

THE NEOTROPICAL COCCID-TENDING ANTS OF THE GENUS ACROPYGA ROGER

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Recent studies by Bünzli (1935) have demonstrated the importance of ants of the genus *Acropyga* (subgenus *Rhizomyrma*) to the cultivation of coffee in Surinam. The ants (*Rhizomyrma paramaribensis* Borgmeier and *R. rutgersi* Bünzli) tend coccids¹ on the roots of the Liberian coffee trees and these coccids transmit an infectious phloem necrosis. This phloem necrosis in epidemic years caused a loss of 20–40 per cent of the coffee production in many fields in Surinam (Stahel, in Bünzli, p. 559). Earlier studies by Göldi (1892), Pickel (1927) and Costa Lima (1928) showed that coccids (*Rhizoecus coffeae* Laing) tended by other species of this subgenus caused severe injury to coffee trees in northeast Brazil. According to Donisthorpe (1936) a species of *Rhizomyrma* has recently been taken associated with a coccid at the roots of coffee in Colombia.

Incidental to studies on leaf-cutting or fungus-growing ants² I was able to collect and make observations on a number of known and new species of this hypogaecic ant genus with their coccids.³ They confirm the much more extensive Brazilian and Surinam biological studies and also indicate that this ant-coccid association may be of importance to the cultivation of cacao as well as possibly other economically important plants such as banana. The collections and observations were made in Trinidad, Venezuela, British Guiana, Colombia, Panama and Haiti. In Trinidad the ants with their coccids were usually found about the roots of cacao, one of the most important crops in this British colony. On three occasions the coccids clearly were pastured on the roots of cacao while in six other instances they were pastured on roots under cacao, coffee, and banana which may have belonged to any one or to all of these plants. One collection of *Rhizomyrma* in British Guiana was of workers found tending coccids on the grass, *Axonopus compressus*. This is a widely used tropical pasture grass. In Venezuela a large colony of *Rhizomyrma* was found tending coccids on roots at the base of a banana clump. These ants with their coccids were discovered on

¹*Rhizomyrma paramaribensis* tends the coccids *Rhizoecus coffeae* Laing, *R. caladii* Green, *R. moruliferus* Green, *Geococcus coffeae* Green, and *Pseudorhizoecus proximus* Green. *Rhizomyrma rutgersi* tends the coccids *Pseudorhizoecus proximus* Green, *P. migrans* Green, and *Pseudococcus radialis* Green.

²Most of the earlier studies were made while holding a National Research Fellowship in Biology at the Imperial College of Tropical Agriculture, Trinidad, B. W. I.

³Representative coccids from these collections are in the hands of Dr. Harold Morrison of the U. S. Department of Agriculture for identification. Specialists in insect groups are usually overburdened with material for identification. The common Trinidad type, a sketch of which appears in this paper, has been referred to as "*Eumyrnococcus* or to some other very closely allied genus," (Wheeler, 1935, p. 325).

roots of coffee in Haiti. Since coccids carried by these ants have been proved to be the vector of an important disease of coffee in Surinam, the findings here reported would suggest that the *Rhizomyrma*-coccid relationship be thoroughly investigated as a possible factor in disease of cacao, coffee and banana in other neotropical countries. Whether a disease is actually transmitted by the coccids or not, the loss of sap alone from the roots is of importance and must weaken the vitality of the trees.

The association between the ants and the coccids is not haphazard but a definite symbiotic arrangement. Not only are the ants and coccids usually, if not always, found together in the same tunnels, but the ants care for the coccids as they care for their own brood and in addition actually disseminate the coccids from place to place. It is quite possible that *Rhizomyrma* ants are obligate coccidophiles, in the New World at least.

These ants have become adapted to their mode of life in several ways. Living underground as they do, there has been a considerable loss of pigment, which loss has been greatest in the worker caste. This caste is pale yellow or brownish-yellow while the female is somewhat darker but never darker than brownish-yellow. Even the comparatively stable male caste is in *Rhizomyrma* only medium brown while in many genera of ants this caste is dark brown or black. Accompanying the loss of pigment in the worker has been a reduction in the eyes so that they have become mere vestiges, pin-points 0.02-0.06 mm. in diameter. The eyes in the female and male are of normal size and they swarm in the air in the usual fashion. The general habitus of the worker is a small to minute size with moderately short legs and no spines or other attenuations of the body which might impede their passage through the soil. All castes have long hairs on the clypeus, especially on the anterior margin, with one hair much the longest and extending well across the space between the closed mandibles and the clypeus. These hairs are doubtless useful in caring for, and carrying, not only their larvae but their coccids.

There are four subgenera of *Acropyga* (*Acropyga*, *s. str.*, *Atopodon*, *Malacomyrma* and *Rhizomyrma*) but only *Rhizomyrma* is recorded from the New World. The subgenera are separated chiefly on the characteristics of the mandibles, the number of antennal segments, and the geographical distribution, but all are closely related and the subgenus *Rhizomyrma* alone contains species running the gamut of mandibular and antennal characters. *Rhizomyrma* was established by Forel in 1893 (Trans. Ent. Soc. London, Part IV, pp. 347-348), as a subgenus of *Acropyga* with the worker characteristics of 7-11 segmented antennae, 2-segmented maxillary and 3-segmented labial palpi, long, narrow mandibles with 3-4 teeth on an extremely oblique border, extremely small eyes, no ocelli, frontal area triangular and distinct, antennae clavate, but otherwise like the other *Plagiolepidini*. The single female which Forel had seen lacked wings and was described merely as like the worker. The male caste was undescribed.

This paper brings together for the first time descriptions of all of the known species of *Rhizomyrma* in the New World. Some of the species are known only from specimens in European or South American

collections which are unavailable for study. Some are unusually hard to evaluate because of the variability in characters or subtle differences in proportions which are difficult to show by description or drawing. The original drawings of *R. rugersi*, for example, show workers with such differences as to indicate that they belong to two species and I have had much trouble in determining whether certain Trinidad, Venezuela and British Guiana ants actually belong to this species.

The species are arranged in chronological order of their description with the new species at the last. The biology of the different species is treated at the end of the taxonomic description of each.

KEY TO THE NEOTROPICAL SPECIES OF ACROPYGA (RHIZOMYRMA)
BASED ON THE WORKER⁴

1.	Antennae 7-8 segmented.	2
	Antennae with 8 or more segments.	3
2 (1).	Mandibles 3-4 toothed; length 1.8 mm.; head approximately as broad as long; antennal scape extending about three-fifths the distance to the occiput (Surinam, B. Guiana).	paramaribensis
	Mandibles 4-toothed; length 1.5-1.9 mm.; head 1.1 times longer than broad; dorsal surface of thorax plane (Trinidad).	urichi
3 (1).	Antennae 8-segmented; mandible 4-toothed.	4
	Antennae 8-11 segmented.	7
4 (3).	Head 1.3 times longer than broad (Panama).	panamensis
	Head 1.1 times longer than broad.	5
5 (4).	Length 1.2-1.3 mm.; antennal scape extending about three-fourths the distance to the occiput (Trinidad, Panama).	kathrynae
	Size larger, scape longer.	6
6 (5).	Length 1.3-1.8 mm.; antennal scape failing to reach occiput by about twice its distal diameter (Trinidad).	berwicki
	Length 1.7-1.9 mm.; antennal scape nearly attaining occiput (Colombia).	fuhrmanni
7 (3).	Antennae 8-9 segmented; mandible 3-toothed.	8
	Antennae 9-11 segmented.	9
8 (7).	Length 1.4-1.6 mm.; funicular segments 5-6 much broader than long (Mexico).	exsanguis
	Length 2 mm.; funicular segments 5-6 as long as broad (Colombia).	robae
9 (7).	Antenna 9-segmented; mandibles 3-toothed.	10
	Antennae 9-11 segmented; mandibles 3-4 toothed.	11
10 (9).	Length 1.5 mm.; head longer than broad (Honduras, Panama).	wheeleri
	Length 2 mm.; head broader than long (Argentina).	bruchi
11 (9).	Head as broad or broader than long.	12
	Head longer than broad.	20
12 (11).	Head as broad as long.	13
	Head broader than long.	14
13 (12).	Length 1.8-2.1 mm.; antennal scape exceeding occiput (Haiti).	mesonotalis
	Length 2.2 mm.; antennal scape failing to reach occiput (Brazil).	pachycera
14 (12).	Mandibles 3-toothed.	15
	Mandibles 3-4 toothed.	16
15 (14).	Head 1.2 times broader than long; penultimate antennal segment barely broader than long (Barbados).	marshalli
	Head 1.0-1.1 times broader than long; penultimate antennal segment markedly longer than broad (Trinidad).	trinitatis
16 (14).	Mandibles with 4 very small teeth; length 1.8-2 mm. (Haiti).	parvidens
	Mandibles with 3-4 well-developed teeth.	17

⁴Because of the unavailability of some species it has been necessary to use in this key the variable characters of antennal-segment and mandibular-tooth numbers which are known for all. In some instances the key will serve only to limit identification to several species and recourse must then be had to the description and figures of these.

17 (16). Head quadrate, occiput not impressed, length 2.7–2.9 mm. (Trinidad)	
Head or size different.....	quadriceps
18 (17). Length 2.4–3.2 mm., mandibles 3–4 toothed; female 3.6–4.8 mm. long, male 2.8–3 mm. long, with 12-segmented antenna (Surinam, B. Guiana, Trinidad).....	18
Smaller in all castes.....	rutgersi
19 (18). Antennal scape exceeding occiput; female 3–3.3 mm. long, antennae 9-segmented; male 2 mm. long, antenna 11-segmented (Brazil).....	19
Antenna not attaining occiput; female 2.8 mm. long, antennae 11-segmented; male 1.3–1.6 mm. long, antennae 9-segmented (Brazil, Surinam)	decedens
20 (11). Antennal scape exceeding occiput.....	pickeli
Antennal scape not attaining occiput.....	21
21 (20). Head 1.1 times longer than broad; diastema between the basal and third mandibular tooth marked (Brazil, B. Guiana).....	22
Head 1.2 times longer than broad; diastema between the basal and third mandibular tooth less marked (B. Guiana).....	göldii
22 (20). Head barely longer than broad; length 1.7 mm. (thorax 0.55 mm.); eyes 0.04 mm. in diameter (B. Guiana).....	guianensis
Head longer.....	oko
23 (22). Length 2.4–2.8 mm. (thorax 0.6 mm.); eyes 0.06 mm. in diameter (B. Guiana).....	23
Length 2.1–2.4 mm. (thorax 0.55–0.57 mm.); eyes 0.03 mm. in diameter (B. Guiana).....	paludis
	donisthorpei

Acropyga (Rhizomyrma) decedens (Mayr)

1887. *Brachymyrmex decedens* Mayr, Vehr. zool.-bot. Ges. Wien, 37: 521 (worker, female, male).
1892. *Brachymyrmex decedens* Göldi, Arch. Mus. Nac. Rio de Janeiro, 8: 176 (worker).
1905. *Rhizomyrma decedens* Emery, Bull. Soc. Ent. Ital., 37: 184, fig. (worker).
1914. *Rhizomyrma decedens* Wheeler, Bull. Amer. Mus. Nat. Hist., 33: 46 (worker).
1925. *Acropyga (Rhizomyrma) decedens* Emery, Genera Insectorum, Fasc. 183, p. 29 (worker, female, male).
1931. *Acropyga (Rhizomyrma) decedens* Borgmeier, Rev. Ent., 1: 105 (worker).
1931. *Acropyga (Rhizomyrma) decedens* Costa Lima, Bol. Biol., Fasc. 17, pp. 2–7 (worker).
1932. *Acropyga (Rhizomyrma) decedens* Costa Lima, Bol. Biol., Fasc. 21, pp. 65–68 (worker).
1935. *Acropyga (Rhizomyrma) decedens* Wheeler, Jour. New York Ent. Soc., 43: 322, 327, 328 (worker, female, male).
1936. *Acropyga (Rhizomyrma) decedens* Donisthorpe, Entomologist, 69: 110 (worker, female, male).

Worker.—Length 2–2.5 mm. Head, excluding mandibles, slightly broader than long, slightly broader in front than behind, broader than thorax, occipital margin nearly straight, faintly concave, anterior clypeal margin convex, eyes small, situated at a level with the posterior margin of the frontal lobes; mandibles 4-toothed, the teeth well developed and situated on a cutting margin nearly at right angles to the inner margin; antennae 9–11 segmented, scapes distinctly exceeding occipital angles, terminal segment distinctly longer than the preceding three taken together but shorter than the preceding four. Pilosity of scanty, long, upright hairs and abundant golden pubescence; yellow, mandibular teeth red-brown. (Mayr, Emery fig.).

