

INSECTS OF PANAMA AND MESOAMERICA

Selected Studies

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THIRTY

Revisionary notes on the Fungus-growing Ants of the genus *Cyphomyrmex*, *rimosus* group (Hymenoptera: Formicidae: Attini)

ROY R. SNELLING AND JOHN T. LONGINO

INTRODUCTION

Cyphomyrmex Mayr, 1862, is a genus of fungus-growing ants belonging to the exclusively New World tribe Attini. Among the dozen genera presently recognized within the Attini, *Cyphomyrmex* is one of the most distinctive. The body is dull and, for the most part, without obvious sculpture, although a few obscure rugules may be present on the mesosoma. The first gastral tergum is without tubercles. Pilosity, except for a few erect simple hairs on the mandibular region of the head, is usually closely appressed to the body surface and is scale-like in appearance; in a few species the pilosity is suberect, but then it is also broad and squamiform. The frontal lobes of the head are exceptionally broad, completely concealing the antennal sockets, and the head is usually widest across the frontal lobes. Mesosomal spines are replaced in most species by low, blunt tubercles; in a few species even these are absent or nearly so.

The biology of *Cyphomyrmex* is not very well known, even though some species are among the mostly commonly encountered terrestrial species. The ants themselves are small, of drab coloration, slow-moving, and often become immobile when disturbed, sometimes for several minutes. When an ant feigns death the appendages are drawn close to the body and the ant then seems to be nothing more than a small particle of soil or other debris.

Colonies are small, probably not exceeding 500 workers and usually far fewer; numerous dealate females are often present within a colony but they apparently are non-reproductive. The colonies are commonly situated in soil or rotting wood on the ground, or distributed within leaf-litter. They may also be located in dead, decaying tree limbs, in mats of moss on tree trunks, or within epiphytic pseudobulbs.

The fungus gardens of *Cyphomyrmex* are grown on insect faeces and other bits of debris collected by the foraging workers. They do not at all resemble the large spongiform fungus gardens of *Atta*, *Acromyrmex*, and some other genera. Instead, the fungus consists of cheese-like bodies up to 0.5 mm in diameter. These bodies, or bromatia, are placed directly on the excrement from which they derive nutriment. Two species in the *rimosus*

group grow a basidiomycete fungus belonging to the Agaricaceae, but the remaining species, as far as is currently known, cultivate bromatia that form solid, polygonal masses of an unidentified yeast-like fungus; Wheeler (1907) named one such fungus *Tyridiomyces formicarum*. However, until these fungi can be cultured to maturity, their identities and affinities remain unresolved.

The genus is largely neotropical in distribution and its constituent species were reviewed by Kempf (1964, 1966). In these two papers, Kempf recognized a minimum of 31 species placed in two species groups: the *strigatus* group (15 species) and the *rimosus* group (16 species). One more species was added to the *rimosus* group by Kempf (1968).

The present study is limited to species in the *rimosus* group and particularly the *rimosus* complex. Kempf (1966) left unresolved the status of 16 infraspecific forms assigned to *C. rimosus*, noting that this '... is both the commonest form in the genus and at the same time a residue of classification. The puzzling variability of the complex, which gave rise to a number of infraspecific names in the past, needs a special study...'

We intend only to amplify and continue the exemplary work of the late Dr Kempf: one adventive species has been discovered in the United States; new synonymy is proposed; four new species are described; and several infraspecific forms assigned to *C. rimosus* are elevated to specific rank.

Collections

Material used in this study is from the following collections: British Museum (Natural History) (BMNH); Museo de Instituto di Zoologia Sistemica, Universita di Torino (MIZS); Museum of Comparative Zoology, Harvard University (MCZ); Museum d'Histoire Naturelle, Geneva (MHNG); Museum National d'Histoire Naturelle, Paris (MNHN); Natural History Museum of Los Angeles County (LACM); United States National Museum of Natural History (USNM); and the personal collections of the junior author (LONG), J. C. Trager (JCT), and G. J. Umphrey (UMPH).

Terminology

In general, the descriptive mode follows that of Kempf (1964, 1966) in order to facilitate comparison with his descriptions. The morphological terminology is conventional and follows Kempf, except that we prefer 'propodeum' to 'epinotum'. The symbol '♂' is used for worker and '♀' is used for female or queen.

Head width is measured between the outer margins of the head, in full frontal view, at the upper margin of the eyes and does not include the supraocular tubercle when it is present. *Head length* is the maximum measurable length between the lower clypeal margin and the apex of the occipital corner, lobe, or spine, as appropriate. The *interocular distance* is the minimum distance between the inner margins of the compound eyes. The *eye length* is the maximum diameter of the eye as seen in lateral view and the *oculomandibular distance* is the minimum distance between the lower eye margin and the mandible base.

In the descriptions of new species, measurements for the holotype are followed, in parentheses, by those for the remaining specimens in the type series.

SYSTEMATICS

In his two papers reviewing the species of *Cyphomyrmex*, Kempf (1964, 1966) divided the genus into two species groups, the *strigosus* group and the *rimosus* group. The subgenus *Cyphomannia* Weber, 1938 (type-species *Cyphomyrmex laevigatus*

Weber, 1938) was treated as a synonym of *Cyphomyrmex* because its type-species was included in the *rimosus* group, to which the generitype also belongs. Although Weber (1966) attempted to reinstate *Cyphomannia*, we find his conclusions less compelling than those of Kempf (1964, 1968).

Kempf (1964) defined the two species groups as follows:

I. Group of *rimosus*: Preocular carina curving mesally above eyes, not joining up with the postocular carina, which extends from the occipital corner to posterior or inferior border of eye (this character is not well-expressed in *longiscapus* and allies, which resemble the *strigosus* group in this respect); mandibles with 5 teeth only; two or no median pronotal tubercles present.

