

The Cactus-Specialist Bees of the Genus *Brachyglossula* Hedicke (Hymenoptera: Colletidae): Notes on Host Associations and Description of a New Species

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ABSTRACT: The pollen-collecting behavior of three species of the South American Andean bee genus *Brachyglossula* is reported. Species studied are *B. martinezi* Trucco Alemán, *B. communis* Trucco Alemán, and *B. ancasti* Roig Alsina and Schlumpberger, new species. The new species, which is comparatively described and illustrated, inhabits the isolated mountain range of Sierra de Ancasti, in the province of Catamarca, Argentina. Observation of the bees in the field, and pollen counts from scopal loads strongly support specialization of these bees on the Cactaceae. Members of both major cactus subfamilies, the Opuntioideae and the Cactoideae, are frequently visited and represented in the pollen loads.

KEY WORDS: bees, pollen collecting, cactus, South America, Colletidae, new species

Brachyglossula Hedicke is a genus of solitary, burrowing bees of the subfamily Colletinae (Hymenoptera: Colletidae). It includes large bees with black integument, frequently with metallic blue or green reflections, and in some species with a partly or entirely red metasoma. The females have scopal hairs on the hind trochanter, femur and tibia, and also a well-developed scopa on the metasomal sterna. The males have large mandibles, with a broad, usually bifid preapical tooth that gives the mandible a tridentate appearance. Also characteristic are the coarsely dentate tibial spurs, and the first metasomal sternum of the male, which bears strong keels and prominences.

These bees inhabit the Andean region of southern Peru, Bolivia and northern Argentina, reaching high altitudes; records for the various species range from 1000 m to 4269 m a.s.l.

The genus has been characterized by Michener (1989, 2000), cataloged by Moure *et al.* (1999), and its species have been reviewed by Trucco Alemán (1999a, b). Seven species are currently recognized: *B. bouvieri* (Vachal) and *B. stolorum* Trucco Alemán from Peru, *B. boliviensis* (Vachal) from southern Peru and Bolivia, *B. virescens* Trucco Alemán from Bolivia, and *B. martinezi* Trucco Alemán, *B. communis* Trucco Alemán, and *B. leucothorax* Trucco Alemán from Argentina. In the present contribution we describe a new species from the Ancasti mountain range in the province of Catamarca, in Argentina, and extend the distribution of *B. martinezi* to the department of Potosí, in Bolivia.

Although species of *Brachyglossula* have been mentioned in the literature as cactus (Cactaceae) bees (Michener, 1989, 2000; Moure *et al.*, 1999), precise records of host associations are scarce. Trucco Alemán (1999b) reports only two records, one for *B. communis* on *Soehrensia ingens* Br. & R. ex Backbg. (syn. to *Echinopsis bruchii* (Britton & Rose) A.Castellanos & H.V.Lelong), and another one for *B. leucothorax*

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on *Opuntia* sp. New records are presented here for three species of *Brachyglossula*, based on the observation of the collecting behavior of the bees in the field, and on pollen counts from scopal loads.

Material and Methods

Terminology for structures follows Michener (1944, 2000), except that metapost-notum is used instead of propodeal triangle (Brothers, 1976). The maximum diameter of the median ocellus (MOD) is used as a reference to express the length of the pubescence and other structures. In the descriptions, the metasomal terga (T) and sterna (S) are identified with Arabic numerals.

Specimens studied are deposited at the Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" in Buenos Aires, Argentina (MACN), the Zoologische Staatssammlung München (ZSM), and the collection of one of the authors (BS).

As a measure for host plant specificity, pollen samples from both male and female specimens were mounted on microscopy slides and embedded in fuchsin stained glycerine jelly. Only samples with at least 500 grains (300 in one case) were controlled under the microscope for frequency of cactus pollen.

Results

Brachyglossula martinezi Trucco Alemán

Brachyglossula martinezi Trucco Alemán, 1999a: 59–61.

COMMENTS: This species was known from the province of Jujuy in northern Argentina. Its range is extended now to the department of Potosí in Bolivia.

FLOWER RECORDS: *Echinopsis* (syn. *Trichocereus*) *tarijensis* ssp. *tarijensis* (Vaupel) H. Friedrich & G.D. Rowley, *E.* (syn. *Trichocereus*) sp., *Opuntia* cf. *sulphurea* Gillies ex Salm-Dyck.

