheeler, 1907: 742 (distribution; reference; natural history); Wheeler, 1910: 397 (distribution; reference); Shelford, 1913: (distribution; reference); Gallardo, 1915: 18 (natural history); Bruch, 1916: 329 (host), 330: fig. 17 e (10-articulated antenna), 331 (distribution; host); Gallardo, 1916: 332-333 (host; natural history); Bruch, 1929: 434 (distribution; hosts); Bruch, 1937: 128 (distribution; host); Gurney, 1937: 106 (list; reference); Roth and Willis, 1960: 8 (list), 312 (distribution; hosts; references), 313 (distribution; host; reference), 315 (hosts); Covelo de Zolessi and Petrone de Abenante, 1973: 158 (distribution; natural history); Covelo de Zolessi and González, 1974: 46 (distribution; natural history); Covelo de Zolessi and González, 1978: 18 (natural history; host), 27: fig. 14 (dorsal aspect), 15

(head); París, [1993] 1994: 149 (syntypes; distribution); Crespo and Valverde, 2005: 113 (list); Bell *et al.*, 2007: 28 (natural history; references), 156 (natural history; references); Crespo and Valverde, 2008: 178 (list), 173 (map); Crespo *et al.*, 2010: 20 (catalogue; distribution; references); Rodríguez *et al.*, 2013: 222 (distribution; host).

Geographic distribution. ARGENTINA (Bolívar, 1905, according to Berg, *in litteris*; Wheeler, 1907; Wheeler, 1910; Gurney, 1937; Roth and Willis, 1960; Roth, 1995; Crespo and Valverde, 2005; Rodríguez *et al.*, 2013): Entre Ríos: Paranacito (Crespo and Valverde, 2008; Crespo *et al.*, 2010); Buenos Aires: [locality not stated, probably Bella Vista], X-1913, transported by numerous males of *A. lundi* (Gallardo, 1915), inside an artificial nest of *A. lundi* (Gallardo, 1916); La Plata, found by hundreds in the fungus gardens of *A. lundi* (Bruch, 1916; Roth and Willis, 1960); with *A. lundi* (Bruch, 1929); near Chascomús, late I-1937, J.B. Daguerre leg., in nest of *A. lundi* (Bruch, 1937); Ciudad Autónoma de Buenos Aires (Crespo and Valverde, 2008; Crespo *et al.*, 2010). URUGUAY (Bolívar, 1901, 1905, according to Berg, *in litteris*; Wheeler, 1907, 1910; Gurney, 1937; Roth and Willis, 1960; Roth, 1995; Crespo and Valverde, 2003; Rodríguez *et al.*, 2013); [locality not stated], in the fungus garden, and in a nuptial flight of *A. lundi* (Covelo de Zolessi and González, 1978); Maldonado: Sierra de las Ánimas, in the fungus garden of *A. hispidus* (Covelo de Zolessi and Petrone de Abenante, 1973), 23/24-III-1968, in the fungus garden of *A. lobicornis* (Covelo de Zolessi and González, 1974); Florida: Casupá, 7-VIII-1960, 9 exx., Carbonell C.S. leg. [CFCU] (Crespo and Valverde, 2003).

Type host. ARGENTINA: Buenos Aires: [probably Buenos Aires city], one alate adult ant without abdomen [MNCN], glued to the same card with *A. bergi* (París,

1994), presumably *A. lundi*, as was stated by Berg *in litteris* to Bolívar (1901).