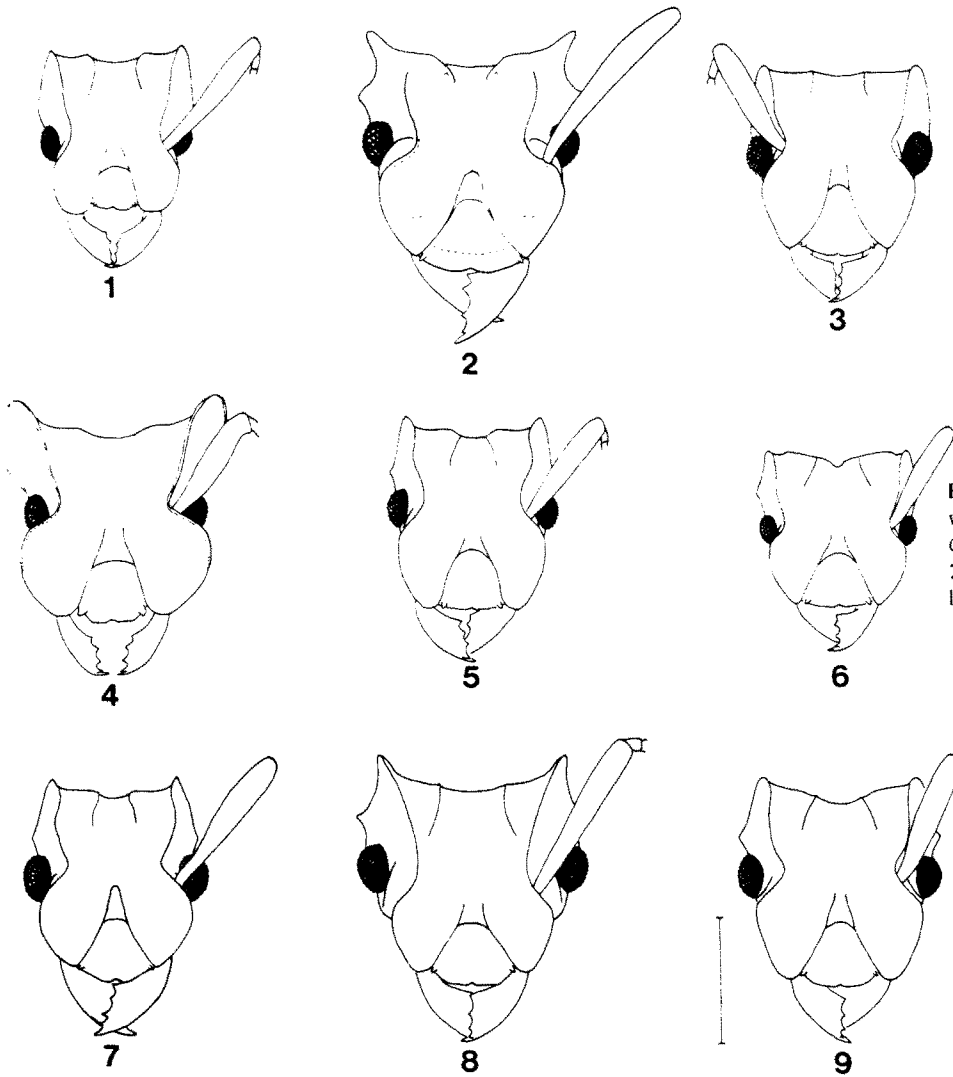
Six subgroups are recognized here: *kirbyi*, *costatus*, *foxi*, *rimosus*, *salvini*, and *laevigatus*.

II. Group of *strigosus*: Preocular carina extending all the way back to the occipital corner, forming the inferior border of the antennal scrobe; mandibles with 7 or more teeth, gradually diminishing in size towards base; a single median pronotal tubercle usually well developed in the worker caste.

The following key will serve to separate workers of the members of the *rimosus* group that we recognize. It is based, in part, on the key by Kempf (1966). The species treatments following the key omit *C. costatus* Mann, *C. wheeleri* Forel (*costatus* subgroup), *C. kirbyi* Mayr, *C. transversus* Emery, and *C. bicornis* Forel; all were adequately covered by Kempf (1966) and we have no new data to present.

Key to species of *rimosus* group workers

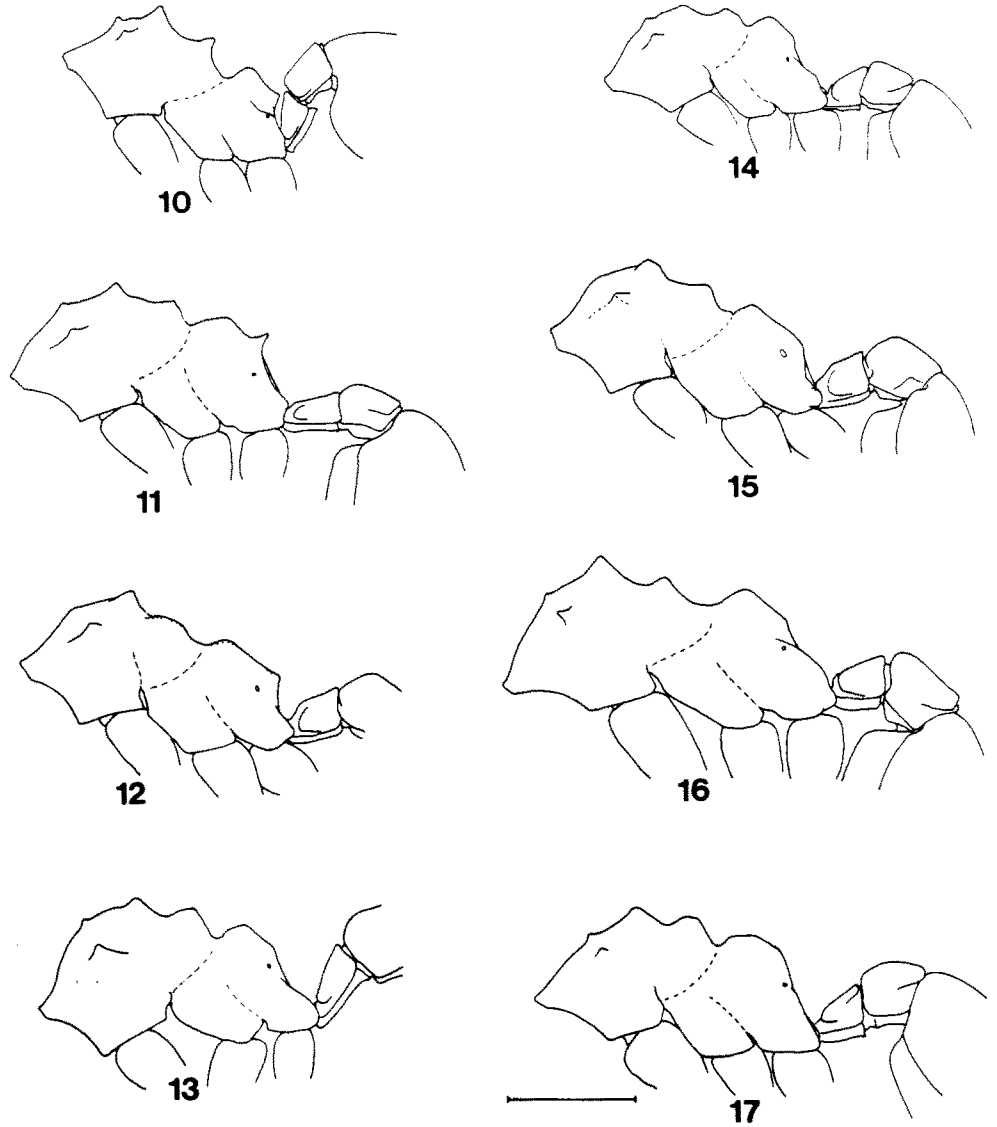
- | | |
|--|--------------------------|
| 1 Preocular carina not curved mesally in front of eye; postero-lateral limit of scrobe marked by a difference in sculpture and usually without posterior carina (Fig. 30.34), except <i>C. wheeleri</i> (Fig. 30.36) | 2 |
| — Preocular carina curved mesally in front of eye; postero-lateral limit of scrobe marked by another carina arising from occipital corner and extending to border of eye, but never confluent with preocular carina (Fig. 30.35) | 4 |
| <hr/> | |
| 2(1) Antennal scape not surpassing occipital corner in repose; lateral pronotal tubercles prominent; posterior genal carina present | 3 |
| — Antennal scape surpassing occipital corner in repose; lateral pronotal tubercles absent; posterior genal carina absent below | <i>longiscapus</i> Weber |
| <hr/> | |
| 3(2) Disc of first gastral tergum with strong longitudinal ridge on each side of middle; mid-pronotal tubercles absent; postero-dorsal margin of petiole neither drawn out nor bidentate | <i>costatus</i> Mann |
| — Disc of first gastral tergum without costa on either side of middle; mid-pronotal tubercles present; postero-dorsal margin of petiole drawn out as foliaceous bidentate lamina | <i>wheeleri</i> Forel |
-