Female.—Length 3–3.3 mm. Mandibles with 4 large, acute teeth; antennae in 3 females 9-segmented, in 7 females the 2nd funicular segment seems divided into two. (Mayr.)

Male.—Length 2 mm. Antennae 11-segmented, scape exceeding occiput, 1st funicular segment twice as long as broad. (Mayr).

Type locality.—Est. Rio de Janeiro, Brazil.

The types were taken by Göldi in 1892 at the roots of coffee with coccids. The coccids were referred to at the time as *Dactylopius* but have since been referred to as of the species *Rhizoecus coffeae* Laing.

Acropyga (Rhizomyrma) göldii Forel

Figure 14

1893. *Acropyga (Rhizomyrma) göldii* Forel, Trans. Ent. Soc. London, pp. 348-349 (worker).
 1912. *Rhizomyrma goeldii* Forel, Mém. Soc. Ent. Belg., 20: 60 (worker).
 1914. *Rhizomyrma goeldii* Wheeler, Bull. Amer. Mus. Nat. Hist., 33: 46 (worker).
 1925. *Acropyga (Rhizomyrma) goeldii* Emery, Genera Insectorum, Fasc. 183, p. 29, Pl. I, fig. 15 (worker, female wing).
 1931. *Acropyga (Rhizomyrma) göldii* Costa Lima, Bol. Biol., Fasc. 17, pp. 4-7 (worker).
 1932. *Acropyga (Rhizomyrma) göldii* Costa Lima, Bol. Biol., Fasc. 21, pp. 65, 67-8 (worker).
 1933. *Acropyga (Rhizomyrma) goeldii* Borgmeier, Rev. Ent., 3: 263 (female wing).
 1935. *Acropyga (Rhizomyrma) goeldii* Wheeler, Jour. New York Ent. Soc., 43: 327 (worker).
 1936. *Acropyga (Rhizomyrma) göldii* Donisthorpe, Entomologist, 69: 110 (worker).

Worker.—Length 2-2.3 mm. Head rectangular, broader than long, broader in front than behind; eyes very small, composed of two or three atrophied facets situated at the anterior third of the sides; mandibles 3-4 toothed, with three long, acute teeth and basally a minute denticle; antennae 10-11 segmented, antennal scapes slightly surpassing the occipital border, terminal segment of funicular swollen, almost as long as the four preceding segments taken together, funicular segments 2-9 one one-fourth times broader than long. Thorax slightly concave longitudinally, mesonotum large and very elevated, meso-epinotal impression very distinct, epinotum rounded, declivous face much longer than the basal. Petiolar node very compressed, oval-rectangular. Legs very short, tarsi a little stout.

Smooth, shining, very finely and regularly punctate. Pilosity of erect, pale yellow, very fine, pointed hairs of irregular length which are abundant over the entire body, and a moderately abundant oppressed yellowish pubescence which is somewhat more abundant on the gaster; tibiae and scapes with very short hairs, oblique on the tibiae, upright on the scapes. Very pale yellow, slightly brighter than in *R. smithi*. (Forel).

Type locality.—Parahyba, Prov. Rio de Janeiro, Brazil.

Cultivating coccids on the roots of coffee.

The British Guiana workers described below agreed perfectly with specimens from Pará, Brazil, (Beebe) determined as *R. göldii* by Dr. W. M. Wheeler. They differ from Forel's description, however, chiefly in having the head distinctly longer than broad and the eyes larger (0.036 mm.), being composed of about six facets. The occipital margin is feebly impressed; the anterior clypeal margin feebly convex, the mandibles 4-toothed and the antennae are 10-segmented although several have indications of an eleventh segment forming, with the scapes

distinctly exceeding the occipital angles. The anterior face of the petiolar scale is convex, the posterior face is feebly concave and the dorsal crest is strongly convex.

Biology.—In virgin rain forest containing many Brazil nut trees (*Bertholletia* sp.) along the New River, in the neighborhood of 3° N. Lat. and 57° W. Long., Couratyne basin, British Guiana, a colony of this species was found July 18, 1936 (No. 576). The ants were tending the common Trinidad type of coccids on rootlets of small plants which were interwoven into the husk of a Brazil nut fruit lying on the ground. Under the husk was yellow sandy clay soil in which the ants had tunnels. The workers maintained the same solicitude for the coccids as did the Trinidad species and carried them off, dorsal side up and anterior end forward, between the ants' legs. Since only coccids were found here and no ant brood the workers evidently had their nest some distance off. Because this was merely a noon stop during strenuous traveling through falls and rapids by boat there was no time for investigating this association.

***Acropyga (Rhizomyrma) göldii* var. *columbica* Forel**

1912. *Acropyga (Rhizomyrma) göldii* var. *columbica* Forel, Mém. Soc. Ent. Belg., 20: 61 (worker).
 1925. *Acropyga (Rhizomyrma) göldii* var. *columbica* Emery, Genera Insectorum, Fasc. 183, p. 29.

Worker.—Length 2.2 mm. Mandibles 3-toothed; differing from the type of the species by the funicular segments 2-9 being about twice as broad as long and the tarsi somewhat less thickened. (Forel).

Type Locality.—Colombia, presumably, although no locality is stated.

***Acropyga (Rhizomyrma) göldii* var. *tridentata* Forel**

1912. *Acropyga (Rhizomyrma) göldii* var. *tridentata* Forel, Mém. Soc. Ent. Belg., 20: 61 (male, female).
 1925. *Acropyga (Rhizomyrma) göldii* var. *tridentata* Emery, Genera Insectorum, Fasc. 183, p. 29.

Female.—Length 3.3-3.5 mm. Head transversely rectangular, 0.7 x 0.57 mm., the occipital margin straight; eyes very small, situated at the anterior third of the head; mandibles with three long, acute teeth, without trace of a denticle; antennal scape surpassing occipital margin by twice its diameter, funicular segments slightly broader than long. Thorax and head equally broad, epinotum moderately convex, junction of basal and declivous surfaces indistinguishable. Wings blackish. Less shining and above all much more densely pubescent and punctate than in the typical *göldii*. Yellow with a touch of brown. (Forel).

Male.—Length 2.5-2.6 mm. Head squarish, slightly broader than long; mandibles 3-toothed; antennae 12-segmented, scape surpassing occipital margin by a fourth its length, middle segments of funiculus slightly broader than long. Thorax broader than head, exterior genital valves very large, very long, terminating in a long, flattened point, recurved above; there is a strongly and vertically recurved prolongation of the middle valves surpassing the border of the exterior

valves. More shining than in the female, otherwise similar. Dark brown, thorax and appendages clear brown. Wings tinted with blackish brown. (Forel).

Type Locality.—Panama. Taken by Christopherson from a nuptial flight.

***Acropyga (Rhizomyrma) smithi* Forel**

1893. *Acropyga (Rhizomyrma) smithi* Forel, Trans. Ent. Soc. London, p. 349 (female).
 1914. *Rhizomyrma smithi* Wheeler, Bull. Amer. Mus. Nat. Hist., 33: 46 (female).
 1925. *Acropyga (Rhizomyrma) smithi* Emery, Genera Insectorum, Fasc. 183, p. 30 (female).
 1935. *Acropyga (Rhizomyrma) smithi* Wheeler, Jour. New York Ent. Soc., 43: 328 (female).
 1936. *Acropyga (Rhizomyrma) smithi* Donisthorpe, Entomologist, 69: 110 (female).

Female.—Length 2.0-2.2 mm. Head an elongate rectangle, much longer than broad, sides and posterior border straight, anterior margin of clypeus emarginate on each side, truncate and slightly concave in the middle, frontal carinae composed of an anterior portion in the form of a small, horizontal lobe and a posterior portion strongly divergent; frontal groove feeble but visible; eyes flat, very large, close to the anterior angles of the head; mandibles 3-4 toothed, feebly curved; antennae 7-segmented, scape extending to a level with the anterior ocellus, terminal funicular segment longer than the preceding 4 taken together, first funicular segment as long as the two following taken together, segments 4-5 broader than long. Pronotum not overhung by mesonotum, scutellum flattened, epinotum rounded. Petiolar node vertical, small, rectangular, the dorsal margin right-angled. Legs short

Very shining, smooth, finely and abundantly punctate. Hairs short, fine, pointed, scattered over body, lacking on scapes and tibiae; pubescence sub-appressed, pale yellow, short and widespread on body, legs and antennae. Pale yellow, mandibular teeth reddish, infuscated about ocelli and anteriorly on head. Wings lacking. (Forel).

Type Locality.—St. Vincent, British West Indies.

The single female was collected by H. H. Smith on Morne à Garou at an elevation of 1500 feet under the bark of a rotten log.

***Acropyga (Rhizomyrma) pachycera* Emery**

1905. *Rhizomyrma pachycera* Emery, Bull. Soc. Ent. Ital., 37: 182-4, Fig. 44 (worker, female).
 1914. *Rhizomyrma pachycera* Wheeler, Bull. Amer. Mus. Nat. Hist., 33: 46-47 (worker).
 1925. *Acropyga (Rhizomyrma) pachycera* Emery, Genera Insectorum, Fasc. 183, p. 30 (worker, female).
 1931. *Rhizomyrma pachycera* Borgmeier, Rev. Ent., 1:106 (worker).
 1935. *Acropyga (Rhizomyrma) pachycera* Wheeler, Jour. New York Ent. Soc., 43: 327, 328 (worker, female).
 1936. *Acropyga (Rhizomyrma) pachycera* Donisthorpe, Entomologist, 69: 110 (worker, female).

Worker.—Length 2.2 mm. Head, excluding mandibles, as broad as long (in figure), occipital margin straight, sides sub-parallel, anterior

clypeal margin convex; mandibles 4-toothed, masticatory margin oblique; antennae 9-segmented, scapes not reaching occipital margin. Pale yellow. (Emery).

Female.—Length 3.7 mm. Antennal scapes attain occipital angles, funicle somewhat more slender than in worker. Thorax as broad as head.

Type Locality.—Tacurù Pucu (Alto Paranà), Brazil.

Acropyga (Rhizomyrma) exsanguis Wheeler

1909. *Rhizomyrma exsanguis* Wheeler, Boll. Lab. Zool. Gen. Agr. Portici, 3: 238 (worker).
 1914. *Rhizomyrma exsanguis* Wheeler, Bull. Amer. Mus. Nat. Hist., 33: 46 (worker).
 1922. *Acropyga (Rhizomyrma) exsanguis* Mann, Proc. U. S. Nat. Mus., 61: 53 (worker).
 1925. *Acropyga (Rhizomyrma) exsanguis* Emery, Genera Insectorum, Fasc. 183, p. 29 (worker).
 1935. *Acropyga (Rhizomyrma) exsanguis* Wheeler, Jour. New York Ent. Soc., 43: 327 (worker).
 1936. *Acropyga (Rhizomyrma) exsanguis* Donisthorpe, Entomologist, 69: 110 (worker).

Worker.—Length 1.4–1.6 mm. Mandibles long, slender, uniformly curved, with parallel borders and 3 acute, oblique teeth. Antennae 8–9 segmented, scapes reaching almost to the occipital corners of the head, all funicular segments, except first and second much broader than long. Eyes extremely minute. Thorax as in *göldii*. Subopaque or finely shining. Hairs very sparse, pubescence not very abundant. Pale yellow. (Wheeler).

Mexico: Jalapa (F. Silvestri). This locality, near Vera Cruz in Latitude 19° 30' N., is the northernmost record for this genus in the New World.

Acropyga (Rhizomyrma) fuhrmanni Forel

Figures 6, 11

1913. *Acropyga fuhrmanni* Forel, Mém. Soc. Sc. Neuchâtel, 5:12 (worker, female).
 1925. *Acropyga (Rhizomyrma) fuhrmanni* Emery, Genera Insectorum, Fasc. 183, p. 29 (worker, female).
 1935. *Acropyga (Rhizomyrma) fuhrmanni* Wheeler, Jour. New York Ent. Soc., 43: 327, 328 (worker, female).
 1936. *Acropyga (Rhizomyrma) fuhrmanni* Donisthorpe, Entomologist, 69: 110 (worker, female).

Worker.—Length 1.7–1.9 mm. Head, excluding mandibles, rectangular, a little longer than broad, broadest in front, occipital margin slightly impressed medially; eyes more distinct than in *exsanguis*; mandibles 4-toothed, with a very distinct terminal border; antennae 8-segmented, scape not quite attaining occipital margin. Promesonotum as in *göldii*; petiolar node vertical, smaller than in *göldii*. Shining, finely punctate, pilosity abundant but passing gradually into an oblique pubescence. Pale yellow, mandibles brown. (Forel).

