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A review of the ant genus *Adelomyrmex* Emery 1897 (Hymenoptera, Formicidae) in Central America

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Abstract

The taxonomy and natural history of the ant genus *Adelomyrmex* Emery is reviewed for the Central American region. They are small, litter-inhabiting ants most often collected in Berlese and Winkler samples. Although the genus and its relatives have a pantropical distribution, Central American cloud forests are the only places where they are abundant and diverse. Several *Adelomyrmex* species are mountain-top endemics with very restricted ranges, and climate change clearly poses the threat of mountain-top extinction. The 21 Mexican and Central American species are treated in some detail and a key to the 26 mainland New World species is provided. Nine new species are described, eight from Mexico and Central America (*A. anxiocalor* **sp. nov.**, *A. bispeculum* **sp. nov.**, *A. dentivagans* **sp. nov.**, *A. marginodus* **sp. nov.**, *A. metzabok* **sp. nov.**, *A. nortenyo* **sp. nov.**, *A. paratristani* **sp. nov.**, and *A. quetzal* **sp. nov.)** and one from the oceanic Isla del Coco in the eastern Pacific (*A. coco* **sp. nov.)**. New synonymy is proposed for *Adelomyrmex tristani* (Menozzi, 1931) (= *A. brevispinosus* Fernández, 2003, **syn. nov.**).

Key words: biodiversity, taxonomy, new species, Myrmicinae, endemism, montane

Introduction

Adelomyrmex is a genus of small myrmicine ants that are part of the "microgenton" (Menozzi 1931), minute arthropods that inhabit rotting wood and leaf litter. Diagnosis of the genus and higher level systematic placement were addressed most recently by Fernández (2004). Fernández and MacKay (2003) provided a species-level treatment of the *A. laevigatus* group, and Fernández (2003) revised the entire genus, with a key to species. The center of *Adelomyrmex* abundance and diversity is Central America, and a few far-flung species occur in New Guinea, Samoa, Fiji, Tonga, New Caledonia, and Isla del Coco (Fernández 2003, Solomon & Mikheyev 2005, Wetterer 2002). In Fernández's 2003 revision there were two species from southern South America that were later segregated in the genus *Cryptomyrmex* (Fernández 2004). Thus the current geographic range of the genus in the New World is (1) the mainland from northern Mexico to Amazonian Brazil; (2) the Galápagos, where the mainland species *A. myops* is probably recently introduced (Herrera & Longino 2008); and (3) Isla del Coco, a small oceanic island north of the Galápagos, with a highly distinctive endemic species newly described in this report. The genus is unknown from the Caribbean islands. The center of abundance and diversity is the Central American highlands south to western Panama. Elsewhere in the range the genus is always very rare with low local diversity.

Over the past decade quantitative sampling of the leaf litter ant fauna has been carried out from Costa Rica to Chiapas, Mexico, as part of three large-scale biodiversity inventory projects: Arthropods of La Selva (ALAS), Conservation International's Tropical Ecological Assessment and Monitoring project (TEAM), and Leaf Litter Arthropods of MesoAmerica (LLAMA). These quantitative inventories have been augmented by extensive non-quantitative sampling using Berlese and Winkler extraction methods. A much larger specimen base than that available to Fernández (2003) now allows a more thorough assessment of the Central American fauna. The purpose of this study is to review the taxonomy of Central American *Adelomyrmex*.

Biology

In Central America, *Adelomyrmex* occur primarily in mature wet forest habitats, in rotten wood and leaf litter on the forest floor. They are far more abundant in montane cloud forest than in lowland rainforest. In some cloud forest habitats they can occur in nearly 100% of miniWinkler samples (1 m^2 samples of sifted litter) and dozens of individuals may occur in samples. In lowland rainforest they are rare, occurring in fewer than 10% of miniWinklers, and usually as one or two individuals per sample. Highland species are typically larger as well. Thus in some cloud forests *Adelomyrmex* make up a large proportion of the ant biomass (often sharing that role with another dominant cloud forest myrmicine genus, *Stenamma*; see Branstetter 2009). In contrast, in lowland habitats they are very rare and a minute proportion of the biomass. In South America they are always rare, whether in lowlands or cloud forest (Fernández, pers. comm.).

Foragers are almost never seen. *Adelomyrmex* workers generally have small eyes and presumably forage almost entirely beneath the litter. In baiting transects in cloud forest, *Adelomyrmex* are occasionally encountered, but not in numbers that reflect their abundance in sifted litter samples. Nothing is known of their feeding habits.

Given their abundance in cloud forest Winkler samples, remarkably few nests have been observed. Small nests of *A. tristani* and *A. paratristani* are occasionally found in bits of rotten wood on the ground. The dark workers curl and lie motionless on disturbance, blending with the background debris. Only the white brood gives them away. An exception is some montane sites in Guatemala and Chiapas where *A. robustus* occurs. *Adelomyrmex robustus* can be a more conspicuous presence, with large colonies in rotten wood at forest edges. *Adelomyrmex bispeculum*, a species endemic to Monteverde, Costa Rica, is only known from three nest collections. These nests were in small chambers in clay soil, one beneath a stone and two in a vertical trailside bank. It is revealing that this species has not been collected in the hundreds of sifted litter samples taken in the Monteverde area, in which *A. tristani* is very abundant. It suggests fine-scale microsite segregation of *Adelomyrmex* species.

The reproductive biology of *Adelomyrmex* is mysterious. In Winkler samples, *Adelomyrmex* workers are routinely accompanied by wingless queens and intercaste individuals. The queens are about the same size as workers but with ocelli, large compound eyes, and the typical enlarged mesosoma of myrmicine queens. The typical sclerites of winged queens and apparent wing scars are present. One queen of *A. silvestrii* from a Winkler sample has a shred of membranous wing, as though it were irregularly torn or chewed off. Intercaste individuals show variable intermediacy between workers and queens, with variable presence of a single median ocellus, compound eyes of intermediate size, and an enlarged promesonotum. In spite of the relative commonness of these putative reproductives, I have never seen a male or a winged queen in all of Central America. None have appeared in any of the hundreds of Winkler samples in the ALAS, TEAM, and LLAMA projects. None have appeared in LLAMA Malaise samples from the same sites where *Adelomyrmex* are abundant in the litter. The only known winged reproductives in the genus are the single report of males and alate queens of *A. vaderi* Fernández, a species from Colombia (Fernández 2003).

The results presented here suggest a high degree of endemism, with numerous isolated mountain-top species. Preliminary DNA barcoding results often suggest deep historical divisions between geographically separate populations of what are considered single species on morphological grounds. These results, along with the lack (or extreme rarity) of males and winged queens suggest a lineage with extremely low dispersability and gene flow, perhaps contributing to the high levels of endemism and geographic variation.

Characters

Castes. The queens are readily recognizable as distinct from workers, but intercaste individuals are problematic and can complicate identification. In isolated individuals, an intercaste may look like the worker of a species with larger eye and promesonotum. Often a trace of a median ocellus reveals an intercaste.

Clypeus. The clypeus is complex and is best viewed with the mandibles spread. This can be achieved prior to dry-mounting by inserting the tip of an insect pin between the closed mandibles from the ventral side and driving it through, so that at least one of the mandibles is wedged open. The clypeus is divided into posterior and anterior portions divided by a transverse carina, with the anterior portion folded under at an acute angle, so that in effect it becomes a ventral face. In full-face view the transverse carina forms a false anterior margin, and the recessed ventral (true anterior) margin is invisible. The carina forms a pronounced, narrow median projection that is typically bilobed or bidentate. The transverse carina descends from the medial projection to the lateral margins of the clypeus. Lateral to the medial projection, on the descending portions of the transverse carina or on the ventral margin of the clypeus, are a pair of triangular teeth (one on each side). In full-face view, these teeth are usually visible, projecting slightly from beneath the false anterior margin, to each side of the median projection.

When the head is viewed anteriorly (with mandibles spread), the ventral portion of the clypeus forms a pronounced triangular concavity delimited by the lateral wings of the transverse carina and the ventral margin of the clypeus. A common formation is for the lateral clypeal teeth to be at two vertices of the triangle, such that the descending transverse carinae and the ventral margin are confluent at the teeth. In *A. robustus*, the lateral teeth are large and confluent with the transverse carina, shifted somewhat medially relative to where the carina approaches the ventral margin. In other cases, most notably in *A. tristani*, the lateral teeth appear to be on the ventral margin and separate from the transverse carina. The carina passes in front of the tooth, and a narrow trough is visible between the carina and the tooth.

Mandible. The inner (ventral) surface of the mandible has a row of lamelliform setae that parallel the masticatory margin, a probable autapomorphy for the genus (Fernández 2003). The most common form of the mandible has the following characters: (1) subtriangular, with differentiated basal and masticatory margins; (2) the masticatory margin has three larger apical teeth followed by a series of two or three smaller teeth; and (3) the proximal basal margin, near the mandibular condyle, has a distinct tooth, with a deep indentation or notch between the tooth and the condyle. There is variation in the distinctness of the proximal teeth on the masticatory margin, and when the proximal teeth are reduced the basal and masticatory margins may not be sharply differentiated, but there is still a clear diastema between the basal tooth of the basal margin and the beginning of the masticatory margin. Some species have a distinctive modification, in which the most proximal tooth of the masticatory margin is shifted downward such that it is adjacent to the basal tooth of the basal margin. Thus there are two teeth on the basal margin, and a diastema separates these from the remaining teeth of the masticatory margin.

In the common formation, when the mandible is closed, the basal tooth rests against the outer face of the lateral clypeal tooth. The lateral clypeal tooth does not go in the notch behind the basal mandibular tooth. Thus, instead of the mandibulo-clypeal complex being a locking mechanism, limiting lateral movement, it may instead be a braking mechanism, such that when the mandible closes, the contact of mandibular and clypeal teeth constrains the degree or force of closure. In the forms with the double basal tooth, the lateral clypeal tooth is flanked by the two basal mandibular teeth. In this case, perhaps the function is both brake and stabilizer.

Surface Sculpture. The face and dorsal promesonotum may be coarsely and densely reticulate or vermiculate rugose, more longitudinally rugose (with varying degrees of linearity), smooth and shining with scattered large foveae, or completely smooth and shining. Occasionally there are combinations of these sculptural categories. The face and dorsal promesonotum can vary independently, with similar or contrasting sculpture. The petiole and postpetiole vary in the presence, density, and position of coarse rugae. Sculptural elements on the petiole and postpetiole distinguish species in some cases but also can be highly intraspecifically variable. The gastral dorsum is always smooth and shining.

Shape. There is relatively little species-specific variation in shape. The degree to which the anterior and dorsal faces of the pronotum are separated by an angle varies and is occasionally useful. The propodeal spines vary from short right angles, to triangular processes, to being spiniform, but they are highly intraspecifically variable and always short. The lateral profile of the petiole and postpetiole is highly variable but has diagnostic value in some species, in particular the strength and positions of transverse rugae on the posterior margins.

Pilosity. The nature of pilosity, although difficult to quantify, has great diagnostic value for separating species. Most species have dense decumbent to suberect pubescence on the scape, and this pubescence can be quite long such that the scapes look strongly setose, but a few species have in addition 1-4 very fine, long, erect setae that are clearly differentiated from the underlying pubescence. These can be difficult to see, and should not be confused with similar long setae that line the frontal carinae on the face (almost universally present). In profile, the setae on the face, mesosoma, and gaster can vary from dense, short, and subdecumbent to sparse, long, and erect. Although continuously variable when considered across all species or across the range of a geographically variable species, differences in dorsal pilosity often separate sympatric species that are otherwise very similar. The tibiae also vary in the presence and number of long erect setae above the underlying pubescence. In most species tibial setae are present, but some species largely lack them, at least in parts of the range. But the character is just variable enough, even within populations, to limit its use in identification.

Measurements. In many ant groups, allometric relationships among body parts vary among species and aid species identification. *Adelomyrmex* appear quite uniform in allometry, such that traditional measures of proportional head width and scape length are of no service. Thus, all that is needed is a standard measure of size. I have used head width to indicate size because the head capsule is a rigid structure with sharp boundaries, and head width is easy to measure on most specimens.

HW: head width; in full-face view, maximum width of head capsule **including eyes** if eyes protrude beyond margins of head.

FSH: facial seta height; measured in profile from surface of approximate midpoint of face to general top of setal layer, e.g. not to maximum height of longest projecting seta.

FSI: FSH/HW.

Methods

Observations were made at 63x magnification with a Leica MZ12.5 dissecting microscope. Measurements were made with a dual-axis micrometer stage with output in increments of 0.001 mm. However, variation in specimen orientation, alignment of crosshairs with edges of structures, and interpretation of structure boundaries resulted in measurement accuracy to the nearest 0.02 mm. All measurements are presented in mm.

All holotypes and paratypes associated with the new species described here have unique specimen-level identifiers ("specimen codes") affixed to each pin. Specimen codes should not be confused with collection codes, which are associated with particular collection events. When reported, collection codes follow the collector. Specimen collection data are derived from a specimen database and are not direct transcriptions of labels. Latitudes and longitudes are reported in decimal degrees, as a precise point (five decimal places) followed by an error term in meters. The new species reported here were collected in the context of large-scale biodiversity surveys and in many cases are represented by tens to more than 100 collection events from small areas. Images of holotypes, distribution maps, and all specimen data on which this paper is based are available on AntWeb (AntWeb 2012).

Repositories

Collections are referred to by the following acronyms, which follow the Insect and Spider Collections of the World website (Evenhuis 2012):

BMNH	The Natural History Museum, London, United Kingdom.
CAS	California Academy of Sciences, San Francisco, CA, USA.
DEI	Senckenberg Deutsches Entomologisches Institut [former Deutsches Entomologisches Institut], Müncheberg, Germany.
EAPZ	Escuela Agricola Panamericana, Tegucigalpa, Honduras.
ECOSCE	Colección Entomológica de El Colegio de la Frontera Sur, Unidad San Cristóbal, Chiapas, Mexico.
IAVH	Instituto Alexander von Humboldt, Villa de Leyva, Colombia.
ICN	Insect Collection, Instituto de Ciencias Naturales, Universidad Nacional de Colombia, Bogotá D.C., Colombia.
INBio	Instituto Nacional de Biodiversidad, Costa Rica.
JTLC	John T. Longino, personal collection, University of Utah, Salt Lake City, UT, USA.
LACM	Los Angeles County Museum of Natural History, Los Angeles, CA, USA.
MCZC	Museum of Comparative Zoology, Cambridge, MA, USA.
MIZA	Museo del Instituto de Zoologia Agricola, Universidad Central de Venezuela, Maracay, Venezuela.
MZSP	Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil.
UCD	University of California, Davis, CA, USA.
UNAM	Universidad Nacional Autonoma de Mexico, Mexico D. F., Mexico.
USNM	National Museum of Natural History, Washington, DC, USA.
UVGC	Colección de Artrópodos, Universidad del Valle de Guatemala, Guatemala City, Guatemala.