Figs 30.1–30.9 *Cyphomyrmex* spp., frontal view of worker head. 1, *C. bicarinatus*; 2, *C. cornutus*; 3, *C. dixus*; 4, *C. laevigatus*; 5, *C. major*; 6, *C. minutus*; 7, *C. nesiotus*; 8, *C. podargus*; 9, *C. rimosus*. Scale line = 0.5 mm.

4(1) Antennal scape not surpassing strongly auriculate occipital corner (Fig. 30.4); pronotum without tubercles (Fig. 30.29)	5
— Antennal scapes usually surpassing occipital corner (Figs 30.1–30.3, 30.5–30.9); if latter are prolonged, at least lateral pronotal tubercles are present (Fig. 30.30)	6
<hr/>	
5(4) Anterior mesonotal tubercles conical, posterior tubercles low and tumuliform; petiole node much less than three times wider than long	<i>bicornis</i> Forel
— Mesosoma completely unarmed, dorsal profile evenly rounded (Fig. 30.29); petiole node about three times broader than long	<i>laevigatus</i> Weber
<hr/>	
6(4) Mid-pronotal tubercle pair absent	7
— Mid-pronotal tubercle pair present	11
<hr/>	
7(6) Metafemur dilated and ventrally carinate at basal one-third (Fig. 30.23); funicular segments 2–8 about as long as broad	8
— Metafemur not dilated and ventrally carinate at basal one-third (Figs 30.26, 30.27); funicular segments 2–8 distinctly longer than broad	9

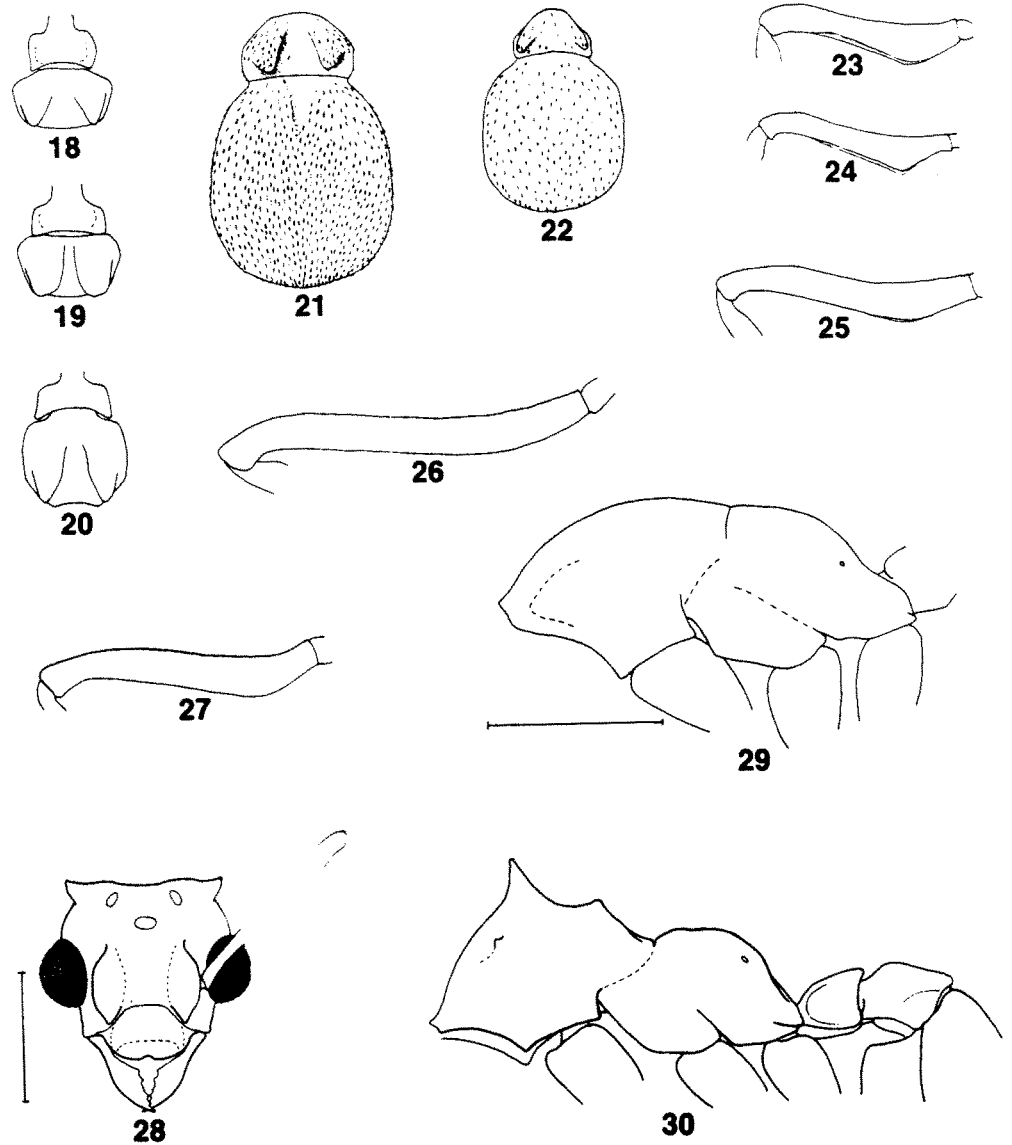
- 8(7) Propodeum dentate with basal face laterally marginate to carinate (Fig. 30.31); apex of scape scarcely surpassing tip of occipital corner
flavidus Pergande
- Propodeum edentate and basal face rounded, neither marginate nor carinate laterally (Fig. 30.32); apex of scape surpassing occipital corner by more than its greatest thickness
peltatus Kempf
-
- 9(7) Occipital corner low and obtuse, not spine-like (Fig. 30.7); anterior mesonotal tubercles low and obtuse (Fig. 30.15) 10
- Occipital corner prominent and spine-like (Fig. 30.2); anterior mesonotal tubercles prominent, acute and distinctly longer than wide at base (Fig. 30.30) *cornutus* Kempf
-
- 10(9) Anterior clypeal margin distinctly emarginate in middle; parafrontal tooth conspicuous (Fig. 30.7); propodeum not angulate in profile (Fig. 30.15) *nesiotus*, new species
- Clypeal margin straight; parafrontal tooth weak; propodeum angulate in profile (Fig. 30.12) *kirbyi* Mayr
-



Figs 30.10–30.17 *Cyphomyrmex* spp., lateral view of worker mesosoma. 10, *C. bicarinatus*; 11, *C. dixus*; 12, *C. kirbyi*; 13, *C. major*; 14, *C. minutus*; 15, *C. nesiotus*; 16, *C. podargus*; 17, *C. rimosus*. Scale line = 0.5 mm.