Female.—Length 2.5–2.7 mm. Antennae 8-segmented, scape reaching occiput and 2nd funicular segment as long as broad. Slightly dirty yellow, on the vertex, thorax and gaster a somewhat yellowish-

brown blotch. Wings brown, radial cell constant, one cubital cell, no discoidal cell. (Forel).

Type Locality.—Puerto de los Pobres, Cauca border, Dép. Antioquia, at an elevation of about 720 m.

Ants which I took in the same region (Rio Porce, R. Cauca tributary, Colombia, July 19, 1938) agree with Forel's description in general. The head of the worker is 1.1 times longer than broad, the occipital margin distinctly impressed, the anterior clypeal margin convex, the eyes 0.02 mm. in diameter, the mandibles with four well developed teeth arranged, however, on an oblique border, and the antennae 8-segmented with the scapes failing to reach the occipital corners by about their distal diameters. In side view the anterior pronotal margin is concave, the mesonotum is only feebly convex and the meso-epinotal impression is indistinct. The basal and declivous surfaces of the epinotum in side view are joined in a rounded angle. The petiolar scale in side view is thin, with a feebly convex anterior and a feebly concave posterior surface; from above and in front the dorsal surface is convex.

The female head, excluding mandibles, is rectangular, 1.1 times longer than broad, with occipital and anterior clypeal margins, subparallel sides, 4-toothed mandibles and 8-segmented antennae. The eyes are distinctive, being large, flattish, and situated less than a third their diameters from the mandibular insertions.

The undescribed male is 1.7 mm. long (thorax 0.5 mm.) has falcate mandibles with a single apical tooth and 9-segmented antennae. The petiolar scale is thin and conic in side view. The head is a dirty, dark brown, the gaster paler and the thorax still paler. The pubescence is moderately abundant and the hairs scanty.

The eggs are elliptical except for being slightly narrowed at one end and are 0.43 x 0.24 mm. (fig. 11). The larvae are moderately slender and have numerous hairs, some of which are simple, some trifid and some flattened and finely divided apically; these are lacking at the sutures (fig. 6).

This species was found twice at the El Hormiguero Mine, Rio Porce. Workers were taken July 19 from rotted wood in the base of a hollow stump 2 meters high but with only a shell 2-5 cm. remaining. About two-fifths of the sides were gone, leaving a protected area open to the north. The stump stood on the open, grassy area close to the Rio El Hormiguero, a small creek. In cells in the rotted wood from ground level to 15 cm. below were various ant colonies (*Anochetus*, *Prionopelta punctulata* Mayr, a female *Camponotus* (*Myrmobrachys*) *lindigi* Mayr, tiny myrmicines, and the *Rhizomyrma*). Termites, spiders and snails were also present. Later in the day a second colony was found a mile or two away but on an almost vertical slope in a ravine with densely wooded slopes. These ants were in wet clay (a disintegrated granite rich in feldspar) at a place with a slope of 70°-90°. The *Rhizomyrma* had formed innumerable tunnels of varying diameter up to 2 mm. On roots of ferns and small herbs piercing the tunnels were pastured coccids of the type tended by *R. berwicki* in Trinidad. Coccids and ant brood were just below the surface to 5 cm. depth. The coccids could be seen to flip their "tails" up and down as do those associated with Trinidad

species. The ants were comparatively active in their movements. In the tunnels were found many males, a few alate females and many pupal females. No queen was seen. The tunnels completely surrounded those of *Strumigenys*, *Pheidole* and colonies of a minute myrmicine.

Acropyga (*Rhizomyrma*) *dubitata* Wheeler and Mann

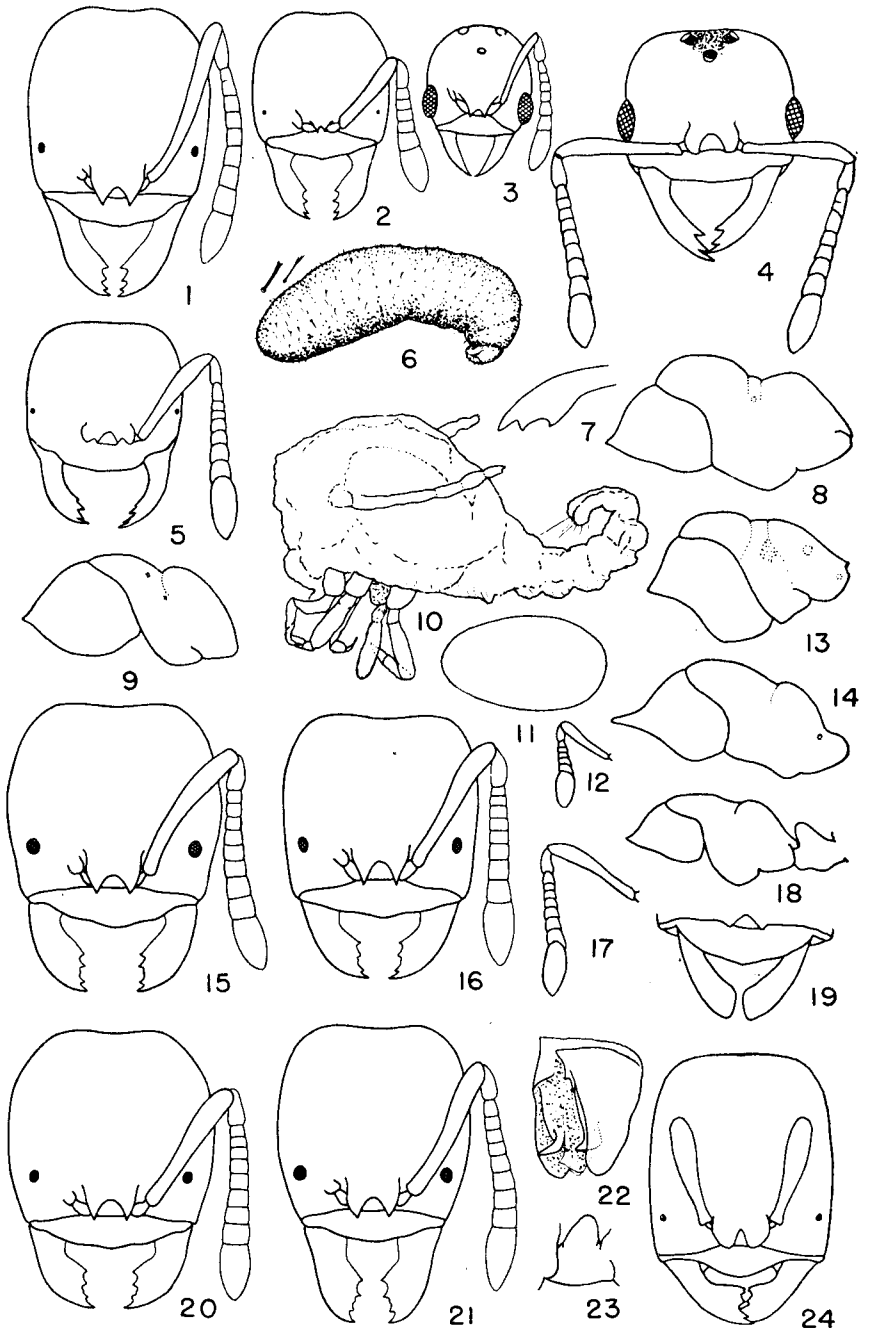
1914. *Rhizomyrma dubitata* Wheeler and Mann, Bull. Amer. Mus. Nat. Hist., 33: 47 (male).
 1925. *Acropyga* (*Rhizomyrma*) *dubitata* Emery, Genera Insectorum, Fasc. 183, p. 29 (male).
 1933. *Acropyga* (*Rhizomyrma*) *dubitata* Borgmeier, Rev. Ent., 3: 263 (male).
 1935. *Acropyga* (*Rhizomyrma*) *dubitata* Wheeler, Jour. New York Ent. Soc., 43: 328 (male).
 1936. *Acropyga* (*Rhizomyrma*) *dubita* Donisthorpe, Entomologist, 69: 110 (male).
 1939. *Acropyga* (*Rhizomyrma*) *dubita* Donisthorpe, Proc. Ent. Soc. London, 8: 154 (male).

Male.—“Length 2 mm. Very similar to the male of *Acropyga*. Head a little broader than long, subrectangular. Eyes rather small, less than half as long as the sides of the head. Mandibles slender, distinctly tridentate. Clypeus convex and almost carinate in the middle, with entire, rounded anterior border. Antennae with long scapes, which reach well beyond the posterior corners of the head; first funicular joint globular, as broad as long, joints 2-7 a little broader than long, remaining joints longer. Thorax robust but not much broader than the head through the eyes. Mesonotum convex in front, slightly overarching the pronotum; scutellum not convex; epinotum rounded, sloping, without distinct base and declivity. Petiole with erect node, which is rather thick though compressed anteroposteriorly, with a blunt, rounded, entire border. Its anterior face in profile is slightly convex, its posterior face more flattened. Gaster rather short and stout; external genital valves large, with broad, bluntly bidentate tips; inner valves shorter, unciform. Wings rather large, like those of *Acropyga* with one cubital cell, no discoidal cell and the radial cell closed.

“Body shining throughout and very finely shagreened. Hairs

EXPLANATION OF PLATE

- FIGURE 1. *Acropyga* (*Rhizomyrma*) *guianensis*, sp. nov. Worker head. 2. *Rh. urichi*, sp. nov. Worker head. 3. *Rh. urichi*, sp. nov. Male head. 4. *Rh. rutgersi* Bünzli. Female head of B. Guiana Colony 340. 5. *Rh. quadriceps*, sp. nov. Worker head. 6. *Rh. fuhrmanni* Forel. Mature larva with two of its hairs enlarged at left. 7. *Rh. trinitatis*, sp. nov. Worker mandible. 8. *Rh. trinitatis*, sp. nov. Worker thorax in side view, Cotype. 9. *Rh. donisthorpei*, sp. nov. Worker thorax in side view. 10. Sketch of Coccid tended by *Rh. berwicki* Wheeler type colony. 11. *Rh. fuhrmanni* Forel. Egg from Colombia Colony 996. 12. *Rh. kathrynae*, sp. nov. Worker antenna. 18. *Rh. mesonotalis*, sp. nov. Worker thorax in side view. 14. *Rh. göldii* Forel. B. Guiana Colony 576, worker thorax in side view. 15. *Rh. paludis*, sp. nov. Worker head. 16. *Rh. oko*, sp. nov. Worker head. 17. *Rh. trinitatis*, sp. nov. Worker antenna. 18. *Rh. trinitatis*, sp. nov.? Worker thorax and petiole in side view. 19. *Rh. trinitatis*, sp. nov.? Abnormal worker mandibles and clypeus. 20. *Rh. donisthorpei*, sp. nov. Worker head, B. Guiana Colony 474. 21. *Rh. donisthorpei*, sp. nov. Worker head, B. Guiana Colony 357. 22. *Rh. berwicki* Wheeler. Genitalia of male type colony. 23. *Rh. rutgersi* Bünzli. Petiole of female of B. Guiana Colony 340. 24. *Rh. panamensis*, sp. nov. Worker head.



pale, erect, absent on the thorax and anterodorsal portion of the gaster, conspicuous on the petiole, venter and genitalia. Pubescence whitish, fine and rather dense, but not concealing the shining surface. Yellow throughout; appendages scarcely paler; only the ocellar triangle blackish or fuscous. In some specimens the body is very slightly tinged with brown. Wings yellowish gray, with colorless veins and stigma." (Wheeler and Mann).

Type Locality.—San Francisco Mts., San Domingo.

***Acropyga (Rhizomyrma) parvidens* Wheeler and Mann**

1914. *Rhizomyrma parvidens* Wheeler and Mann, Bull. Amer. Mus. Nat. Hist., 33: 46-47 (worker).
 1925. *Acropyga (Rhizomyrma) parvidens* Emery, Genera Insectorum, Fasc. 183, p. 30 (worker).
 1935. *Acropyga (Rhizomyrma) parvidens* Wheeler, Jour. New York Ent. Soc., 42: 327, 328 (worker).
 1936. *Acropyga (Rhizomyrma) parvidens* Donisthorpe, Entomologist, 69: 110 (worker).

