

A New Species of Thief Ant of the Genus *Solenopsis* from the Galápagos Islands (Hymenoptera: Formicidae)

by

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ABSTRACT

A new ant species, *Solenopsis gnoma*, was found while excavating a nest of *Tetramorium bicarinatum* in a rotten trunk on Santa Cruz Island in the Galápagos. The worker is golden brown with a dark brown gaster and the female is concolorous dark brown. We include a description of both the worker and female castes, key characters accompanied with illustrations, as well as a key to the *Solenopsis* species in the Galápagos Islands.

Key Words: New thief ant, *Solenopsis gnoma*, Galápagos Islands, Ecuador, key to local species.

RESUMEN

Una nueva especie de hormiga, *Solenopsis gnoma*, fue encontrada, mientras se exploraba un nido de *Tetramorium bicarinatum* dentro de un tronco podrido en la isla Santa Cruz en Galápagos. La obrera es café dorado con el gaster café oscuro mientras que la hembra es uniformemente café oscuro. Incluimos una descripción para ambas castas, caracteres dominantes con ilustraciones, así como una clave de las especies de *Solenopsis* presentes en las islas Galápagos.

INTRODUCTION

The genus *Solenopsis* is known primarily for “fire ants,” but also includes smaller lestopibiotic (stealthy thievery of food or brood from other ant species) species known as “thief ants.” These thief ants are inconspicuous, smaller species that are often strictly subterranean and rarely collected, while the larger fire ant species are ground dwelling and commonly collected.

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In general, *Solenopsis* are ants in which the mandibles have 4 teeth. The clypeus is bicarinate with 0-5 teeth on the anterior margin, with a single seta present between the carinae on the anterior margin. The antennae of the workers have 10 segments, with a 2-segmented club, with the scapes rarely reaching the posterior lateral corners of the head. The metanotal suture is most often deeply impressed. Most species lack sculpturing on all body surfaces and are smooth and shiny.

The workers of the thief ant group have the above characteristics, but are very small (the majority rarely exceeding 2 mm in total length), with minute eyes (usually 1-5 ommatidia, rarely more than 18), and are most often concolorous yellow. The minor funicular segments 2-3 are most often slightly wider than long. Most species of thief ant are monomorphic or weakly polymorphic; a few of the Latin American species are strongly dimorphic to polymorphic.

There have only been three attempts at a synthetic work containing the thief ants. The first was that of Creighton (1930), where he provided keys to the workers of the former subgenus *Euophthalma* that occur in the New World and placed most of the other New World thief ants into species complexes. Creighton (1950) provided keys to the 10 United States species. Finally, Moreno-Gonzalez (2001) provided keys to the species of 3 out of the 5 species complexes that occur in North America. Unfortunately, these works consisted of isolated descriptions of few species or new castes with Creighton (1930, 1950) addressing only 20 species (10 from North America and 10 from South America) and Moreno-Gonzalez including 30 species restricted to North America.

Consequent studies have only addressed the fire ants of the genus *Solenopsis*, with a few small papers directed towards thief ants. Trager (1991) revised the larger fire ants of the *geminata* group, excluding the thief ants. In 1989, Thompson worked on the thief ants of Florida which addressed the 10 species that occur in that state. Subsequent papers have only contained descriptions of new species in localized areas such as those by Mackay and Vinson (1989), Snelling (2001), and Davis and Deyrup (2006). The South American thief ants of the genus *Solenopsis* have been ignored for the most part and are in need of revision (see Pacheco 2007).

We here describe a new diminutive species of thief ant that was discovered in a nest of *Tetramorium bicarinatum* in a rotten trunk from Bellavista, in the Island of Santa Cruz, in the Galápagos.

MATERIALS AND METHODS

Measurements and Indices

Measurements were made using a micrometer in a Wild stereoscope at 80X. All measurements are in millimeters. Acronyms of the morphometric characteristics are listed below. The measurements for medial ocellus length (MOL) and width (MOW) are solely for the gyne.