- 11(6) Maximum expansion of frontal carinae less than, or equal to, distance between eyes (Fig. 30.8); mesosoma finely but distinctly rugose (lateral pronotal and anterior mesonotal tubercles long and spine-like) 12
 — Maximum expansion of frontal carinae conspicuously greater than distance between eyes (Figs 30.1–30.7); mesosoma granulate, without rugae 13
-
- 12(11) Expanse of frontal carinae less than interocular distance; propodeum with pair of longitudinal submedian carinae; dorsal lobes of post-petiole strongly raised and subspiniform *foxi* André
 — Expanse of frontal carinae at least equal to interocular distance; propodeum without longitudinal submedian carinae; dorsal lobes of post-petiole low and rounded *podargus*, new species
-
- 13(11) Occipital corners, in frontal view, elevated as a broad lobe (Figs 30.1, 30.5) or distinctly spine-like; anterior mesonotal tubercles high, usually conical 14
 — Occipital corners, in frontal view, low and subangulate, neither elevated nor spine-like (Figs 30.6, 30.9); anterior mesonotal tubercles usually low and tumuliform 17
-
- 14(13) Occipital corner produced as spine-like process (Fig. 30.1) and frontal carina not reaching base of process; anterior mesonotal tubercle high, conical 15
 — Occipital corner produced as broad lobe, frontal carina extending to top of lobe to join posterior carina (Fig. 30.5); anterior mesonotal tubercle high but obtuse (Fig. 30.13) *major* Forel
-
- 15(14) Basal longitudinal groove of first gastral tergum distinct; posterior mesonotal tubercles conical; appressed and subappressed hairs of first gastral tergum broad and scale-like 16
 — Basal longitudinal groove of first gastral tergum weak or absent; posterior mesonotal tubercles low, not tooth-like; hairs of first gastral tergum slender or broad, all appressed *vorticis* Weber
-
- 16(15) Occipital spine higher than broad at base; propodeum without sharply defined lateral ridges and without tooth on declivity; posterior mesonotal tubercle lower and more obtuse than anterior tubercle *salvini* Forel
 — Occipital spine broader at base than high; propodeum with sharply defined lateral carinae terminating on declivity as a triangular tooth (Fig. 30.10); posterior mesonotal tubercle nearly as high and acute as anterior tooth *bicarinatus* new species
-
- 17(13) Node of petiole less than three times as broad as long; disc of node of post-petiole with median impression shallow and ill-defined; body hairs usually fine 18
 — Node of petiole three times as broad as long; disc of node of post-petiole broad and deeply impressed; body hairs thickly squamose *transversus* Emery
-
- 18(17) Hairs on head and gaster appressed and scaliform; mesosomal tubercles usually low and tumuliform, but if subacute or dentiform, propodeum is bispinose 19
 — Hairs on head and first gastral tergum recurved or hook-like, neither appressed nor scaliform; thoracic tubercles sharply pointed and propodeum without spines *hamulatus* Weber
-

- 19(18) Declivitous face of propodeum slightly angulate or with pair of broad, tooth-like protuberances (Figs 30.14, 30.17) 20
- Declivitous face of propodeum with pair of definitely spiniform processes (Fig. 30.11)
dixus, new species
-
- 20(19) Small species, head width 0.56 mm or less; hairs in centre of first gastral tergum closely appressed and mostly separated by more than their own lengths; median basal groove of first gastral tergum short and usually indistinct (Fig. 30.22) *minutus* Mayr
- Larger species, head width more than 0.62 mm; hairs in centre of first gastral tergum coarse, not fully appressed, and mostly separated by less than their own lengths; basal groove of first gastral tergum distinct and more than twice as long as wide (Fig. 30.21)
rimosus (Spinola)
-



Figs 30.18–30.30 *Cyphomyrmex* spp. 18–20 Dorsal view of worker petiole and post-petiole: 18, *C. dixus*; 19, *C. bicarinatus*; 20, *C. podargus*. 21–22 Dorsal view of worker post-petiole and first gastral tergum: 21, *C. rimosus*; 22, *C. minutus*. 23–27 Worker metafemur: 23, *C. flavidus*; 24, *C. minuteus*; 25, *C. rimosus*; 26, *C. cornutus*; 27, *C. nesiotus*; 28: Frontal view of male head, *C. nesiotus*. 29–30 Lateral view of worker mesosoma: 29, *C. laevigatus*; 30, *C. cornutus*. Scale line = 0.5 mm. (Note: Fig. 30.29 is not drawn to the same scale as the remaining figures).

***kirbyi* subgroup**

This is a small complex consisting of five species that share the following characters: preocular carina curved mesally in front of eye; antennal scrobe subopaque and indistinctly granulose; antennal scape surpassing the non-auriculate occipital corners; pronotum with distinct lateral tubercles, but submedian tubercles absent.

Species included in this subgroup are *C. cornutus*, *C. flavidus*, *C. kirbyi*, *C. peltatus*, and one new species described below.

***Cyphomyrmex peltatus* Kempf (Figs 30.32, 30.35)**

Cyphomyrmex peltatus Kempf, 1966:164, 181-3; ♀.

Kempf described this species from specimens from the Brazilian States of Santa Catarina and Rio Grande do Sul. We have seen the following additional material. BRAZIL: 'Sinop. rest area, Jesuit Society,' Matto Grosso, 11 Dec. 1984 (J.C. Trager; LACM, JCT), nest in rotten log, rain forest. BOLIVIA: Caranavi, near radio, 800 m elev., 24-26 June 1981 (Kugler and Lambert; LACM), from Berlese funnel of leaf litter, steep and rocky secondary forest with few primary trees.

***Cyphomyrmex cornutus* Kempf (Figs 30.2, 30.30)**

Cyphomyrmex cornutus Kempf, 1968: 35-8; ♀.

This very distinctive species was described from workers and females from Colombia. Two small series of workers have been seen from ECUADOR: 2-6 km above Cochancay on Guayaquil-Tambo highway, Prov. Cañar, 500-700 m elev., 25 July 1973 (W. L. Brown; MCZ); Univ. Miami Research Sta., Río Palenque, 30 July 1978 (G. J. Umphrey, no. 872; UMPH), from a piece of hollow 'bamboo' in forest. There are a few specimens in the LACM collections from COSTA RICA, Heredia Prov.: Finca La Selva, various dates from March to June, 1974 (Talbot and Van Devender), all from berlese funnel of forest leaf litter.