Worker.—"Length 1.8-2 mm. Head subrectangular, a little broader than long, as broad in front as behind, with straight sides and a slight angular excision in the middle of the posterior border. Eyes minute, consisting of about 4 small ommatidia, situated at the anterior third of the head. Mandibles oblique but with distinct basal and apical borders, the latter with 4 small subequal teeth, much smaller than in any of the known species of the genus. Clypeus short and convex, with the anterior border entire, straight and transverse in the middle. Frontal area distinct, triangular; frontal and occipital grooves distinct. Antennae 10-jointed; scapes reaching to the posterior corners of the head; first funicular joint longer than broad, second joint small, as long as broad; joints 3-5 much broader than long, joints 7-8 as long as broad, terminal joint as long as the 3 preceding joints together. Thorax shaped much as in *R. göldii* Forel, but shorter and stouter, at least behind, where it is as broad as in front; seen from above the sides are rather concave in the middle; pronotum much broader than long, with less convex humeri than in *göldii*, mesonotum not longer than broad, as it is in *göldii*, fitting into the semicircular excavation of the posterior portion of the pronotum, convex and rising above the latter in profile, abruptly sloping behind to the meso-epinotal constriction which is pronounced but very short. Epinotum distinctly broader than long, in profile lower than the mesonotum, with rather straight base and declivity meeting at a rounded, obtuse angle, the base distinctly longer than the declivity. Petiole with an erect, well-developed scale, which is a little more than half as broad as the epinotum, but not as high, compressed anteroposteriorly, with flattened anterior and posterior surfaces and rather blunt, entire, broadly rounded superior border. Gaster rather large, elliptical. Legs stout.

"Body shining, finely shagreened and sparsely punctate. Mandibles and clypeus somewhat more opaque.

"Hairs and pubescence whitish or pale yellow, the former rather long, unequal, erect and confined to the body, the latter rather dense

and short, covering both body and appendages, but not obscuring the shining surface.

"Pale brownish yellow throughout; legs and antennae a little paler, head in some specimens a little darker, only the eyes and mandibular teeth brown." (Wheeler and Mann).

Type Localities.—Petionville and Diquini, Haiti.

***Acropyga (Rhizomyrma) marshalli* Crawley**

1921. *Acropyga (Rhizomyrma) marshalli* Crawley, Ann. Mag. Nat. Hist., 7: 93-95, fig. 2 (worker).
 1925. *Acropyga (Rhizomyrma) marshalli* Emery, Genera Insectorum, Fasc. 183, p. 30 (worker).
 1935. *Acropyga (Rhizomyrma) marshalli* Wheeler, Jour. New York Ent. Soc., 43: 327 (worker).
 1936. *Acropyga (Rhizomyrma) marshalli* Donisthorpe, Entomologist, 69: 110 (worker).

Worker.—Length 2 mm. Head, excluding mandibles, 1.2 times broader than long (according to figure), sides diverging anteriorly, occipital margin feebly impressed, anterior clypeal margin convex, feebly sinuate; eyes of 2-4 minute facets at anterior third of head; mandibles 3-toothed; antennae 10-11 segmented, the second funicular segment being only partly divided, scapes attaining occipital margin, funicular segments 3-7 broader than long, 8-9 barely broader than long; terminal segment equaling the 4 preceding taken together. Thorax broader than long, epinotum broader than long, in profile as high as mesonotum, the base rounded, the declivity feebly concave. Petiolar scale viewed from in front flat, straight along the top, sides diverging slightly, becoming broadest in middle of sides. Legs short and stout. Head subopaque, finely shagreened, thorax and gaster similarly shagreened but more shining. Head, antennae, legs and gaster covered with a fairly dense whitish pubescence; sparse long hairs on clypeus, posterior portion of pronotum and shorter hairs on mesonotum, base of mesonotum and margins of gastric segments. Pale yellow, some specimens slightly darker. (Crawley).

Type Locality.—Barbados, B. W. I. (J. R. Bovell No. 346).

Recorded in soil around a sugar cane root.

***Acropyga (Rhizomyrma) wheeleri* Mann**

1922. *Acropyga (Rhizomyrma) wheeleri* Mann, Proc. U. S. Nat. Mus., 61: 52-53 (worker, female).
 1925. *Acropyga (Rhizomyrma) wheeleri* Emery, Genera Insectorum, Fasc. 183, p. 30 (worker, female).
 1935. *Acropyga (Rhizomyrma) wheeleri* Wheeler, Journ. New York Ent. Soc., 43: 327-328 (worker, female).
 1936. *Acropyga (Rhizomyrma) wheeleri* Donisthorpe, Entomologist, 69: 110 (worker, female).

Worker.—Length 1.5 mm. Head subrectangular, a little longer than broad, occipital margin shallowly excised; mandibles 3-toothed, basal and apical borders distinct; eyes of one facet; antennae 9-segmented, scapes attaining occipital border, first funicular segment as long as second and third taken together, segments 2-5 strongly transverse, segments 6-7 about as long as broad, terminal segment nearly as long as the three preceding segments taken together. Pro-

notum broader than long, mesonotum longer than broad and about as long as pronotum. Base of pronotum more than twice as broad as long at middle, rounding gradually into declivous surface. Petiolar scale flattened, dorsal border rounded. Shining, hairs very fine, short and abundant on head, longer and sparser on body. Pale brownish yellow with brown mandibular teeth. (Mann).

Female.—Length 2 mm. Head shorter than in worker, second funicular segment longer than broad and segments 4–5 less transverse than in worker. Petiolar scale rather thick in profile. (Mann).

Type Locality.—Lombardia, Honduras.

Workers and a female (No. 1142) which I took on Barro Colorado Island, Panama Canal Zone, August 13, 1938, agree well with Dr. Mann's description except in larger size and with longer funicular segments. Both castes have 3-toothed mandibles and 9-segmented antennae; one worker has 8-segmented antennae on one side and 9-segmented on the opposite side.

The ants were taken in soil chambers around a nest of *Sericomyrmex amabilis* Wheeler. Both nests were in Quadrate 1 of the *Anacardium* tree being studied by Doctors Park, Voth and Williams, at a distance of 60 cm. from the base of the tree in luxuriant rain forest. Unfortunately there was time for no other observations.

Acropyga (Rhizomyrma) pickeli Borgmeier

1927. *Acropyga (Rhizomyrma) pickeli* Borgmeier, Bol. Mus. Nac. Rio de Janeiro, 3:287 (worker) (not seen).
 1927. *Acropyga (Rhizomyrma) pickeli* Pickel, Chacaras E Quintaes, 36: 592 (worker).
 1927. *Acropyga (Rhizomyrma) pickeli* Pickel, *Rhizoecus Lendea*, n. sp., Imprensa Industrial, Recife, p. 27 (worker).
 1928. *Acropyga (Rhizomyrma) pickeli* Costa Lima, Relatório Sobre A Doença Dos Cafeeiros Em Pernambuco. Imprensa Official, Rio de Janeiro. p. 23.
 1931. *Acropyga (Rhizomyrma) pickeli* Borgmeier, Rev. Ent., 1: 105–6 (worker).
 1931. *Acropyga (Rhizomyrma) pickeli* Costa Lima, Bol. Biol., Fasc. 17, pp. 2–7, figs. 2–10, 12 (worker, female wing).
 1932. *Acropyga (Rhizomyrma) pickeli* Costa Lima, Bol. Biol., Fasc. 21, pp. 65–69 (worker).
 1933. *Acropyga (Rhizomyrma) pickeli* Borgmeier, Rev. Ent., 3: 263 (worker, female and male wing).
 1935. *Acropyga (Rhizomyrma) pickeli* Wheeler, Jour. New York Ent. Soc., 43: 322–9 (worker, female, male).
 1936. *Acropyga (Rhizomyrma) pickeli* Costa Lima, Terceiro Catalogo Dos Insectos Que Vivem Nas Plantas Do Brazil, Rio de Janeiro, p. 182 (worker).
 1936. *Acropyga (Rhizomyrma) pickeli* Donisthorpe, Entomologist, 69: 110 (worker, female, male).

Worker.—Length 2–2.2 mm. Head, excluding mandibles, broader than long, occipital margin impressed, sides convex, rounding broadly into the occiput, anterior clypeal margin truncate or feebly convex; eyes minute; mandibles 4-toothed, the basal tooth being minute; cutting margin more oblique than in *decedens*; antennae 10–11 segmented, scape distinctly not reaching occipital angles. Color yellow. (Borgmeier).

Female.—Length 2.8 mm. Head, excluding mandibles, squarish; mandibles 4-toothed; antennae 11-segmented. Pale yellow.

Male.—Length 1.3–1.6 mm., antennae 9-segmented. (Donisthorpe).

Type Localities.—Parahyba do Norte and Pernambuco, Brazil. Also known from Surinam.

This species cultivates coccids on the roots of coffee. The ants transport the coccids from place to place and excavate a labyrinth of galleries for this purpose. Winged females disseminate the coccids by carrying them on the nuptial flight. The coccids and ants are thus enabled to spread widely. For further information on these ants the works of Pickel and Costa Lima may be consulted.

***Acropyga (Rhizomyrma) bruchi* Santschi**

1929. *Acropyga (Rhizomyrma) bruchi* Santschi, An. Soc. Cient. Argentina, 107: 38 (of reprint) (worker).
 1935. *Acropyga (Rhizomyrma) bruchi* Wheeler, Jour. New York Ent. Soc., 43: 327 (worker).
 1936. *Acropyga (Rhizomyrma) bruchi* Donisthorpe, Entomologist, 60: 110 (worker).

Worker.—Length about 2 mm. Head broader than long, sides straight or a little convex, occipital margin straight, anterior clypeal margin straight; eyes small, of one or two facets, situated a little in front of anterior third of sides; mandibles 3-toothed, the apical double the length of the basal tooth, teeth on a cutting margin forming an angle with the inner margin of mandibles; antennae 9-segmented, scape scarcely attaining occipital margin, second funicular segment scarcely as long as 3-5 taken together; 2 and 7 as long as broad, 3-5 about $1\frac{2}{3}$ - $1\frac{1}{2}$ broader than long, terminal segment a little longer than the three preceding taken together. Pronotum shorter, more convex and more "abrupt" than in *goldii*, mesonotum a little more convex, metanotum a little narrower. Petiolar scale vertical, thin, the dorsal border feebly convex, blunt. Shining, no erect hairs on thorax, very scattered on gaster, pubescence abundant. Pale yellow. (Santschi).

Type Locality.—Rosario de Santa Fe, Argentina.

This species is recorded merely as a "coccidophile."

***Acropyga (Rhizomyrma) paramaribensis* Borgmeier**

1933. *Acropyga (Rhizomyrma) paramaribensis* Borgmeier, Rev. Ent., 3: 263 (worker, female, male).
 1934. *Acropyga (Rhizomyrma) paramaribensis* Borgmeier, Arq. Inst. Biol. Veget. Rio de Janeiro, 1: 109-110, figs. 8-9, Pl. 1; figs. 1, 4, Pl. 2, figs. 1-2 (worker, female, male).
 1935. *Acropyga (Rhizomyrma) paramaribensis* Bünzli, Mitteil Schweiz Ent. Ges., 16: 453-593, 51 figs. (worker, female).
 1935. *Acropyga (Rhizomyrma) paramaribensis* Wheeler, Jour. New York Ent. Soc., 43: 327-8 (worker, female, male).
 1936. *Acropyga (Rhizomyrma) paramaribensis* Donisthorpe, Entomologist, 69: 110 (worker, female, male).

Worker.—Length 1.8 mm. Head, excluding mandibles, approximately as broad as long, occipital margin distinctly impressed, sides subparallel, rounding broadly into occiput; eyes minute, of 3-4 facets, situated on the anterior fourth of the head; mandibles 3-4 toothed, apical the largest; antennae 7-8 segmented, scape short, extending about three-fifths the distance to the occiput, second funicular segment may be divided (in the 8-segmented form); terminal segment

longer than the preceding four taken together (in the 8-segmented form). Thorax broader anteriorly than posteriorly, in profile with slightly concave pronotum, distinct pro-mesonotal impression, moderately convex mesonotum, two impressions in the meso-epinotal region and epinotum convex with a declivous surface much longer than the basal. Petiolar node inclined forward, anterior face in profile convex, apex somewhat pointed, posterior face feebly convex.

Moderately shining, finely shagreened. Pubescence pale yellow, abundant; pilosity erect, short. Color yellow, teeth infuscated. (Borgmeier).

Female.—Length 2.5 mm. Head, excluding mandibles, slightly broader than long, occipital margin distinctly impressed, sides subparallel, anterior clypeal margin convex; eyes large, convex, situated closer to the mandibular insertions than their diameter; mandibles 3-toothed; antennae 7-9 segmented, first funicular segment a little longer than the second. Epinotum abrupt, basal face extremely short. Wing 2.5 mm. (Borgmeier).

Male.—Length 2.2 mm. Head, excluding mandibles, broader back of eyes than long, occipital margin impressed, anterior clypeal margin convex; eyes very large, convex; mandibles 3-4 toothed, the teeth large and acute; antennae 10-segmented, scape not quite attaining the occipital corners. (Borgmeier).