TL Total length from head to gaster measured in lateral view with head vertical. This measurement should be viewed as imperfect due to specimen shrinkage and variation in the orientation of the head and gaster; an occurrence especially seen in the gaster. It is merely included in this study for general comparison of overall size. Head length, head width, and Weber's length are better measures for overall size comparison.

HL Head length, measured in full frontal view, from the anterior margin of the medial lobe of the clypeus medial to the posterior border of the head.

HW Head width, measured in full frontal view, maximum width excluding eyes (measured immediately posterior to the eyes).

EL Eye length, maximum diameter of the eye.

ED Eye diameter, minimum diameter of the eye.

MOL Median ocellus length, maximum diameter of the ocellus.

MOW Median ocellus width, minimum diameter of the ocellus.

SL Scape length, excluding the basal condyle.

FSL Funicular segment length, referring to the total length of the minor segments 3-8.

CI Cephalic index, $HW/HL \times 100$.

SI Scape index, $SL/HL \times 100$.

PSL Propodeal spiracle length, maximum diameter of spiracle.

PSW Propodeal spiracle width, minimum diameter of spiracle.

PL Petiole length, maximum length of node measured in dorsal view, starting at posterior edge of peduncle and ending at anterior edge of helcium.

PW Petiole width, maximum width of the node measured in dorsal view.

PI Petiolar index, $PL/PW \times 100$.

PPL Postpetiole length, maximum length of the node measured in dorsal view, starting posterior to the helcium and ending anterior to the gaster.

PPW Postpetiole width, maximum width of node measured across node in dorsal view.

PPI Postpetiolar index, $PPL/PPW \times 100$.

WL Weber's length, a diagonal line from the top of the anterior edge of the pronotum to the posterior edge of the metapleural lobes.

Definitions (Modified from Pacheco 2007)

Lateral clypeal teeth — extensions of the longitudinal carinae, referring to the bicarinate projections extending past the anterior clypeal margin. These projections can be well defined “teeth,” angular “teeth” or lacking entirely within *Solenopsis*.

Extralateral clypeal teeth—referring to the additional projections extending laterally on the anterior clypeal margin adjacent to the lateral clypeal teeth. The projections can be well-defined teeth, angular projections or swollen bumps.

Antennal segments—antennal components consist of an elongate basal segment, the *scape*, followed distally by 9 smaller segments which together constitute the *funiculus*, with the last two segments swollen to form a *club*. The total antennal count is therefore 10. The lengths of segments 3-8 (the minor funicular segments) are an important character within the thief ants.

Digital micrographs can be found at the following websites: <http://www.utep.edu/leb/mackayantlab/pacheco.htm> and www.antweb.org