MATERIAL EXAMINED: **Bolivia, Potosí.** Villazón: 1 female on *Opuntia* cf. *sulphurea*, 12-XII-2002, B. Schlumpberger (MACN), 1 male on *Echinopsis* sp., 12-XII-2002, B. Schlumpberger (MACN). **Argentina, Jujuy.** n. Humahuaca (S 22° 57,213' W 65° 23,998') 3450 m: 1 male on *Echinopsis tarijensis*, 11-XI-2006, B. Schlumpberger (BS).

Brachyglossula communis Trucco Alemán

Brachyglossula communis Trucco Alemán, 1999a: 54–59.

COMMENTS: Although in the original description of *B. communis* the vestiture of both sexes is mentioned as black, there is some variation in the color of the hairs of the metasomal terga of some males. Males with dark metasomal integument have dark hairs, but males with reddish metasoma may have yellowish-brown hairs on T3–T7, particularly on T6–T7. Males with dark and pale hairs co-occur in several localities.

This species was recorded for the provinces of Salta, Catamarca, Tucumán and Mendoza in Argentina; it is also recorded now for the provinces of Jujuy and La Rioja.

FLOWER RECORDS: *Echinopsis* (syn. *Acanthocalycium*) *thionantha* (Speg.) Werderm. ssp. *ferrarii* (Rausch) Lowry, *Austrocylindropuntia verschaffelti* (Cels ex F.A.C. Weber) Backeb., *Echinopsis ancistrophora* Speg., *E.* (syn. *Trichocereus*) *candicans* (Gillies ex Salm-Dyck) F.A.C. Weber ex D.R. Hunt, *E.* (syn. *Lobivia*) *chrysochete* Werderm., *E.* (syn. *Lobivia*) *saltensis* Speg., *E.* (syn. *Trichocereus*) *smrziana* Backeb.,

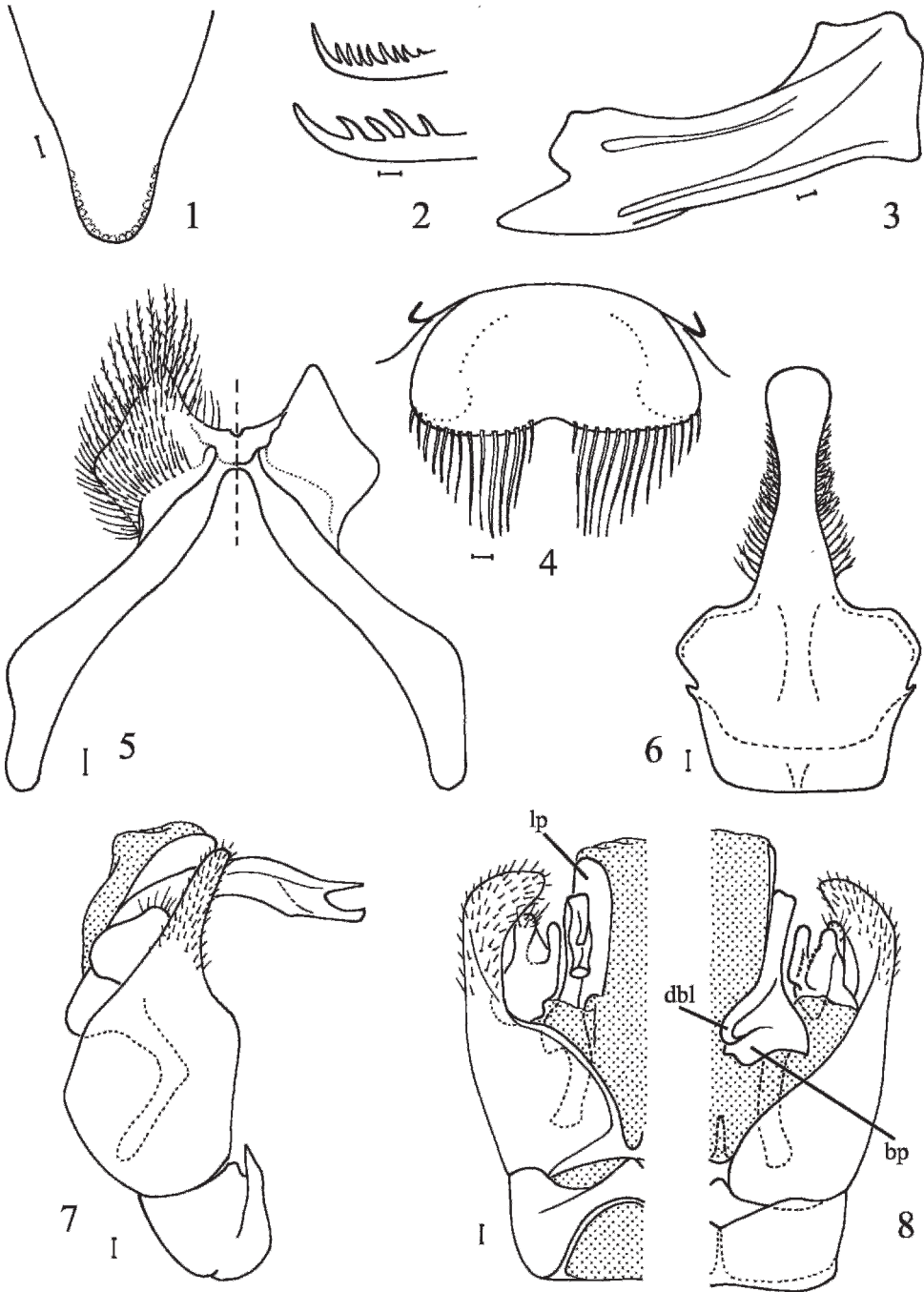
Maihueniopsis ovata (Pfeiff.) F. Ritter, *Opuntia schickendantzii* F.A.C. Weber, *O. sulphurea*, *Parodia aureicentra* Backeb., *P. microsperma* (F.A.C. Weber) Spig. (syn. *P. setifera* Backeb., *P. cebilarensis* Weskamp), *Tunilla soehrensii* (Britton & Rose) D.R. Hunt & J. Iliff.