***Cyphomyrmex flavidus* Pergande (Figs 30.23, 30.31)**

Cyphomyrmex flavidus Pergande, 1896: 895; ♀.

Cyphomyrmex rimosus dentatus Forel, 1901: 124-5; ♀. NEW SYNONYMY.

Cyphomyrmex rimosus dentatus: Wheeler, 1907: 722-3; ♀♀.

Cyphomyrmex flavidus: Wheeler, 1907: 726-7; ♀. Kempf, 1966:172.

Cyphomyrmex dentatus: Kempf, 1966:164, 184-6; Figs 8, 21, 31, 46; ♀♀.

Pergande (1896) described *C. flavidus* from seven worker specimens collected by Eisen and Vaslit at Santiago Ixtcuintla, near Tepic, Nayarit, Mexico. He compared this new species with *C. kirbyi* Mayr and *C. morschi* Emery. Three of the original seven cotypes are in the USNM; the remaining four have not been accounted for. Wheeler (1907) received one from Pergande, which may be in the AMNH; it was not located at MCZ in October, 1983.

Forel's (1901) *C. rimosus dentatus* was also described from Mexican specimens, collected by Wheeler at Cuernavaca, Morelos. This form was compared only with *C. rimosus*; several cotypes are in the MCZ collections.

When Wheeler (1907) treated the North American fungus-growing ants, he had available to him cotypes of both of these names. It is curious that he failed to recognize their co-identity. He redescribed *C. flavidus* from the cotype, compared it with *C. wheeleri*, and asserted it to be '... intermediate in several respects between *wheeleri* and *rimosus*...'

It may be that Wheeler's comparison of *C. flavidus* with *C. wheeleri* led Kempf (1966) to conclude that *C. flavidus* is 'rather close to *wheeleri*, with the same reticulate-punctate integument'. This, in fact is not true and in particular, the surface of the antennal scrobe is opaque and microgranulose, not at all shiny and reticulate as in *C. wheeleri*. Also, unlike *C. wheeleri*, the preocular carina is curved mesally in front of the eye. These two features, plus the absence of the mid-pronotal tubercles and the dilated and ventrally carinate metafemur, would place *C. flavidus* in the *dentatus* subgroup of the *rimosus* group.

In Kempf's (1966) key to the species of the *rimosus* group, the cotypes of *C. flavidus* run directly and unequivocally to *C. dentatus*. They match the figures and description supplied by Kempf, and agree with the cotypes of *C. rimosus dentatus* in the MCZ collection. There is no doubt that the two are conspecific.

Of the three cotypes of *C. flavidus* from the USNM, one bears a label, in Pergande's handwriting: 'Cyphomyrmex flavidus (n. sp.) Type [lower left] and Perg. [lower right]'. This specimen has been marked Lectotype. The two remaining specimens are paralectotypes; one has been returned to the USNM and one is in the LACM.

In addition to specimens from Cuernavaca and Santiago Ixtcuintla. We have seen the following additional records. MEXICO: Cocula, Jalisco, Nov. 1923 (W. M. Mann; USNM); Estación Biología 'Chamela', Jalisco, 18 June 1984 (D. H. Feener; LACM); 75 km S. Culiacán, Sinaloa, 28 Aug. 1959 (L. A. Stange and A. S. Menke; LACM); Alamos, Sonora, 13 July 1976 (A. Mintzer; LACM). UNITED STATES: Arizona, Tempe, Maricopa Co., 11 Nov. 1932 (Murphree; USNM); Headquarters, 1600 ft elev., Organpipe Cactus National Monument, Pima Co., 1 Nov. 1952 (W. S. Creighton; LACM); Bloxton, Santa Cruz Co., 23 Sept. 1923 (W. M. Mann; USNM). CALIFORNIA: Indian Pass Rd., 500 ft elev., 7 mile E. Ogilby Rd., Imperial Co., 7 May 1978 (R. R. Snelling and C. D. George, RRS No. 78-44; LACM), from midden of dolichoderine ant. *Forelius foetidus* (Buckley), on hillside cactus scrub.

***Cyphomyrmex nesiotus*, new species (Figs 30.7, 30.15, 30.27, 30.28)**

Diagnosis. A member of the *kirbyi* subgroup related to *C. kirbyi* Mayr. Workers and females differ from these castes of *C. kirbyi* by the presence of conspicuous parafrontal tubercles on the clypeus, the sinuate apical clypeal margin and the very different profile of the mesosomal dorsum (compare Figs 30.12, 30.15

Males are unknown for most species of the *kirbyi* complex including *C. kirbyi*, and it is not presently possible to arrive at a meaningful suite of diagnostic features (see the Discussion).

Description

Worker holotype. Measurements: Total length 3.3 (2.9–3.4); head length 0.82 (0.74–0.86); head width 0.72 (0.68–0.73); mesosoma length 1.13 (1.00–1.14); metafemur length 1.01 (0.91–1.03) mm.

Ferruginous, front of head and mesosomal tubercles darker, dorsum of gaster very weakly darker; mandibles brighter reddish. Integument opaque throughout, minutely granulose.

Head shape as in Fig. 30.7. Mandible very finely longitudinally striolate; basal tooth much smaller than others. Anterior margin of clypeus with shallow median emargination; parafrontal tooth distinct. Frontal area impressed. Margin of frontal lobe rounded, corner above parafrontal tooth broadly rounded; posterior portion of frontal carina sigmoidal and attaining occipital corner. Submedian carinae of vertex short, obtuse, subparallel. Postocular carina absent. Supraocular tubercle very weak. Occipital corner little projecting, not dentate. Occipital margin, in frontal view, broadly concave, more strongly emarginate in middle. Posterior genal margin subcarinate to base of mandible. Scape, in repose, extending beyond occipital corner by about its own greatest thickness; funicular segments 2–8 distinctly longer than broad. Eye with about nine facets along greatest diameter; eye length equal to, or slightly greater than, oculomandibular distance.

Mesosoma as in Fig. 30.15. Submedian pronotal tubercles absent; lateral tubercle low and obtuse; humeral ridge anterior to lateral tubercle, present but weak to obsolete; antero-lateral corner of pronotum nearly right-angular. Disc of mesonotum slightly depressed; anterior tubercle obtuse-conical; weak ridge present between anterior tubercle and indistinct posterior tubercle. Mesometanotal impression deep. Dorsal ridges of propodeum very weak. Metafemur (Fig. 30.27) neither dilated nor ventrally ridged in basal one-third.

Node of petiole depressed and only a little broader than long. Posteromedian depression of post-petiole shallow and poorly defined.

Pilosity flattened, scale-like, and appressed on most surfaces, more slender on scape and femora; hairs more erect, but curled, on gena and distally on gaster; gaster with suberect to erect, long, simple hairs distally and on ventral segments.

Female. Measurements: Total length 3.83–4.00; head length 0.88–0.90; head width 0.78–0.81; mesosoma length 1.23–1.28; metafemur length 1.03–1.06; forewing length 3.33 mm.

Head as in worker except that minute ocelli are present; eye with about 13–15 facets along greatest diameter.