Type Locality.—Paramaribo, Surinam.

These ants were taken by Bünzli from the roots of Liberian coffee where they were tending the coccids previously mentioned. His observations began early in 1931 and on April 16 winged females were taken on the surface of the ground. After a series of rainy days at 9 A. M. one morning he found three winged females, each carrying a small coccid (*Rhizoecus coffeae*) between her mandibles.

In 1932 (January 16 and 26, February 4 and 8) he found females flying with coccids at heights of 3-7 meters both in the morning 8-10 A. M.) and early afternoon (2-3 P. M.).

Rhizomyrma rutgersi females which occurred in the same locality were not observed to carry coccids.

For further information on the biology of this species Bünzli's paper may be consulted.

A female of this species was taken in virgin rain forest bordering the Oko River, a short tributary of the Mazaruni River, British Guiana June 26, 1936, by myself. The ant was found in a small tunnel at the base of the turret entrance to the nest of the fungus-growing ant, *Trachymyrmex phaleratus* Wheeler. The ants nested in heavy clay soil and there was no cultivated coffee or cacao for many miles.

Acropyga (*Rhizomyrma*) *rutgersi* Bünzli

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1935. *Acropyga* (*Rhizomyrma*) *rutgersi* Bünzli, Mitteil. Schweiz Ent. Ges., 16: 453-593, 51 figs. (worker, female, male).

1936. *Acropyga* (*Rhizomyrma*) *rutgersi* Donisthorpe, Entomologist, 69: 110 (worker, female, male).

Worker.—Length 2.4-3.2 mm. Head in front view, excluding mandibles, in Bünzli's Abb. 12J and Abb. 8A is 1.1 times broader than

long, in his Abb. 12K it is 1.1 times *longer* than broad, anterior clypeal margin straight in Abb. 12J, feebly convex in Abb. 12K; mandibles 3-4 toothed, in Abb. 8A mandible with two teeth and a median denticle, in Abb. J-K with three distinct teeth; antennae 9-11 segmented, scape in Abb. 8A distinctly not reaching occiput and the second funicular segment is partially divided so that the antenna has 10 complete segments. (Bünzli).

Female.—Length 3.6-4.8 mm. Head in front view, excluding mandibles, in Bünzli's Abb. 8B is 1.14 times broader than long, occipital margin straight; one eye in the figure is higher than the other and both are convex; mandibles with three well developed teeth; antennae 10-11 segmented, the respective lengths of the scapes in the figure are 26.5 and 28 mm. so that the scapes either extend to the occiput or beyond it. (Bünzli).

Male.—Length 2.8-3 mm. Mandibles 3-toothed, antennae 12-segmented. (Bünzli).

Type Locality.—Paramaribo, Surinam.

If the drawings of worker heads in Bünzli's paper are accurate, the proportions of his figures J and K are those of different species. On the supposition that the figures are not all accurate I have identified a colony which I collected at Macuto, near La Guaira, Venezuela, as this species. In this colony (No. 673, August 16, 1936) the worker is 2.5-2.8 mm. long, has the head as broad as or slightly broader than long, (1.1 : 1), the anterior clypeal margin is convex, the mandibles are 3-toothed and the antennae 10-segmented. The female, 3.9 mm. long, has the head 1.1 times broader than long, the occipital margin straight, the mandibles 3-toothed and the antennae 11-segmented. The male, 2.5 mm. long, has 3-toothed mandibles and 12-segmented antennae.

Other collections, of females, made in Trinidad and British Guiana (Nos. 196.2, 255, 340) appear to be of this species though when typical specimens of *rutgersi* are available they may prove to belong to a new subspecies. They have the following characters:

No. 196.2—Rio Claro, Trinidad, 16. vi. 1935, 3.3 mm. long, head 0.62 x 0.57 mm., rest as in No. 340.

No. 255—Imperial College of Tropical Agriculture, Trinidad, 3. viii. 1935, 3.2 mm. long, head 0.65 x 0.58 mm., rest as in No. 340.

No. 340—Forest Settlement, Mazaruni R., British Guiana, 29. viii. 1935. Length 3.4 mm. (of thorax 1.0 mm.), head in front view broader than long, 0.66 x 0.59 mm., mandibles 3-toothed, antennae 11-segmented.

One more collection, of a colony (No. 286) from British Guiana (Forest Settlement, Mazaruni R., 17. viii. 1935), is evidently of *rutgersi* but may also prove to be a new subspecies unless *rutgersi* is unusually variable. These ants have the following characters:

Worker.—Length 2.2-2.8 mm. (of thorax 0.5-0.6 mm.), average 2.5 mm. Head in front view, excluding mandibles, slightly broader than long, mandibles 3-toothed; antennae 10-segmented, in one worker 9-segmented with a partially formed tenth segment, scapes extending to the occiput. Differing chiefly from the Venezuelan specimens of *R. rutgersi* (*q. v.*) in smaller size, narrower head, shorter scapes and duller, dirtier yellow color.

Female (Deålale).—Length 3.9 mm. (of thorax 1.0 mm.). Head in front view, excluding mandibles, 1.15 times broader than long; mandibles 3-toothed, antennae 11-segmented. Differing from the female of No. 340 chiefly in having a broader head and paler and duller color, the brown ocellar blotch being especially paler.

Male.—Length 2.4 mm. (of thorax 0.86 mm.). Mandibles 3-toothed, the apical being separated by a greater diastema than that between the middle and basal teeth which are also much smaller; antennae 12-segmented, the scapes exceeding the occipital corners by a third their lengths.

Biology.—The important studies of Bünzli (Bünzli, 1935) are summarized in the beginning of this paper and deal with this species and *R. paramaribensis* (*q. v.*). His paper should be consulted for the complete account. *R. rugersi* tends coccids on the roots of Liberian coffee and Bünzli concluded that the ants are obligate coccidophiles. The swarming of this species was not observed but Bünzli was convinced that its habits were essentially similar to those of *R. paramaribensis*.

My Venezuelan specimens were taken from their nest at the base of a banana clump up the river valley $\frac{1}{2}$ –1 mile back of the village. The bananas grew at a point where a reservoir emptied from the side into the stream bed and produced a small, wet area in an otherwise semi-arid region. The soil was an alluvium of sandy clay, gray-brown in color. The *Rhizomyrma* nest was in small chambers in the soil about a nest of the fungus-growing ant, *Acromyrmex octospinosus* Reich. In a blind pocket several centimeters beneath the surface about a dozen tiny coccids, unlike the common Trinidad form in habitus, and two or three large, plump coccids were found with ants. Coccids were also pastured on roots leading to the banana clump. The coccids were carried by the ants grasping them in the middle of the body, long axis parallel with that of the ants, but not always with the dorsal side uppermost. The coccids folded their legs when being transported. Ant eggs and coccids occurred in several chambers. Many winged females and males were in several chambers and one male took flight, indicating that he was mature. The soil 1–6 cm. down was permeated by the ant tunnels. No cacao was noticed in this area but there were in the vicinity what may have been young coffee plants.

The Guiana females (No. 340) were taken as they flew west just before and after sunset around 6 P. M. from the direction of a savannah area bordering the Mazaruni River towards the high rain forest a few rods from where I captured them. On this morning as well as on the previous day it had been raining heavily. The evening, however, was clear and calm. The ants pursued a steady course 5 to 7 feet above the ground and it was at once apparent that each was carrying a gleaming white object in her jaws. Upon capture each was found to be carrying a plump coccid by grasping the dorsum just back of the carapace and between the legs of the ants. The females flew near zigzagging swarms of small male ants of this species but were not seen to enter these swarms. They may have mated earlier.

The female taken near Rio Claro, Trinidad, flew into our touring car as we passed through heavy rain forest in the late afternoon. It, too, was carrying a plump coccid in its jaws.

Only one female was seen at St. Augustine, Trinidad, but this was flying close to one of a number of swarms of male *Rhizomyrma* which may well be of this species. In the twilight and just preceding the setting of the sun (6-6:30 P. M.) fully a dozen swarms of the males were zigzagging at a height above ground of six inches to five feet. The swarms were dense, approximately columnar in form, one to several feet high and six inches to one foot in diameter. The solitary female flew a few feet from one of the swarms and was easily distinguished by her much larger size and bright yellow color. The males were small and dark with 3-toothed mandibles and 12-segmented antennae.

The Guiana colony (No. 286) was discovered hardly a mile east of the place where the Guiana females (No. 340) were flying and the latter seemed to have come directly from the more easterly locality. The colony was a few rods from the Mazaruni River in a grassy savannah and was found 10 cm. beneath the entrance to a nest of *Atta sexdens* ssp. *rubropilosa* Forel in yellowish sand. Colonies of *Cyphomyrmex rimosus*, *Holcaponera*, *Pheidole* and other ants likewise occurred nearby in the sand heaped up by the *Atta* or in soil about the fungus gardens. No coccids were found with the few scattered *Rhizomyrma* workers taken this day, August 17. August 31 the site was revisited and after diligent searching in the yellowish sand in the same spot additional workers, two dealate females, males, brood and coccids were taken about the roots of grass (later determined by Miss Chase of the U. S. Dept. Agriculture as *Axonopus compressus* (Swartz) Beauv.). Brood and coccids were taken at depths of 6-15 cm. on the small roots or in chambers. Most of the coccids were in blind pockets with the brood but away from the roots. Some coccids, however, were taken directly on the roots. A black *Pheidole* worker carried off a live *Rhizomyrma* worker while other *Pheidole* carried *Rhizomyrma* brood.

Axonopus compressus is an important forage grass in the tropics. No damage from the ant-coccid association was obvious here, however, for the grass grew luxuriantly.

If *R. rutgersi* and its coccids are not confined to coffee roots the problem of control is made much more difficult, for this grass, bananas and probably numerous other plants to which these insects might be attracted are widespread.

Acropyga (*Rhizomyrma*) berwicki Wheeler

Figures 10, 22

1935. *Acropyga (Rhizomyrma) berwicki* Wheeler, Jour. New York Ent. Soc., 43: 321-329, fig. 1 (worker).
 1936. *Acropyga (Rhizomyrma) berwicki* Donisthorpe, The Entomologist, 69: 110 (worker).

Worker.—Length 1.5-1.8 mm. "Integument thin and collapsible. Head as long as broad, with nearly straight, parallel sides, broadly rounded posterior corners and feebly convex posterior border. Eyes minute but deeply pigmented, consisting of 6 or 7 unequal, indistinct ommatidia, situated at the anterior sixth of the sides of the head. Mandibles narrow, curved, with very oblique apical borders bearing four subequal, acute teeth, the basal tooth separated from the other three by a distinct diastema and in some specimens stouter and less

obliquely inserted. Clypeus rather short, convex in the middle, with broadly rounded anterior border. Frontal carinae small, rounded; frontal area distinct, impressed, subtriangular; frontal groove obsolete. Antennae 8-jointed; scapes not reaching the posterior border of the head by fully one-fifth of their length; first funicular joint as long as the two succeeding joints together; second joint slightly longer than broad, narrowed at the base; 3-6 distinctly broader than long, increasing gradually in size distally to the terminal joint which is swollen and somewhat longer than the three preceding together. Thorax very short, less than twice as long as broad, widest through the pronotum which is twice as broad as long, in profile rising posteriorly to the mesonotum which is small but convex, sloping posteriorly to the distinct but short meso-epinotal constriction; epinotum broader than long, broader behind than in front, in profile nearly as high as the mesonotum, with anteriorly rather abruptly convex base passing gradually into the longer, flattened, sloping declivity. Petiole short, convex ventrally, its scale erect, rather small and thin, though thicker at the base than at the superior border, which is blunt broadly rounded and much lower than the base of the epinotum. Gaster large and convex anteriorly as in the other species of the genus. Fore tarsi slightly dilated.

"Shining; mandibles smooth, with a few scattered, piligerous punctures; remainder of body very finely reticulate, or superficially shagreened.

"Pilosity and pubescence yellowish, short, erect or suberect, the former dense and abundant, especially on the head, merging with the pilosity which is much sparser and longest on the pro- and mesonotum and tip of gaster.

"Pale yellow throughout, except the mandibular teeth which are deep red or dark brown." (Wheeler).

Type Locality.—San Raphael, Trinidad, B. W. I.

The descriptions below are taken from the type colony which I visited with its discoverer, Mr. E. J. H. Berwick. Only workers were taken originally by Mr. Berwick.

Worker.—Length 1.3-1.8 mm. Antennal scapes in some are shorter than in Dr. Wheeler's figure and fail to reach the occiput by about twice their distal diameter. Basal teeth are also more reduced and the occipital impression more distinct. Of 44 workers, all had both right and left antennae 8-segmented and had 4-toothed mandibles.