Material examined. ARGENTINA: Entre Ríos: Paranacito, 1931, Daguerre leg., # 28994, 6 exx. (1 pin) [MACN], loaned; Buenos Aires: Castelar, Viana-Maniglia leg., # 41175, 10 exx. (2 pins) [MACN], loaned; Moreno, 30-XI-1938, M.D. Jurado leg., # 7780, 1 ex., # 7781, 1 ex. [MACN], loaned; San Miguel, 25-VIII-2015, 1 ex., attached to a male *A. lundi* (Figure 2b), 4 exx, attached to another male *A. lundi*, both treating to copulate with a female ant, Zubarán G. leg.; CFA-AR-286/291 [CFA-Ar] (Table 2) (Figure 2a); Tigre, # 34433, 3 exx. (1 pin) [MACN], loaned; Km 30, F.C.G.B., Di Iorio leg., 18-X-2012, 12 exx., CFA-AR-292/304 [CFA-Ar], 15-X-2013, 2 exx., CFA-AR-305/306 [CFA-Ar], 31-X-2014, 32 exx., CFA-AR-307/338 [CFA-Ar], attached to males and females of *A. lundi* (Table 2); Ciudad Autónoma de Buenos Aires: Buenos Aires, 23-II-1905, J. Brèthes leg., # 7779, 1 ex. [MACN], loaned; Buenos Aires, # 10943, 2 exx. [MACN], loaned; Parque Centenario, 1-XI-2014, L. Compagnucci leg., 3 exx. [MACN], attached to females of *A. lundi* (Table 2).

Comments. *Attaphila bergi* was described without any indication of country and locality of origin (Bolívar, 1901). According to a partially transcribed letter written by Carlos Berg, Bolívar (1901) says that the cockroaches lives in ant nests of *A. lundi* from Argentina and Uruguay. Thus, these countries may be the syntype localities of *A. bergi bergi*, but it is unknown if the specimens received by Bolívar had been collected in these two localities (see below), or if both countries were only the result of observations previously made by Berg (1890) who did not mention cockroaches associated with ants from Argentina, Chile and Uruguay in his catalog.

Bolívar (1901) clearly stated that he had two males and six females (syntypes)

of *A. bergi bergi*, but Crespo *et al.* (2010) erroneously mentioned a "Holotype" at MNCN (original source not stated). According to París (1994), not cited by Crespo *et al.* (2010), there are two syntypes at MNCN, one male and one female glued to the same card. The type locality of these syntypes was Buenos Aires, Argentina (París, 1994), most probably the city of Buenos Aires where Carlos Berg lived, and where *A. bergi* can still be found associated to the same host.

The location of the remaining male and five female syntype specimens (one slide mounted) of the series examined by Bolívar (1901) is unknown (París, 1994; París, IV-2020 pers. comm.). These specimens may probably appear in other Blattaria or Orthoptera collections because the exchange of type specimens at the beginning of the twentieth century was a common practice.

Attaphila bergi minor Bruch, 1916

Figures 1-3

Synonymy. *Attaphila bergi* var. *minor* Bruch, 1916: 329-330 (description; distribution), 330: fig. 17 a (female), b (head in frontal view), c (maxillary palp), d (12-articulated antenna), f (fore leg); Gurney 1937: 106 (list; reference). *Attaphila bergi*, in part: Roth and Willis, 1960: 312 (distribution; host; reference), 313 (distribution; hosts; reference), 315 (host); Princis, 1963 (list, distribution); Crespo and Valverde, 2008: 173(distribution, map), 178 (list, distribution); Crespo *et al.*, 2010: 20 (distribution)

Geographic distribution. ARGENTINA (Gurney 1937): Catamarca: Huasan, possibly a variety of *A. bergi*, in the nest of *A. lobicornis* (Bruch, 1916; Roth and Willis, 1960); with *A. lobicornis* (Bruch, 1929); Belén (Princis, 1963; Crespo and Valverde, 2008; Crespo *et al.*, 2010); Córdoba: with *A. lobicornis* (Bruch, 1929); San Luis (Crespo *et*

al., 2010); Alto Pencoso [syntype locality], in nest of *A. silvestrii* (Bruch, 1916; Roth and Willis, 1960).

Comments. *Attaphila bergi minor* was listed as a different variety by Gurney (1937), later listed in the synonymy of *A. bergi* by Princis (1963). According to the ICZN (1999), the varieties described before 1960 must be treated as subspecies until they can be taxonomically revised, a fact that was never accomplished in this case (see Note 3 below).