Synopsis of the genus *Adelomyrmex* Emery 1897

Adelomyrmex Emery, 1897: 590. Type species: *Adelomyrmex biroi* Emery, by monotypy.

Adelomyrmex in Myrmicinae, Leptothoracini: Emery, 1914: 42; Forel, 1917: 245; Wheeler, W.M. 1922: 664; Emery, 1924: 268; Donisthorpe, 1943: 620; Chapman & Capco, 1951: 110; Kempf, 1972: 18; Wheeler, G.C. & Wheeler, J. 1985: 257; Dlussky & Fedoseeva, 1988: 79; Jaffe, 1993: 11.

Adelomyrmex in Myrmicinae, Stenammini: Ashmead, 1905: 383; Bolton, 1994: 106.

Adelomyrmex incertae sedis in Myrmicinae, Stenammini: Bolton, 2003: 59.

Adelomyrmex in Myrmicinae, Adelomyrmecini: Fernández, 2004: 326.

Apsychomyrmex Wheeler, W.M. 1910: 261. Type species: *Apsychomyrmex myops* W.M. Wheeler, by monotypy.

Apsychomyrmex in Myrmicinae, Leptothoracini: Emery, 1914: 42; Forel, 1917: 245; Wheeler, W.M. 1922: 664; Emery, 1924: 268; Donisthorpe, 1943: 624. Junior synonym of *Adelomyrmex*: Kempf, 1972: 18.

Arctomyrmex Mann, 1921: 457 [as subgenus of *Adelomyrmex*]. Type-species: *Adelomyrmex (Arctomyrmex) hirsutus* Mann, by original designation. Junior synonym of *Adelomyrmex*: Brown, 1973: 178 [provisional]; Bolton, 1994: 106.

Taxonomic synopsis (New World species)

Adelomyrmex anxiocalor **sp. nov.**
Adelomyrmex betoi Fernández, 2003
Adelomyrmex bispeculum **sp. nov.**
Adelomyrmex brenesi Longino, 2006
Adelomyrmex coco **sp. nov.**
Adelomyrmex costatus Fernández, 2003
Adelomyrmex cristiani Fernández, 2003
Adelomyrmex dentivagans **sp. nov.**
Adelomyrmex foveolatus Fernández in Fernández & MacKay, 2003
Adelomyrmex grandis Fernández, 2003
Adelomyrmex laevigatus MacKay in Fernández & MacKay, 2003
Adelomyrmex longinoi Fernández, 2003
Adelomyrmex mackayi Fernández, 2003
Adelomyrmex marginodus **sp. nov.**
Adelomyrmex metzabok **sp. nov.**
Adelomyrmex micans Fernández in Fernández & MacKay, 2003
Adelomyrmex microps Fernández in Fernández & MacKay, 2003
Adelomyrmex minimus Fernández in Fernández & MacKay, 2003
Adelomyrmex myops (W.M. Wheeler, 1910)
Adelomyrmex nortenyo **sp. nov.**
Adelomyrmex paratristani **sp. nov.**
Adelomyrmex quetzal **sp. nov.**
Adelomyrmex robustus Fernández, 2003
Adelomyrmex silvestrii (Menozzi, 1931)
Adelomyrmex striatus Fernández, 2003
Adelomyrmex tristani (Menozzi, 1931)
= *Adelomyrmex brevispinosus* Fernández, 2003, **syn. nov.**
Adelomyrmex vaderi Fernández, 2003

Key to the species of *Adelomyrmex* (workers)

This key contains only species known from the mainland Americas. Species from Melanesia and elsewhere (including a new species from Isla del Coco described in this paper) are not included.

1. Postpetiole in profile with a posterior triangular projection extending over gaster and closely appressed to it; in dorsal view postpetiole longer than wide; face and mesosomal sculpture of vermiculate rugae, never with beaded appearance; HW 0.5–0.6. Mexico to Costa Rica . . . . . *A. silvestrii* (Menozzi)
- Postpetiole in profile may have a posterior rim or slight projection over gaster, but rarely with a large triangular projection, in dorsal view about as wide as long or wider than long, if longer than wide, face and mesosomal rugae beaded or HW > 0.8 . . 2
2. Scape with 1–4 long erect setae projecting above underlying dense pubescence. 3
- Scape lacking long erect setae. 6
3. Mandible lacking differentiated basal and masticatory margins; counting from basal tooth on basal margin (near mandibular insertion), second tooth closer to basal tooth than to third tooth, or equidistant betweeen them (Fig. 1A) 4

- Mandible with differentiated masticatory and basal margin; with a single tooth at base of basal margin that is well separated from teeth of the masticatory margin (Fig. 1B) (masticatory margin dentition variable, may have 5 or 6 teeth, apical 3 always present and large, basal 2–3 often reduced to small denticles or absent) 5

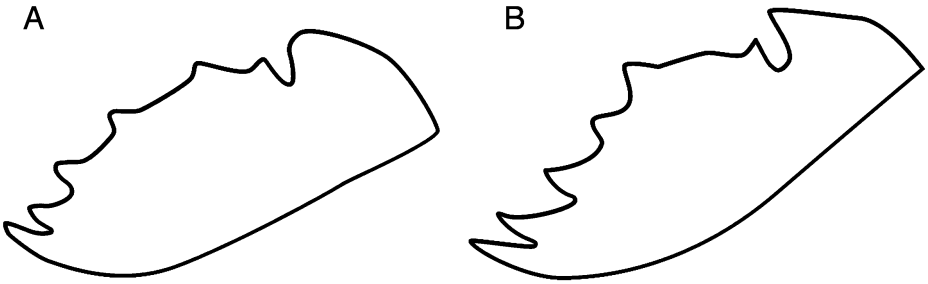

FIGURE 1. Mandibular dentition of (A) *Adelomyrmex dentivagans* and (B) *A. tristani*.

4. Metanotal groove not impressed in profile view; setae on dorsal surfaces of head, mesosoma, and gaster long and erect; petiolar node more quadrate in profile, posterior and dorsal faces more distinctly separated by a transverse carina; rugae of lateral and dorsal faces of pronotum wavy but somewhat longitudinally oriented (Fig. 2A). Southern Mexico to Honduras . . . . . *A. dentivagans* **sp. nov.**
- Metanotal groove impressed; setae on dorsal surfaces shorter, denser, and more decumbent; petiolar node more rounded dorsally; pronotal rugae more reticulate, with no longitudinal orientation (Fig. 2B). Northern Mexico. . . . . *A. nortenyo* **sp. nov.**

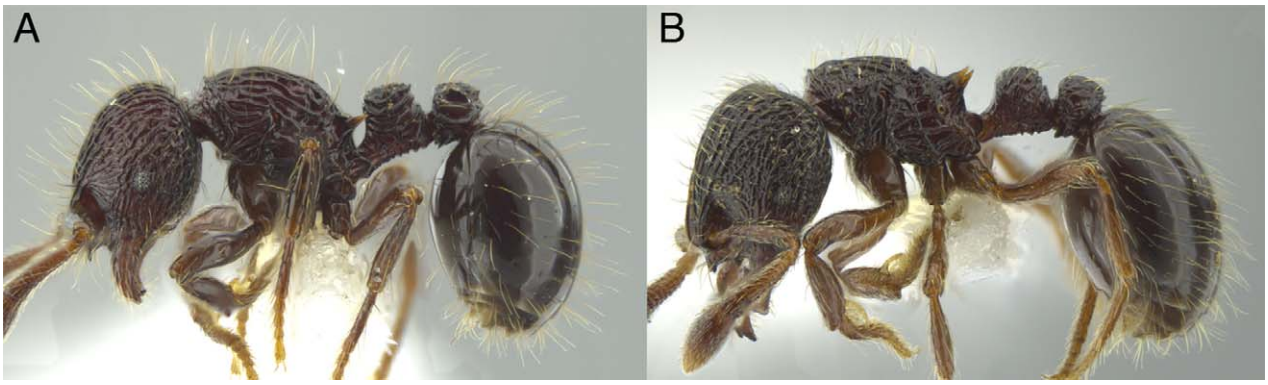

FIGURE 2. Profile of (A) *Adelomyrmex dentivagans* and (B) *A. nortenyo*.

5. Anterior and dorsal face of pronotum less sharply differentiated in profile; posterior margin of postpetiole lacking pronounced transverse rim (Fig. 3A). Honduras to Costa Rica . . . . . *A. longinoi* Fernández
- Anterior and dorsal face of pronotum more sharply differentiated in profile; posterior margin of postpetiole with sharp projecting transverse rim (Fig. 3B). Southern Mexico to Honduras . . . . . .*A. marginodus* **sp. nov.**

FIGURE 3. Profile of (A) *Adelomyrmex longinoi* and (B) *A. marginodus*.

6. Mandible lacking differentiated basal and masticatory margins; counting from basal tooth on basal margin (near mandibular insertion), second tooth closer to basal tooth than to third tooth, or equidistant betweeen them (Fig. 1A) 7
- Mandible with differentiated masticatory and basal margin; with a single tooth at base of basal margin that is well separated from teeth of the masticatory margin (Fig. 1B) 9

7. Size small, HW < 0.55. Colombia, Ecuador . . . . . *A. cristiani* Fernández
- Larger, HW > 0.55. Central America 8
8. Strongly bicolored, with dark brown head and mesosoma, light yellow brown gaster; metanotal groove impressed. Southern Mexico, Guatemala . . . . . *A. mackayi* Fernández
- Concolorous dark brown; metanotal groove not impressed. Guatemala . . . . . *A. quetzal* **sp. nov.**
9. Face smooth and shining, or smooth and shining with coarse foveae; if rugose sculpture present it is faint and restricted to anterior and lateral margins 10
- Face densely rugose or costate throughout 14
10. Face completely smooth and shining, lacking foveae (Fig. 4A) 11
- Face with sparse large foveae, interspaces smooth and shining (Fig. 4B) 12

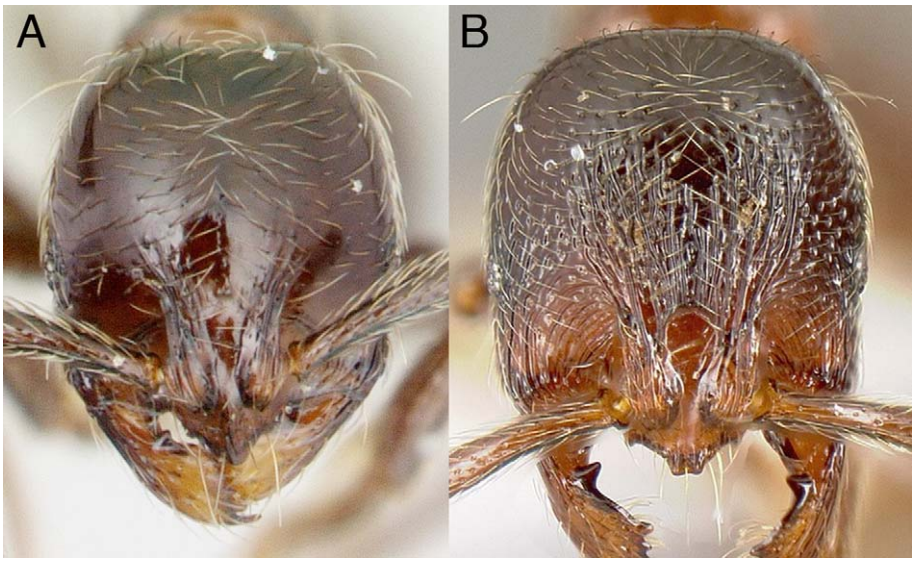

FIGURE 4. Face of (A) *Adelomyrmex micans* and (B) *A. brenesi*.

11. Dorsal promesonotum completely smooth and shining. Southern Mexico to Honduras . . . . . *A. micans* Fernández
- Dorsal promesonotum longitudinally rugose. Honduras. . . . . *A. anxiocalor* **sp. nov.**
12. HW approximately 0.7mm; propodeum depressed below level of promesonotum, juncture of promesonotum and propodeum step-like. Costa Rica . . . . . *A. brenesi* Longino
- HW < 0.6mm; promesonotum and dorsal face of propodeum form a continuous convexity 13
13. Eyes with 7–8 ommatidia; HW approximately 0.5 mm. Costa Rica . . . . . *A. foveolatus* Fernández
- Eyes with 1 ommatidium; HW < 0.5 mm. Costa Rica . . . . . *A. minimus* Fernández
14. Dorsal promesonotum completely smooth and shining 15
- Dorsal promesonotum rugose or costate 16
15. Color dark brown to black; confluent dorsal and posterior faces of propodeum with four or more transverse rugae above epipetiolar carina, subequal in size; gastral pilosity short, much shorter than height of postpetiole above posterior carina (Fig. 5A). Costa Rica . . . . . *A. laevigatus* MacKay
- Color red brown; confluent dorsal and posterior faces of propodeum with a single strong transverse ruga between propodeal spines, no rugae or a very faint ruga between it and epipetiolar carina, 1–2 faint rugae above it; gastral pilosity usually longer and denser, about as long as height of postpetiole above posterior carina (Fig. 5B). Costa Rica, Honduras . . . . . *A. microps* Fernández

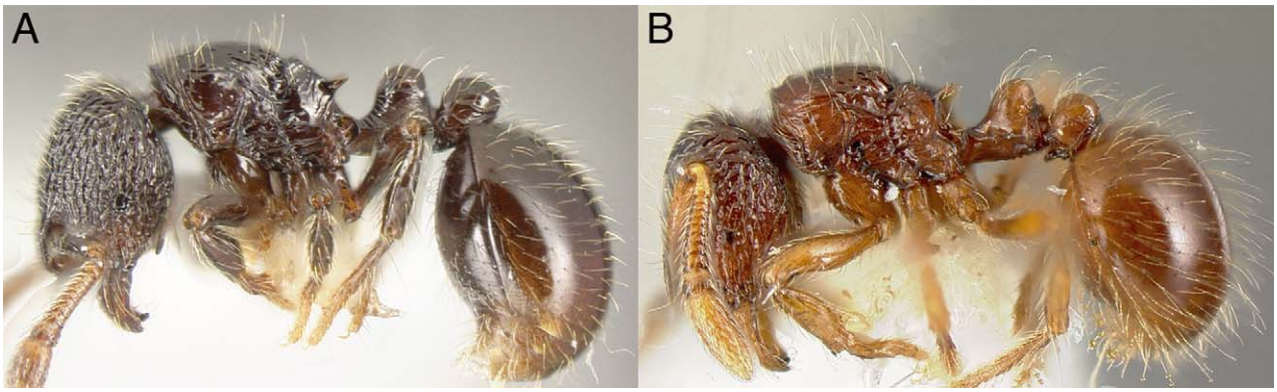

FIGURE 5. Profile of (A) *Adelomyrmex laevigatus* and (B) *A. microps*.