Female (Undescribed).—Length 2-2.5 mm. Head in front view, excluding mandibles, slightly broader than long, sides sub-parallel, occipital margin convex; eyes large, situated closer to the mandibular insertions than their diameters; antennae 8-segmented, scapes reach a level with the posterior ocelli; mandibles 4-toothed, the basal tooth small and of variable development. Dull, densely pubescent, the hairs partly reclinate, partly upright. Head and thorax brownish yellow, remainder paler, mandibular teeth and ocellar area infuscated.

Male (Undescribed).—Length 1.4 mm., antennae of 19 males 8-segmented right and left, mandibles 4-toothed. Petiolar node from above twice as broad as long, sides convex.

May 31, 1935, a few months after my friend, Mr. Berwick, discovered the colony originally we visited the site together near San Rafael. He had discovered the workers in cylinders of soil taken from beneath cacao trees on a large cacao estate in connection with soil studies. The holes left in the soil by the removal of the cylinders were still visible and guided us to the exact site of the colony. Fifteen inches from the base of a cacao tree all castes and coccids were taken in the top inch of heavy clay soil. Females and males were in separate chambers about eight inches apart, with workers and coccids. These chambers were merely slight enlargements of the tunnels which ramified through the top inch or two of clay under a layer of cacao leaves. Coccids were found pastured on the cacao rootlets. Earthworms and other tunnelling animals were also present in the clay and were inimical to the ants in that their tunnelling activities tended to break up the ant tunnels. In places where the earthworms were abundant the ant tunnels were mostly deserted. The ants have weak mandibles and probably could not bite the earthworm cuticula to an appreciable extent.

Additional collections of this species were made in Trinidad as follows:

April 1, 1935—Basin Hill Forest Reserve (central part of island at 700 ft. above sea level). The ants occurred in second growth scrub forest called lastro and there was no cacao or coffee within hundreds of feet at the minimum or about a mile along a road. Coccids were pastured on the roots of herbs and other plants in deep shade at a depth of between one and two inches only. The workers sought to carry the coccids away. A winged female was found on my collecting kit some rods away.

May 11, 1935—Mt. St. Benedict, Northern Range, in stream flood debris under cacao.

May 12, 1935—Foothills north of Tunapuna, in tunnels immediately beneath soil surface under cacao. Soil a friable clay under humus and leaf mold. Tending coccids which "lashed" their tails in a vertical plane over their dorsal surfaces when they were disturbed.

June 18, 1935—A half mile up Tucuragua River, a tributary of the Tucuragua River, Northern Range. In rotted wood and humus under cacao.

April 28, 1935—Mason's estate just north of Arima. A colony with females, workers, brood and coccids nested in damp clay-loam alluvial soil under cacao, coffee, banana and Immortelle shade trees in a new section of the plantation. The cacao and Immortelle trees were old remnants. The ants and coccids were in small anastomosing tunnels in the upper few centimeters of soil. The coccids were in bare tunnels and probably they and the ants were "marking time" until the rains came so as to be able to get on juicy rootlets. All of the plantation was very dry except a small area adjacent to several watercourses.

The April 1st colony was collected with soil and placed in an observation nest. During the night of April 2 workers of a pest *Monomorium* invaded the nest and ate all the sugar syrup which was placed in the nest for the *Rhizomyrma*. The *Monomorium* were exterminated. By April 5 the colony had stabilized, the ants having gathered all brood and coccids in several tunnels which they had made in the soil. The

ants were, of course, strongly photophobic and could rarely be studied to advantage. April 18 they were moved to a better nest. April 25 a number of workers, one queen and larvae were found in a piece of clay which was broken up for examination. The larvae were attached to the sides of the tunnels by their hairs. April 30 a worker, when I examined the nest, waved its antennae in my direction as though it saw me; the nest was glass-covered. May 20 the colony, upon breaking the soil up, was found to be dead. Young and adult cheese mites were moving in masses through the tunnels.

The May 12 colony was also collected and placed in an observation nest. They also tunneled into the soil. Under a binocular the colony was watched May 21. A large coccid with bifurcated "tail" excreted a clear droplet on the dorsum of the "tail" at the base of the bifurcation where there was a tuft of long hairs. It was disturbed by the light and wandered awkwardly about with the "tail" held horizontally. An ant, ignoring the droplet, finally grasped it by its dorsal surface at the "carapace" and carried it down a tunnel. All the coccids, large and small, were similarly carried away with the long axis parallel to that of the ant and head end forward.

Acropyga (Rhizomyrma) robae Donisthorpe

1936. *Acropyga (Rhizomyrma) robae* Donisthorpe, *Entomologist*, 69: 108-111, figs. 1-3 (worker, female, male).

Worker.—Length 2.3 mm. "Pale yellow, apex of mandibles and teeth reddish-brown, eyes brown, whole body clothed with longer and shorter, erect or sub-erect, pale yellow hairs, extremely finely and closely punctured.

"Head subrectangular, about as long as broad, sides feebly rounded, posterior border slightly emarginate; eyes very small, consisting of about three facets, situated on the sides of the head about a quarter of the length of the head from anterior border; mandibles narrow, curved, armed with three pointed teeth, the apical one being the longest; clypeus convex, rounded in front; frontal area distinct, moderate, triangular; frontal furrow not present; frontal carinae moderate, bisinuate; antennae 8-jointed; scape curved, not quite reaching the posterior corners of the head when bent back; funiculus increasing in breadth to apex, first two joints elongate, third and fourth transverse, fifth and sixth as long as broad, last joint pointed, as long as the three preceding taken together. Thorax robust, not quite as long as the head and mandible taken together; pronotum transverse, rounded at sides; mesonotum convex, higher than pronotum, suture between distinct; meso-epinotal suture somewhat deep, well defined; epinotum convex round, sloping gradually to the declivity, which is longer than the dorsal region. Petiole short, furnished with a node which is pointed above, the anterior surface flat, the posterior surface slightly concave; gaster rather long and bulky, pointed at apex. Legs moderate, not very slender." (Donisthorpe).

Female.—Length 3.4 mm. Pale yellow, apex of mandibles and teeth reddish-brown, eyes, ocelli and a spot at insertion of fore wing black. Larger, but with structure, etc., except the usual differences,

much as in the worker. The mandibles and apical tooth are longer; eyes and ocelli well formed; wings somewhat dusky, one cubital cell, no discoidal cell, radial cell closed." (Donisthorpe).

Male.—"Length 2.3 mm. Smaller than the female, dirty brownish yellow, head blackish. Eyes large; ocelli moderate; mandibles thin, curved, with an angulation near apex (but no teeth); apical tooth pointed; antennae 10-jointed; node of petiole rather large, rounded above, anterior and posterior surfaces flat. Wings as in female." (Donisthorpe).

Type Locality.—La Esperanza, Colombia.

The colony was taken associating with a small coccid at the roots of coffee in April, 1935.

***Acropyga (Rhizomyrma) borgmeieri* Donisthorpe**

1939. *Acropyga (Rhizomyrma) borgmeieri* Donisthorpe, Proc. Ent. Soc. London, 8: 153-4 (male).

Male.—"Length 2.2 mm. Pale brownish-yellow, head somewhat darker, legs and antennae lighter, very finely punctured, shining, clothed with decumbent pubescence, especially on the gaster, and longer and shorter, suberect hairs. Head transverse, evenly rounded from behind eyes to posterior border, posterior border very slightly sinuate in centre; clypeus transverse, convex, anterior border evenly rounded; frontal area distinct; frontal furrow shallow, reaching median ocellus; eyes large, hemispherical, projecting, occupying nearly half the side of the head; ocelli moderate; mandibles slender, arched, with three teeth to the masticatory border; antennae 12-jointed, fairly long, scapes extending a little beyond posterior angles of head, funiculus with 1st joint triangular, about as broad as long, broader than joints 2-7, which are transverse, the rest longer, last joint a little longer than the two preceding taken together. Thorax convex; mesonotum rounded anteriorly, over-reaching the pronotum; scutellum transverse, slightly convex; epinotum convex, rounded without marked declivity; petiole nodiform, with a blunt rounded point above, slightly convex anteriorly, concave posteriorly and narrowly margined; gaster with genitalia somewhat elongate; external genitalia very large and prominent, stipes long, curved and furnished with a triangular hook, volsellae short and hooked, sagittae narrow with blunt turned-up apex. Wings translucent, covered with minute hairs, pterostigma and veins pale brownish-yellow, no discoidal cell, one cubital cell and closed radial cell." (Donisthorpe).

Type Locality.—Forest Settlement, Mazaruni R., British Guiana.

***Acropyga (Rhizomyrma) mesonotalis*, sp. nov.**

Figure 13

Worker.—Length 1.8-2.1 mm. (of thorax 0.5-0.6 mm.). Head in front view, excluding mandibles, as broad as long or very slightly broader, occipital margin distinctly impressed, sides convex and rounding broadly into the occiput, anterior clypeal margin feebly convex; eyes small, 0.03-0.04 mm. in diameter, situated on the

anterior fourth of the sides of the head; mandibles 4-toothed, the teeth situated on an oblique cutting border and progressively decreasing in size from the large, acute apical tooth; antennae 9-10 segmented, the second funicular segment being in some specimens incompletely or completely divided, scapes slightly exceeding occipital corners. Thorax in side view characterized by a high mesonotum and an almost evenly convex epinotum whose basal and declivous margins are indistinctly separated; from above the pronotum appears lunate and is much wider than the epinotum, meso-epinotal region moderately impressed, the impression involving the posterior extension of the mesonotum. Petiolar node in profile sub-vertical with almost parallel anterior and posterior margins, the former being slightly convex, apex blunt; when viewed anteriorly the apex is truncate and the sides have prominent stigmata near the apex. Gaster elongate-ovate. Legs moderately short and slender.

Shining, densely and finely punctate. Pilosity of a short, appressed and somewhat thin pubescence, the individual hairs being clearly separated from one another; longer and upright hairs are sparse and distributed over the body, scapes and legs, being of irregular lengths and most abundant on the legs and gaster apically. Brownish yellow, head darker than rest of body and mandibular teeth infuscated.

Female (Dealate).—Length 3.4 mm. (of thorax 0.8 mm.). Head in front view, excluding mandibles, distinctly broader than long, occipital margin slightly concave, sides convex and rounding broadly into the occipital margin, anterior clypeal margin faintly angular; eyes moderately large, 0.06 mm. in greatest diameter, closer than their diameters from the mandibular insertions; mandibles 4-toothed, the teeth on an oblique cutting margin and all acute, apical much the longest and the basal slightly smaller than the median two; antennae 10-11 segmented, the second funicular segment being partially divided. Thorax in side view with pronotum and mesonotum rising almost vertically together at their anterior margins, epinotum feebly convex, petiolar scale in profile thin, anterior and posterior margins nearly straight, less parallel than in the worker, apex truncate. Legs moderately short and slender.

Shining, densely and finely punctate. Pilosity and color as in worker, ocellar region with a brown blotch.

Cotypes.—Workers and a female of a colony (No. 727) with coccids which I took June 6, 1938, between Petionville and Kenscoff at an elevation of about 4500 feet in the Republic of Haiti. The coccids were tended by the ants on the roots of coffee in red clayey humus from the top of the soil to 4 cm. in depth.

Though *R. parvidens* is recorded from Petionville also, this species differs distinctly, when compared with the *parvidens* description, chiefly in having much larger teeth, the antennal scapes longer, the meso-epinotal impression longer, the epinotum more rounded in profile, the petiolar node truncate above, the body not shagreened and the pubescence thinner. This is the third species recorded from Hispaniola but the first taken with coccids.

Acropyga (*Rhizomyrma*) panamensis, sp. nov.

Figure 24

Worker.—Length 1.5 mm. (thorax 0.41 mm.). Head in front view, excluding mandibles, rectangular, 1.3 times longer than broad, occipital margin rounded, faintly impressed medially, sides widest apart at a level with the distal ends of antennal scapes, clypeal margin convex; eyes minute; antennae 8-segmented, short, the scapes fail to reach occipital corners by a distance equal to half their length, first funicular segment longer than 2-5 taken together, terminal segment 0.18 x 0.29 mm., compressed; mandibles stout, 4-5 toothed, the basal tooth being broad and bifurcated on the right side making that mandible 5-toothed while the left basal tooth is similarly broad at the base but with only one cusp. Thorax from above 1.8 times longer than broad, two-thirds as broad through epinotum as through pronotum, moderately compressed in the meso-epinotal region; in side view rising steeply at the pronotum to a plane dorsal surface. Petiolar scale in side view thick, blunt at apex, anterior surface convex. Gaster elongate-ovate. Legs moderately short.