Lateral pronotal tooth low, blunt. Mesonotum anteriorly with weak swelling between mid-line and Mayrian furrows; disc slightly depressed; notauli indistinct. Axilla flat, margin rounded. Posterior margin of scutellum bidentate, emargination semicircular. Propodeum, in profile, evenly sloping,

without differentiated basal face; lateral carina obsolete. Dorsal depression of post-petiole distinct.

Male. Measurements: Total length 3.67; head length 0.74; head width 0.63; mesosoma length 1.27; wing length 3.23 mm.

Head and body dark brown, appendages reddish brown, mandible, apical funicular segments, and distitarsi paler. Wings dark brownish.

Head as in Fig. 30.28. Mandible with four distinct triangular teeth and minute inner tooth; diastema between second and third teeth much shorter than that between third and fourth. Apical margin of clypeus abruptly depressed below disc, with small median emargination. Frontal lobe strongly raised, outer margin weakly convex, lower end angulate in frontal view; frontal carina absent above frontal lobe. Occipital corner obtuse, not projecting; occipital margin concave in frontal view. Posterior margin of gena carinate to base of mandible. Scape extending beyond occipital corner by more than three times its greatest thickness; funicular segments 2–5 about twice longer than wide. Eye large, eye length about twice longer than oculomandibular length. Head granulopunctate and with fine, irregular rugules, becoming reticulate on vertex.

Lateral pronotal tubercle small, acute, with distinct carina extending forward from tubercle to transverse post-marginal ridge; propleuron with a few longitudinal rugulae. Mayrian furrows of mesonotum broad and deep; parapsidal lines weak. Scutellum depressed below level of mesonotum, apico-lateral teeth distinct, margin between them shallowly concave. Propodeum in profile without distinct basal face, sublateral carinae distinct to apex. Integument dull, reticulo-punctate and with irregular rugulae, coarser on dorsal surface.

Petiole with antero-ventral process; node depressed. Post-petiole with weak depression along length of node. Petiole and post-petiole dull, reticulo-punctate.

Gaster slightly shiny, shagreened and with sparse fine punctures on first tergum.

Pilosity of head and body sparse, depressed and not at all scale-like; a few longer, suberect hairs on apex and venter of gaster.

Type material

Holotype worker: Isla Isabella, Santo Tomas V. Sierra Negra, elev. 1050 ft., Galápagos, ECUADOR, 9 June 1982 (Y. D. Lubin, No. 147), in Natural History Museum of Los Angeles County.

Paratypes: six workers, three females, one male, same data as holotype; two workers and two females, Los Tintos, 1100 feet elev. Sierra Negra, Isla Isabella, 10 June 1982 (Y. D. Lubin, No. 156). Paratypes in LACM, MCZ, USNM.

Etymology. Latinization of the Greek *nesiotes* (insular).

Discussion. In Kempf's key to species of the *C. rimosus* group, *C. nesiotes* will go to *C. kirbyi* Mayr. Mayr's worker types were from an unknown locality in Colombia. Santschi (1921) recorded specimens from Guayaquil, Ecuador, as *C. kirbyi*. The

Guayaquil specimens are in the collection of the Paris Museum; they are incorrectly identified and belong to an apparently undescribed species.

The worker of *C. kirbyi* was redescribed, from type material, by Kempf (1966). The following differences have been noted between *C. kirbyi*, as redescribed by Kempf, and *C. nesiotus*: in *C. kirbyi* the clypeal apex is without a median emargination; the parafrontal tooth is obsolete; the antennal scape extends beyond the occipital corner by nearly twice its maximum thickness; the mesosomal profile is different (Fig. 30.12); the petiole does not possess an antero-ventral process. These differences, except that of mesosomal profile, also exist between females of the two species.

Male specimens are more difficult to deal with, since this caste is unknown for many members of the *C. rimosus* group. We have seen only males of *C. minutus* Mayr, *C. wheeleri* Forel, and *C. rimosus* (Spinola). The male of *C. wheeleri* has slender propodeal spines and is easily separated from that of *C. nesiotus*. In addition, the apical margin of the clypeus is evenly convex in frontal view and is not abruptly depressed below the level of the disc, and frontal carina is present to the occipital corner.

In males of *C. minutus*, the apical portion of the clypeus is somewhat depressed, but not abruptly so as in *C. nesiotus*, and the margin is transverse. The frontal carina is present above the frontal lobe in *C. minutus*, but ends at about the level of the anterior ocellus. The occipital corners are prominent and dentiform in *C. minutus* and, in this species, the propodeum is dentate and there is no antero-ventral process on the petiole.

foxi subgroup

Characteristics of this subgroup are: preocular carina curved mesally in front of eye; antennal scrobe subopaque and indistinctly granulose; antennal scape distinctly surpassing the auriculate occipital corners; lateral pronotal tubercles long and spine-like and submedian tubercles present. Included species are *C. foxi* André and *C. podargus*, new species.

Cyphomyrmex foxi André (Fig. 30.33)

Cyphomyrmex foxi André, 1892:55–6; ♀. Wheeler, 1917: 461–2; ♀. Weber, 1940: 408–09, 412; ♀. Kempf, 1966: 164, 186–8; ♀.

This species is known only from Jamaica and is one of the more distinctive species of *Cyphomyrmex*, being one of the few known species in the *rimosus* group in which the breadth of the frontal lobes is less than the distance between the inner margins of the eyes. In this respect it is approached by *C. podargus*, described below, but in that species the width of the frontal lobes equals or slightly exceeds the interocular distance. The two differ, moreover, in that the dorso-lateral lobes of the post-petiole are elevated and somewhat spine-like in profile in *C. foxi* (Fig. 30.33), while they are low, rounded, and inconspicuous in *C. podargus* (Fig. 30.16).

There are four cotypes of *C. foxi* in the Paris Museum and they are in agreement with the interpretations of Wheeler (1917) and subsequent authors. One of the four cotypes has been marked as the Lectotype; the three remaining cotypes are paralectotypes and all are in the MNHN, Paris. Apparently the only known specimens other than the types are the series of workers collected by C.T. Brues at Newton, 3000 ft. elev., Jamaica, January, 1912. Specimens from this collection are in a number of institutional collections.

Weber (1940) suggested that *C. rimosus* var. *arnoldi* Aguayo, 1932, is a synonym of *C. foxi*; we do not agree with Weber's classification. Presumably, Aguayo treated his form as a variety of *C. rimosus* (actually *C. minutus*) because it closely resembled that species, with which he surely was quite familiar, inasmuch as it is the common *Cyphomyrmex* species found throughout the Caribbean. On the other hand, *C. foxi*, known only from Jamaica, is a much larger and more coarsely sculptured ant and does not at all superficially resemble *C. minutus*. Since Aguayo did not mention any of the numerous differences that exist between *C. foxi* and *C. minutus* in his description, but mentioned only superficial differences between var. *arnoldi* and *C. 'rimosus'*, we think it much more likely that var. *arnoldi* is, in fact, a synonym of *C. minutus*.