16. Dorsal promesonotum vermiculate rugose, without strong longitudinal orientation of rugae (Fig. 6A) (see additional discussion under *A. myops* for problematic differentiation of *A. myops* and *A. paratristani* in some cases) 17
- Dorsal promesonotum more linearly rugose, with substantial longitudinal orientation of rugae (Fig. 6B) 18

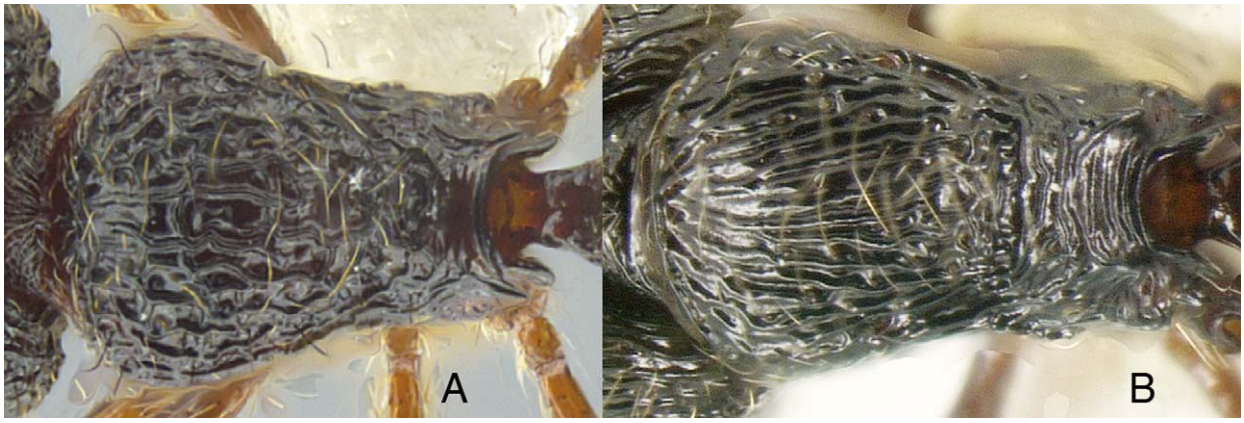

FIGURE 6. Promesonotal dorsum of (A) *Adelomyrmex myops* and (B) *A. tristani*.

17. Promesonotum strongly produced, highest at mesonotum, steeply dropping to dorsal face of propodeum; posterior faces of petiole and postpetiole each with dorsal transverse ruga, such that in profile nodes appear somewhat flat-topped and with posterior tooth (Fig. 7A). Southern Mexico, Guatemala . . . . . *A. metzabok* **sp. nov.**
- Promesonotum lower, not strongly elevated above dorsal face of propodeum; petiolar and postpetiolar nodes more rounded dorsally in profile (Fig. 7B). Guatemala to Panama, Galapagos . . . . . *A. myops* (W.M. Wheeler)

FIGURE 7. Profile of (A) *Adelomyrmex metzabok* and (B) *A. myops*.

18. Rugae of face and mesomal dorsum with beaded appearance (Fig. 8A); HW < 0.6; postpetiole distinctively shaped with short, concave, smooth and shining posterior face that is closely appressed to gastral dorsum, sharply separated from sculptured dorsal face by a pronounced sharp transverse carina; with dorsal pilosity abundant or nearly lacking. Southern Mexico . . . . . *A. betoi* Fernández
- Rugae of face and mesosomal dorsum not beaded (Fig. 8B); HW variable; postpetiole with taller posterior face that is not closely appressed to gastral dorsum and not sharply divided from dorsal face 19

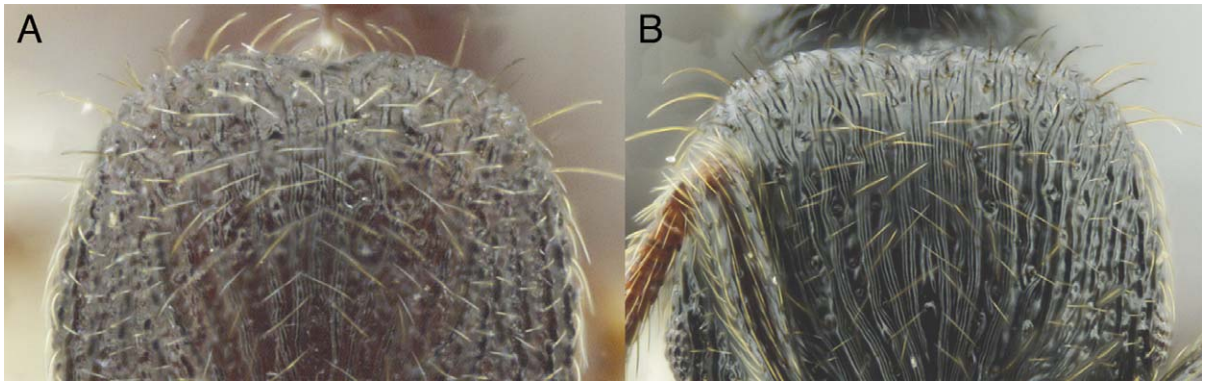

FIGURE 8. Face of (A) *Adelomyrmex betoi* and (B) *A. paratristani*.

19. Antennal fossa with large completely smooth and shining patch that extends to level of posterior margin of compound eye, sharply differentiated from coarse sculpture that covers the rest of the face (Fig. 9A); petiolar and postpetiolar nodes largely smooth and shining, evenly rounded, without differentiated anterior, dorsal, and posterior faces; hind and mid tibia lacking long erect setae that project above subdecumbent pilosity. Costa Rica . . . . . *A. bispeculum* **sp. nov.**

- Antennal fossa completely sculptured (Fig. 9B), or with a small smooth area that does not extend to posterior margin of eye; petiolar and postpetiolar nodes with variable extent of coarse rugae and often with more differentiated anterior, dorsal, and posterior faces; tibial setae present or absent 20

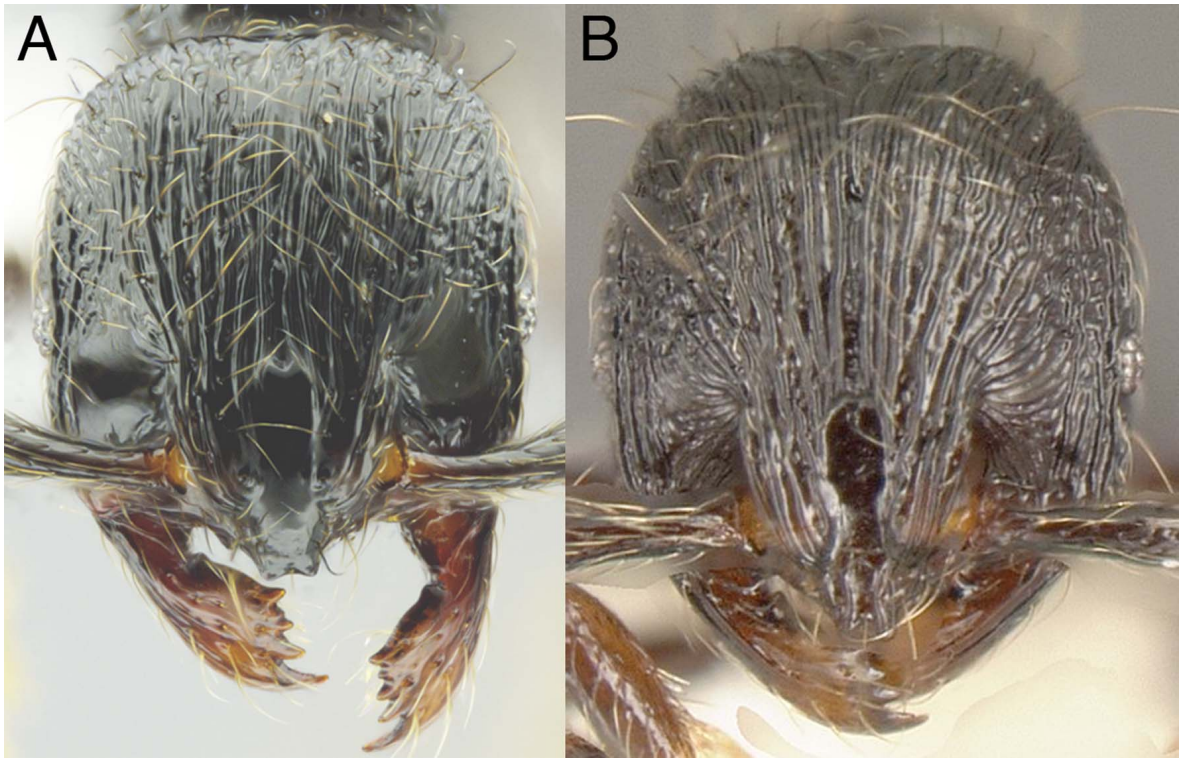

FIGURE 9. Face of (A) *Adelomyrmex bispeculum* and (B) *A. tristani*.

20. HW > 0.7 21
- HW < 0.7 23
21. Mandible with six teeth on masticatory margin 22
- Mandible with five teeth on masticatory margin. Southern Mexico, Guatemala . . . . . *A. robustus* Fernández
22. Uniformly dark brown; face and mesosoma more regularly and evenly striate; postpetiole in dorsal view wider than long, in lateral view with posterodorsal carina less developed. Colombia. . . . . *A. grandis* Fernández
- Somewhat bicolored, with dark head and mesosoma, lighter red brown gaster; face and mesosoma more irregularly reticulate-striate; postpetiole in dorsal view longer than wide, in lateral view with more pronounced posterodorsal carina or projection. Colombia . . . . . *A. vaderi* Fernández
23. Face and mesosomal sculpture very regularly costate, with broad, flattened costae and narrow interspaces (Fig. 10A) 24
- Face and mesosomal sculpture more irregularly rugose, rugae sharper and with broader interspaces (Fig. 10B) 25
24. Promesonotum strongly convex anteriorly, with an asymmetrical profile. Amazonian Brazil, Ecuador, Peru . . . . . *A. striatus* Fernández
- Promesonotum more evenly convex, more symmetrical, and not produced anteriorly. Colombia . . . . . *A. costatus* Fernández
25. Dorsal pilosity of head, mesosoma, and gaster relatively short, dense, and subdecumbent (Fig. 11A); FSH usually < 0.06 mm, FSI < 0.1; HW 0.48–0.62 (queen mesonotum largely smooth and shining in northern part of range, from Honduras northward; grading to form in Nicaragua and Costa Rica with sculpture like *A. paratristani*) (problematic specimens of *A. myops* may key here; see additional discussion under *A. myops*) (some specimens of *A. cristiani*, from South America, may key here; see additional discussion under *A. cristiani*). Southern Mexico to Costa Rica . . . . . *A. tristani* (Menozzi)
- Dorsal pilosity of head, mesosoma, and gaster relatively long, less dense, and more erect (Fig. 11B); FSH usually > 0.06 mm, FSI > 0.1; HW 0.54–0.71 (queen mesonotum longitudinally rugose except for anteromedian triangular patch that is smooth and shiny). Southern Mexico to Nicaragua . . . . . *A. paratristani* **sp. nov.**

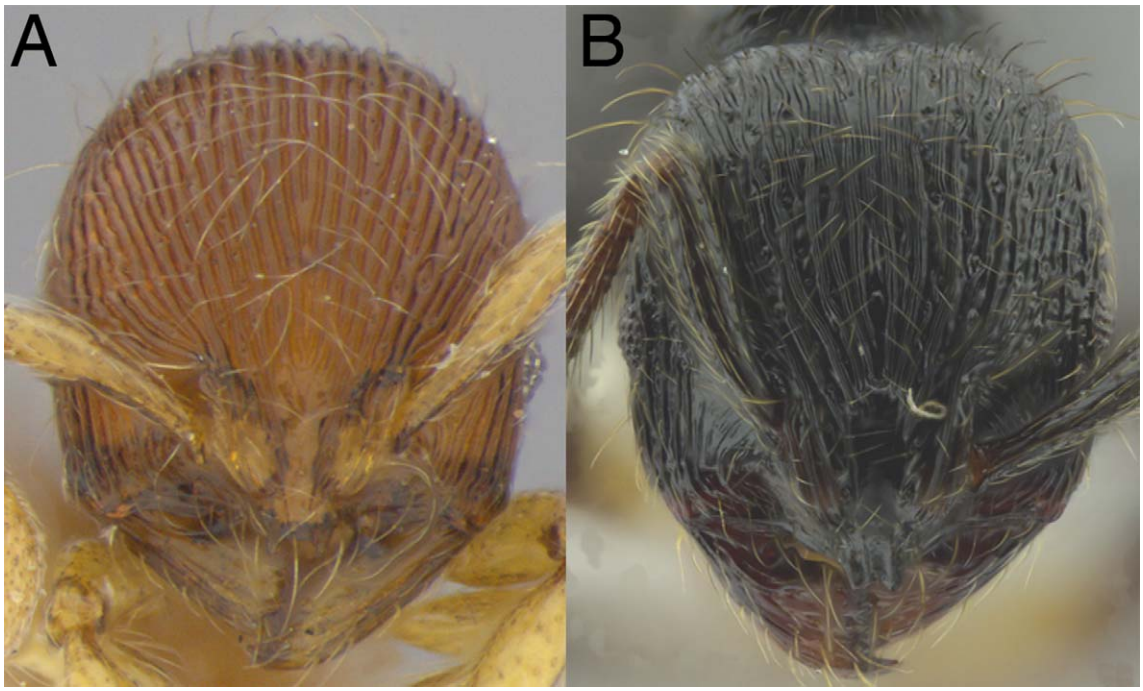

FIGURE 10. Face sculpture of (A) *Adelomyrmex striatus* and (B) *A. paratristani*.

FIGURE 11. Profile of (A) *Adelomyrmex tristani* and (B) *A. paratristani*.

Species accounts

Adelomyrmex anxiocalor Longino, sp. nov.

(Figs 12, 21)

Type material. *Holotype worker.* Honduras, Olancho: 11km N Catacamas, 14.94949 −85.91559 ±20 m, 2080 m, 8 May 2010 (LLAMA Wa-C-02-2-07) [CAS, unique specimen identifier CASENT0615104]. *Paratypes* (workers): Honduras, Olancho: 12km N Catacamas, 14.95307 −85.91669 ±20 m, 2190 m, 13 May 2010 (R.S.Anderson 2010-028) [BMNH, CASENT0628586], [EAPZ, CASENT0628587], [ECOSCE, CASENT0628588], [ICN, CASENT0628590], [INBIO, CASENT0628591], [LACM, CASENT0628594], [MCZC, CASENT0628583], [MZSP, CASENT0628584], [UCD, CASENT0628589], [UNAM, CASENT0628592], [USNM, CASENT0628585], [UVGC, CASENT0628593].

Geographic range. Honduras.

Diagnosis. Face largely smooth and shining, without prominent rugae or large foveae; promesonotal dorsum uniformly sculptured with linear, longitudinal rugae (promesonotal dorsum is smooth and shiny on the similar *A. micans*).