***Solenopsis gnoma* Pacheco, Herrera & Mackay New Species**

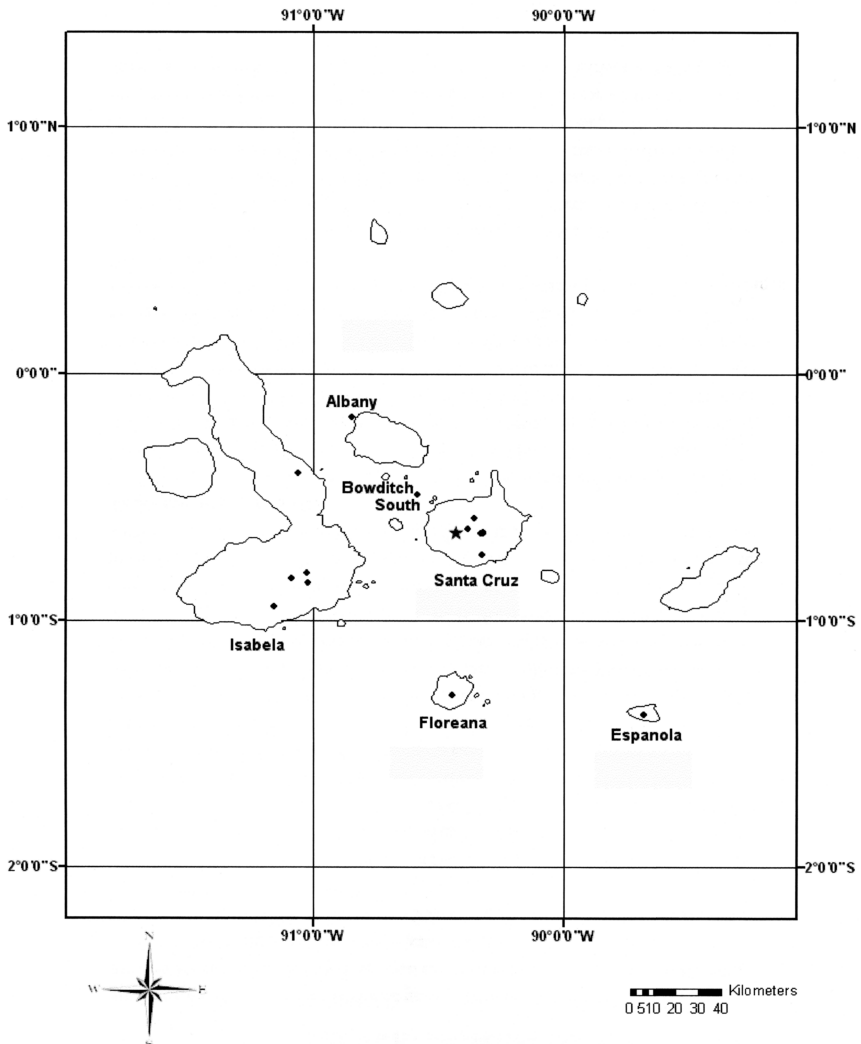
(Figs. 1-6; Map 1)

Diagnosis:

Worker. The worker of this species is bicolored, with a golden-brown body and brown gaster. The head is rectangular and is semi-coarsely punctated. The lateral clypeal teeth are well-developed and the extralateral teeth are angulate. The clypeal carinae converge posteriorly between the frontal lobes. The pronotum has semi-coarse punctation. The propodeal margin is

rounded, lacking a defined dorsal face. The petiole forms a triangular node viewed laterally.

Female. The female of this species is minute (2 mm in total length) and is concolorous dark brown, with golden-brown appendages. The clypeal carinae are well defined and converge posteriorly. The frontal lobes are vertically stri-



Map 1. *Solenopsis gnoma*. The star represents the type locality and the dots are additional localities.

ated. The medial ocellus is very small (0.03 mm). The metapleuron is horizontally striated. The petiole and postpetiole have roughened sculpturing.

Male. Unknown.

Worker measurements (n=7), mean in parenthesis:

TL 1.08-1.20 (1.16); HL 0.330-0.360 (0.353); HW 0.300; EL 0.036; ED 0.030; SL 0.250-0.258 (0.255); FSL 0.102; CI 83.3-90.9 (85.2); SI 70.0-75.8 (72.3); PL 0.060-0.066 (0.061); PW 0.078-0.084 (0.081); PI 71.4-78.6 (75.9); PPL 0.084-0.090 (0.086); PPW 0.108-0.114 (0.109); PPI 77.9-78.9 (78.1); WL 0.240-0.270 (0.259); PSL 0.030; PSW 0.030

Worker description:

Small, bicolored, golden-brown head, brown gaster; head rectangular, longer than wide, semicoarsely punctated; lateral clypeal teeth well developed, extralateral teeth angulate; clypeal carinae well defined, converge posteriorly on clypeus; frontal lobes vertically striated; scapes reach $\frac{3}{4}$ length to posterior lateral corner of head, semicoarsely punctated; minor funicular segments 3-8 short; eye small, black, 3-5 ommatidia; pronotum semicoarsely punctated, mesopleuron smooth and shiny; metapleuron horizontally striated; propodeal spiracle small; posterior propodeal margin rounded, lacking defined dorsal face; petiole forming triangular node, anterior and posterior face approximately 50 degree angles, lacking tooth ventrally; postpetiole node semicircular viewed laterally, wider than petiole and oval viewed dorsally, lacking tooth ventrally; gaster semicoarsely punctated.