The distinctive characters of *A. bergi minor* given by Bruch (1916) respect to *A. bergi bergi* were the following: 1) its smaller size; 2) the very pale yellow color (instead of reddish or orange); 3) the last two abdominal segments rounded (instead of truncated); 4) the antenna 12-articulated (instead of 10-articulated); 5) the antennal segments obconic, and more robust (instead of longer and slender) (Figure 3). These differences deserve further study in order to verify if

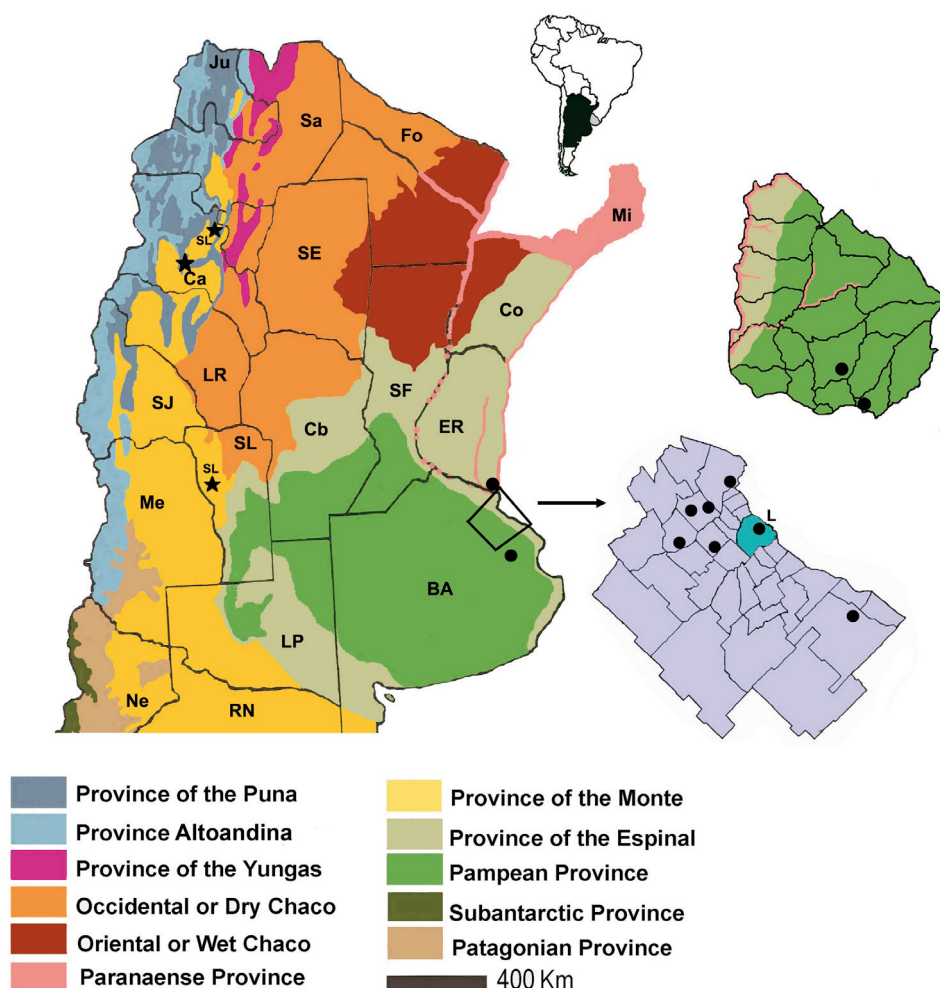


Figure 1 - Geographic distribution of *Attaphila* in Argentina and Uruguay: *A. bergi bergi* (circles); *A. bergi minor* (stars).

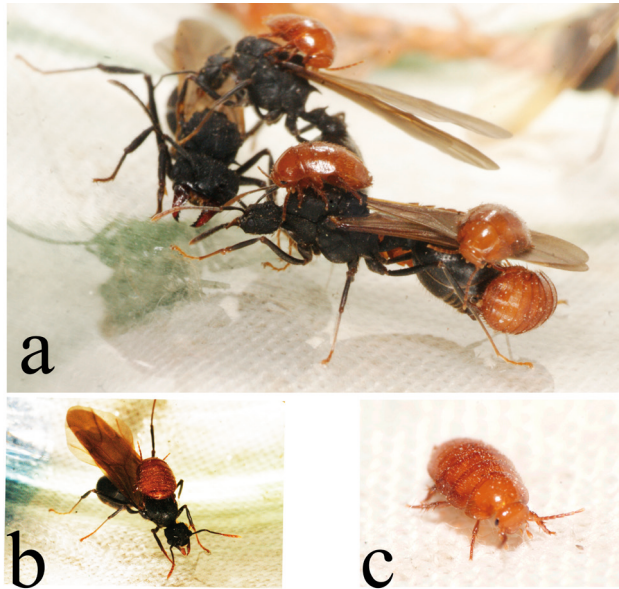


Figure 2 - *Attaphila bergi bergi* with of *Acromyrmex lundi*. **a**: group attached to a male of *Acromyrmex lundi*; **b**: one attached to a male of *Acromyrmex lundi*; **c**: aspect to *Attaphila bergi bergi*.