Cyphomyrmex podargus, new species (Figs 30.8, 30.16, 30.20)

Diagnosis. A member of the *foxi* subgroup and closely resembling *C. foxi*, but with maximum width across frontal lobes equal to, or slightly greater than, interocular distance; dorsal lobes of post-petiole low and rounded, rather than elevated and spiniform as in *C. foxi*.

Description

Worker holotype. Measurements: Total length 3.48 (3.24–3.48); head length 0.85 (0.81–0.83); head width 0.78 (0.73–0.79); mesosoma length 1.20 (1.14–1.22); metafemur length 1.12 (1.06–1.13) mm.

Uniformly blackish brown, with dark brown legs; mandibles, funiculus, and tarsi ferruginous; coxae dusky ferruginous.

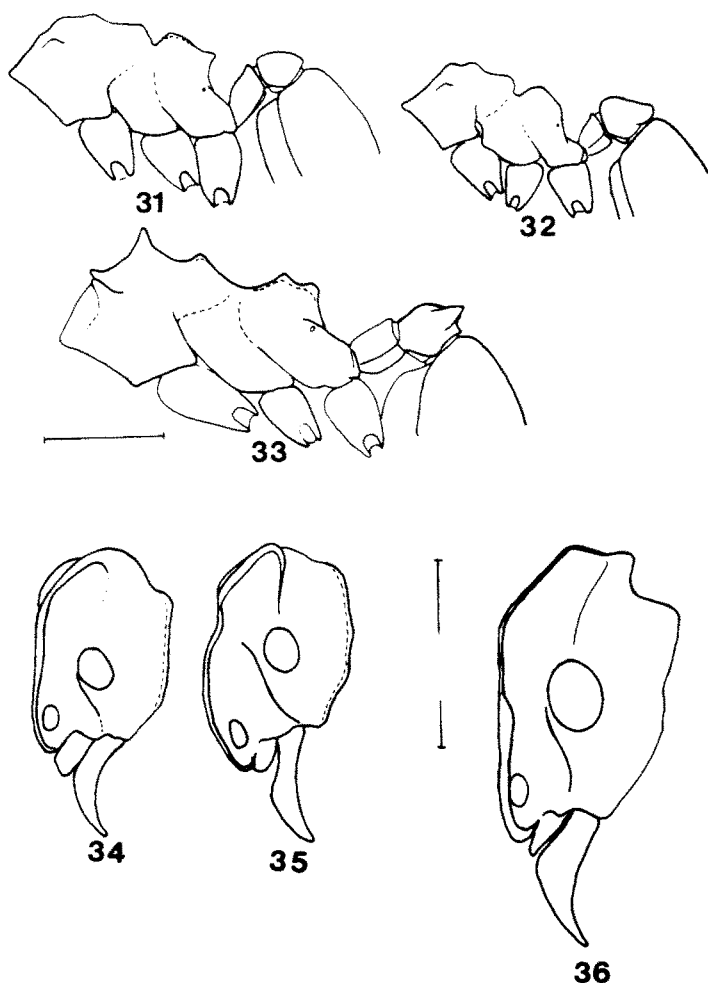
Integument opaque, finely and densely granulo-punctate and with numerous short, fine rugae, especially on front of head (longitudinal) and dorsum of mesosoma (transverse).

Head shape as in Fig. 30.8. Mandible very finely longitudinally lineolate; margin with five teeth, innermost tooth only slightly smaller than fourth tooth. Anterior margin of clypeus transverse and without median emargination; parafrontal tooth minute. Frontal area weakly impressed. Margin of frontal lobe broadly rounded, not acutely rounded above parafrontal tooth; dorsal portion of frontal carina low and weak, but discernible to occipital corner. Submedian carinae of occiput low and weak, subparallel. Postocular carina absent. Supraocular tubercle prominent. Occipital corner with projecting spine-like process. Occipital margin nearly flat in frontal

view. Posterior genal margin subcarinate to below level of lower eye margin, continued very weakly to near mandible base. Scape extending beyond occipital process by about 1.5 times its greatest thickness; funicular segments 2–8 distinctly longer than broad. Eye with about 9 facets in greatest diameter; oculomandibular distance 0.93–1.00 times eye length.

Mesosomal profile as in Fig. 30.16. Submedian pronotal tubercles present; lateral tubercles long and slender; no humeral ridge anterior to lateral tubercle. Disc of mesonotum flat; anterior tubercle large, conical; posterior tubercle much smaller, acute. Mesometanotal impression broad and shallow. Dorsal propodeal ridges absent; posterior face without tubercle or denticle. Ventral margin of metafemur weakly, obtusely dilated at basal one-quarter and without carina or ridge distally of dilation.

Petiole and post-petiole as in Fig. 30.20. Node of petiole flattened and about one-third broader than long. Post-median impression of post-petiole weak and postero-lateral lobes weak.



Figs 30.31–30.36 *Cyphomyrmex* spp. 31–33 Lateral view of worker mesosoma: 31, *C. flavidus*; 32, *C. peltatus*; 33, *C. foxi*. 34–36 Lateral view of worker head: 34, *C. costatus*; 35, *C. peltatus*; 36, *C. wheeleri*. Scale lines = 0.5 mm.

Dorsum of first gastral segment without antero-median impression.

Pilosity slender and recurved or hook-like; gastral venter with coarse, erect hairs.

Type material

Holotype and 13 *paratype workers*: Quick Step, 380 m elev. (18° 18'N, 77° 45'W), Trelawny, JAMAICA, 22–23 Mar. 1984 (J. Longino, No. 1010); Welcome, 590 m elev. (18° 17'N, 77° 20'W), St. Ann, JAMAICA, 15 Mar. 1984 (J. Longino, No. 1–5). *Holotype* in Natural History Museum of Los Angeles County; *paratypes* in LACM, LONG, and MCZ.

Etymology. The specific name is of Greek origin, meaning 'swift-footed' and was suggested by the name of the type locality.

rimosus subgroup

The species belonging to this subgroup share the following combination of characters: preocular carina curved mesally in front of eye; antennal scrobe subopaque and indistinctly granulose; antennal scape surpassing the non-auriculate occipital corners; lateral and submedian pronotal tubercles present, usually low and obtuse, but lateral tubercles may be prominent and acute.

We believe that a large part of the confusion in this complex may be traced to two unfortunate facts: (1) Roger's (1863) pronouncement that the Cuban *C. minutus* Mayr was a synonym of the Brazilian *C. deformis*, a misspelling for *C. difformis* (F. Smith) and (2) of all the myrmecologists who have dealt with this complex, only Emery actually studied presumed types of *C. rimosus* (Spinola), now considered to be a senior synonym of *C. difformis*. For unknown reasons, subsequent workers have chosen to ignore Emery's (1894) characterization of *C. rimosus* and have assumed that there was little, or no, difference between this ant and *C. minutus*. Weber (1940) certainly treated the two as being the same, and his many subspecies and varieties of *C. rimosus* are compared to the common Antillean form (*C. minutus*) and not to the true *C. rimosus*. Weber included 13 forms under *C. rimosus* in a completely unworkable key.

