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# Transfer of two South American ant species from *Tapinoma* Foerster 1850 to *Forelius* Emery 1888 (Hymenoptera: Formicidae: Dolichoderinae)

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## Abstract

Some species of the ant genus *Forelius* can be misclassified as the genus *Tapinoma* due to the convergent reduction of the petiolar scale. I review the taxonomic status of *Tapinoma antarcticum* Forel 1904 and *Tapinoma heyeri* Forel 1902. Morphological evidence supports the transfer of these names to the ant genus *Forelius*. Proposed taxonomic changes are as follows: *Forelius antarcticus* (Forel) **comb**. **nov**. (=*Forelius fazi* (Santschi 1923) **comb**. **nov**., =*Forelius eidmanni* Goetsch 1933 **comb**. **rev**.); *Forelius heyeri* (Forel) **comb**. **nov**. (=*Forelius heyeri risii* (Forel 1912) **comb.** and **syn**. **nov**., =*Forelius pusillus* (Santschi 1922) **syn**. **nov**., =*Forelius tucumanus* (Kusnezov 1953) **syn. nov.**). Lectotypes for *Forelius antarcticus* and *Forelius heyeri* are designated. The worker of *Forelius heyeri*, as well as the worker and queen of *Forelius antarcticus* are diagnosed and redescribed. Multifocus images for lectotype workers are provided. Morphological variation within and between species of *Forelius* with rounded spiracles is discussed.

**Key words**: Chilean ants, morphology, multi-focus images, taxonomy, Uruguayan ants

## Introduction

The ants of the subfamily Dolichoderinae are found world-wide (Shattuck 1992) and eleven of the genera occur in the New World. The subfamily Dolichoderinae and its genera are natural taxa, since inference of evolutionary trees using both morphological (Shattuck 1995; Brandão *et al*. 1998) and molecular data (Chiotis *et al*. 2000; Ward *et al*. 2010; Boudinot *et al*. 2016) support monophyly. Within the Dolichoderinae, the genera *Forelius* Emery 1888 and *Tapinoma* Foerster 1850 belong to distantly related clades, the tribes Leptomyrmecini and Tapinomini, respectively (Ward *et al*. 2010; Boudinot *et al*. 2016). *Tapinoma* is cosmopolitan in distribution (Shattuck 1992); *Forelius* is restricted to the New World (Cuezzo 2000).

*Forelius* and *Tapinoma* can be differentiated from each other by the degree of development of the petiolar scale in the worker and queen: present in *Forelius*, and reduced or absent in *Tapinoma* (Shattuck 1992). Other morphological traits associated with the clypeus and the mandibles also establish differences between these two ant genera (Table 1). Unfortunately, these distinctions are not always clear, leading to confusion between the two genera. For example, some *Forelius* species have a petiole scale so reduced that at first glance they may be mistakenly placed in the genus *Tapinoma*. The latter has been one of the most taxonomically neglected ant genera, and some species described as *Tapinoma* may be misplaced. In contrast, *Forelius* was reviewed by both Shattuck (1992) and Cuezzo (2000), and the generic placement of its constituent species is more assured.

In this paper, I review the taxonomic placement of *Tapinoma antarcticum* Forel 1904 and *Tapinoma heyeri* Forel 1902. I assess the morphological traits listed in Table 1 and conclude that these taxa belong to *Forelius* and not *Tapinoma*. I redescribe the worker and queen of *Forelius antarcticus* and the worker of *Forelius heyeri*. Biological aspects of *Forelius antarcticus* are discussed in light of the new taxonomic changes.

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**TABLE 1.** Morphological differentiation between the workers of the ant genus *Tapinoma* and *Forelius*. Character states in *Tapinoma* are only recorded from species distributed in the Neotropical region, including *Tapinoma melanocephalum* (Fabricius 1793). Characteristics for *Tapinoma* species from other zoogeographic regions can be consulted in Shattuck (1992). Information adapted from Shattuck (1992) and Cuezzo (2000).

| Character | *Tapinoma* | *Forelius* |
|---|---|---|
| Anteromedial clypeal margin | broad, shallow concavity | entire, without a concavity or depression any of type |
| Anteroclypeal setae | 2–4 hairs shorter than or about the same length as the closed mandibles, those hairs straight to moderately curved ventrally | at least 2 long hairs curved ventrally, reaching or exceeding the closed mandibles |
| Mandible shape | subtriangular, with the external and basal margin strongly diverging distally | rectangular, with the external and basal margins subparallel to each other |
| Dentition pattern of the mandibular masticatory margin | 3–7 teeth and about 7 denticles | 3–7 teeth and 0–4 denticles |
| Mandibular basal margin | crenulate or denticulate along the entire surface smoothing proximally | completely smooth |
| Mandibular basal angle | undifferentiated | differentiated |
| Junction between the basal and masticatory margins of the mandible | relatively continuous, with an uninterrupted curve | delimited by a conspicuous basal tooth |
| Petiolar scale | very reduced or absent | reduced to weakly developed, strongly inclined anteriorly and with the anterior face much shorter than the posterior, in some cases pointed. |

## Material and methods

I studied type material of *Tapinoma antarcticum*, *Tapinoma heyeri*, and *Tapinoma heyeri risii.* I examined additional material from museum collections and new field collections. The following are acronyms for the institutions whose material I examined. Those marked with an asterisk (*) are not registered in Evenhuis (2020).