Worker Pilosity:

Abundantly hairy, pilosity yellow; erect and suberect hairs of various lengths (0.03-0.09 mm) covering all body surfaces; long (0.072-0.09 mm) semierect hairs on first gastral tergum, curve posteriorly.

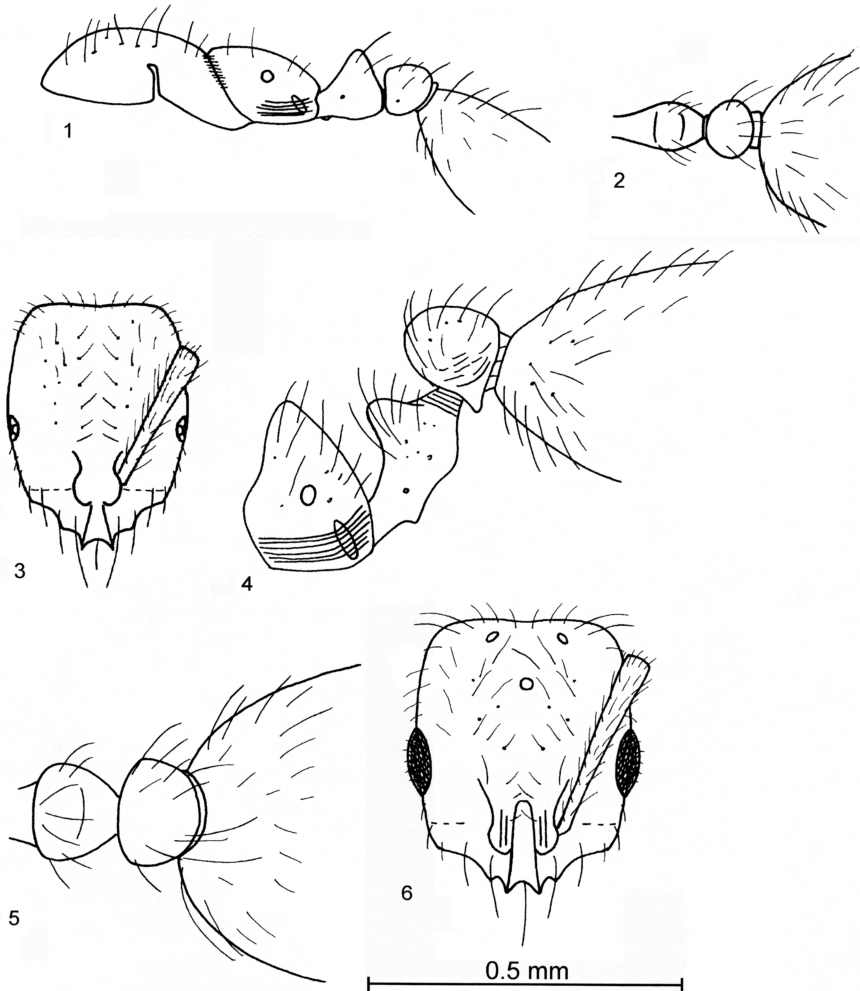
Female measurements (n=3):

TL 1.92-2.16 (2.08); HL 0.408-0.432 (0.420); HW 0.360; EL 0.120; ED 0.090-0.096 (0.094); MOL 0.030-0.036 (0.032); MOD 0.030-0.036 (0.032); SL 0.300; FSL 0.132; CI 83.3-88.2 (85.8); SI 69.4-73.5 (71.5); PSL 0.036-0.042 (0.038); PSW 0.030; PL 0.096-0.120 (0.108); PW 0.150; PI