FIGURE 12. *Adelomyrmex anxiocalor* **sp. nov.**, holotype (Honduras, CASENT0615104). Scale bars are 0.5 mm for face and dorsal views, 1.0 mm for lateral view.

Description. *Worker.* HW 0.65–0.76 (n=5); mandible with differentiated masticatory and basal margins; masticatory margin with 5–6 teeth; basal margin sinuous with a distinct basal tooth and notch between tooth and condyle; dorsal surface of mandible with 2–3 faint longitudinal striae and several large piligerous puncta; in full face view, lateral clypeal teeth project from beneath clypeal shelf; lateral clypeal teeth located on anterior (ventral) margin of clypeus and separate from transverse carina that forms clypeal shelf; hypostomal tooth present as a minute denticle; compound eye composed of 8–11 ommatidia; face largely smooth and shining, with clusters of thin, weak, longitudinal rugae near frontal carinae and medial to compound eye.

Short anterior face of pronotum weakly separated from dorsal face, a low transverse ruga irregularly present; promesonotum evenly and shallowly convex; metanotal groove impressed; propodeal spines well-developed, spiniform, slightly upturned; space between propodeal spines a broad concavity without distinct dorsal and posterior faces, smooth and shiny with 2–5 transverse rugae; dorsal promesonotum and side of mesosoma more or less uniformly covered with linear, longitudinal rugae; petiolar and postpetiolar nodes rounded, posterior face of petiole variably rounded to subquadrate; petiole and postpetiole coarsely rugose; postpetiole in dorsal view about as long as wide, evenly rounded posteriorly; gastral dorsum smooth and shining.

Scape with abundant subdecumbent pubescence; clypeus and frontal carinae with long erect setae; posterior and posterolateral margins of head with long erect setae; mid and hind tibia with abundant long subdecumbent setae and 2–3 differentiated erect setae that are longer than width of tibia; in profile, dorsal surfaces of head, mesosoma, and gaster with relatively sparse, long, erect setae; FSH 0.08 mm, FSI 0.10.

Color dark brown to black.

Queen. Similar to worker except for queen-specific characters of large compound eyes, ocelli, and enlarged mesosoma with queen-typical sclerites; pronotum smooth medially, laterally with coarse parallel rugae; mesonotum entirely smooth and shining; scutellum with longitudinal parallel rugae, weaker medially;

katepisternum smooth and shining except for short longitudinal rugae along posterior margin; lower half of anepisternum smooth and shining, upper half with longitudinal parallel rugae; side of propodeum with longitudinal parallel rugae.

Biology. This species is known exclusively from La Picucha, the highest peak in the Sierra de Agalta in eastern Honduras. It occurs only above 2000 m elevation, in the wet cloud forest around the peak and in the short dwarf forest on the peak itself. It did not occur in multiple Winkler samples taken between 1500–1700 m on the same slope. Most collections are from sifted litter; two collections are workers that came to baits. The species was abundant, occurring in 80% of miniWinkler samples. This is a mountain top endemic threatened by climate change.

Etymology. Fearing heat, in reference to its vulnerability to climate change.

Adelomyrmex betoi Fernández, 2003
(Figs 8, 21)

Adelomyrmex betoi Fernández, 2003: 13, fig. 72. Holotype worker: Mexico, Veracruz: Córdoba, Paraje Nuevo, Nacimiento, tropical evergreen forest, 7 Aug 1969 (S. & J. Peck, Ver. 176) [MZSP] (not examined). Paratype worker: Mexico, Veracruz: 4.4mi N Huatusco, 4200', 2 Aug 1973 (A. Newton) [MZSP] (not examined). Paratype worker: Mexico, Oaxaca: 15 miles S Valle Nacional, 21 May 1971 (S. Peck B204) [JTLC] (examined).

Geographic range. Mexico (Oaxaca, Veracruz).

Biology. *Adelomyrmex betoi* is only known from the three collections reported in Fernández (2003) and a fourth potentially conspecific collection discussed below. The holotype is from evergreen wet forest around some springs 10km NNE of Córdoba. Although I do not have the precise georeference for this area, the elevation of the region is between 1000 and 1500 m. A second site near Córdoba is reported, also near 1000 m elevation. The third reported site was 15 miles south of Valle Nacional. Although reported with an elevation of 400 ft, this is almost certainly an error. Fifteen miles south on the main highway from Valle Nacional is between 1500–1600 m elevation. Thus *A. betoi* occurs in wet forest habitats above 1000 m in the mountains of Oaxaca and Veracruz states, Mexico.

Comments. *Adelomyrmex betoi* has a highly distinctive habitus. The rugae on the face and dorsal mesosoma are beaded, unlike all other species in the genus. The postpetiole has a short, concave, smooth and shining posterior face that is closely appressed to the gastral dorsum and sharply separated from the sculptured dorsal face by a pronounced sharp transverse carina. The postpetiole shape may represent a transitional stage between the long, posteriorly pointed postpetiole of *A. silvestrii* and the more globular to trapezoidal postpetiole of all other species.

The three collections reported by Fernández are unique in the genus in being essentially hairless, with no erect setae on the dorsal surfaces of the head, mesosoma, and gaster. All other species in the genus are abundantly setose. However, a fourth collection is tentatively identified as *A. betoi*, although the workers differ dramatically in pilosity. A series of six workers was collected in a Berlese sample by R. S. Anderson in 1992 (RSA92-029), within a few km of the same locality as the Peck paratype, south of Valle Nacional in Oaxaca. In all size, shape, and sculpture characters they are identical to the paratype I have in my collection (S. Peck B204). However, they are abundantly clothed in dorsal pilosity, expressing the condition typical for the genus. Further work is needed to determine whether this variation is intra or interspecific.

Adelomyrmex bispeculum Longino, sp. nov.
(Figs 9, 13, 21)

Type material. *Holotype worker.* Costa Rica, Alajuela: 4km ENE Monteverde, 10.31716 −84.7761 ±10 m, 1675 m, 23 Dec 2010 (J. Longino#7220) [CAS, unique specimen identifier CASENT0618512]. *Paratypes* (workers): same data as holotype [BMNH, CASENT0627886], [EAPZ, CASENT0627887], [ECOSCE, CASENT0627888], [ICN, CASENT0627890], [INBIO, CASENT0627891], [LACM, CASENT0627894], [MCZC, CASENT0627883], [MZSP, CASENT0627884], [UCD, CASENT0627889], [UNAM, CASENT0627892], [USNM, CASENT0627885], [UVGC, CASENT0627893].

Geographic range. Costa Rica.

Diagnosis. With the characters of *A. tristani*, differing in the presence of an expansive, completely flat, smooth, shining space on anterolateral head, from level of compound eye across to frontal carina, anteriorly to clypeus, with abrupt transition to strong rugose sculpture on rest of face; petiolar and postpetiolar nodes smooth and shining, without coarse rugae.

FIGURE 13. *Adelomyrmex bispeculum* **sp. nov.**, holotype (Costa Rica, CASENT0618512). Scale bars are 0.5 mm for face and dorsal views, 1.0 mm for lateral view.

Description. *Worker.* HW 0.54–0.59 (n=3); mandible with differentiated masticatory and basal margins; masticatory margin with 5–6 teeth; basal margin sinuous with a distinct basal tooth and notch between tooth and condyle; dorsal surface of mandible largely smooth and shining, with a few faint longitudinal striae and several large piligerous puncta; in full face view, lateral clypeal teeth project from beneath clypeal shelf; lateral clypeal teeth forming juncture between anterior (ventral) margin of clypeus and transverse carina that forms clypeal shelf; hypostomal tooth absent; compound eye composed of 8–9 ommatidia; face with longitudinally oriented, parallel linear rugae, barring smooth space described in diagnosis.

Short anterior face of pronotum meeting dorsal face at obtuse angle, separated by a low, simple transverse ruga; promesonotum evenly and shallowly convex; metanotal groove impressed; propodeal spines short, triangular, acute at tip; space between propodeal spines a broad concavity without distinct dorsal and posterior faces, smooth and shiny with 3–4 transverse rugae, strongest anteriorly; rugae of dorsal promesonotum and side of mesosoma mostly with strong, longitudinally oriented, parallel linear rugae; petiolar and postpetiolar nodes rounded, smooth and shining, without rugae; postpetiole in dorsal view about as long as wide, evenly rounded posteriorly; gastral dorsum smooth and shining.

Scape with abundant subdecumbent pubescence; clypeus and frontal carinae with long erect setae; posterior and posterolateral margins of head with long erect setae; mid and hind tibia with abundant subdecumbent pilosity but lacking any differentiated erect setae; in profile, dorsal surfaces of head, mesosoma, and gaster with relatively short, dense subdecumbent to suberect setae; FSH about 0.04–0.06, FSI 0.07–0.11 (n=3).

Color dark brown to black.

Queen. Similar to worker except for queen-specific characters of large compound eyes, ocelli, and enlarged mesosoma with queen-typical sclerites; pronotum smooth medially, laterally with a few faint rugulae; dorsal mesonotum completely smooth and shining; scutellum smooth and shining medially, longitudinally rugose laterally; katepisternum smooth and shining; anepisternum smooth ventrally, longitudinally rugose dorsally; side of propodeum longitudinally rugose.

Biology. This species occurs in montane cloud forest. It is known only from three nest collections in the cloud forest of Monteverde, Costa Rica, and not from any of the many Winkler samples that have been taken at the site. The nests were collected at 1400 m and 1675 m elevation. One nest was under a stone on the forest floor. It was a 1 cm diameter chamber that contained a few workers and brood. Two additional nests were found in close proximity in a shaded, moss-covered clay bank along a trail. The bank material was moderately friable, not stiff clay. For one nest, the entrance was a horizontal turret, about 1 cm long and 1 cm outer diameter, 5 mm inner diameter. The turret was of fresh material, with a rough surface of adhering particles. A large lower chamber extended 2–3 cm into the bank. A smaller upper chamber, about 1 cm long, had an entrance in the ceiling of the lower chamber. Most workers and brood were in the upper chamber; a few workers were in the lower chamber. The nest contained one dealate queen, 17 workers, and brood. A similar nest was about 50 cm higher on the bank. The internal structure was nearly identical to the first nest, but it lacked a turret; the entrance was a simple hole in the bank. This second nest contained 76 workers and brood.

Etymology. Two mirrors, referring to the shiny patches on the face.

Adelomyrmex brenesi Longino, 2006
(Figs 4, 21)

Adelomyrmex brenesi 2006: 132, figs. 1–3. Holotype worker: Costa Rica, Heredia Prov., 6 km ENE Vara Blanca (10° 11' N, 84° 07' W), 2000 m elevation, 13. III.2002, (Project ALAS) [specimen code JTLC000003382] [INBio] (examined).

Geographic range. Costa Rica.

Biology. This species is still only known from the material reported in Longino (2006). It is a montane endemic, known only from the peak of Volcan Barva. This is a forested mountaintop of relatively small area in the Cordillera Volcánica Central of Costa Rica. *Adelomyrmex brenesi* is restricted to a narrow elevation range at the very top of the peak, around 2000 m, and does not occur at lower elevations (Longino & Colwell 2011). In a quantitative inventory at this site, it occurred in 13 of 150 miniWinkler samples. This is a species clearly in danger of mountaintop extinction due to climate change (Colwell et al. 2008).

Adelomyrmex coco Longino, sp. nov.
(Fig. 14)

Type material. *Holotype worker.* Costa Rica, Puntarenas: Isla de Coco, 5.53773–87.05295 ±30 m, 70 m, Feb 2006 (S. Solomon & A. Mikheyev, Transect C) [INBio, unique specimen identifier CASENT0628121]. *Paratypes* (workers)**:** Costa Rica, Puntarenas: Isla de Coco, 5.52918 –87.07052 ±30 m, 470 m, Feb 2006 (S. Solomon & A. Mikheyev, Transect D) [CAS, CASENT0628122]; Costa Rica, Cocos Island, 5°31.70'N 87°04.21'W, 490 m, Jul 2003 (S. Solomon & A. Mikheyev, transect E pitfall) [MCZC, JTLC000004336].

Geographic range. Costa Rica, Isla de Coco.

Diagnosis. *Adelomyrmex coco* shows the least amount of surface sculpture of any known species. The mesosoma is completely smooth and shining throughout. The face varies from longitudinally striate to largely smooth and shining. The mandible is similar to many mainland species in having a differentiated basal and masticatory margin and a distinct tooth at the base of the basal margin, but the masticatory margin only has four teeth instead of the usual five or six.

Description. *Worker.* HW 0.58–0.60 (n=2); mandible with differentiated masticatory and basal margins; masticatory margin with four teeth, apical the largest and three proximal subequal in size; basal margin sinuous

with strong tooth at base near condyle, but without notch proximal to this tooth; dorsal surface of mandible with several weak longitudinal striae and several large piligerous puncta; in full face view, lateral clypeal teeth project from beneath clypeal shelf; lateral clypeal teeth confluent with both anterior (ventral) margin of clypeus and transverse carina that forms clypeal shelf, forming vertices of concave triangular space on ventral face of clypeus; median clypeal lobe small, narrow, truncate but not bidentate; hypostomal tooth present as a small denticle; compound eye composed of 6–7 ommatidia; face sculpture highly variable, holotype with fine longitudinal striae covering most of face, with rows of distinct piligerous puncta between striae; one paratype (JTLC000004336) with face largely smooth and shining, with faint longitudinal rugulae on genal spaces medial and anterior to compound eye, and medial to frontal carinae, and with sparse small piligerous puncta on rest of face posterior to compound eye; a second paratype (CASENT0628122) intermediate, with longitudinal striae on anterior half of face.

FIGURE 14. *Adelomyrmex coco* **sp. nov.**, holotype (Costa Rica, CASENT0628121). Scale bars are 0.5 mm for face and dorsal views, 1.0 mm for lateral view.

Short anterior face of pronotum separated from dorsal face by a weak angle; dorsal profile of promesonotum and propodeum forming a single arched convexity, metanotal groove not impressed; propodeal spines short triangular denticles; space between propodeal spines a broad concavity without distinct dorsal and posterior faces; entire mesosoma smooth and shining, with no trace of rugae, dorsal promesonotum with sparse, small piligerous puncta; petiolar node taller than long, subquadrate, with differentiated anterior, dorsal, and posterior faces, distinctly taller than postpetiole; petiole and postpetiole smooth and shiny; postpetiole in dorsal wider than long, with rounded posterior margin; gastral dorsum smooth and shining.

Scape with abundant long subdecumbent pubescence, lacking any longer suberect setae; clypeus and frontal carinae with long erect setae; posterior and posterolateral margins of head with long erect setae; mid and hind tibia with abundant long subdecumbent setae and about three differentiated erect setae that are longer than width of tibia; in profile, dorsal surfaces of head, mesosoma, and gaster with abundant, medium-length, suberect setae; FSH about 0.05, FSI 0.08.

Color light red brown.