CBUM Centro de Colecciones Biológicas de la Universidad del Magdalena, Santa Marta, Magdalena, Colombia. *
CPDC Centro de Pesquisas del Cacao, Comissão do Plano de Lavoura, Itabuna, Bahia, Brazil.
MHNG Museum of Natural History, Geneva, Switzerland.
MZLS Museé Zoologique, Lausanne, Switzerland.
MZSP Museu de Zoología da Universidade de São Paulo, São Paulo, Brazil.
NHMB Naturhistorisches Museum, Basel, Switzerland.
PSWC Phillip S. Ward personal collection, University of California at Davis, CA, USA.*

Morphological descriptions and measurements of specimens were performed using a Nikon SMZ 740 binocular stereomicroscope equipped with a micrometer at magnifications of 96X. Morphometric characters were examined in workers and queens. The following measurements and indices were used (measurements expressed in millimeters): Head Length (HL), in full-face view, the maximum length taken from a line tangential to the posterior cephalic margin to the maximum projection of the anterior border of the clypeus; Head Width (HW), in full-face view, the maximum width of the cephalic capsule, recorded posterior to the compound eyes; Scape Length (SL), in full-face view, the maximum length of the first segment of the antenna (scape), excluding the neck that occurs just distal of the condylar bulb; Weber's Length (WL), in lateral view of the mesosoma, an oblique line from the point at which the pronotum meets the cervical shield to the lower posterior corner of the metapleural sclerite; Cephalic Index (CI), (HW/HL)*100; and Scape Index (SI), (SL/HW)*100.

High resolution images of *Tapinona antarcticum* workers, a *Forelius mccooki* (McCook 1880) queen, a *F. pruinosus* (Roger 1863) queen, and *Forelius pusillus* Santschi 1922 workers were downloaded from http://www.antweb.org . For each image I measured HL, HW, SL, and WL using Image J software (NIH, Bethesda, MD, USA). SL measured from images is an approximation and a minimum value, due to the unknown degree of inclination of the scape with respect to the focal plane of the equipment.

The type images are from www.antweb.org. In each case, unique specimen identifiers (e.g., CASENT0909784) and credits to photographers are provided.

Lectotypes of *Forelius antarcticus* and *Forelius heyeri* were designated by selecting a worker from the syntype series.

## Results

The two putative *Tapinoma* species and their corresponding synonyms listed below are transferred to the genus *Forelius* to generate new taxonomic combinations. These nomenclatural changes are supported by morphological traits of the specimens examined here (type series and additional material). Configuration of the anterior margin of the clypeus and mandibular characters place them in *Forelius*.

## Taxonomic accounts

### *Forelius antarcticus* (Forel 1904) comb. nov.

(Fig 1–4)

*Tapinoma antarcticum* Forel 1904: 17. Syntype series [two workers, three queens], Valparaíso, Chile (Hoffmann) [MHNG, examined]. One syntype worker (bottom specimen on the pin, CASENT0909784) here designated **lectotype**; remaining syntypes here designated **paralectotypes** (MHNG).

*Tapinoma fazi* Santschi 1923: 270. Syntype worker, male: Valparaíso, Chile (Faz) [NHMB and MZLS, AntWeb images of syntypes examined]. As junior synonym of *Tapinoma antarcticum*: Menozzi (1935): 321.

*Forelius eidmanni* Goetsch 1933: 28. Syntype worker, queen: Several localities (Cerro San Cristobal, Copiapó, Puntas Coloradas, Cerro de Provincia, and Zapallar), Chile [not examined] **comb. rev**. As junior synonym of *Tapinoma antarcticum*: Menozzi (1935): 321.

*Forelius fazi* (Santschi). Combination in *Forelius* (**comb. nov.**): present study.

**Additional Material examined**. Chile: Santiago de Chile, Curva 18, road below Farallones; manual collection; 22.Dec.1985; foraging in *Kageneckia* bush; SP Courtney, coll. (3w, one of those imaged CASENT0249758) (PSWC). Santiago de Chile, Rio Clarillo; 31.Mar.1993; AMD Aguiar (18w) (CEPLAC). Valpariso, no more data. (2w) (MZSP).

**Additional specimen images examined, provided by www.antweb.org**. Chile: same data as lectotype; (1w) Staatliches Museum für Naturkunde Karlsruhe (SMNK, Karlsruhe, Germany), FOCOL0717; Valparaíso, (1w) Musee Zoologique (MZLS, Lausanne, Switzerland), CASENT0907582; Valparaíso, (1w) Natural History Museum Basel (NHMB, Switzerland), CASENT0911576; Punta Colorada, (1w) Natural History Museum Basel (NHMB, Switzerland), CASENT0911575.

**Worker measurements.** Lectotype worker CASENT0909784: HL 0.61, HW 0.49, SL 0.51, WL 0.65, CI 81, SI 104.

Non-type and paralectotype workers (n= 13): HL 0.57–0.61, HW 0.49–0.51, SL 0.48–0.51, WL 0.61–0.65, CI 81–86, SI 98–104.

**Diagnosis**. Head with convex sides and posterior margin with a wide but relatively shallow concavity mesad. In profile, wide mesopropodeal depression formed by the posterior face of the mesonotum and the anterior propodeal face. Propodeal declivity twice as long as its dorsal face. Dorsum of pronotum with two erect setae, longer and thinner than those found in *F. heyeri*. Concolorous brown ants.