MATERIAL EXAMINED: **Argentina. Jujuy.** Santa Victoria (S 22° 12,235' W 65° 12,177'), 4269 m: 1 male on *Echinopsis chrysochete*, 12-XII-2006, B. Schlumpberger (MACN). **Salta.** nw Cachi: 2 males on *Parodia aureicentra*, 9-II-1997, B. Schlumpberger (BS); Escoipe (S 25° 11,189' W 65° 46,975'), 2250 m: 2 males on *Opuntia sulphurea*, 3-XII-2002, B. Schlumpberger (MACN); 2 males (03102, 03103) on *Opuntia sulphurea*, 12-XII-2003, B. Schlumpberger (MACN); 1 male on *Opuntia schickendantzii*, 12-XII-2003, B. Schlumpberger (MACN); 4 females (03104, 03106, 03110, 03113) 1 male (03108) on *Echinopsis ancistrophora*, 12-XII-2003, B. Schlumpberger (MACN). Cebilar (S 25° 40, 101' W 65° 29,527'), 1800 m: 1 male on *Opuntia sulphurea*, 5-XII-2003, B. Schlumpberger (MACN); 1 female on *Parodia microsperma*, 5-XII-2003, B. Schlumpberger (MACN); 1 female, 1 male on *Echinopsis saltensis*, 29-X-2003, B. Schlumpberger (MACN). Cuesta del Obispo: 1 female on *Austrocylindropuntia verschaftelti*, 26-XI-2006; 3 males and 1 female on *Echinopsis smrzianus*, 26-XI-2006, B. Schlumpberger (BS). **Tucumán.** se Amaicha: 4 females, 1 male on *Opuntia sulphurea*, 15-XII-2006, B. Schlumpberger (MACN, 1 female BS); 3 female, 3 male on *Maihueniopsis ovata*, 15-XII-2006, B. Schlumpberger (BS); 1 female, 4 males on *Tunilla soehrensii*, 15-XII-2006, B. Schlumpberger (BS). **La Rioja.** n Corrales (S 28° 59,513' W 67° 30,849'), 1370 m: 1 male on *Echinopsis candicans*, 14-XI-2006, B. Schlumpberger (MACN); 1 male on *Opuntia sulphurea*, 14-XI-2006, B. Schlumpberger (BS).