Biology. This species is known only from the evergreen wet forest of Isla del Coco in the Pacific Ocean, southwest of Costa Rica and north of the Galapagos. This is an oceanic island with high levels of endemism. Two

of the known workers were collected in forest floor litter samples, and one was collected in a pitfall trap. One of the workers was from near sea level, and two were from cloud forest near the highest point of the island.

Etymology. Referring to the type locality.

Adelomyrmex costatus Fernández, 2003

Adelomyrmex costatus Fernández, 2003: 17, figs. 35, 75. Holotype worker: Colombia, Cauca, PNN Isla Gorgona, Alto El Mirador, 380 m., 31.iii.00 (R. Duque leg.) [IAVH] (not examined).

Geographic range. Colombia.

Adelomyrmex cristiani Fernández, 2003

Adelomyrmex cristiani Fernández, 2003: 16, figs. 36, 75. Holotype worker: Colombia, Cordillera Occidental, transecto Tatamá, 1650 m, 1983 (Th. van der Hammen *et al*., TAT 205) [ICN] (not examined).

Geographic range. Colombia, Ecuador.

Comments. The holotype of *A. cristiani* came from a series of Berlese samples from the Tatamá elevational transect studied by van der Hammen *et al*. (van der Hammen & Ward 2005). I examined three additional workers provided by P. S. Ward. Two were from two additional sites on the Tatamá transect (TATA206 and TATA212, at 1540 m and 1950 m elevation, respectively), and one was from a wet forest site in Pichincha Province, Ecuador, at 1500 m (PSW11503.9). The specimens showed discordant character variation. The Ecuador and TAT212 specimens have similar mandibular dentition: there are three main apical teeth, two or three small denticles, and a broad triangular tooth that is near the basal tooth. Thus, these specimens exhibit the character of the Central American species *A. dentivagans*, *A. mackayi*, *A. nortenyo*, and *A. quetzal*. The mandibles on TAT206 are difficult to observe, but one partially open mandible appears to have a more typical dentition, lacking the large triangular tooth on the basal margin. The Ecuador and TAT206 specimens have the petiolar node smooth and shiny; the TAT212 specimen has the node irregularly rugose.

Adelomyrmex dentivagans Longino, sp. nov.

(Figs 1, 2, 15, 22)

Type material. *Holotype worker.* Mexico, Chiapas: Lago Metzabok, 17.12630 −91.63052 ±50 m, 570 m, 5 Jun 2008 (LLAMA Wa-A-06-1-18) [CAS, unique specimen identifier JTLC000014362]. *Paratypes* (workers)**:** Mexico, Chiapas: 13.7km NW Metzabok, 17.19052 −91.73748 ±50 m, 540 m, 14 Jul 2007 (J. L. Cozar) [INBIO, CASENT0600030]; same locality and date but (J. Longino JTL6046-s) [MCZC, JTLC000010023], [MZSP, JTLC000009719], [USNM, JTLC000010022]; same locality and date as holotype but (LLAMA Wa-A-06-1-11) [BMNH, JTLC000014356], (LLAMA Wa-A-06-1-17) [EAPZ, JTLC000014360], [ECOSCE, JTLC000014361], (LLAMA Wa-A-06-1-18) [UCD, JTLC000014363], (LLAMA Wa-A-06-1-37) [ICN, JTLC000014380].

Geographic range. Mexico (Chiapas), Guatemala, Honduras.

Diagnosis. Mandible lacking differentiated basal and masticatory margins; counting from apex, fifth tooth equidistant between fourth tooth and sixth (basal) tooth; scape with one or two long erect setae projecting above underlying pubescence. Differing from the similar *A. nortenyo* in longer, sparser, more erect setae on dorsal surfaces; in profile, petiolar node more quadrate, with pronounced transverse carina sharply separating dorsal and posterior faces; rugae on dorsal and lateral faces of pronotum less reticulate, more wavy with some longitudinal orientation.

Description. *Worker.* HW 0.61–0.69 (n=6); mandible without differentiated masticatory and basal margins, with six distinct teeth distributed from apex to base, fifth tooth equidistant between fourth and sixth (basal) tooth, and with a deep notch between sixth tooth and basal condyle; dorsal surface of mandible with several coarse longitudinal striae and several large piligerous puncta; in full face view, lateral clypeal teeth project from beneath

clypeal shelf; lateral clypeal teeth confluent with both anterior (ventral) margin of clypeus and transverse carina that forms clypeal shelf, forming vertices of concave triangular space on ventral face of clypeus; hypostomal tooth absent; compound eye composed of 7–8 ommatidia; face fully sculptured with reticulate rugae, with weak longitudinal orientation medially.

Short anterior face of pronotum well separated from dorsal face by a weakly elevated transverse ruga; dorsal profile of promesonotum and propodeum forming a single arched convexity, metanotal groove weakly impressed; propodeal spines pronounced, acute; space between propodeal spines a broad concavity without distinct dorsal and posterior faces, smooth and shiny with a few transverse rugae; rest of mesosoma strongly rugose, rugae wavy and generally longitudinally oriented; petiolar node subquadrate with strongly differentiated anterior, dorsal, and posterior faces; posterior face of petiolar node slightly concave and separated from dorsal face by distinct transverse ruga; petiole and postpetiole coarsely irregularly rugose; postpetiole in dorsal view about as long as wide, with straight anterior margin and evenly rounded posterior margin; gastral dorsum smooth and shining.

Scape with abundant long subdecumbent pubescence, and with one or two long suberect setae that are differentiated from the pubescence and project above it; clypeus and frontal carinae with long erect setae; posterior and posterolateral margins of head with long erect setae; mid and hind tibia with abundant long subdecumbent setae and about three differentiated erect setae that are longer than width of tibia; in profile, dorsal surfaces of head, mesosoma, and gaster with relatively sparse, long, erect setae; FSH about 0.11, FSI 0.16.

Color dark red brown.

Biology. This species occurs in second growth to mature evergreen wet forest, from 400–1200 m elevation. It does not occur in hot lowland rainforest, below 300 m elevation. In a ridge-top cloud forest in Parque Nacional Cerro Azul Meambar in Honduras, it occurred in 20% of miniWinkler samples. Most collections are from Winkler and Berlese samples of sifted litter. A few workers were taken at baits at Cerro Azul Meambar.

Etymology. Wandering tooth, referring to the characteristic mandibular dentition.

FIGURE 15. *Adelomyrmex dentivagans* **sp. nov.**, holotype (Mexico, JTLC000014362). Scale bars are 0.5 mm for face and dorsal views, 1.0 mm for lateral view.

Adelomyrmex foveolatus Fernández in Fernández & MacKay, 2003
Figure 22

Adelomyrmex foveolatus Fernández in Fernández & MacKay, 2003: 599, figs. 8A,B. Holotype worker: Costa Rica, Heredia: Estación Biológica La Selva, 10°26'N 84°00'W, 50 m, 14 Oct 1991, sifted leaf litter in wet forest (J. Longino #3078-s) [specimen code INBIOCRI001237378] [INBio] (examined). Paratype queen: same locality as holotype, 2 Jul 1992 (J. Longino No. 3202-s). See also: Fernández, 2003: 17.

Geographic range. Costa Rica.

Biology. This species occurs in lowland rainforest leaf litter. It is still known only from the type locality and vicinity, where it is extremely rare. At La Selva Biological Station it is known from six Winkler samples of sifted litter (less than 1% of similar samples), each with one to three individuals. An additional specimen was collected at 500 m elevation on the slopes of Volcan Barva above La Selva.

Adelomyrmex grandis Fernández, 2003

Adelomyrmex grandis Fernández, 2003: 18, figs. 34, 75. Holotype worker: Colombia, Nariño, Barbacoas, vereda Berlín, El Diviso, 520 m, 22.viii.94 (F. Escobar leg. No.294) [ICN] (not examined).

Geographic range. Colombia.

Comments. *Adelomyrmex grandis* and *A. vaderi* are two Colombian species that are similar in size but differ in a number of sculpture, shape, and color characters (Fernández, pers. com.). In *A. grandis*, the whole body is the same color, versus somewhat bicolored in *A. vaderi* (with lighter-colored gaster). The postpetiole of *A. grandis* is more typical, wider than long in dorsal view, and without a pronounced posterodorsal projection or carina in lateral view. In *A. vaderi*, the postpetiole is longer than wide in dorsal view, with a bluntly acute posterodorsal projection in lateral view. Also, the rugose sculpture on the face of mesosoma of *A. grandis* is more regular and less reticulate compared to *A. vaderi*. The two are geographically separate, with *A. grandis* being in the southwest of Colombia, on the western slope of the Cordillera Occidental, and *A. vaderi* in central Colombia on the eastern slope of the Cordillera Oriental.

Adelomyrmex laevigatus MacKay in Fernández & MacKay, 2003
(Figs 5, 21)

Adelomyrmex laevigatus MacKay in Fernández & MacKay, 2003: 600, figs. 4–7. Holotype worker: Panama, Chiriquí: Volcán, Hartman's Finca, 16 Jun 1995 (R. Anderson #17801) [MCZC] (not examined). See also: Fernández, 2003: 19.

Geographic range. Costa Rica, Panama.

Biology. This species occurs in mature cloud forest leaf litter. It is found from 800–1500 m elevation, apparently in all the cordilleras of Costa Rica and western Panama. It is usually a lower density species than the sympatric *A. tristani*. At a 1000 m site on the Volcan Barva transect in Costa Rica, it was found in 18 of 150 miniWinkler samples, while it was not found at adjacent 500 m and 1500 m sites with similar sampling intensity (Longino & Colwell 2011).

Comments. *Adelomyrmex laevigatus* appears to be an upland version of *A. microps*, with *A. laevigatus* being darker, more robust, and with shorter pilosity. Although they occur on the same mountain slope (Volcan Barva in Costa Rica), so far they have not been found together, with *A. laevigatus* only known from 800 m elevation and above, *A. microps* below 500 m.

Adelomyrmex longinoi Fernández, 2003
(Figs 3, 22)

Adelomyrmex longinoi Fernández, 2003: 21. Holotype worker: Costa Rica, Heredia: Est. Biol. La Selva, 10°26'N 84°01'W, 50–150 m, 18 Jun 1999, ex sifted leaf litter (Project LLAMA W/10/005) [specimen code INBIOCRI002720661] [unknown] (examined). The queen is described but not listed among paratype material.

Geographic range. Guatemala to Costa Rica.

Biology. This species occurs in mature wet forest leaf litter. It is most abundant in the lowlands but can occur as high as 1100 m elevation (Parque Nacional Azul Meambar, Honduras). The northern limit appears to be just across the Motagua fault in southeastern Guatemala. It is widespread in wet forests of Honduras and Nicaragua. In Costa Rica it occurs on both lowland Atlantic and southern Pacific slopes, but only to 500 m elevation. When present it is always a low-density element of the fauna, occurring in 1–10% of miniWinkler samples, and usually as one or two individuals per sample.

Comments. In the northern part of its range *A. longinoi* is sympatric with the closely similar *A. marginodus*, and the two species may occur together in the same Winkler samples. The anterior and dorsal faces of the pronotum are less sharply differentiated in *A. longinoi*, and the posterior margin of the postpetiole lacks a pronounced transverse rim. DNA barcoding evidence supports the distinctness of the two species. Fernández (2003) commented on Chiapas specimens tentatively identified as *A. longinoi*; these are almost certainly *A. marginodus*.

The holotype of *A. longinoi* is currently missing. Queries have not located it at BMNH, IAVH, ICN, INBIO, LACM, MIZA, MZSP, USNM. However, abundant material from the type locality is available in museums, and multiple specimens exist from the same miniWinkler sample.

Adelomyrmex mackayi Fernández, 2003
(Fig. 21)

Adelomyrmex mackayi Fernández, 2003: 22. Holotype worker: Mexico, Chiapas: 2.1 km NW Pueblo Nuevo, Solistahuacán, Yerbabuena preserve, 2070 m, 23 Sep 1992 (R.S. Anderson No. 92-114) [MCZC] (not examined).

Geographic range. southern Mexico, Guatemala.

Description. *Queen***.** Similar to worker except for queen-specific characters of large compound eyes, ocelli, and enlarged mesosoma with queen-typical sclerites; pronotum smooth medially, reticulate rugose laterally; dorsal mesonotum smooth and shining anteriorly and on median strip, longitudinally rugulose posterolaterally; scutellum longitudinally rugose; katepisternum smooth and shining; anepisternum smooth ventrally, rugose dorsally; side of propodeum rugose.

Biology. This species is now known from one area in north central Chiapas and two sites in central Guatemala. The three sites are high montane cloud forest between 1900 and 2100 m elevation. It is clearly a high elevation specialist. At Biotopo El Quetzal in Guatemala, the cloud forest on the slopes around 1700 m were dominated by *A. robustus* and *A. paratristani*. *Adelomyrmex mackayi* was only found by hiking up to the ridge crests at 2000 m. *Adelomyrmex mackayi* is in danger of mountain-top extinction resulting from climate change.

Comments. *Adelomyrmex mackayi* is immediately recognizable by being sharply bicolored, with dark head and mesosoma and light yellow brown gaster. Such sharply contrasting coloration is unique in the genus.

Adelomyrmex marginodus Longino, sp. nov.
(Figs 3, 16, 21)

Type material. *Holotype worker* Honduras, Atlántida: 7 km SSW Tela, 15.72337 −87.45177 ±20 m, 190 m, 15 Jun 2010 (LLAMA Wa-C-08-2-43) [CAS, unique specimen identifier CASENT0627826]. *Paratypes* (workers): Honduras, Atlántida: 7 km SSW Tela, 15.72453 −87.45192 ±20 m, 190 m, 15 Jun 2010 (LLAMA Wa-C-08-2-17) [MCZC, CASENT0618409]; Honduras, Atlántida: 12km SW La Ceiba, 15.69130 −86.86076 ±20 m, 280 m, 19 Jun 2010 (LLAMA Wa-C-09-2-17) [BMNH, CASENT0627830], [EAPZ, CASENT0627831], [ECOSCE, CASENT0627832], [MZSP, CASENT0627828], [UCD, CASENT0627833], [USNM, CASENT0627829]; same data but 15.69116 −86.86075 ±20 m (LLAMA Wa-C-09-2-20) [ICN, CASENT0627834].

Geographic range. southern Mexico, Guatemala, Honduras, Nicaragua.

FIGURE 16. *Adelomyrmex marginodus* **sp. nov.**, holotype (Honduras, CASENT0627826). Scale bars are 0.5 mm for face and dorsal views, 1.0 mm for lateral view.

Diagnosis. Differing from the similar *A. longinoi* in (1) more sharply differentiated anterior and dorsal face of pronotum in profile; and (2) posterior margin of postpetiole with sharp projecting transverse rim.