Shining, densely and finely punctate. Pilosity of a moderately abundant reclinate pubescence, a few scattered longer and upright hairs, especially about mouthparts and terminal gastric segments. Pale yellow, mandibles infuscated and head more intense yellow than thorax and gaster.

Holotype.—One worker (No. 922(27)) taken by Dr. E. C. Williams, Jr., on Barro Colorado Island, Panama Canal Zone. This is the species referred to as *Rhizomyrma* n. sp. (Williams, 1941, p. 79). The ant was probably among leaves on the forest floor.

Acropyga (*Rhizomyrma*) quadriceps sp. nov.

Figure 5

Worker.—Length 2.7-2.9 mm. Head in front view, excluding mandibles, quadrate, very slightly broader than long, occipital margin truncate, corners rounded, sides subparallel except converging behind, occipital margin feebly convex; eyes minute; antennae 10-segmented, scapes in most specimens not quite reaching occipital angles, in several workers they barely exceed the angles; mandibles 4-toothed, the basal tooth minute, the others much larger and well developed. Thorax in side view with feebly concave anterior pronotal margin, balance of pronotum and the mesonotum forming a distinct, convex lobe; meso-epinotal impression broad, deep and distinct; basal surface of epinotum short, convex, passing gently into the much longer and slightly convex declivous surface; from above broadest through pronotum, meso-epinotal region strongly constricted above. Petiole in side view conic with thick, blunt apex and straight posterior surface, crest evenly convex. Gaster ovate. Legs of moderate length.

Integument shining, finely punctate, collapsible in thorax and gaster. Pilosity of scanty long, upright hairs, more numerous but shorter upright hairs, and a fine, appressed pubescence most abundant

on head and gaster. Yellow with a brownish cast most apparent on head, mandibular teeth infuscated.

Cotypes.—Workers of one colony (No. 74) which I took March 23, 1935, near Maracas Waterfall in the Maracas Valley, Northern Range, Trinidad, B. W. I., at an elevation of 900 ft. These ants were taken within a few rods of the spot where the cotypes of *R. kathrynae* were taken. They were, however, not under trees but were found in the clay soil of the roadway in tunnels with coccids at depths of 2.5–8 cm. There were no roots in these tunnels and it is possible that heavy rains of the morning and preceding night may have forced them to this place from the adjoining forest. There were no cacao trees for hundreds of feet.

This species, compared with *R. pickeli* cotypes, is larger and with similar teeth. The occiput, however, is not impressed, the pubescence more abundant, and the pro-mesonotal impression less marked. They are closely related.

The colony was collected and placed in a small observation nest. The next morning the entire colony was hidden in a cell in a small pile of clay in a glass container placed in the nest. Some of the smaller coccids were outside the cell on moist soil. The following morning small coccids were still outside the ant cell but most had been carried in by the ants. March 26 there was no change in the appearance except that fungus had developed on banana and papaya fruit which I placed in the nest for food. March 27 the coccids had congregated at one place in the bottom of the cell, visible through the glass from below, and were tended by the ants. The ants were highly photophobic then as before. March 29 conditions were as before until the glass container was accidentally upset and ants and coccids fell out with the clay. The workers immediately grasped the coccids and buried into the soil. The next day all were together in a cell as before. March 31 the colony was alive but several coccids were alone. Between April 1 and April 18 the members of the colony gradually died. Evidently observation nests to be successful would require living plant roots to nourish the coccids who would in turn nourish the ants.

Acropyga (Rhizomyrma) kathrynae, sp. nov.

Figure 12

Worker.—Length 1.2–1.3 mm. (of thorax 0.36–0.37 mm.). Head in front view, excluding mandibles, slightly longer than broad, 0.35 x 0.39 mm., distinctly impressed medially at occiput, sides slightly convex, anterior clypeal margin truncate; eyes small, about 0.02–0.03 mm. in diameter, situated at a distance from the mandibular insertions equal to about twice their diameters; mandibles stout, with four distinct teeth of which the basal is smallest, mandibles broadest through basal tooth; antennae 8-segmented, antennal scapes extend slightly over three-fourths the distance to the occipital corners. Thorax in side view with anterior pronotal margin concave and with convexities in pronotal-mesonotal and epinotal regions, the mesoepinotal region being slightly concave; from above the thorax is about twice as broad through the pronotum as through the basal surface of

epinotum, meso-epinotal region strongly constricted. Petiolar scale convex dorsally, in side view conic, compressed, the apex rounded. Gaster elongate-ovate with pointed apex. Legs moderately short and slender.

Integument shiny, thin and collapsible. Pilosity of scattered, irregular, upright hairs most numerous on thorax and gaster; abundant short, upright hairs chiefly on head and gaster; an appressed pubescence most abundant on head and gaster. Pale straw yellow, only the mandibular teeth infuscated.

Cotypes.—Workers of one colony (No. 76) which I took March 23, 1935, near Maracas Waterfall in the Maracas Valley, Northern Range, Trinidad, B. W. I., at an elevation of 900 ft. The ants, and several of this species taken March 19 at the same spot, were found among humus on the forest floor in a shady ravine. Growing nearby were cacao as well as other trees. This species, which is dedicated to my mother, is close to *fuhrmanni* but is smaller and with distinctly shorter antennal scapes.

Workers (Nos. 1172, 1178, 1185, 1187) which I took on Barro Colorado Island, Panama Canal Zone, agree closely with the cotypes. Several of the specimens are slightly larger (1.5 mm.) and slightly less impressed in the meso-epinotal region but all have similar head proportions, etc., and have the same pale, almost ivory, color of the thorax. They were taken on the same day, August 15, 1938. Workers were found in soil about the nest of *Cyphomyrmex costatus* Mann with its guest ant, *Megalomyrmex (Cepobroticus) wheeleri* Weber, which was under a small stone. Occupying the same runways with the *Rhizomyrma*, as well as adjacent and anastomosing chambers, were workers of a tiny yellow myrmicine. The second record was of *Rhizomyrma* workers close to a nest of *Cyphomyrmex costatus* Mann⁵ but under a nearby stone. Both localities were on a rocky slope in luxuriant rain forest. The third and fourth records were both under rocks, one having tunnels anastomosing with those of a minute yellow myrmicine, the other similarly associated with a very small yellow ponerine ant.

***Acropyga (Rhizomyrma) urichi*, sp. nov.**

Figures 2, 3

Worker.—Length 1.5–1.9 mm. (of thorax 0.4 mm.). Head in front view, excluding mandibles, 1.1 times longer than broad, occipital margin distinctly impressed, sides convex and converging broadly to occiput, anterior clypeal margin convex; eyes minute, 0.02 mm. in diameter; mandibles 4-toothed, the basal tooth small and not greatly more distant from the third than the third is from the fourth; antennae 7–8 segmented, scapes short, failing to reach the occipital angles by about twice their distal diameter. Thorax in side view with concave anterior pronotal margin, distinct pro-mesonotal impression, flat dorsal surface which forms a distinct angle with the declivous surface of the epinotum; thorax from above one and two-thirds times longer than broad, strongly compressed in the meso-epinotal region. Petiolar scale with convex anterior and largely straight posterior surface, truncate at apex. Gaster elongate-ovate. Legs moderate.

⁵A photograph of the nest and site has appeared (Weber, 1941, Pl. 2).

Shining, finely punctate. Pilosity of a fine, appressed to reclinate pubescence which is most conspicuously abundant on the thorax and legs; with upright, longer and sparse hairs of variable lengths scattered generally over the body. Pale yellow, mandibular teeth infuscated.

Female.—Length 2.2 mm. (of thorax 0.7 mm.). Head in front view, excluding mandibles, 1.1 times longer than broad, occipital margin feebly convex, sides sub-parallel, anterior clypeal margin faintly convex, nearly straight; eyes large (0.11 mm.), situated much closer to the mandibular margin than their diameters; antennae 8-segmented, scapes failing to reach occipital angles by a distance about equal to their distal diameters, funiculi short, segments 3–5 as broad or broader than long. Petiole in side view cuneate, blunt and thick at apex, from above truncate apically. Gaster elongate, cylindrical. Legs moderate.

Shining, finely punctate. Pubescence on the head short, reclinate and abundant, on the thorax longer, more upright, on the gaster, longer, reclinate and abundant; appendages with abundant, long pubescence; pilosity of scattered, long, upright hairs. Head brown, ocellar region and mandibles infuscated; thorax, appendages and petiole light yellowish brown; gastric segments becoming dark brown posteriorly.

Male.—Length 1.8 mm. (of thorax 0.5 mm.). Head in front view, including mandibles, ovate; antennae 9-segmented; mandibles with a single long, acute apical tooth and a concave cutting margin which is separated from the inner margin by an obtuse angle. Epinotum in profile convex. Petiole thick, truncate at apex, the sides rounded. Wings hyaline, iridescent, with pale brown veins. Shining, finely punctate. Pilosity of a moderately abundant reclinate pubescence and sparse, upright, long hairs. Head and thorax brown, thorax and appendages pale brown.

Cotypes.—Specimens of all castes from two colonies (Nos. 438 and 440) which contained coccids and were 265 meters apart under cacao at the La Montserrat Estate, Maracas Valley, Trinidad, B. W. I., May 27, 1936. This species, which is dedicated to the late Mr. F. W. Urich, is close to *R. berwicki* but differs especially in having a narrower head and a plane dorsal surface of the thorax. The basal tooth of the mandible is closer to the other teeth and the antennal scapes are somewhat shorter.

Biology.—Colony 438 occurred under a cacao tree and 90 cm. from its trunk. The colony was surrounded by not only cacao but also banana and coffee, the nearest banana plant being 190 cm. and the nearest coffee tree 380 cm. distant. In an area with a diameter of 10 cm. were found nests of the termite, *Anoplotermes* sp., and ants of this *Rhizomyrma*, *Prionopelta*, and *Pheidole*, all having chambers or tunnels anastomosing with one another at depths of 2.5–7.5 cm. in reddish clay soil beneath a layer of leaf mold, largely from cacao leaves. Heavily shading this area were the cacao and Immortelle trees as well as numerous vines and herbs which were mostly about 20 cm. high. This valley has an annual rainfall probably of about 80 inches.

Two queens and most of the broad and coccids found were in a chamber at a depth of 7.5 cm. which lacked any roots. The tunnels

radiating out from the chamber were penetrated by roots which likely came, at least in part, from the nearby cacao tree and which supplied the food for the coccids. The termites and other ant colonies probably had no particular relationship with the *Rhizomyrma* and merely occupied the same habitat.

Colony 440 was 45 cm. from a cacao tree of the same plantation. The males and most of the brood and coccids were in clay 1-2 cm. from the surface while the workers and brood occurred still deeper to 8 cm. 185 cm. away was a coffee tree with green fruit and 160 cm. in the opposite direction was a smaller coffee tree. Coccids were found pastured on cacao roots close to the surface.

The same cacao tree was also suffering from the attacks of membracids which were tended on the cacao pods by *Azteca* ants. The ants erected carton sheds over the membracids, generally on the protected side touching the trunk of the tree. Other membracids were freely exposed but were similarly tended by these active, vicious and exceedingly aggressive ants which emit a sticky, offensive-smelling anal fluid of a whitish color. Under one *Azteca* carton shed on the cacao pod nearest the ground a flourishing colony of *Monomorium* with brood occurred, though the *Azteca* could easily have demolished the carton. Clearly they tolerated one another.

***Acropyga (Rhizomyrma) trinitatis*, sp. nov.**

Figures 7-8, 17-19

Worker.—Length 2-2.2 mm. (of thorax 0.64 mm.). Head, excluding mandibles, squarish, between 1.0 and 1.1 times broader than long, occipital margin faintly impressed medially, sides feebly convex and rounding broadly into occiput, anterior clypeal margin feebly convex; eyes minute, 0.02 mm. in diameter, situated posterior to a level with the posterior margin of the frontal lobes; mandibles 3-toothed, the apical tooth large and acute, the basal teeth acute but much shorter, in some specimens all teeth greatly worn down to vestiges, teeth on a cutting margin which runs into the inner margin without forming a distinct angle; antennae mostly 10-segmented, occasionally 9- or 11-segmented, the loss of a segment or the adding of a segment taking place distal to the first funicular segment. Thorax in side view with pro-mesonotal and meso-epinotal sutures distinctly impressed, the anterior pronotal margin faintly concave; thorax from above one and two-thirds times longer than broad through pronotum, moderately impressed in the meso-epinotal region. Petiolar scale in side view inclined forward, anterior margin convex, posterior margin straight, apex blunt, rounded and with the dorsal margin convex when viewed from in front. Contracted gaster short-ovate. Legs of moderate length.