**Worker description.** Head dorsoventrally flattened, posterior cephalic corners rounded and evenly continuing to vertex; head width increasing behind compound eyes; dorsal surface densely punctate-reticulate, relatively shiny; abundant decumbent whitish setae on surface, lateral ventral margin with shorter setae; two pairs of long, thick

erect setae directed anteriorly, one pair in the middle of the length of the frontal carina, the other one in the middle of the lateral-posterior margin of the clypeus close to the antennal toruli; maxillary palps long, with segments 2 to 6 similar in length; eyes slightly convex and bulging. Mandibles wide, with the external margin curved especially in the area near the apical tooth, subtriangular in shape; dorsal surface in the mid-posterior region finely striated with abundant decumbent setae on the surface, the anteromedial portion smooth and relatively shiny, with long setae separated and curved downwards; ventral face near the external margin with some long protruding setae curved inwards; masticatory margin armed with a long, falcate apical tooth, subapical tooth triangular and slightly larger than the remaining three, 3rd and 4th teeth small and similar in size, 5th tooth separated from the penultimate by a diastema similar to the length of the 3rd tooth, clearly separating the masticatory margin of the basal one. Antero-clypeal margin completely entire and convex with one long erect central seta, slightly above and equidistant to the central two long erect setae directed anteriorly, the three setae exceeding the length of the closed mandibles; dorsal surface of the clypeus with some scattered suberect short setae. Scape with subparallel sides, slightly widened at the tip; relatively long, exceeding the posterior margin of the head capsule by a length equal to the length of the pedicel (~ 0.14 mm ± 0.02); pedicel cuneiform, twice as long as the second flagellomere, penultimate flagellomere subrectangular and of similar length, the last a little longer but as wide as the rest; scape and flagellomeres with abundant scattered suberect setae.

In lateral view, the promesonotum almost continuous, with the profile slightly broken by the promesonotal suture, pronotum convex meso-anteriorly, the rest flattened continuing towards the mesonotum, the latter smoothly sloping posteriorly; pronotal sides and mesopleuron smooth and shiny; in profile, metanotal suture impressed; in profile, dorsal face of the propodeum inclined upwards and forming a blunt angle with the declivitous face, this corner as high as the mesonotum; propodeal declivity smooth and shiny, almost twice the length of the dorsal face; propodeal spiracle small and circular, located below the margin of the declivity. Mesosoma with very short pilosity, surface punctate with some longitudinal reticulation on the dorsum of the pronotum.

Petiolar node with a very pronounced scale, directed forward; scale with a straight anterior face, posteriorly directed dorsal face, straight ventral face without a lobe of any kind; Gastral tergites with abundant decumbent whitish setae sparse enough to reveal the gastral surface; First gastral tergite without setae, 2nd and 3rd gastral terga with a pair of setae, 4th tergite with six thick setae; first gastral sternum with many long thick erect setae anteriorly and two or three on the posterior margin, 2nd gastral sternum with two thick erect setae.

Ants with short decumbent whitish setae. Relatively opaque body surface except in the meso and metapleural areas, which are smooth and shiny.

**Queen. Measurements** (n=3): HL 0.83–0.85, HW 0.73–0.77, SL 0.69–0.77, WL 1.59–1.63, CI 88–91, SI 92–105.

**Diagnosis**. Head rectangular, twice as long as wide (CI ≤ 46). Relatively long antennal scapes, SL > 0.70 mm. Large ants with shorter mesosomas (WL ≤ 1.65 mm) than *Forelius pruinosus* (WL 1.74) and *Forelius mccooki* (WL 1.67).

**Description.** Head with lateral margins straight, converging from the anterior half of the eyes towards the insertion of the mandibles, wider above the middle of the compound eye, cephalic vertex straight to where it meets the lateral margins, with a relatively shallow narrow medial concavity, cephalic vertex corners blunt and continuous with lateral margins; three large ocelli close to the concavity of the cephalic vertex; compound eyes large, surpassing the lateral margins of the head capsule more or less from the anterior half of the eyes in full-face view; integument surface densely punctate but punctures well separated from each other, abundant whitish and decumbent pilosity on the surface. Mandibles wide and elongate, with the external margin longer than the basal one; masticatory margin oblique, giving the mandibles a triangular shape; masticatory margin with six teeth: a long apical tooth, three times as long as the subapical, wide at the base and very acute, a triangular subapical tooth, a 3$^{rd}$ tooth slightly smaller than the preceding, 4$^{th}$ and 5$^{th}$ similar to the subapical tooth, and a 5$^{th}$ tooth reduced to an angle differentiating the masticatory margin from the basal tooth; two small projections present between the 3$^{rd}$ and 4$^{th}$ and 4$^{th}$ and 5$^{th}$ teeth; basal margin smooth. Mandibular dorsal surface with striae, slightly foveate with suberect setae, ventral face of the mandible smooth, with the same type of setae; mandibles reddish. Anterior clypeal margin complete, strongly convex medially; anteroclypeal rim with ventrally curved setae and one long central seta; dorsal face with few short, suberect and erect setae. Antennal scapes surpassing the posterior cephalic corners by less than half the pedicel length; the latter long (0.18 mm), wider distally and tapering towards the base; scapes and flagellomeres densely punctate and with subdecumbent setae; scapes with smooth and shiny surface, but flagellomeres opaque; last flagellomere almost twice the length of previous one.

In lateral view, pronotum as a broad band located anteriorly; dorsum of the mesonotum higher than the metanotum and propodeum; in dorsal view, mesoscutum diamond-shaped and convex anteriorly, higher amplitude medially and posterior face straight; conspicuous and slightly deep notauli, arising on each side of the posterior region of the mesoscutum, notauli running parallel and diverging towards the anteromedial region of the sclerite; in dorsal view, scutellum broad at the base, tapering posteriorly; anepisternum and katepisternum divided by almost imperceptible anapleural sulcus, impressed only in the center of the mesoepisternum; propodeal suture deeply impressed; in lateral view, propodeum inflated, with the dorsal face almost the same length as the posterior face but without an angle differentiating the faces, forming a continuous inclined profile; propodeal spiracle circular and located in the middle of the lateral face of the propodeum; metapleural gland open, with a thick, protruding ventral flange; integument finely and abundantly punctate, with relatively long, abundant, and well separated whitish setae; pronotum with two erect setae near the neck, four long erect setae spaced on the upper part of the posterior pronotal margin, three long erect setae on the anterior part of the mesoscutum and two long erect setae in the middle of the scutellum; bulla of the metapleural gland with abundant silver-gold setae, short erect setae on the ventral rim of the gland; legs with setae like those on the mesosoma.