Description. *Worker.* HW 0.44–0.50 (n=5); mandible with differentiated masticatory and basal margins; masticatory margin with 5 teeth; basal margin sinuous with a distinct basal tooth and notch between tooth and condyle; dorsal surface of mandible with several coarse longitudinal striae and several large piligerous puncta; in full face view, lateral clypeal teeth small but still projecting from beneath clypeal shelf; lateral clypeal teeth located on anterior (ventral) margin of clypeus and separate from transverse carina that forms clypeal shelf; hypostomal tooth a minute triangular denticle; compound eye composed of 1–4 ommatidia; face coarsely reticulate rugose, with weak longitudinal orientation.

Short anterior face of pronotum meeting dorsal face at nearly right angle, separated by a low, simple transverse ruga; promesonotum evenly and very shallowly convex; metanotal groove weakly impressed; propodeal spines pronounced, triangular, acute at tip; space between propodeal spines a broad concavity without distinct dorsal and posterior faces, smooth and shiny with a moderately strong transverse ruga between propodeal spines, a few weaker rugulae above it; sculpture of dorsal promesonotum and side of mesosoma reticulate rugose like face; petiolar node relatively tall with differentiated anterior, dorsal, and posterior faces, rugose; postpetiolar node low and rounded, rugose laterally, smooth and shiny dorsally; in profile, postpetiolar node with a pronounced posteroventral rim; postpetiole in dorsal view about as long as wide, evenly rounded posteriorly; gastral dorsum smooth and shining.

Scape with abundant subdecumbent pubescence, and with two long suberect setae that are differentiated from the pubescence and project above it; clypeus and frontal carinae with long erect setae; posterior and posterolateral

margins of head with long erect setae; mid and hind tibia with abundant long subdecumbent setae and 2–3 differentiated erect setae that are longer than width of tibia; in profile, dorsal surfaces of head, mesosoma, and gaster with relatively short, dense subdecumbent setae; FSH about 0.03, FSI 0.06.

Head and mesosoma red, gaster lighter yellow red.

Queen. Similar to worker except for queen-specific characters of large compound eyes, ocelli, and enlarged mesosoma with queen-typical sclerites; pronotum weakly reticulate rugose medially, coarsely reticulate rugose laterally; dorsal mesonotum smooth and shiny medially, grading into concentric rugulae peripherally; scutellum more coarsely reticulate rugose; katepisternum, anepisternum, and side of propodeum rugose, rugae somewhat more longitudinally oriented than on lateral pronotum.

Biology. This species is known from lowland rainforest sites, from sea level to 400 m elevation. All records are from Winkler samples of sifted litter. It is typically rare, but at one Honduran site it occurred in 17% of miniWinkler samples.

Comments. This species is very similar to *A. longinoi*. Character differences are subtle yet consistent across a broad zone of sympatry in Guatemala, Honduras, and Nicaragua. See further discussion under *A. longinoi*.

Etymology. Referring to the posterior rim of the postpetiole.

Adelomyrmex metzabok Longino, sp. nov.

(Figs 7, 17, 21)

Type material. *Holotype worker.* Mexico, Chiapas: Lago Metzabok, 17.12614 −91.63061 ±50 m, 570 m, 5 Jun 2008 (LLAMA Wa-A-06-1-14) [CAS, unique specimen identifier CASENT0627820]. *Paratypes*: Mexico, Chiapas: Laguna Metzabok, 17.12550 −91.63082 ±50 m, 600 m, 14 Jul 2007 (J. Luna-Cozar) [UCD, JTLC000010100]; 13.7km NW Metzabok, 17.19052 −91.73748 ±50 m, 540 m, 14 Jun 2007 (R. S. Anderson 2007-012) [ECOSCE, CASENT0601933]; Lago Metzabok, 17.12562 −91.63090 ±50, 570 m, 5 Jun 2008 (LLAMA Wa-A-06-1-01) [MCZC, JTLC000014343]; Lago Metzabok, 17.12566 −91.63088 ±50 m, 570 m, 5 Jun 2008 (LLAMA Wa-A-06-1-02) [MZSP, JTLC000014346]; Lago Metzabok, 17.12602 −91.63068 ±50 m, 570 m, 5 Jun 2008 (LLAMA Wa-A-06-1-11) [USNM, JTLC000014355]; same data as holotype [BMNH, CASENT0627822], [EAPZ, CASENT0627821].

Geographic range. Southern Mexico, Guatemala.

Diagnosis. Differing from *A. myops* in (1) promesonotum strongly produced, higher at mesonotum than pronotum, steeply dropping to dorsal face of propodeum (lower and more evenly and shallowly convex in *A. myops*); and (2) posterior faces of petiole and postpetiole each with dorsal transverse ruga, such that in profile nodes appear somewhat flat-topped and with posterior tooth (petiolar and postpetiolar nodes more rounded in *A. myops*).

Description. *Worker.* HW 0.58–0.63 (n=6); mandible with differentiated masticatory and basal margins; masticatory margin with five or six teeth, apical three always large and distinct, decreasing in size, remaining two or three highly variable in degree of development; basal margin sinuous with a distinct basal tooth and notch between tooth and condyle; dorsal surface of mandible with several coarse longitudinal striae and several large piligerous puncta; lateral clypeal teeth large, in full face view projecting from beneath clypeal shelf; lateral clypeal teeth located on anterior (ventral) margin of clypeus and separate from transverse carina that forms clypeal shelf; hypostomal tooth a minute denticle; compound eye composed of 6–9 ommatidia; face fully sculptured with reticulate rugae, with weak longitudinal orientation medially.

Short anterior face of pronotum meeting dorsal face at obtuse angle, separated by a low, sometimes crenulated ruga; promesonotum robust, strongly produced, sloping up posteriorly, dropping abruptly to metanotal groove; propodeal spines triangular, acute; space between propodeal spines a broad concavity without distinct dorsal and posterior faces, smooth and shiny with a few transverse rugae; rest of mesosoma strongly reticulate rugose, rugae of dorsal promesonotum strongly wavy reticulate, with little longitudinal orientation; posterior faces of petiole and postpetiole each with dorsal transverse ruga, such that in profile nodes appear somewhat flat-topped and with posterior tooth; petiole and postpetiole coarsely irregularly rugose, postpetiole with smooth dorsum; postpetiole in dorsal view about as long as wide, triangular, with blunt posterior projection; gastral dorsum smooth and shining.

Scape with abundant long subdecumbent pubescence; clypeus and frontal carinae with long erect setae; posterior and posterolateral margins of head with long erect setae; mid and hind tibia with abundant long

subdecumbent setae and 3–4 differentiated erect setae that are longer than width of tibia; in profile, dorsal surfaces of head, mesosoma, and gaster with relatively short, dense suberect setae; FSH about 0.08, FSI 0.13.

Color dark brown to black.

Queen. Similar to worker except for queen-specific characters of large compound eyes, ocelli, and enlarged mesosoma with queen-typical sclerites; pronotum smooth medially, reticulate rugose laterally; dorsal mesonotum with widely-spaced longitudinal rugae evenly covering surface with exception of small anteromedian smooth area; scutellum more coarsely reticulate rugose; katepisternum smooth and shining; anepisternum smooth ventrally, rugose dorsally; side of propodeum rugose.

Biology. *Adelomyrmex metzabok* occurs in mature and second growth wet forest habitats in the eastern lowlands of Chiapas and the eastern Petén region of Guatemala. Records are from sea level to just below 1000 m elevation. All records are from Winkler or Berlese extractions from sifted litter, with the exception of one occurrence at a bait. It can be locally abundant, occurring in up to 26% of miniWinkler samples. Queens occasionally occur together with workers in Winkler samples.

Etymology. Referring to the type locality.

FIGURE 17. *Adelomyrmex metzabok* **sp. nov.**, holotype (Mexico, CASENT0627820). Scale bars are 0.5 mm for face and dorsal views, 1.0 mm for lateral view.

Adelomyrmex micans Fernández in Fernández & MacKay, 2003
(Figs 4, 21)

Adelomyrmex micans Fernández in Fernández & MacKay, 2003: 601. Holotype worker: Mexico, Chiapas: 5 km W San Cristobal, Cerro Huitepec, 2700 m, 14 Sep 1992 (R. S. Anderson No. 92-101) [MCZC] (not examined). Paratype queen:

Mexico, Chiapas, 4 km N Unión Juarez, Volcán Tacana, lower slopes, 2000 m, 19 Sep 1992 (R. S. Anderson No. 92-110). See also: Fernández, 2003: 23.

Geographic range. Southern Mexico to Honduras.

Biology. *Adelomyrmex micans* is a high elevation specialist inhabiting mature cloud forest from 1700–2700 m, usually above 2000 m. Most specimens are from sifted litter, and when present it occurs in 1–5% of quantitative miniWinkler samples. Workers are occasionally encountered at baits. At a site in the Cordillera de Chiapas, LLAMA project participant D. J. Cox hand-collected a specimen 25 m high in a cloud forest tree, by searching under epiphytes.

Adelomyrmex microps Fernández in Fernández & MacKay, 2003

Figure 5, 21

Adelomyrmex microps Fernández in Fernández & MacKay, 2003: 602, fig. 8C. Holotype worker: Costa Rica, Heredia: Estación Biológica La Selva, 10°26'N 84°01'W, 50–150 m, 1 Oct 1993 (Project ALAS B/04/246) [specimen code INBIOCRI001266263] [INBio] (examined). See also: Fernández, 2003: 23.

Geographic range. Honduras, Nicaragua, Costa Rica.

Biology. *Adelomyrmex microps* occurs in lowland rainforest and is extremely rare. It is currently known from 13 specimens. Ten of those are from La Selva Biological Station, from eight different Berlese and MiniWinkler samples (far less than 1% of samples). The LLAMA project collected a specimen in a MiniWinkler sample from a 280 m elevation site near La Ceiba, Honduras, and two in MiniWinkler samples from 310 m elevation on Cerro Saslaya, Nicaragua.

Comments. *Adelomyrmex microps* is a lowland version of *A. laevigatus*, differing in lighter color, less robust sculpture, and denser, longer pilosity. Additional material shows that the key characters used in Fernández and Mackay (2003) will not separate the species: both usually have smooth shiny areas on the side of the pronotum and stout hypostomal teeth. Ommatidial count is variable. One specimen from Costa Rica (La Selva Biological Station), currently considered a nanitic or aberration, has short, sparse, completely appressed pilosity on the face and gaster, and the overall sculpture is feeble. The specimen from Honduras has several longitudinal rugae on the side of the pronotum instead of a smooth patch.

Adelomyrmex minimus Fernández in Fernández & MacKay, 2003

Figure 21

Adelomyrmex minimus Fernández in Fernández & MacKay, 2003: 602. Holotype worker: Costa Rica, Puntarenas: Rincón, in the stomach of *Dendrobates granuliferus* (CRE 705) [LACM] (not examined). See also: Fernández, 2003: 24.

Geographic range. Costa Rica.

Comments. This species is still known only from the holotype. It is apparently a Pacific slope version of the Atlantic slope *A. foveolatus*, differing only in the smaller eyes and perhaps smaller size. But these are both traits that vary, and sample sizes are insufficient to assess morphological distinctness.

Adelomyrmex myops W.M. Wheeler, 1910

Figure 6, 7, 22

Apsychomyrmex myops Wheeler, W.M. 1910: 261, fig. 2. Holotype worker: Guatemala, Livingston, “10.87” (Schwarz and Barber) [USNM type No. 13198] (examined). Description of larva: Wheeler, G.C. & Wheeler, J. 1955: 29. Description of queen: Fernández, 2003: 25. Combination in *Adelomyrmex*: Kempf, 1972: 18.

Geographic range. Guatemala to Panama, Ecuador (Galapagos).

Biology. Most records reveal *A. myops* to be a lowland species but with less habitat specificity than other *Adelomyrmex*. It occurs in mature forest of varying seasonality, from aseasonal wet forest to strongly seasonal dry

forest. It also has been collected in disturbed habitats, including a cacao plantation in Honduras. There is a record from the Galapagos Islands, where it is probably introduced (Herrera & Longino 2008). It can be locally abundant, occurring in up to 20% of quantitative miniWinkler samples. The great majority of records are from 600 m elevation or lower, but an anomalous site is Cerro Musún in Nicaragua. *Adelomyrmex myops* occurred in Winkler samples from 1000–1100 m, but not in quantitative Winkler sampling around 700 m.

Comments. Fernández (2008) had a broad concept of *A. myops* and recognized the likelihood that it would resolve into multiple species. Additional material has proven him correct, and some of the variants discussed by him are here recognized as separate newly-described species.

In some cases, the dorsal promesonotal rugae of workers are somewhat longitudinally oriented, blurring the distinction between *A. myops*, *A. tristani*, and *A. paratristani*. The dorsal rugae are never strongly linear, like most collections of *A. tristani* and *A. paratristani*. Nearly all *A. tristani* have strongly linear dorsal rugae, but there is more variation in *A. paratristani*, where some workers have strongly vermiculate rugae, approaching the condition of some *A. myops* workers. In other words, *A. myops* occupies the range of variation from completely reticulate rugose to strongly vermiculate rugose with some longitudinal orientation, while *A. paratristani* ranges from the latter condition to having completely linear, parallel, longitudinal rugae. *Adelomyrmex myops* has dorsal pilosity more like *A. tristani* than *A. paratristani*. This is most evident on the gaster, where *A. paratristani* usually has sparse, long, erect setae, with very reduced presence of more decumbent setae beneath them, while *A. myops* has a denser brush of erect and subdecumbent setae.

Queens of *A. myops* have an abrupt transition from longitudinal rugae on the mesonotum to coarse, reticulate rugosity on the scutellum. In *A. tristani* and *A. paratristani*, the scutellum has longitudinal, subparallel rugae.

Adelomyrmex nortenyo Longino, sp. nov.

Figure 2, 18

Type material. *Holotype worker.* Mexico, Tamaulipas: Rancho del Cielo, nr cabins, 23.10105 −99.19233 ±50 m, 1200 m, 17 Jul 2006 (R. S. Anderson 2006-0005) [CAS, unique specimen identifier CASENT0627812]. *Paratypes* (workers): same data as holotype [BMNH, CASENT0627813], [EAPZ, CASENT0603623], [ECOSCE, CASENT0603622], [MCZC, CASENT0627809], [MZSP, CASENT0627810], [USNM, CASENT0627811].

Geographic range. Mexico (Tamaulipas).

Diagnosis. Mandible lacking differentiated basal and masticatory margins; counting from apex, fifth tooth closer to sixth (basal) tooth than to fourth tooth; scape with three or more long erect setae projecting above underlying pubescence. Differing from the similar *A. dentivagans* in shorter, denser, more decumbent setae on dorsal surfaces; in profile, petiolar node more rounded, without pronounced transverse carina sharply separating dorsal and posterior faces; rugae on dorsal and lateral faces of pronotum reticulate, with no longitudinal orientation.