Shining, faintly punctate. Pilosity of a scanty short, appressed, pubescence on the head and a few long, upright hairs on the clypeus; thorax with a sparser pubescence. Pale yellow, mandibular teeth infuscated.

Female.—Length 2.6 mm. Head in front view, excluding mandibles, 1.1 times broader than long; mandibles with three blunt teeth

of which the apical and second are closest together; antennae 11-segmented. Head with a very few hairs; gaster with a more abundant pubescence and scattered hairs most numerous posteriorly.

Cotypes.—Workers and female of a colony (No. 108) which I took April 7, 1935, between the 11th and the 11¼ mile of the Arima-Blanchisseuse Road at an elevation of 1800 feet in the Northern Range, Trinidad, B. W. I. A worker and a winged female taken at this same spot (the same several square yards) March 28, 1935, probably belong to this species although the worker lacks even the vestiges of teeth and has 9-segmented antennae. The female is 3 mm. long, has the mandibles 4-toothed and in addition indications of one or two denticles, and has the antennae 9-segmented. This species is near *R. rutgersi* but comparison with the original figures of *rutgersi* is difficult because of their variability. From Venezuelan specimens ascribed to *rutgersi* this species differs in having much smaller eyes, smaller size and duller color.

Biology.—The ants were found in an area having an annual rainfall of about 120 inches and the surrounding rain forest contained tree ferns. The April ants were taken with coccids at a depth of about 3 cm. in damp clay under grass beside the road and close to a log. Brood and adults were in small chambers. The March worker was taken under this log while the winged female was found on it. The April 7 colony was taken back to the Imperial College and placed in a small observation nest with damp clay. The next morning the ants had tunneled into a piece of wet clay and had all gathered there. The marked photophobia of the ants was noted on this and successive days. April 11 several larvae and a coccid were preserved and the female was momentarily chloroformed in order to count the teeth and antennal segments. April 12 the female was alive and active while all the ants had gathered into a small cell in soaking wet clay. April 26 the colony was transferred to a Petri dish but observations were still difficult to make and by May 20 the ants had died. Fungi sprouted in numerous places on their bodies at the sutures. Long, threadlike hyphae on some terminated in yellow spherical clusters of conidia, other and shorter hyphae terminated in white spherical clusters.

A single worker was taken in humus at the base of bromeliads in low, dripping wet cloud forest on the summit of El Tucuché, 3072 feet, the second highest peak in Trinidad.

Acropyga (Rhizomyrma) donisthorpei, sp. nov.

Figures 9, 20-21

Worker.—Length 2.1-2.4 mm. (thorax length 0.55-0.57 mm.). Head in front view, excluding mandibles, 1.1 times longer than broad, occipital margin slightly impressed medially, sides and anterior clypeal margin moderately convex; eyes minute, about 0.03 mm. in diameter, situated at a level with the frontal lobes; mandibles 4-toothed; antennae 11-segmented, scapes failing to reach occipital angles by a distance equal to less than their distal diameter. Thorax in side view with strongly convex pro-mesonotum, the pro-mesonotal suture being feebly impressed, meso-epinotal impression deep, the

epinotum rising as a short convexity; from above thorax less than twice as broad as long, less than one and one-third times broader through pronotum than through epinotum, meso-epinotal region moderately impressed. Petiolar scale in side view blunt and feebly emarginate at apex, anterior margin convex, pedicel produced ventrally as a rounded lobe. Gaster elongate-ovate, legs moderately long and slender.

Shining, finely punctate. Pilosity of an abundant, comparatively long reclinate pubescence, and sparse, scattered, long, upright hairs. Brownish yellow, mandibles and clypeal margins infuscated.

Cotypes.—Workers of one colony (No. 474) which I took on Kartabo Point, between the Cuyuni and Mazaruni Rivers, British Guiana, June 15, 1936. The workers were found in wet, rotted wood of a log lying in high rain forest. When a sack of this wood and leafy humus with twigs from the upper surface of the log was examined at camp the ants were seen tending tiny, white coccids of the common Trinidad type on bright orange roots of some herb or vine. 22½ miles west of Kartabo Point on September 8, 1935, I took a worker of this species in humus from the rain forest floor on top of a white sand ridge.

This species is near *R. decedens*, *göldii* and *rutgersi*. It has shorter scapes than *göldii* and is darker, has a longer head than *decedens* with more distinct median occipital impression, and has a more distinct meso-epinotal impression than have the above species or *rutgersi*.

Acropyga (Rhizomyrma) oko, sp. nov.

Figure 16

Worker.—Length 1.7 mm. (of thorax 0.55 mm.). Head in front view, excluding mandibles, barely longer than broad, occipital margin broadly and distinctly impressed, sides convex and rounding broadly into the occipital corners, anterior clypeal margin feebly convex; eyes comparatively large (0.04 mm. diameter), situated less than three times their diameters from the mandibular insertions; mandibles 4-toothed, the basal teeth being small and widely spaced, mandibles distinctly broadest through the basal tooth; antennae 11-segmented, scapes failing to reach occipital angles by a distance about equal to their distal diameters, first funicular segment equal in length to 2-4 taken together, 3-9 transverse. Thorax in side view with concave pronotal anterior margin, strongly convex pro-mesonotum, protuberant spiracles in meso-epinotal region, the suture being distinctly impressed, basal surface and declivous surface of epinotum forming one even convexity; from above thorax nearly 1.6 times longer than broad, about 1.3 times broader through pronotum than through epinotum, sides moderately impressed in meso-epinotal region. Petiolar scale blunt at apex and feebly emarginate. Gaster elongate-ovate. Legs moderately long and slender.

Shining, finely punctate. Pilosity of an abundant long, reclinate pubescence and sparse, scattered, upright hairs. Pale brownish yellow, head darker, mandibular margins infuscated.

Cotypes.—Several workers of one colony (No. 481) which I took beside the Oko River, tributary of the Cuyuni River, about 37 miles

by trail from Kartabo Point, British Guiana, June 19, 1936. The ants were found in clay soil about a nest of *Myrmicocrypta unidentata* Weber which was itself in soil above a large nest of *Atta cephalotes* L.

R. oko is close to *R. donisthorpei* from which it differs chiefly in smaller size, larger eyes, shorter head and paler color.

Acropyga (Rhizomyrma) guianensis sp. nov.

Figure 1

Worker.—Length 2.3 mm. (of thorax 0.6 mm.). Head in front view, excluding mandibles, 1.2 times longer than broad (0.54 x 0.46 mm.), occipital margin broadly and distinctly impressed, sides and anterior clypeal margin convex, eyes 0.04 mm. in diameter, situated at that distance above a level with the posterior margin of the frontal lobes; antennae 10-segmented, scapes distinctly exceeding occipital angles, first funicular segment as long or longer than 2-3 taken together but shorter than 2-4, second funicular segment may or may not be partially divided by a suture; mandibles stout, with four stout teeth on a cutting margin which forms an obtuse angle with the inner margin, third tooth separated by a greater diastema than the others. Thorax in side view forming with the epinotum a convexity only slightly broken by the feebly concave anterior margin of pronotum, feeble pro-mesonotal and meso-epinotal impressions, and the slight angularity of the epinotum; from above one and two-thirds times longer than broad through pronotum, slightly impressed in meso-epinotal region. Petiolar node in profile thick and blunt at apex, anterior margin distinctly convex, posterior margin plane, truncate dorsally. Gaster elongate-ovate. Legs moderately long and slender.

Shining, finely punctate. Pilosity of an abundant reclinate pubescence which is somewhat scanty on the thorax, and long, upright hairs most numerous on thorax and gaster. Brownish yellow, mandibular teeth infuscated.

Cotypes.—Several workers (No. 314) which I took August 23, 1935, in virgin greenheart forest (*Ocotea Rodioei* (Schomb)) fully 4 miles north northwest of the Forest Settlement, Mazaruni River, British Guiana. This species is close to *R. göldii* but has a slightly longer head and a more distinct meso-epinotal impression. It may possibly be the worker caste of *R. borgmeieri* which is known only by the male caste.

Biology.—In a small collection of leaves and humus taken from the base of a large greenheart tree and brought back to camp, these ants were later found. In the collection were coccids which had probably been tended by these ants on the roots of herbs and trees just under the surface in pure gray sand. At the time of making the collection a single worker *Rhizomyrma* was seen here beneath a greenheart fruit which I had just overturned but it escaped. Also found in the collection was a new fungus-growing ant, *Myrmicocrypta unidentata* Weber 1937. According to the forester, Mr. T. A. W. Davis, whom I accompanied on this day, this greenheart forest may be considered a climax type. From then on, however, the composition of this locality will be changed since the Indians were just starting to cut out the smaller trees to give the younger greenhearts a better chance to develop.

***Acropyga (Rhizomyrma) paludis*, sp. nov.**

Figure 15

Worker.—Length 2.4–2.8 mm., average of 9 workers 2.5 mm. (of thorax 0.6 mm.). Head in front view, excluding mandibles, 1.1 times longer than broad, occipital margin distinctly impressed medially, sides and anterior clypeal margin convex; eyes comparatively large (0.06 mm. in diameter), situated a distance about twice their diameters from the mandibular insertions; antennae 11-segmented, scapes failing to reach occipital angles by a distance less than their distal diameters, first funicular segment about equal to the next three taken together; mandibles stout, 4-toothed, the teeth stout and one worker with a denticle between the second and the third tooth of the right mandible. Thorax in side view with concave anterior pronotal margin, distinctly impressed pro-mesonotal suture, evenly convex mesonotum, broad and impressed meso-epinotal area with distinct spiracles, and convex epinotum; from above one and two-thirds times longer than broad through pronotum, meso-epinotal region slightly impressed. Petiole in side view, with convex anterior surface, blunt apex, which is emarginate above, and feebly concave posterior surface. Gaster elongate-ovate. Legs moderate.

Shining, finely punctate. Pilosity of a comparatively scanty reclinate pubescence which becomes coarser and longer posteriorly and sparse, long, upright hairs. Yellowish brown, head darker, mandibular teeth infuscated.

Male.—Length 2.7 mm. (of thorax 0.8 mm.). Head in front view, excluding mandibles, 1.1 times longer than broad back of eyes, occipital margin convex, anterior clypeal margin convex, eyes large (0.2 mm.), hemispherical, separated from the mandibular insertions by one-fifth the eye diameter; antennae 12-segmented, scapes exceeding occipital angles by over one-fifth their lengths, first funicular segment slightly shorter than next three taken together, terminal segment about as long as the three preceding taken together; mandibles stout, 3-toothed, the apical tooth large and acute, a distinct diastema between the apical and the second tooth, second and third teeth broad, blunt. Epinotum in side view with basal and declivous surfaces joined in a rounded angle. Petiole in side view cuneate with a rounded apex which from above is slightly emarginate, posterior surface feebly concave. Wings hyaline, iridescent, with pale brown veins.

Shining, finely punctate. Pilosity of a rather sparse reclinate pubescence and a few long, upright hairs. Head and antennae brown, rest of body pale yellowish brown.

Cotypes.—Workers and a male of one colony (No. 308) with coccids which I took August 21, 1935, in swamp rain forest a mile back of the Forest Settlement, Mazaruni River, British Guiana. This is in the type locality of *R. borgmeieri* but comparing with the original description of the latter the present species in the male caste differs particularly in having much longer antennal scapes, first funicular and terminal segments; a marked declivity to the epinotum and a feebly emarginate apex to the petiolar node. Comparing with my *Macuto*,

Venezuela, males of *rutgersi* the present species has a longer head, which is convex instead of concave on the occipital margin medially, and is much darker. A direct comparison of the male with a *dubitata* cotypter showed distinct differences. The worker is near *göldii* and *decedens* but has larger eyes and shorter scapes than the former and with longer head and shorter scapes than the latter.

Biology.—This species was taken in true swamp rain forest miles from any cultivated coffee or cacao in what may well be the original habitat of the neotropical members of the subgenus, the vast Guianan forest between the Orinoco and Amazon Rivers. The colony nested in the hummock of decayed wood (of corkwood, *Pterocarpus officinalis*) and humus at the base of a small tree in a locality with many buttressed trees and stilt palms. Roots of lianas and aroids extended into the hummock and upon these the ants were pasturing coccids. During midday patches of sunlight would fall upon the hummock. During most of the year this hummock would be surrounded by water. On this day, at the onset of the dry season, it was surrounded by muck and some water so as to be in effect an island. The ants were highly photophobic. Coccids and ant brood occurred in the same cavities, many of which were of carton from termites which were still working the hummock. The ants carried away the coccids by grasping them with their mandibles on the dorsal surface of the "carapace" with head end forward, the whole coccid being carried between the ant legs. Their own larvae were carried in a similar manner except that they were not particular about which end or side of the larva was uppermost.

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