Petiolar node with a very pronounced scale inclined strongly forward, ventral face with a well-formed posterior lobe; first gastral tergite with a deep frontal concavity to receive the petiolar scale; gastral tergal plates with silver pubescence, many long erect setae distributed near the posterior border and in the middle of the gastral plates.

Concolorous brown like the worker caste.

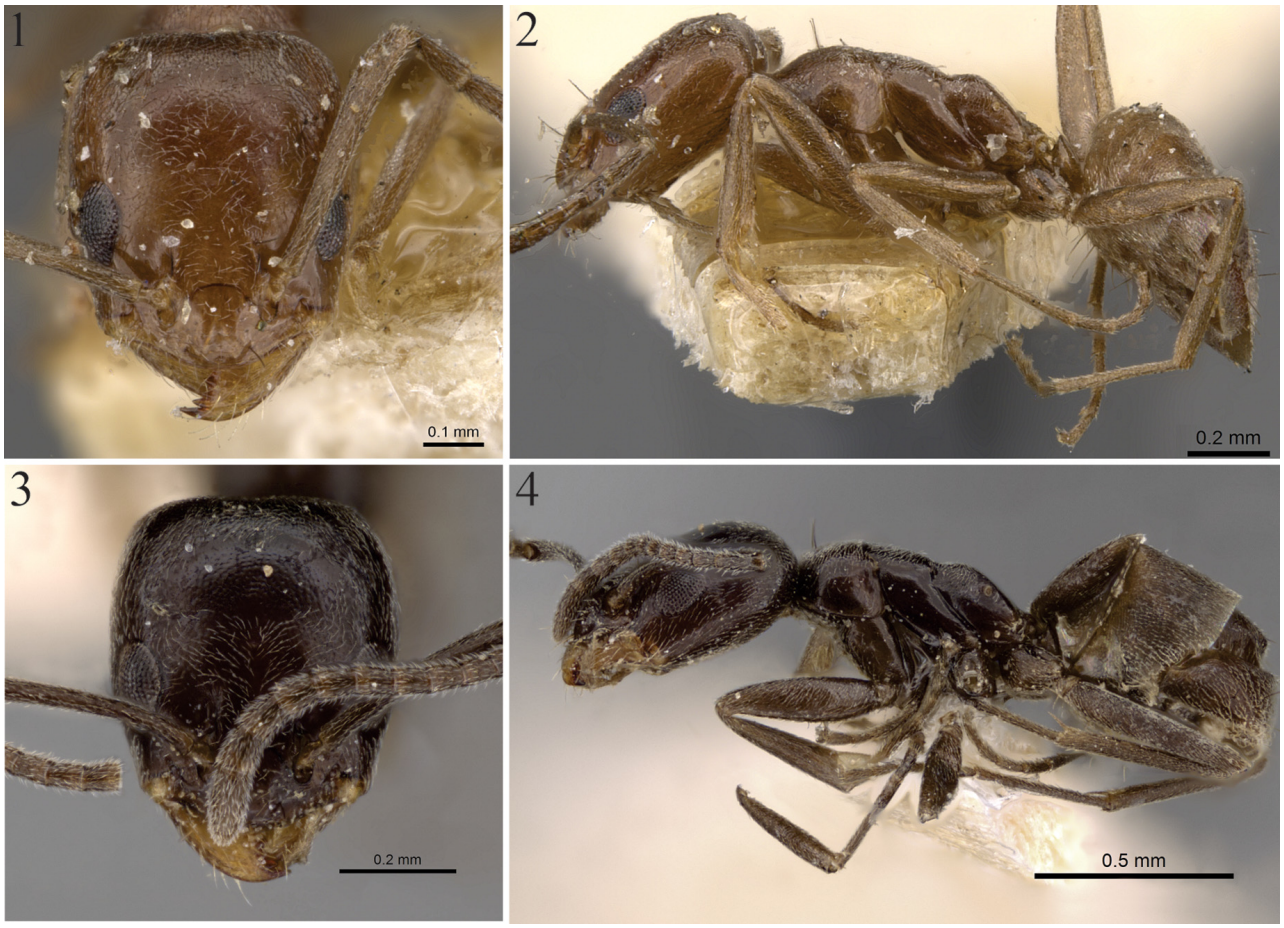


**FIGURE 1–4.** *Forelius antarcticus* (Forel, 1904) workers. 1–2) Full face view of the head, and profile of lectotype worker (CASENT0909784). 3–4) Full face view of the head, and profile of worker from Santiago de Chile (CASENT0249758). Images 1–2 by Will Ericson, and images 3–4 by Estella Ortega. All images from www.antweb.org.

**Comments**. The nominal taxon *Tapinoma antarcticum* and its junior synonyms, *Tapinoma fazi* Santschi and *Tapinoma eidmanni* (Goetsch), are transferred to the genus *Forelius*. The syntype specimens used by Forel (1904) to describe *T. antarcticum* are consistent with the diagnostic features of *Forelius* and not *Tapinoma*. The anterior clypeal margin is completely entire and convex, with three setae as follows: a medial long erect seta, and two flank-

ing long erect setae directed anteriorly, which together exceed the closed mandibles. In addition, the masticatory margin of the mandible is armed with five conspicuous teeth of different sizes, and the smooth basal margin is clearly differentiated from the masticatory margin by a tooth relatively smaller than the others. The characters examined correspond to those proposed by Shattuck (1992) and Cuezzo (2000) for the diagnosis of *Forelius* workers, contrasting notably with the diagnostic morphology for *Tapinoma* workers (see Shattuck 1992).