Brachyglossula ancasti Roig-Alsina and Schlumpberger, new species
(Figs. 1–8)

DIAGNOSIS: This species is characterized by the lack of metallic reflections on the integument, by the pygidial plate of the female, which has its apical third margined with a rim, by the mandible of the male, with a truncate preapical tooth, by the labrum of the male, with a median apical emargination and thick lateral margins, and by details of the male genital capsule, which are discussed below. The species is also distinguished among all other *Brachyglossula* by the color of the vestiture. The females have reddish-brown hairs on the head, mesosoma and legs, and yellowish-brown hairs on the metasoma. The males may have either a completely yellowish or dark vestiture all over the body.

DESCRIPTION: **Holotype male.** Length 14.5 mm (paratypes 12.4–16.6 mm); length of forewing 11.5 mm (paratypes 9.5–11.6 mm). *Color.* Black, without metallic blue or green reflections; the following parts reddish brown: base and apex of scape, most of mandible except apex, labrum, inner surface of front tibia and basitarsus, tibial spurs, distal tarsomeres of all legs, apical margin of T1, T2 (although partly black basally and laterally), T3–T7, apex of S1, and S2–S6. Pedicel and flagellum orange. Wings infusate with darker apex; veins brown, pterostigma yellowish brown. *Pubescence.* Yellowish to ocher, with golden hue on metasomal terga, dark brown to black on mid and hind legs beyond femora. Pubescence of head erect, dense around antennal socket, 1.0–2.0 times MOD, sparser and shorter on rest of head, on sides of clypeus 0.7–1.0 times MOD. Scape with erect hairs as long as those on clypeus. Mesosoma clothed with erect hairs, except metapostnotum bare; hairs on center of



Figs. 1–8. *Brachyglossula ancasti*, new species. Female: 1. Pygidial plate. 2. Outer margin of midtibial spur (above), inner margin of inner hind tibial spur (below). Male: 3. Mandible. 4. Labrum. 5. S7, ventral (left) and dorsal (right) views. 6. S8, ventral view. 7. Genital capsule, lateral view. 8. Genital capsule, ventral (left) and dorsal (right) views; lp, lateral plate of penis; dbl, dorso-basal lobe of penis valve; bp, basal plate of penis valve. Scale lines = 0.1 mm.

scutum 1.0–1.5 times MOD, on mesopleuron longer, 2.0–2.5 times MOD. Legs with pubescence erect, longer on underside of front femora. T1 on basal vertical surface with erect hairs 1.0–1.5 times MOD, disc of tergum with scattered short hairs 0.2–0.4 times MOD. T2–T5 densely covered with short, appressed hairs, those on T2–T3 0.2–0.4 times MOD; hairs on T6–T7 also appressed, but longer, on T7 bordering longitudinal median bare stripe. Metasomal sterna mostly bare, with scattered hairs; S1–S5 without sternal fringes; S6 with dense apical fringe of hairs as long as MOD. *Sculpture*. Head and mesosoma strongly punctured, except smooth and shining above mandibular articulations, and impunctate metapostnotum, which is tessellate throughout. Disc of clypeus and supraclypeal area with punctures separated by 0.5–2.0 times their diameter, more separated along median line and closer and smaller on sides of clypeus; interspaces between punctures smooth and shining; rest of head microtessellate between punctures. Mesosoma tessellate between punctures, those on scutum separated by 0.5–1.5 times their diameter. Metasoma finely tessellate; T1 sparsely punctate and with large impunctate apical zone; T2–T6 dense and finely punctate. S1–S6 with few, sparse punctures. *Structure*. Inner orbits diverging below, proportion of upper to lower interocular distance 1:1.05. Ocellocular distance greater (1.5 times) than interocellar distance. Vertex behind ocelli elevated; distance between lateral ocellus and posterior margin of head 2.3 MOD. Gena swollen, with maximum width at level of middle of eye, and as wide as 0.8 times maximum eye width. Clypeus protuberant in lateral view, for a distance 0.6 times maximum eye width. Antennocular distance slightly smaller (0.9 times) than interantennal distance. Clypeus transverse, 3.5 times as wide as long; apical margin bordering labrum with distinct apicolateral tooth. Labrum 2.1 times as wide as long, lateral margin swollen with convexity smooth; disk weakly concave, finely tessellate on sides and above, and medially smooth and shining; apical margin bearing stiff setae, except on median weak emargination. Mandible with broad, truncate preapical tooth, scarcely emarginate, so mandible not distinctly tridentate as in other species. First flagellomere longer (1.8 times) than its apical width; proportion of lengths of scape, pedicel and proximal three flagellomeres 3:0.5:1:0.4:0.4. Mid and hind tibial spurs coarsely dentate, with curved apices. S1 with median longitudinal elevation strongly rugose and carinate, not reaching posterior margin of tergum. S7 and S8 as in figures 5 and 6. Genital capsule as in figures 7 and 8. Bifid apex of penis valve with sharp upper branch and transversely truncate lower branch; gonocoxite in lateral view with rounded apex.