Description. *Worker.* HW 0.64–0.69 (n=4); mandible without differentiated masticatory and basal margins, with six distinct teeth distributed from apex to base, a diastema between fourth and fifth teeth, and with a deep notch between sixth tooth and basal condyle; dorsal surface of mandible with several coarse longitudinal striae and several large piligerous puncta; lateral clypeal teeth large, in full face view projecting from beneath clypeal shelf; lateral clypeal teeth located on anterior (ventral) margin of clypeus and separate from transverse carina that forms clypeal shelf; hypostomal tooth a minute denticle; compound eye composed of 5–6 ommatidia; face fully sculptured with reticulate rugae, with weak longitudinal orientation medially.

Short anterior face of pronotum well separated from dorsal face by a weakly elevated transverse ruga; promesonotum robust, dorsal profile a single shallow convexity, dropping abruptly to pronounced metanotal groove; propodeal spines large, broad-based but still acute at tips, slightly upcurved; space between propodeal spines a broad concavity without distinct dorsal and posterior faces, smooth and shiny with a few transverse rugae; rest of mesosoma strongly reticulate rugose, rugae of dorsal pronotum fully reticulate or irregular, those of dorsal mesonotum with some weak longitudinal orientation; petiolar node with weakly differentiated anterior, dorsal, and posterior faces; petiole and postpetiole coarsely irregularly rugose, postpetiole with smooth dorsum; postpetiole in dorsal view about as long as wide, triangular, with blunt posterior projection; gastral dorsum smooth and shining.

Scape with abundant long subdecumbent pubescence, and with three or more long suberect setae that are differentiated from the pubescence and project above it; clypeus and frontal carinae with long erect setae; posterior and posterolateral margins of head with long erect setae; mid and hind tibia with abundant long subdecumbent setae and about three differentiated erect setae that are longer than width of tibia; in profile, dorsal surfaces of head, mesosoma, and gaster with relatively short, dense setae, many of those of head and gaster subdecumbent; FSH about 0.05, FSI 0.08.

Color dark red brown.

Biology. *Adelomyrmex nortenyo* is known only from the type locality, which is also the northern range limit of the genus. Specimens were collected in montane cloud forests, at elevations between 1200 and 1450 m. Forest types were described as mixed oak and *Liquidambar*/oak. Workers occurred in multiple Winkler samples.

Etymology. Referring to its northern locality, at the northern limit of the genus.

FIGURE 18. *Adelomyrmex nortenyo* **sp. nov.**, holotype (Mexico, CASENT0627812). Scale bars are 0.5 mm for face and dorsal views, 1.0 mm for lateral view.

Adelomyrmex paratristani Longino, sp. nov.

(Figs 8, 10, 11, 19, 21)

Type material. *Holotype worker.* Honduras, Olancho: PN La Muralla, 15.09798 −86.72081 ±15 m, 1850 m, 3 May 2010 (J. Longino#6956) [CAS, unique specimen identifier CASENT0615554]. *Paratypes* (workers): same data as holotype [BMNH, CASENT0627878], [INBIO, CASENT0627879], [MCZC, CASENT0627875], [MZSP, CASENT0627876], [UNAM, CASENT0627880], [USNM, CASENT0627877], [UVGC, CASENT0627881]; PN La Muralla, 15.09852 −86.72227 ±30 m, 1810 m, 3 May 2010 (J. Longino#6958) [EAPZ, CASENT0615557], [LACM, CASENT0627882]; PN La Muralla, 15.09721 −86.73840 ±100 m, 1480 m, 4 May 2010 (J.

Longino#6997-s) [ICN, CASENT0615607]; PN La Muralla, 15.09814 −86.74039 ±20 m, 1530 m, 2 May 2010 (LLAMA Wa-C-01-1-02) [UCD, CASENT0615493]; PN La Muralla, 15.09934 −86.74069 ±20 m, 1530 m, 2 May 2010 (LLAMA Wa-C-01-1-29) [ECOSCE, CASENT0615007].

Geographic range. southern Mexico to central Nicaragua.

FIGURE 19. *Adelomyrmex paratristani* **sp. nov.**, holotype (Honduras, CASENT0615554). Scale bars are 0.5 mm for face and dorsal views, 1.0 mm for lateral view.

Diagnosis. With the characters of *A. tristani*; differing in the relatively longer, sparser, more erect pilosity on the face, mesosoma, and gaster; FSH usually > 0.06 mm, FSI > 0.1 (in *A. tristani*, FSH usually < 0.06 mm, FSI < 0.1); in sympatry, *A. paratristani* is larger than *A. tristani*.

Description. *Worker.* HW 0.54–0.71 (n=8); mandible with differentiated masticatory and basal margins; masticatory margin with 5–6 teeth; basal margin sinuous with a distinct basal tooth and notch between tooth and condyle; dorsal surface of mandible with several coarse longitudinal striae and several large piligerous puncta; in full face view, lateral clypeal teeth project from beneath clypeal shelf; lateral clypeal teeth located on anterior (ventral) margin of clypeus and separate from transverse carina that forms clypeal shelf; hypostomal tooth present as a minute denticle; compound eye composed of 6–16 ommatidia; face with longitudinally oriented rugae, linear to vermiculate.

Short anterior face of pronotum meeting dorsal face at obtuse angle, separated by a low, simple to somewhat crenulated transverse ruga; promesonotum evenly and shallowly convex; metanotal groove impressed; propodeal spines short, triangular, acute at tip; space between propodeal spines a broad concavity without distinct dorsal and posterior faces, smooth and shiny with 2–5 transverse rugae; rugae of dorsal promesonotum and side of mesosoma longitudinally oriented, linear to vermiculate; petiolar and postpetiolar nodes rounded, with coarse rugae; postpetiole in dorsal view about as long as wide, evenly rounded posteriorly; gastral dorsum smooth and shining.

Scape with abundant subdecumbent pubescence; clypeus and frontal carinae with long erect setae; posterior and posterolateral margins of head with long erect setae; mid and hind tibia with abundant long subdecumbent setae and 3–4 differentiated erect setae that are longer than width of tibia; in profile, dorsal surfaces of head, mesosoma, and gaster with relatively sparse, long, erect setae; FSH 0.06–0.11 mm, FSI 0.11–0.15 (n=8).

Color dark brown to black.

Queen. Similar to worker except for queen-specific characters of large compound eyes, ocelli, and enlarged mesosoma with queen-typical sclerites; pronotum smooth medially, laterally with coarse parallel rugae; mesonotum largely with longitudinal parallel rugae, with an anteromedian triangular patch that is smooth and shining; scutellum with longitudinal parallel rugae; katepisternum smooth and shining on anteroventral 2/3, with longitudinal parallel rugae along posterior and dorsal margins; anepisternum and side of propodeum with longitudinal parallel rugae.

Variation. In the northern and southern limits of the range, the posterior margin of the worker postpetiole has 4–5 transverse rugae. The lowermost ruga is the largest, but not so much so that it forms a projecting step-like profile. In the center of the range, from central Honduras to southern Chiapas, the uppermost rugae on the postpetiolar node are reduced, resulting in a smaller, smoother postpetiole. The lowermost ruga on the posterior margin remains large, resulting in a step-like profile of the posterior face of the postpetiole. There is no evidence of sympatry of forms; instead they occur as allopatric populations on mountain tops. However, the transition can sharp and somewhat interdigitated. For example, in Honduras, Cerro Comayagua has the peripheral form, and Cerro Azul Meambar, 50 km to the northwest, has the central form.

Biology. This species occurs in montane wet forest, second growth and mature, from 1100–2500 m elevation. Forests can be diverse mesophyll cloud forest and various mixes of pine, oak, and *Liquidambar* forest. Specimens are most often collected in Winkler or Berlese samples of sifted litter. Dealate queens occasionally occur in these samples. They can be dominant ants in cloud forest litter, and can occur in nearly 100% of miniWinkler samples. Workers also occasionally recruit to baits, and workers have been taken in beating samples of low vegetation.

A few nest collections are known. At Parque Nacional La Muralla, Honduras, a nest was found in a rotting *Cecropia* branch on the ground (in the sclerynchyma cylinders that resist decomposition); only workers and brood were found. Other nests have been found in larger pieces of rotting wood, usually just with workers and brood. In a cloud forest near Somoto in northern Nicaragua, a single small nest chamber was found in rotting wood. It contained 11 workers, one small larva, what appeared to be numerous eggs of the *Adelomyrmex*, and one large sphere that looked like a centipede egg. At this site workers were also found beneath dry epiphytes on a recent treefall. At the peak of Cerro Saslaya in east central Nicaragua, a moss-covered elfin forest, workers and brood were found in a small nest in the dense duff layer on the ground. Near Coapilla, Chiapas, Mexico, D. J. Cox observed either a mixed nest or two closely approximate nests in a dead hardwood gall on the ground, one of *A. paratristani* and one of *A. robustus*. At the time of collection he observed workers entering the gall. On later dissection, he observed a single entrance and three chambers. One chamber contained only larvae, one only pupae, and one mixed brood and workers. After dissection he realized there were two species of workers: *A. paratristani* and *A. robustus*. Among the *A. paratristani* were three dealate queens.

Comments. Some collections of *A. paratristani* are difficult to differentiate from the lower elevation *A. myops*. See further discussion under *A. myops*.

Etymology. Referring to its close similarity to *A. tristani*.

Adelomyrmex quetzal **Longino, sp. nov.**

(Figs 20, 21)

Type material. *Holotype worker.* Guatemala, Baja Verapaz: Biotopo Quetzal, 15.21224 −90.21421 ±50 m, 1750 m, 7 May 2009 (LLAMA Wa-B-02-1-39) [CAS, unique specimen identifier CASENT0614520]. *Paratypes* (workers): Guatemala, Baja Verapaz: 4.5km S Purulha, 15.226 −90.2 ±10 km, 1630 m, 21 May 1991 (R. S. Anderson 91-006) [ICN, CASENT0604444], [INBIO, CASENT0604450], [UCD, CASENT0604453], [UNAM, CASENT0604443]; same data but 24 May 1991 (R. S. Anderson 91-019) [LACM, CASENT0603653], [UVGC, CASENT0603652]; 7.5km S Purulha, 15.2 −90.2 ±12 km, 1630 m, 26 May 1991 (R. S. Anderson 91-026) [BMNH, CASENT0601496], [EAPZ, CASENT0601501], [ECOSCE, CASENT0601495], [MCZC, CASENT0627819], [MZSP, CASENT0627816], [USNM, CASENT0627815].

Geographic range. Guatemala.

Diagnosis. Mandible lacking differentiated basal and masticatory margins; counting from apex, fifth tooth closer to sixth (basal) tooth than to fourth tooth; scape lacking long erect setae projecting above underlying

pubescence; gaster dark red brown, concolorous with rest of body (gaster contrastingly yellow in the similar *A. mackayi*); metanotal groove not impressed (impressed in *A. mackayi*).

FIGURE 20. *Adelomyrmex quetzal* **sp. nov.**, holotype (Guatemala, CASENT0614520). Scale bars are 0.5 mm for face and dorsal views, 1.0 mm for lateral view.

Description. *Worker.* HW 0.67–0.71 (n=6); mandible without differentiated masticatory and basal margins, with six distinct teeth distributed from apex to base, fifth tooth closer to sixth (basal) tooth than to fourth tooth, and with a deep notch between sixth tooth and basal condyle; dorsal surface of mandible with several coarse longitudinal striae and several large piligerous puncta; in full face view, lateral clypeal teeth project from beneath clypeal shelf; lateral clypeal teeth located on anterior (ventral) margin of clypeus and separate from transverse carina that forms clypeal shelf; hypostomal tooth absent; compound eye composed of 11–13 ommatidia; face fully sculptured with longitudinal rugae.

Short anterior face of pronotum well separated from dorsal face by an elevated transverse ruga; dorsal profile of promesonotum and propodeum forming a single arched convexity, metanotal groove not impressed; propodeal spines pronounced, acute; space between propodeal spines a broad concavity without distinct dorsal and posterior faces, smooth and shiny with a few transverse rugae; rest of mesosoma with strong, linear, longitudinal rugae; petiolar and postpetiolar nodes subquadrate with differentiated anterior, dorsal, and posterior faces; petiole and postpetiole coarsely irregularly rugose laterally, transversely rugose dorsally; postpetiole in dorsal view about as long as wide to slightly longer than wide, with straight anterior margin and evenly rounded posterior margin; gastral dorsum smooth and shining.

Scape with abundant long subdecumbent pubescence; clypeus and frontal carinae with long erect setae; posterior and posterolateral margins of head with long erect setae; mid and hind tibia with abundant long subdecumbent setae and 2–3 differentiated erect setae that are longer than width of tibia; in profile, dorsal surfaces of head, mesosoma, and gaster with relatively sparse, long, erect setae; FSH about 0.08, FSI 0.11.

Color dark red brown.

Biology. This species occurs in cloud forest, from 1550–1750 m elevation. It is known from ten different Winkler samples of sifted litter, from two regions of Guatemala.

Etymology. Referring to the type locality.

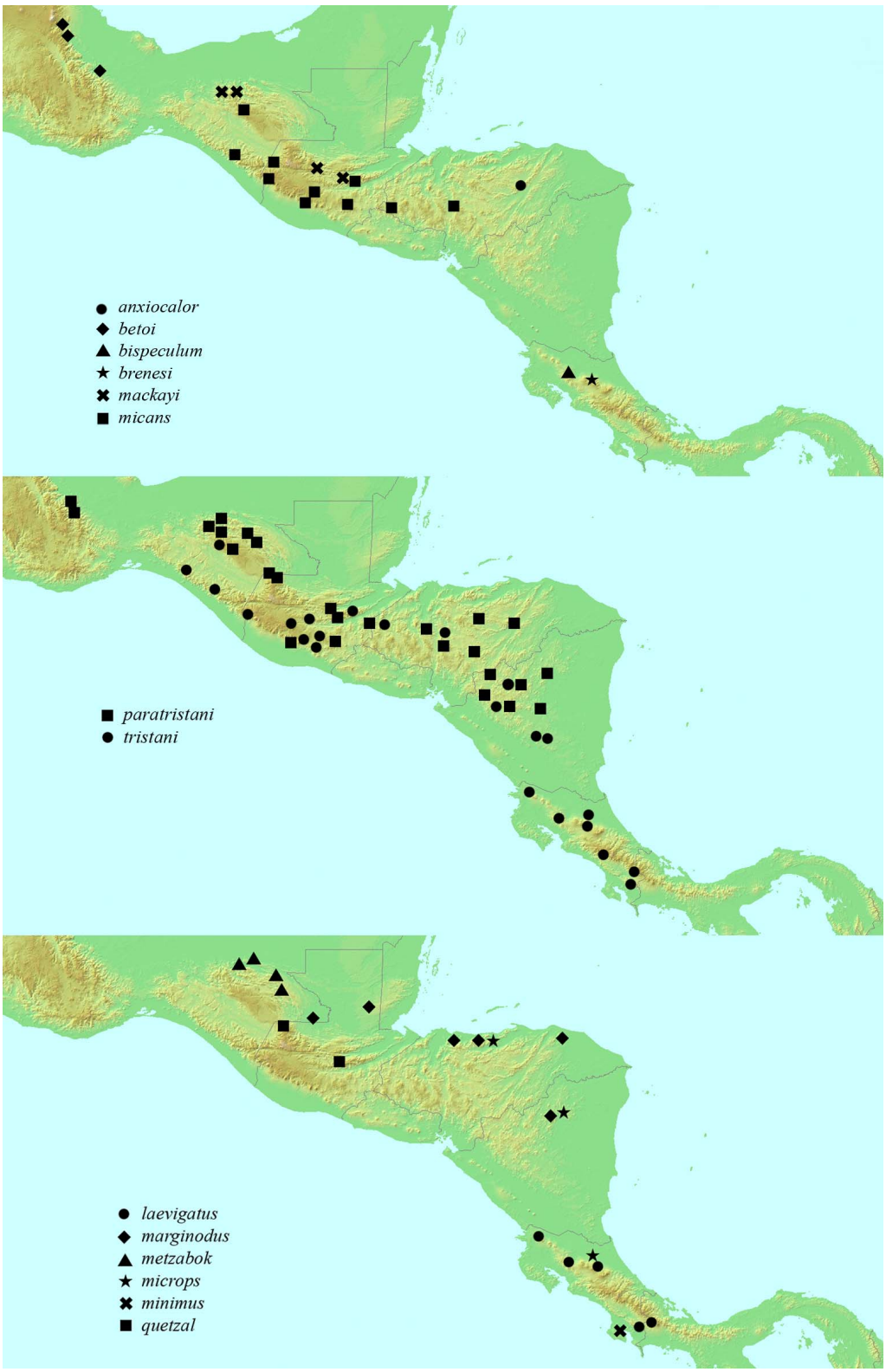

FIGURE 21. Distribution of material examined in this study: *Adelomyrmex anxiocalor* **sp. nov.**, *A. betoi*, *A. bispeculum* **sp. nov.**, *A. brenesi*, *A. laevigatus*, *A. mackayi*, *A. marginodus* **sp. nov.**, *A. metzabok* **sp. nov.**, *A. micans*, *A. microps*, *A. minimus*, *A. paratristani* **sp. nov.**, *A. quetzal* **sp. nov.**, *A. tristani*.