Several taxonomic problems have been associated with the name *Tapinoma antarcticum*, perhaps derived from morphological misinterpretations or the lack of systematic comparison of previously described specimens. Forel (1904) described *Tapinoma antarcticum* from workers and queens collected in Valparaiso (Chile). Later Santschi (1923) described *Tapinoma fazi* from the same locality as *T. antarcticum*. Goetsch (1933) described *Forelius eidmanni*, but Menozzi (1935) suggested that this species corresponded to the genus *Tapinoma* and not to *Forelius*, thus deriving the new combination *Tapinoma eidmanni* (Goetsch). Menozzi (1935) also suggested that both *T. fazi* (Santschi) and *T. eidmanni* (Goetsch) corresponded to *Tapinoma antarcticum*, therefore, those two names were proposed as junior synonyms of *T. antarcticum*. It is evident that sometimes the use of material from the same locality, by several authors or perhaps by the same author, can result in the description of the same species under different names, as is the case with *Tapinoma panamense* Wheeler 1934 and its junior synonym *Tapinoma canalis* Wheeler 1942, both described from the same series of ants from Panama (Shattuck 1992).

The queen of *Forelius antarcticus* is relatively smaller than those of *F. pruinosus* (Roger 1863). The head length of the queen of *F. antarcticus* is longer that the *F. pruinosus* queen (HL 0.75), but the mesosoma is relatively short (WL ≤ 1.65) compared to that of *F. pruinosus* (WL 1.74–2.7). *Forelius antarcticus* and *F. pruinosus* queens bear abundant decumbent whitish setae on the surface of the head and scapes, although they are relatively longer in *F. pruinosus* queens.

### *Forelius heyeri* (Forel 1902) comb. nov.

(Figs 5–10)

*Tapinoma heyeri* Forel 1902: 296. Syntype workers [two workers], São Leopoldo, Rio Grande do Sul, Brazil (Heyer) [MHNG, examined]. One syntype worker (CASENT0909771) here designated **lectotype**.

*Tapinoma heyeri* var. *risii* Forel 1912: 58. Holotype worker (by monotypy), Montevideo, Uruguay (D. Ris) [MHNG, examined] (CASENT0909772).

*Forelius breviscapus* var. *pusilla* Santschi 1922: 374. Syntype worker(s), Cordoba, Argentina (Biraben) [NHMB, AntWeb image of syntype examined, CASENT0911547].

*Forelius pusillus* Santschi. Status as species, senior synonym of *Forelius tucumanus* (Kusnezov 1953): Cuezzo 2000: 263. Junior synonym of *F. heyeri* (**syn. nov.**): present study.

*Forelius heyeri risii* (Forel). Combination in *Forelius* (**comb. nov.**) and junior synonym of *F. heyeri* (**syn. nov.**): present study.

*Neoforelius tucumanus* Kusnezov 1953: 330, figs. 1–12. Holotype male, nontype workers, queens: Argentina, Tucumán, 14 Dec 1949 (Kusnezov) [not examined]. Junior synonym of *Forelius pusillus* Santschi: Cuezzo 2000: 263.

*Forelius tucumanus* (Kusnezov). Combination in *Forelius*: Shattuck 1992: 95. Junior synonym of *F. heyeri*: present study (**syn. nov.**).

**Additional Material examined**. Uruguay: Lavalleja; 34º17’02.6”S 55º15’27.7”W; 4 m; manual collection; 07.Jun.2016; foraging on coarse sand dune; RJ Guerrero RJGF-0185 (3w) (CBUMAG).

**Additional specimen images examined, provided by www.antweb.org**. Paraguay: Canindeyú, Tendal, 24°12’20.112”S 55°33’57.167”W; 212m; 20.Nov.2002. A.L. Wild AWL1710 (1w) (ALWC). CASENT0173739.

**Worker measurements.** Lectotype: HL 0.57, HW 0.51, SL 0.47, WL 0.69, CI 90, SI 92.

**Other material** (n= 7): HL 0.45–0.53, HW 0.39–0.51, SL 0.32–0.43, WL 0.48–0.68, CI 83–96, SI 80–91.

**Diagnosis**. Posterior cephalic margin completely straight. Mandible with five teeth and one denticle. Scape much shorter (≤ 0.43 mm) than that of *F. antarcticus* (SL ≥ 0.69 mm), below or barely reaching the posterior cephalic margin by a length less than the width of the pedicel. Pronotum with two thick dark erect setae that contrast with the light integument, each seta arising from a distinct fovea.

**Description.** Head slightly longer than broad to subquadrate, with subparallel sides, slightly straight above the middle of the eyes to almost the most posterior region of the head where the margin curves inward; posterolateral corners blunt but differentiated; dorsal and ventral faces flattened, surface finely punctate and covered with abundant, very short, decumbent setae; four long erect setae arising from between the frontal carinae; eyes flattened,

relatively large (~ 0.16 mm), and located within the head capsule some distance from the lateral margin in frontal view; maxillary palps long and digitiform, reaching the middle of the occipital foramen, 2nd to 6th segment almost the same length. Mandibles relatively wide, with well differentiated semiparallel external and basal margins; masticatory margin reddish and armed with a very long, pointed and falcate apical tooth, followed by a subapical tooth ¼ of the length of the apical, a third tooth of equal size to the subapical, a fourth tooth followed by robust denticle, a diastema crenulate, and usually a small basal tooth; mandibular surface smooth and opaque, with widely spaced setae and coarse foveae. Clypeus with the anterior margin entire and convex; with setae of relatively equal length directed downwards, a very long median clypeal seta (0.14 mm in the Lectotype), curved downwards just beyond the closed mandibles and flanked by two shorter frontally directed setae. Antennae with scapes slightly widening distally; pedicel elongated, almost twice the length of the second flagellomere, 2nd to 7th flagellomeres semirectangular and equal in length, the remaining four increasing in length and width, with the last flagellomere very enlarged and almost twice the length of the preceding one; abundant short, decumbent and separate setae.