Female. Length 13.0 mm (paratype 13.2 mm); length of forewing 9.8 mm (paratype 10.3 mm). *Color* of integument as in male, except that black on mandible and scape more extended. *Pubescence*. Reddish-brown on head, most of thorax, propodeum, base of T1 and most of legs; blackish to black on venter of thorax, hind legs, and metasomal scopa; yellowish-brown on metasomal terga, including prepygidial fimbria; pygidial fimbria with mixed yellowish-brown and dark hairs. Scutum with hairs 0.7–1.1 times MOD, and scattered longer hairs 1.7–1.9 times MOD; hairs of mesopleuron 2.4–2.9 times MOD. Disk of T2–T4 with short, appressed hairs 0.5–0.7 times MOD; prepygidial and pygidial fimbriae well developed, with long plumose hairs. Scopal hairs on S2–S5 extremely long, 4.0–6.0 times MOD. *Sculpture*. Similar to that of male, with most of integument finely tessellate, and clypeus and supraclypeal area with smooth, shining interspaces between punctures. *Structure*. Inner orbits weakly concave on upper third, upper and lower interocular distances equal. Ocellocular distance greater (1.4 times) than

interocellar distance. Clypeus 2.2 times as wide as long; apical margin depressed, forming bare rim hidden by dense fringe of stiff setae. Labrum 2.3 times as wide as long, with strong preapical carina. First flagellomere longer (1.6 times) than its apical width; proportion of lengths of scape, pedicel and proximal three flagellomeres 3.1:0.6:1:0.45:0.45. Mid and hind tibial spurs with curved apices and coarsely dentate; outer margin of mid tibial spur with 7–8 teeth; inner margin of inner hind tibial spur with four strong teeth. Pygidial plate with rounded apex, granulose disc, and apical third margined with rim.

ETYMOLOGY: The species is named after the mountain range in which all known specimens were found, the Sierra de Ancasti.

COMMENTS: In the key to species of *Brachyglossula* presented by Trucco Alemán (1999b), the new species runs to *B. communis*. Besides characters mentioned in the diagnosis, differences in the genital capsule allow to separate both species: the apex of the gonocoxite is rounded in lateral view (pointed in *communis*); the apex of the penis valve is even more strongly curved ventrally, so that the sclerotized lateral plate of the penis (lp, Fig. 8) is visible in lateral view (hidden by the penis valve in *communis*, figure 54 in Trucco Alemán, 1999a); the penis valve is continued basad to the dorso-basal lobes (dbl, Fig. 8) by a distinct plate (bp, Fig. 8) (penis valve in *communis* without distinct plate basad to the dorso-basal lobes). The bifid apex of the penis valve is similar in both species; the proximal branch is truncate and the distal branch is spatulate, not spiniform as in other species.

The color variation present in *B. ancasti* is striking. Most studied males have yellowish to ocher pubescence, but three males have their pile completely black, much as in *B. communis*. These three males are not included as paratypes, and are mentioned as “other material” below. Future collections may reveal if there are intermediates between these two color morphs. The females, with reddish-brown pile on the head and the thorax, differ from the two types of males.