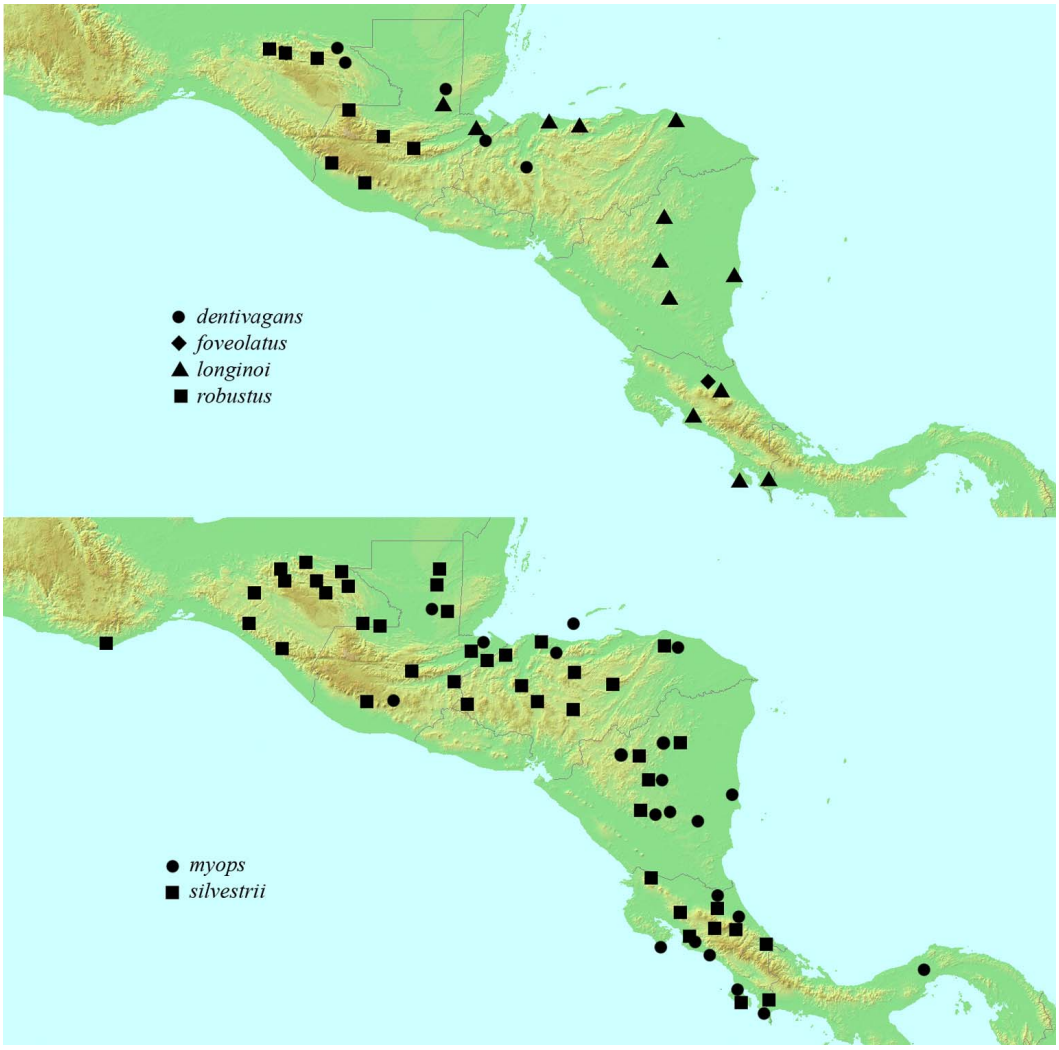

FIGURE 22. Distribution of material examined in this study: *Adelomyrmex dentivagans* **sp. nov.**, *A. foveolatus*, *A. longinoi*, *A. myops*, *A. robustus*, *A. silvestrii*. Occurrences of *A. myops* in the Galapagos and *A. silvestrii* in northern Mexico (Tamaulipas) not shown.

Adelomyrmex robustus Fernández, 2003
(Fig. 22)

Adelomyrmex robustus Fernández, 2003: 26, figs. 4–6, 25–30, 72. Holotype worker: Mexico, Chiapas: 8 mi N Pueblo Nuevo, Solistahuacán, 6000 feet, 26–27 Aug 1973, leaf litter forestry floor (A. Newton No. 12a) [MZSP] (not examined). Paratype queens from Chiapas described.

Geographic range. Southern Mexico, Guatemala.

Biology. *Adelomyrmex robustus* occurs in mature cloud forest habitats, most often from 1600–1900 m elevation. It can be very abundant, occurring in over 90% of quantitative miniWinkler samples and being frequent at baits on the forest floor. It even appears to forage on low vegetation, occasionally occurring in beating samples. In many sites it is sympatric with *A. paratristani*, which can also be abundant, and two can be difficult to distinguish in samples. Project LLAMA participant D. J. Cox observed multiple nests in dead wood at a site in Chiapas. Nests of both *A. robustus* and *A. paratristani* were found in a single dead gall that contained several chambers. In other cases nests were found in close proximity to *Perissomyrmex snyderi* nests, in the same piece of rotten wood. Nests occurred with brood dispersed in multiple chambers.

Adelomyrmex silvestrii (Menozzi, 1931)
Figure 22

Apsychomyrmex silvestrii Menozzi, 1931: 270, fig.6. Holotype worker: Costa Rica, San José (Tristan) [presumably DEI] (not examined). Combination in *Adelomyrmex*: Kempf, 1972: 18. See also: Fernández, 2003: 28.

Geographic range. northern Mexico (Tamaulipas) to Costa Rica.

Description. *Queen*. Similar to worker except for queen-specific characters of large compound eyes, ocelli, and enlarged mesosoma with queen-typical sclerites; pronotum smooth medially, reticulate rugose laterally; dorsal mesonotum mostly longitudinally rugose, weaker anteromedially; scutellum longitudinally rugose; katepisternum smooth and shining with thin strip of rugosity along posterior border; anepisternum and side of propodeum longitudinally rugose.

Biology. *Adelomyrmex silvestrii* is perhaps the most easily identified *Adelomyrmex* species, and it is widespread and abundant. It occurs in a wide variety of habitats, mature to secondary, wet to seasonally dry, and sea level to 1700 m elevation cloud forest. It can occur in over 70% of quantitative miniWinkler samples. In spite of its abundance, a nest has never been reported.

Adelomyrmex striatus Fernández, 2003
Figure 10

Adelomyrmex striatus Fernández, 2003: 29, figs. 37, 74. Holotype worker: Brazil, Amazonas, Igarapé Marianil, R. Branco, Rod. Km 24 NE Manaus, 22.viii.62 (W.L. Brown Jr. leg. M-13) [MZSP] (image of paratype examined).

Geographic range. Brazil (Amazonas), Ecuador, Peru.

Comments. I received from P. S. Ward a series of three workers and one queen from a single Winkler sample from Peru (Loreto, 15km WSW Yurimaguas, 5°59'S, 76°13'W, 200m, PSW8701) that showed strong variation among the workers. One worker was identical to images of the Manaus paratype, with sharp spiniform teeth on the median clypeal lobe and regular costate sculpture on the petiolar and postpetiolar nodes. In contrast, the other two workers and the queen had less pronounced teeth on the median clypeal lobe, and the petiolar and postpetiolar nodes were smooth and shiny. Also, on these latter specimens, the facial costae were somewhat thinner and less regular. I also received a worker from Ecuador (Napo, Jatun Sacha, 1°04'S, 77°37'W, 400m, PSW11364) that was similar to the Manaus paratype.

Adelomyrmex tristani (Menozzi, 1931)
(Figs 1, 6, 9, 11, 21)

Apsychomyrmex tristani Menozzi, 1931: 269, fig. 6. Holotype worker: Costa Rica, La Palma (Tristan) [presumably DEI] (not examined). Combination in *Adelomyrmex*: Kempf, 1972: 18. Description of queen: Fernández, 2003: 30.

Adelomyrmex brevispinosus Fernández, in Fernández & MacKay, 2003: 596, figs. 1–3. Holotype worker: Costa Rica, Heredia: 9 km N Volcán Barba, 10°13'N 84°06'W, 1750 m, 4 Jul 1986, wet forest litter (J. Longino #1314-s) [specimen code INBIOCRI001279889] [INBio] (examined). See also: Fernández, 2003: 15. **NEW SYNONYMY**.

Geographic range. southern Mexico to Costa Rica, Ecuador(?)

Biology. *Adelomyrmex tristani* is a common cloud forest ant throughout Central America. It is most often collected in Winkler samples, but may also occur at baits.

At multiple sites in Central America it occurs in sympatry with *A. paratristani*, a species whose range is contained largely within the range of *A. tristani*. There is a tendency for *A. tristani* to be most abundant in regions peripheral to the range of *A. paratristani*. There is some geographic variation in both *A. tristani* and *A. paratristani*, such that both could be split into multiple allopatric or parapatric species in the future, but currently there is no evidence for multiple sympatric forms within the current definition of *A. tristani*.

Adelomyrmex tristani is most abundant in the northern part of its range, in the Cordillera de Chiapas, extending into the mountains of western Guatemala. It is abundant in cloud forest from 1500-2000 m, occurring in up to 70%

of quantitative miniWinkler samples. It occurs as high as 2700 m at Cerro Huitepec near San Cristobal de las Casas, Chiapas.

AntWeb images of a specimen from an Ecuadorian cloud forest look like *A. tristani*, and thus the range may extend into South America.

Comments. *Adelomyrmex tristani* was recognized by Fernández (2003) as highly variable and likely consisting of multiple cryptic species. Large community samples taken by the LLAMA project revealed that at several sites in Central America, two sympatric species occur that both key to *A. tristani*. In this work I hypothesize two broadly sympatric species, each of which shows substantial geographic variation. In general, when the two species co-occur, *A. tristani* is the smaller of the two, with shorter, denser, more reclining pilosity, especially on the face and gaster. *Adelomyrmex paratristani* is larger, with longer, sparser, more erect setae. Where the range of *A. tristani* overlaps with *A. paratristani*, the queen has the mesonotum largely smooth and shining, while *A. paratristani* has the mesonotum largely longitudinally rugose, with an anteromedian triangular patch that is smooth and shining. In the southern part of the range, where it does not overlap with *A. paratristani*, the queens have mesonotal sculpture like *A. paratristani*.

In broad terms, *A. tristani* shows centers of abundance along the Pacific side of Central America, in the Sierra de Chiapas, the Guatemalan volcanoes from Volcan Atitlán to the mountains east of Guatemala City, the Sierra de Comayagua in Honduras, western and southern Nicaraguan mountains, and the mountains of Costa Rica. It becomes a rare element as one moves inland and eastward. In contrast, *A. paratristani* dominates the core mountain areas of northern Nicaragua, Honduras, Guatemala, and central Chiapas.

Two populations sampled by the LLAMA project are distinctive variants. The population on the south slope of Volcán Atitlán has very short propodeal spines, reduced to short, 90° angles, and the pilosity is very short. Populations in the Sierra de Chiapas to the north and the mountains around Guatemala City to the east have more developed, acute propodeal spines, and the pilosity is slightly longer. A population near La Unión, Guatemala, in Zacapa Department, has relatively sparse, erect gastral pilosity, like *A. paratristani*, and the dorsal promesonotal rugae are weak, on some specimens leaving a smooth shiny region anteromedially. The population is clearly differentiated from the local version of *A. paratristani*, in pilosity and size. HW of *A. tristani* in this population is 0.48–0.56 mm. The local population of *A. paratristani* has HW 0.62–0.68, and the pilosity is longer.

Adelomyrmex brevispinosus was differentiated from *A. tristani* by a small median smooth spot on the dorsal promesonotum. Specimens were reported from Costa Rica and Chiapas. However, specimens of *A. brevispinosus* from these two different regions otherwise look identical to their respective surrounding populations of *A. tristani*, paralleling the geographic variation. I conclude that *A. brevispinosus* falls within the intraspecific variability of *A. tristani*.

Adelomyrmex vaderi Fernández, 2003

Adelomyrmex vaderi Fernández, 2003: 33, figs. 41–44, 75. Holotype worker, paratype queen, male, worker: Colombia, Cundinamarca, Medina, Gazaunta river, Cristalina creek, 1750 m, 8.iii.1997 (F. Escobar leg.) [IAVH, USNM] (USNM paratype worker examined).

Geographic range. Colombia.

Comments. This is a large species known from montane forest sites in the cordillera just east of Bogotá. The holotype came from a nest series that contained the only known *Adelomyrmex* males. A distinctive feature of *A. vaderi* is that the postpetiole is long and narrow in dorsal view, longer than wide, and projecting posteriorly over the gaster. In this regard it is similar to *A. silvestrii*. In contrast to *A. silvestrii*, the postpetiole is tall, with the posterodorsal projection higher and not closely appressed to the gaster.

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