In lateral view, promesonotum continuous, slightly elevated in the region where these sclerites join, mesonotum flat, in lateral view metanotal groove marked but not deeply impressed, mesonotum and propodeum almost continuous with a slight sinuosity where meet them (in dorsal view fully fused); dorsal face of the propodeum almost the same length as the propodeal declivity, without an angle that differentiates the two faces; spiracle large and circular, aligned with upper margin of propodeal declivity; dorsum of head with long, thin appressed hairs, integument with very short, spaced hairs; mesopleuron and part of the metapleuron smooth and shiny, the latter with a few long yellow hairs separated from each other, extending over the surface of the metapleural bulla.

Petiolar scale very small, projecting forward, generally concealed by the front of the first gastral segment; gaster surface finely punctate, pilosity like that of the head; first and second gastral terga with no erect setae, third and fourth gastral tergites with four and six thick erect setae, respectively; gastral sternites 1–4 with 3 to 4 erect setae on each plate, the last sternum with two central setae.

Dull yellow to light yellowish brown throughout the body.

**Comments**. The name *Tapinoma heyeri* is transferred to the genus *Forelius* as the type workers have a completely convex and entire anterior margin of the clypeus, and they have three long setae on the anterior clypeal vertex which are equal in length to the semi-closed mandibles. Furthermore, the masticatory margin of the mandible bears five conspicuous teeth and two denticles, and the basal margin is smooth and differentiated from the masticatory margin by an acute angle.

Although the type specimens of *Forelius heyeri* and *F. heyeri risii* differ in size, they both share two pairs of long thick setae on the dorsum of the head, the first pair on the oblique-lateral side of the posterior portion of the clypeus, and the second pair near to the upper end of the frontal carinae. In both cases the setae are directed anteriorly. Both taxa have a continuous mesosomal profile, with the posterior end of the propodeum rounding evenly into the oblique posterior face, and short and appressed setae on the surface of the body. Two erect pronotal setae are visible in *F. heyeri*, but in the type specimen of *F. heyeri risii* these are difficult to evaluate (CASENT0909772). Three workers collected in Lavalleja (Uruguay) are relatively similar to the type *F. heyeri risii* but all bear the pair of erect pronotal setae found on the type of *F. heyeri*.

There are morphometric differences between the specimens associated with both names (Fig 11). The type of *F. heyeri risii* is much smaller than the type of *F. heyeri* (WL = 0.49 vs. 0.69, respectively). The head of *F. heyeri* is broader (CI≥ 90), with subparallel sides converging slightly anteriorly, and a straight vertex with an almost imperceptible medial depression, while the head of the worker of *F. heyeri risii* is narrower (CI= 83), with convex lateral margins, continuing in a straight vertex. Both specimens also differ in the length of the scape relative to head width. In *F. heyeri* the scape is relatively long (SI = 81–83) surpassing the vertex by a very short distance, just 0.04 mm, while in *F. heyeri risii* the apex of the scape is well below the cephalic vertex (SI = 67). The coloration is variable among the specimens studied, from dull yellow in *F. heyeri* to light brown in *F. heyeri risii*. Although the type specimens show differences, the specimens recently collected in Uruguay show a relative continuity in the morphological and metric traits between the types of *F. heyeri* and *F. heyeri risii* (Fig 11).

Cuezzo (2000) raised *F. pusillus* Santschi to the species level, offering a diagnosis and measurements that differentiated this *Forelius* species from all other species in South America. The taxonomic delimitation of *F. pusillus* by Cuezzo (2000) together with the measurements recorded here from a type specimen of *F. pusillus* and a non-type worker from Paraguay (measurements generated from images with codes CASENT0911547 and CASENT0173739, respectively) were compared with the diagnosis and description provided here for *F. heyeri*. *Forelius pusillus* and

*F. heyeri* fully agree in their morphology as follows: the workers of *F. pusillus* also have two thick, erect pronotal setae, as well as a mesosomal profile similar to that found in *F. heyeri*; the measurements are relatively variable throughout the distribution of these two putative taxa, with a similar morphometric space between those named *F. heyeri risii* and *F. pusillus*, but the nest-mate workers collected in Uruguay agree as much with those of *F. heyeri* as those of *F. pusillus* (Fig 11). In this sense, I do not find morphological evidence to differentiate between these taxa and I propose *F. pusillus* as junior synonym of *F. heyeri*.