FLOWER RECORDS: Various taxa of the *Echinopsis huascha* (F.A.C.Weber) H.Friedrich & G.D.Rowley group (syn. *Echinopsis/Trichocereus/Helianthocereus/Lobivia huascha, grandiflora* Linke, *grandiflora* var. *pumila* Rausch, *rowleyi* H. Friedrich, *lobioides* Backeb.), *Echinopsis* (syn. *Trichocereus*) sp., and *Gymnocalycium baldianum* Speg.

MATERIAL EXAMINED: **ARGENTINA, Catamarca.** Holotype male, Sierra de Ancasti (28°27.895'S, 65°35.222'W), 1848 m a.s.l., 17-XI-2006, on *Echinopsis grandiflora*, B. O. Schlumpberger (MACN). The following are paratypes: Sierra de Ancasti (S 28° 25,049' W 65° 32,760'), 1988 m: 1 male on *Echinopsis huascha*, 16-XI-2006, B. Schlumpberger (BS); Sierra de Ancasti (S 28° 28,815' W 65° 36,717'), 1711 m: 1 male on *Gymnocalycium baldianum*, 2-XI-2006, B. Schlumpberger (MACN); Sierra de Ancasti, Cuesta de Portezuelo (S 28° 29,689' W 65° 36,877'), 1593 m: 1 female on *Echinopsis* sp. (white flower), 18-XI-2006, B. Schlumpberger (MACN); Sierra de Ancasti (S 28° 41,670' W 65° 37,395') 1418 m: 1 male and 1 female on *Echinopsis huascha* s.str., 18-XI-2006, B. Schlumpberger (ZSM). Other material: Sierra de Ancasti (S 28° 41,670' W 65° 37,395') 1418 m: 2 males same data as previous specimens (1 BS, 1 ZSM), 1 male same data as holotype (BS).

Additional observations on food spectrum and behavior of *Brachyglossula*

Males and females of *B. ancasti* were found sleeping in closed, wilted cactus flowers during periods of rainy and cold weather (*Echinopsis huascha* group: *E.*

huascha s.str. and *E. grandiflora*). More than one bee could be found in individual flowers.

Males of *B. communis* were often seen to patrol on flowers of various cactus species in order to search for potential mating partners. During patrolling flights, males would either approach flowers without landing, or enter flowers briefly (with potential of pollinating them). A different male strategy is to wait for females inside cactus flowers. Mating was observed in the cactus flowers' well, with actual copula lasting a few seconds only.

Females of *B. communis* were frequently observed collecting cactus pollen, e.g., in flowers of *Echinopsis smrzianus*. Pollen samples taken from collected specimens of *B. communis* revealed a high proportion of cactus pollen (97.8%, $n = 10$). Additional samples from other species document similarly high levels of cactus pollen with 98.4% ($n = 1$) for *B. martinezii* and 99.2% ($n = 2$) for *B. ancasti*.

Flowers are also visited for nectar uptake, as observed e.g., in *Austrocylindropuntia verschaffelti*.

Discussion

Brachyglossula ancasti was as yet only found in the medium to high elevations of the Sierra de Ancasti, Catamarca. As the surroundings of this mountain range are lowland Chaco forest, which seems to be unsuitable for *Brachyglossula*, it may be endemic in that region. However, without further field observations it can not be excluded that this species also occurs in some of the neighboring mountain chains, such as the Sierra de Ambato.

Both morphology and distribution of the new species suggest a close affinity to *B. communis*. The lack of metallic reflections of the integument, the shape of the male eighth metasomal sternum, as well as characteristics of the genital capsule, relate the two species. Even though *B. ancasti* is apparently restricted to the Sierra de Ancasti, a sierra isolated from the major western ranges, it falls within the latitudinal distribution of *communis*, which is distributed along the Andes mountains from Jujuy in the north to Mendoza in the south. It may be speculated that *B. ancasti* represents a vicariant event, or a colonization event followed by divergence from the widespread *B. communis*.

Our observations of *Brachyglossula* on flowers of many different cactus species as well as pollen analyses strongly support the supposed specialization on the Cactaceae. Members of both major subfamilies, the Opuntioideae and the Cactoideae, are frequently visited and represented in the pollen loads in similar frequencies. Mating and sleeping in cactus flowers further supports a close bee-host plant association.

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