64.0-80.0 (72.0); PPL 0.120-0.150 (0.130); PPW 0.174-0.180 (0.178); PPI 66.7-83.3 (72.9); WL 0.460-0.480 (0.473)

Female description:

Small; concolorous dark brown with golden-brown appendages; head



Figs 1-6. *Solenopsis gnoma*: 1, paratype worker, lateral view of mesosoma, petiole, postpetiole, and anterior part of gaster; 2, paratype worker, petiole and postpetiole as seen from above; 3, paratype worker, frontal view of head; 4, holotype female, lateral view of petiole, postpetiole, and anterior part of gaster; 5, holotype female, petiole and postpetiole as seen from above; 6, holotype female, frontal view of head. All figures are drawn to same scale.

rectangular, longer than wide, sides nearly straight, posterior border straight, semicoarsely punctated; lateral clypeal teeth well developed, extralateral teeth angulate; clypeal carinae well defined; frontal lobes vertically striated; scape extends to level of medial ocellus; eyes small, black, extend 0.036 mm past lateral margin of head; medial ocellus minute, without pigment; mesosoma smooth and shiny; metapleuron horizontally striated; petiole and postpetiole with roughened sculpturing, both lacking tooth or flange ventrally; first gastral tergum semicoarsely punctated.

Female Pilosity:

Abundantly hairy, pilosity light brown and yellow; erect and suberect hairs of various lengths (0.03-0.12 mm) covering all body surfaces; hairs on petiole and postpetiole longer (0.132 mm) than those on mesosoma, curve posteriorly; first tergum of gaster abundantly hairy with subsequent tergum nearly without any pilosity.

Biology and Habitat:

Females and workers of the type series were collected among a nest of *Tetramorium bicarinatum* in a rotten trunk. This species has also been found from as low as 170 m to 864 m at the top of Cerro Crocker (Crocker Hill) on Santa Cruz Island, between the Transition Zone and Humid Zone. It is common to find it foraging on rocks and on litter. It is most commonly found in humid places; nevertheless it has been found in dry localities like Albany, Bowditch South and Española Island.

Distribution:

Ecuador, Galápagos Islands: Albany; Bowditch South; Española; Floreana; Isabela and Santa Cruz: Bellavista (type locality).

Type series:

Holotype female (deposited in the Charles Darwin Research Station [IC CDRS]), Puerto Ayora, Santa Cruz-Galápagos and ANTWEB Casent# 104994, ECUADOR, Galápagos: Santa Cruz, Bellavista, 00°38'18.4" S, 090°25'44.6" W, 20-vii-2005, Colecta Manual, H. Herrera # HWH 137; 2 paratype workers (IC CDRS and 1 worker ANTWEB casent# 104995); 1 paratype female and 2 paratype workers deposited in the Museum of Comparative Zoology (MCZC); 1 paratype female and 2

paratype workers deposited in the collection of William and Emma McKay (CWEM).

Etymology:

From Latin, *gnomus*, meaning diminutive fabled being, referring to the minute size of the worker and female of this species (a noun in apposition).

Other material examined:

ECUADOR, Galápagos: ALBANY: 17-21.viii.2000, Micles A., 1 Worker (IC CDRS); BOWDITCH SOUTH: 27.vi.1999, Johnson. M., 1 worker (IC CDRS); ESPAÑOLA: 10.i.1998, Anónimo, 1 worker (IC CDRS); FLOREANA: Zona Agrícola, S01.1784020 W090.2663530, v.2003, tuna bait, Von Aesch L., 15 workers (IC CDRS); ISABELA: S[ierra] N[egra], Pampa, ii.1986, Barrido, A[bedrabbo] S., 1 worker (IC CDRS), SN, xii.1986, Barrido, AS, 104 workers (IC CDRS), SN, Pampa, 06-12.ii.1987, P[itfall] T[rap], AS, 19 workers (IC CDRS), SN, Pampa, 16-18.ii.1987, Barrido, AS, 8 workers (IC CDRS), SN, Pampa, vi.1987, PT, AS., 8 workers (IC CDRS), SN, Pampa, 13-25.vi.1987, PT, AS, 7 workers (IC CDRS), SN, Pampa, 23.ix.1987-04.x.1987, PT, AS, 109 workers (IC CDRS), SN, Pampa, 08-20. ix.1988, PT, AS, 40 workers (IC CDRS), SN, Pampa, 16-18.ix.1990, PT, AS, 1♀ and 50 workers (IC CDRS); V[olcán] A[lcedo], 570m, 03.vi.1997, cebo mantequilla de maní, R[oque] L., 1 worker (IC CDRS); VA, 850m, 06.vi.1997, cebo mantequilla de maní, RL, 14 workers (IC CDRS), VA, 900m, 13.v.2000, Litter, RL., 46 workers (IC CDRS), VA, 850m, cebo atún, RL, 24 workers (IC CDRS), VA, 1100m, 06.vi.1997, ex colectado en madera, RL, 1♀ and 1 worker (IC CDRS); Zona Agrícola, 05-08.iv.2006, PT, Stoa B., 2 workers; SANTA CRUZ: Bellavista, Finca R. Mora, 150m, 12.xi.1992-22.i.1993, PT, Lasso M., 4 workers, (IC CDRS); Bellavista, Zona de transición, 180m, 00°38'18.4"S, 090°25'44.6"W, 02.i. 2007, Colecta Manual, H. Herrera #HWH178, 1 worker (IC CDRS); Cerro Crocker, cumbre, 16.vii-15.viii.1993, PT, SA, 1W (IC CDRS); L[os] G[emelos], 27.viii.1997, RL, 1 worker (IC CDRS); LG, 03.xi.1997, V[iteri], P., 1♀ and 13 workers (IC CDRS), LG, 04.xi.1997, ex in ferns, RL, 5♀ and 4 workers (IC CDRS), LG, 04.xi.1997, ex in wood, RL, 42 workers (IC CDRS), LG, 04.xi.1997, ex in soil, RL, 25 workers (IC CDRS), LG, 08.xi.1997, VP., 5 workers (IC CDRS); LG, Zona de Scalecia, 17-20.iv.2006, PT, S[toa] B., 13 workers (IC CDRS); LG, Anónimo, 5♀ (IC

CDRS); M[edia] L[una], 21.vi.1992, Berlese, P[alacios], J., 3 workers (IC CDRS), ML, 630m, xii.1992, PT, PJ #369, 1♀ and 54 workers (IC CDRS); ML, Zona de Helechos, 19.v.2006, PT, SB, 18 workers (IC CDRS); Mirador, 11.vi.1992, Berlese, PJ #6.6., 1 worker (IC CDRS); Picachos, 670m, vi.1992, PT, PJ, 1♀ and 18 workers (IC CDRS); Transect Pto Ayora-Itabaca Z-Flank, 350m, 15.ii-01.iii.1986, PT, Baert L #86-102pf, 1♀ (IC CDRS); 24.ii.1998, Winkler, RL., 14 workers (IC CDRS); Finca M. Arias, 16.vi.2005, Colecta Manual, H. Herrera #HWH137, 10 workers (IC CDRS).

DISCUSSION

Solenopsis gnoma is one of three species of *Solenopsis* present on the Galápagos Islands and is apparently endemic. The other two species are *S. globularia pacifica*, a member of the former subgenus *Euophthalma*, and *S. geminata*, a fire ant from the *geminata* species complex. Queens and workers of *S. gnoma* are small even within the minute thief ants of the genus and its small size easily distinguishes it. Moreover, *S. gnoma* is monomorphic while *S. globularia* and *S. geminata* are both polymorphic. However, both the major and minor workers of both *S. globularia* and *S. geminata* are easily distinguished from *S. gnoma*.