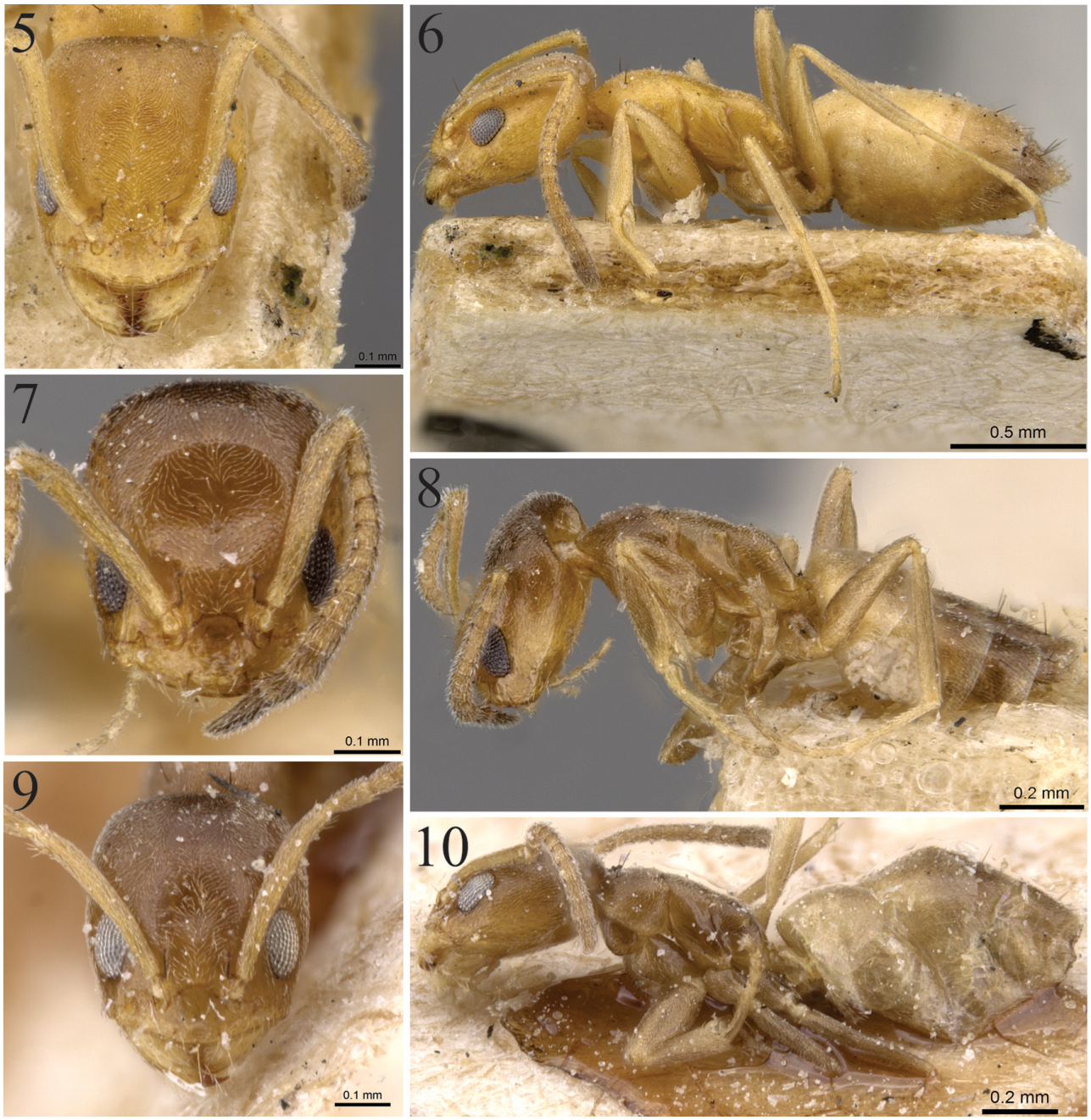


**FIGURE 5–10.** *Forelius heyeri* workers; type specimens of *F. heyeri* and its junior synonyms (*F. heyeri risii* and *F. pusillus*). 5–6) Full face view of the head, and profile of the *Forelius heyeri* lectotype worker (CASENT0909771). 7–8) Full face view of the head, and profile of the *Forelius heyeri risii* holotype worker (CASENT0909772). 9–10) Full face view of the head, and profile view of the *Forelius pusillus* syntype worker (CASENT0911547). Images 5–8 by Zach Lieberman, and images 9–10 by Will Ericson. All images from www.antweb.org.