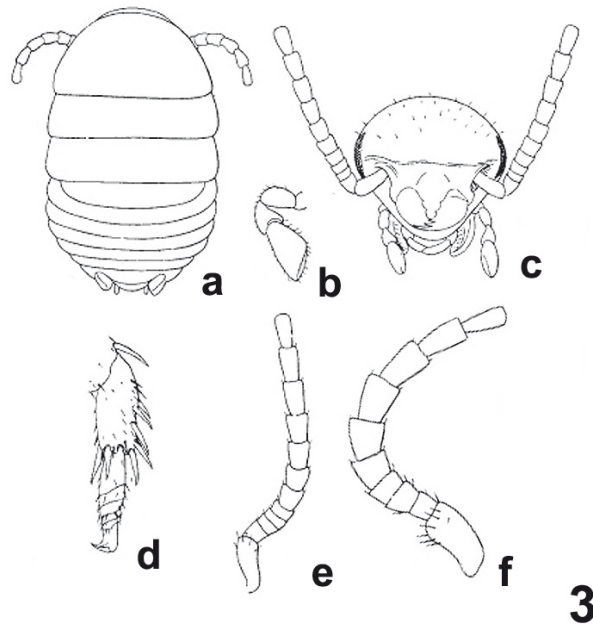


Figure 3 - *Attaphila bergi minor*: **a** (a), female; **b** (c), maxillary palp; **c** (b), head; **d** (f), fore leg; **e** (d), antenna 12-articulated; *Attaphila bergi bergi*: **f**, antennae 10-articulated (extracted and modified from Bruch 1916).

A. bergi minor is co-specific with *A. bergi*, or even if it constitutes a different species.

The type specimens of *Attaphila bergi minor* (syntypes) were not located among the pinned specimens of Blattaria and/or ants at MACN.

Attaphila bergi var. *minor* was not mentioned by Crespo *et al.* (2010), but Catamarca and San Luis are included in the distribution of *A. bergi bergi* if we take into account the synonymy previously made by Princis (1963) cited among the references.

A place named Huasan, cited by Bruch, is located not far north from Andalgalá (Catamarca). The record from Belén in the same province given by Crespo *et al.* (2010), was based on literature (Princis 1963).

The record from Córdoba was not discriminated between *A. bergi bergi* and *A. bergi minor* by Bruch (1929). This province is tentatively mentioned here for *A. bergi minor* (Table 2), but new material from this province is needed for further examination.

DISCUSSION

There are two different *Attaphila* in Argentina, both taxa with a restricted and differential distribution across the provinces. Unlike *A. bergi bergi*, *A. bergi minor* is distributed in the phytogeographic province of Monte (Figure 1), where several endemic species of insects are also distributed. Nevertheless, its taxonomic status depends on a further revision of new material.

Natural history of *Attaphila bergi bergi*

In order to colonize new ant nests, adults of *A. bergi bergi* ride alate adults of *Acromyrmex* during the nuptial flights (Bolivar, 1901; Gallardo, 1915; Covelo de Zolessi and González, 1978). Gallardo (1915) mentioned numerous males of *A. lundii* transporting

the cockroaches in Argentina (Bella Vista, Buenos Aires). In Uruguay, Covelo de Zolessi and González (1978) mentioned that *A. bergi bergi* rides males and females of *A. lundii*.