Solenopsis globularia pacifica is distinguished by its greatly dilated, globose postpetiole. Additionally, the clypeal carinae are well developed with 5 teeth present on the anterior clypeal margin. The extralateral teeth are present as angles, the lateral teeth are well developed and a medial tooth is present as well. Moreover, the workers have horizontal striae present on the mesopleuron as well as the metapleuron and this species varies in color from light to dark brown. Furthermore, the eyes are large, with 15-25 ommatidia. *Solenopsis globularia pacifica* is most often found on beaches under rocks or in logs.

Solenopsis geminata are considerably larger than both *S. gnoma* and *S. globularia pacifica*, with a head length ranging from 1.06-2.20 mm, a length often larger than the total length of the workers of *S. gnoma* and *S. globularia pacifica*. *Solenopsis geminata* is distinguished further as both the minors and majors lack horizontal striae on the mesopleuron and metapleuron. Moreover, the petiole of the workers have a thin flange ventrally, a character lacking in both *S. globularia pacifica* and *S. gnoma*. Color is also variable within this

species ranging from red-orange to dark brown (occasionally bicolored) (Trager 1991).

Trager (1991) states that *S. geminata* found on the Galápagos is morphological identical to populations on the mainland, but are just smaller in size, similar to the western populations found in Colombia and Peru. *Solenopsis gnoma*'s size may be attributed to its insular isolation as seen with *S. geminata*. *Solenopsis gnoma* is similar to *S. tenuis*, a species found in Colombia and Ecuador, but it markedly smaller in total length in both the worker and female castes. Additionally, *S. tenuis* has smaller cephalic punctures and less developed lateral clypeal teeth.

KEY TO GALAPAGOS SOLENOPSIS

1. Large (HL 1.06-2.20, HW 1.00-2.33); second and usually third segment of funiculus at least 1 ½ times as long as broad; petiole with thin flange ventrally *geminata* Fabricius
- Smaller (HL 0.33-0.60, HW 0.30-0.50); second and at least third segment of funiculus only slightly longer than broad, usually broader than long; petiole lacking flange ventrally 2
- 2(1) Postpetiole greatly dilated, globose; eye with 15-25 ommatidia.....
..... *globularia pacifica* Wheeler
- Postpetiole oval-shaped (not dilated or globose); eye with 3-5 ommatidia ***gnoma* Pacheco, Herrera & Mackay, New Species**

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Galapagos Conservation Fund. This publication is the contribution N° 1056 of the Charles Darwin Foundation.

REFERENCES

- Creighton, W.S. 1930. The New World species of the genus *Solenopsis*. Proceeding of the America Academy of Arts and Sciences 66: 39-151.
- Creighton, W.S. 1950. The ants of North America. Bulletin of the Museum of Comparative Zoology of Harvard College 104: 1-585.
- Davis, L. & M. Deyrup 2006. *Solenopsis phoretica*, a new species of apparently parasitic ant from Florida (Hymenoptera: Formicidae). Florida Entomologist 89(2): 141-143.
- Mackay, W. P. & S. B. Vinson 1989. Two new ants of the genus *Solenopsis* (Diplorhoptum) from eastern Texas (Hymenoptera: Formicidae). Proceedings of the Entomological Society of Washington 91: 175-178.
- Moreno-Gonzalez, I. 2001. Revision of the North American Thief Ants, Thesis, The University of Texas at El Paso. 99 pp.
- Pacheco, J. 2007 The New World Thief Ants of the Genus *Solenopsis* (Hymenoptera: Formicidae), Dissertation, The University of Texas at El Paso. 565 pp.
- Snelling, R.R. 2001. Two new species of thief ants (*Solenopsis*) from Puerto Rico (Hymenoptera: Formicidae). Sociobiology 37: 511-525.
- Thompson, C.R. 1989. The thief ants, *Solenopsis molesta* group, of Florida (Hymenoptera: Formicidae). Florida Entomologist 72: 268-283.
- Trager, J. C. 1991. A revision of the fire ants, *Solenopsis geminata* group (Hymenoptera: Formicidae, Myrmicinae). Journal of the New York Entomological Society 99: 141-198.