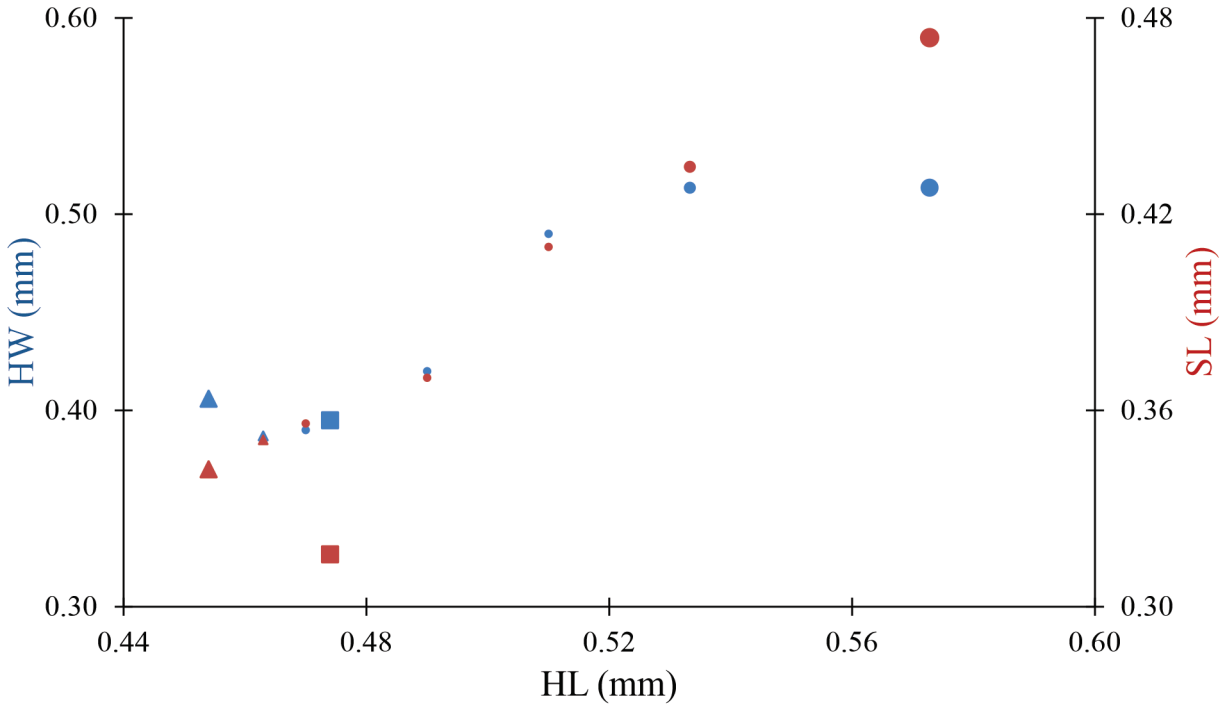


**FIGURE 11.** Bivariate plot relating the head length (HL) to both the head width (HW, left) and the scape length (SL, right) of *Forelius heyeri*. Small circles: three workers from a series recently collected in Uruguay. Medium circle: second syntype of *F. heyeri*. Large circle: *F. heyeri* lectotype. Square: *F. heyeri risii* lectotype. Small triangle: worker from Paraguay identified as *F. pusillus* on AntWeb (CASENT0173739). Large triangle: syntype of *F. pusillus*.

## Discussion

The genus *Forelius*, with a distribution exclusively in the Americas, is polymorphic with respect to the shape of the propodeal spiracle (Cuezzo 2000). A group of 13 species with an elongated spiracle are restricted to central and southern South America, while the other group of species bears a rounded spiracle and has a disjunct distribution, separated by the Amazon basin (Guerrero & Fernández 2008): four species ranging from southern North America to northern South America, and two species overlapping in their distribution with the assemblage of species with an elongated spiracle (Cuezzo 2000). In this taxonomic work, two species of *Forelius* with rounded spiracles are added to the South American fauna, *Forelius antarcticus* (Chile) and *F. heyeri* (Argentina, Brazil, Paraguay and Uruguay), while *Forelius pruinosus* and *F. damiani* Guerrero & Fernández (2008) are species that occur from Colombia and Venezuela northward.

There are many similar traits between *Forelius antarcticus* and *F. heyeri*, but the contrasting dark brown to black color in *F. antarcticus* and yellow to light brown in *F. heyeri* allows them to be separated. Furthermore, the dorsal face of the mandibles is striated in *F. antarcticus*, while in *F. heyeri* it is smooth, and the masticatory margin differs in the number of teeth and denticles, with 5 teeth and no denticles in *F. antarcticus* whilst *F. heyeri* with 4–5 teeth and one denticle. Additionally, the mesosomal profile is different between these species, much straighter and continuous to the dorsal face of the propodeum in *F. heyeri*, while in *F. antarcticus* the propodeum is slightly depressed and separated from the rest of the mesosoma by a wide and relatively deep groove.

In the Chilean ant list of Snelling & Hunt (1975), the taxonomic position of *Tapinoma antarcticum* is questioned, with the generic name in quotation marks (i.e, "*Tapinoma*" *antarcticum*), although there is no discussion of the taxonomic position of this taxon. When analyzing the figures (Snelling & Hunt (1975): figs 61–64), the habitus of both the worker and the queen clearly show morphological characteristics that match those of *Forelius*. For example, the anterior clypeal margin in both castes is entire and convex, the petiolar scale in the queen is very tall, and the petiolar scale in the worker is relatively prominent. In fact, one of the junior synonyms of *T. antarcticum* was originally described in *Forelius* as *Forelius eidmanni* Goetsch, 1933. *Forelius eidmanni* was recognized by Menozzi

(1935) as being misplaced and was then transferred to *Tapinoma* (as a junior synonym of *T. antarcticum*), a position supported by Kusnezov (1953).

In the description of *Neoforelius* (a junior synonym of *Forelius*), Kusnezov (1953) suggests that *Tapinoma fazi* perhaps corresponded to *Neoforelius* and not to *Tapinoma*, due to the similarity in some characteristics mentioned by Santschi (1923), such as the very small petiolar scale compared to the tall scale found in the *Forelius* of South America known up to that time. Considering the above, a characteristic that definitely supports the transfer of these ants to *Forelius* is the length of the scape in the males of "*Tapinoma*" *fazi* described by Santschi (1923), with the scape barely reaching the posterior third of the head, which contrasts with the long scapes that reach or exceed the vertex, an exclusive trait of *Tapinoma* males (synapomorphic character in Shattuck [1992]).

Ecological observations of *Forelius antarcticus* (Torres-Contreras [2001] and references therein) and *F. heyeri* (Santos-Sousa 2017) suggest that these species prefer dry to semi-desert habitats, environmental preferences that until now have not been recorded in any *Tapinoma* species within the Neotropical region. In general, *Tapinoma* species inhabit dry or humid or montane forest environments, using dead branches, leaves and live or dead stems, as a nesting resource (personal observations), but there are no data on nesting in bare soil with high solar exposure, which is characteristic of *Forelius*.

In conclusion, both the morphological evidence and the ecological information recorded for these species support their transfer from the genus *Tapinoma* to *Forelius*, resulting in the new combinations *Forelius antarcticus* and *Forelius heyeri*. The nomenclatural changes and taxonomic decisions made in this review provide taxonomic stability within the dolichoderine genera *Forelius* and *Tapinoma* and likewise improve biological knowledge of the genera.

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