According to Bell *et al.* (2007), “these myrmecophiles have large arolia” (Gurney, 1937) that may assist them in clinging to their transport. Several questions arise concerning this phoretic relationship. Do both male and female cockroaches disperse with the alates, or only fertilized females? Since the nuptial flight of male ants is invariably fatal, do the cockroaches choose the sex of their carrier? If cockroaches do choose male alates, perhaps they can transfer to female alates while the ants are copulating. The vast majority of the thousands of released virgin queens die within hours of leaving the nest; do their associated cockroaches subsequently search for nests on foot?”

Accordingly, adults of *A. bergi bergi* found during nuptial flights of *A. lundii* were attached to more alate male than female ants (Table 1). In general, the cockroaches were attached to the thorax, a few were on the wings, and a very small number were on the abdomen, but in all cases a single cockroach was on each ant (Di Iorio pers. obs.). In an exceptional case, three or four cockroaches were observed to be attached to a single male ant: one on the abdomen, one on the wings, and one on the thorax (Figure 2a).

As the new nests of *Acromyrmex* and *Atta* are initiated by a single female ant after the nuptial flight, the following questions similar to Bell *et al.* (2007) arise: 1) Is an *Attaphila* specimen mounted on a male ant able to switch to a female ant during copulation? or, 2) Can we infer that individuals of *Attaphila* mounted on a male ant have no chance to colonize a new nest? These questions conduct to new ones: 1) Are all Attini nests of the same species in the same area colonized by *Attaphila*? or, 2) Does the average number of ants nests colonized

by *Attaphila* show a similar proportion to the average number of females transporting cockroaches? Could this number vary with respect to the nest, number of females or number of cockroaches? Another element that remains to be established is the relationship cockroach sex/ ant sex. This will require observing whether each cockroach transported in a nuptial flight stays attached to its transporting ant or if it switches during copulation.

The questions that arise about the behavior of these cockroaches during the nuptial flight, that is from the moment they prepare for it inside the nest to what happens once

the queens copulate, were already posed by other authors. Further research is needed to try to answer some of them.

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We would like to thank Mercedes París [MNCN] for quickly replying to our long introduction on the problems and questions about types and original labels of *A. bergi bergi*; Arturo Roig-Alsina (MACN) for the information on the specimens of *A. bergi bergi* loaned to Horst Bohn (Germany).

Table 1 - Species of *Attaphila* and ant hosts mentioned in literature.

<i>Attaphila</i> spp.	Country	Ant host	References
<i>A. fungicola</i>	United States	<i>Atta texana</i>	Wheeler 1900
	Trinidad & Tobago	<i>Atta cephalotes</i>	Brossut 1976
	Colombia	<i>Atta cephalotes</i>	Rodriguez <i>et al.</i> 2013
<i>A. aptera</i>	Colombia	<i>Acromyrmex octospinosus</i>	Bolívar 1905
<i>A. schuppi</i>	Brazil	<i>Acromyrmex niger</i>	Bolívar 1905
<i>A. sexdens</i>	Brazil	<i>Atta sexdens</i>	Bolívar 1905
<i>A. flava</i>	Belice	-	Gurney 1937
<i>A. bergi bergi</i>	Argentina	<i>Acromyrmex lundii</i>	Bolívar 1901; Bruch 1916; Gallardo 1916
	Uruguay	<i>Acromyrmex lundii</i>	Covelo de Zolessi & González 1978
	Uruguay	<i>Acromyrmex hispidus</i>	Covelo de Zolessi & Petrone de Abenante 1973
	Uruguay	<i>Acromyrmex lobicornis</i>	Covelo de Zolessi & González 1974
<i>A. bergi minor</i>	Argentina	<i>Acromyrmex lobicornis</i>	Bruch 1916
	Argentina	<i>Acromyrmex silvestrii</i>	Bruch 1916

Table 2 - Number of males and females of *Acromyrmex lundii* (Hymenoptera: Formicidae) transporting *Attaphila bergi bergi* (Blattaria: Polyphagidae) during nuptial flights in Buenos Aires province, Argentina.

Data	<i>Attaphila bergi</i>	<i>Acromyrmex lundii</i>		
	Totals	Males	Females	Totals
18-X-2012	12	9	3	12
15-X-2013	2	2	-	2
31-X-2014	32	25	7	32
1-XI-2014	3	-	3	3
25-VIII-2015	4	2	-	2
Totals	53	38	13	51

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