Kempf (1966) made the first steps toward resolving the difficulties of this group when he recognized that three of the supposed subspecies were distinct species. There remained, however, a residuum of 16 infraspecific names (including presumed synonyms) attached to *C. rimosus*, which Kempf was not then prepared to consider.

The only way to resolve the remaining problems within this complex is to reconsider Emery's recharacterization of *C. rimosus*. We have seen Spinola's original material, and have additional specimens collected in and near Belém, Brazil, the type locality of *C. rimosus*. It might be noted that specimens from Belém appear to be rare in collections, a fact that has undoubtedly contributed to the uncertainties surrounding this species.

With these specimens at hand, we are able to affirm that *C. rimosus* and *C. minutus* are distinct from one another, as predicted by Creighton (1950). Furthermore, it is evident that many of the forms attributed to *C. rimosus* are variants of *C. minutus*. Herein, we recognize seven species in the *rimosus* subgroup, one of which is new; the remaining names are placed in synonymy. We wish to add a caveat at this point; we do not believe that we have solved all the problems in this subgroup. A few samples, mostly from Brazil, appear to be intermediate between *C. rimosus* and *C. minutus*. The study of additional material may eventually enable us to resolve the status of these forms.

The following is a synonymic list of the species we recognize in the *rimosus* subgroup:

- C. dixus*, new species
- C. humulatus* Weber, 1938
= *trinitatis* Weber, 1938. NEW SYNONYMY
- C. longiscapus* Weber, 1940
- C. major* Forel, 1901. NEW STATUS
- C. minutus* Mayr, 1862. NEW STATUS
= *steinheili* Forel, 1884
= *comalensis* Wheeler, 1907
= *atratus* Forel, 1912. NEW SYNONYMY
= *arnoldi* Aguayo, 1932. NEW SYNONYMY
= *flavidus* Wheeler, 1936. Preoccupied. NEW SYNONYMY
= *breviscapus* Weber, 1938. NEW SYNONYMY
= *venezuelensis* Weber, 1938. NEW SYNONYMY
= *flavescens* Weber, 1940. NEW SYNONYMY
- C. rimosus* (Spinola, 1853) NEW STATUS
= *difformis* F. Smith, 1858
= *deformis* (sic!): Roger, 1863
= *fuscus* Emery, 1894. NEW SYNONYMY
= *fusculus* Emery, 1922.
= *curiapensis* Weber, 1938.
= *cochunae* Kusnezov, 1949. NEW SYNONYMY
- C. transversus* Emery, 1894
= *olindanus* Forel, 1901
= *pencosensis* Forel, 1914

***Cyphomyrmex dixus*, new species (Figs 30.3, 30.11, 30.18)**

Diagnosis. Worker only: A member of the *rimosus* subgroup and most similar to *C. minutus*, with which it is sympatric; differs from *C. minutus* and other species in the *rimosus* subgroup in the presence of well-defined, spine-like propodeal tubercles, but with other mesosomal tubercles (except lateral pronotals) low and obtuse. The sexual forms are unknown.

Description

Worker holotype. Measurements: Total length 3.08 (3.07–3.28); head length 0.73 (0.70–0.79); head width 0.67 (0.63–0.73); mesosoma length 1.07 (1.03–1.10); metafemur length 0.95 (0.90–0.97) mm.

Blackish, grading to brownish ferruginous on lower side of

mesosoma, on legs (tibiae darker), petiole, and post-petiole; flagellum and mandibles dull ferruginous. Integument opaque throughout, minutely granulose.

Head shape as in Fig. 30.3. Mandible very finely longitudinally lineolate; margin with five teeth. Anterior margin of clypeus very weakly convex and without median notch; parafrontal tooth inconspicuous, bluntly triangular. Frontal area weakly impressed. Frontal lobe broadly rounded and corner above parafrontal tooth rounded; dorsal portion of frontal carina weakly sinuate and attaining occipital corner. Submedian carinae of vertex short, obtuse, and subparallel. Postocular carina present, but low and vaguely indicated, extending to occipital corner. Supraocular tubercle low, obtuse. Occipital corner not at all produced and occipital tubercle absent (i.e. there is no tubercle present on side of occiput behind occipital corner). Occipital margin broadly concave. Posterior genal margin carinate to base of mandible. Scape projecting beyond occipital corner by less than its greatest thickness; funicular segments 2–8 about as long as broad. Eye with 10–12 facets along greatest diameter; oculomandibular distance 1.07–1.08 times eye length.

Mesosomal profile as in Fig. 30.11. Submedian pronotal tubercles present but very weak; lateral tubercle short and bluntly triangular; humeral ridge anterior to lateral tubercle low and rounded. Disc of mesonotum weakly concave; anterior tubercle low and blunt; posterior tubercle low, bluntly triangular. Mesometanotal impression deep and narrow. Dorsal ridges of propodeum weak; posterior face with a pair of spine-like, subacute tubercles that are longer than broad at base. Ventral margin of metafemur subangularly dilated at basal one-third, but without definite carina distally of dilation.

Petiole and post-petiole as in Fig. 30.18. Node of petiole depressed and about twice broader than long. Postero-median depression of post-petiole moderately deep. Antero-median depression of first gastric tergum longer than broad, weakly defined.

Pilosity flattened, scale-like, and appressed on most surfaces; gastral venter with sparse, suberect to erect, long, slender hairs.

Type material

Holotype and 197 **paratype workers** (some preserved in alcohol): Monteverde, 10° 18' N, 84° 39' W, 1100 m, elev. Puntarenas Province, COSTA RICA, 7 Aug. 1985 (J. Longino, No. 691), in Natural History Museum of Los Angeles County. **Paratypes** in BMNH, LACM, LONG, MCZ, and USNM.

Etymology. The specific epithet is of Greek origin and means double, referring to the pair of propodeal spines.

Discussion. Additional specimens (not paratypes) are from Parque Nacional Corcovado, Sirena, 18° 28' N, 83° 35' W, 0–100 m, elev. Puntarenas Province, 1 and 11 July 1982 (J. Longino).

Within the broad *C. rimosus* group, only *C. flavidus*, *C. wheeleri* and *C. bicarinatus* possess propodeal spines. In *C. flavidus*, mid-pronotal tubercles are absent and the metafemur is abruptly

dilated and carinate on the ventral margin. The propodeal spines of *C. wheeleri* project from a pair of submedian carinae (absent in *C. dixus*); in *C. wheeleri* the preocular carina does not curve mesally in front of the eye, and the node of the petiole bears an apical tooth in lateral view. From *C. bicarinatus* this species differs in lacking occipital spines and in possessing supraocular tubercles.

Cyphomyrmex hamulatus Weber

Cyphomyrmex rimosus subsp. *trinitatis* Weber, 1938:189; .
NEW SYNONYMY.

Cyphomyrmex rimosus subsp. *hamulatus* Weber, 1938:190; .
Cyphomyrmex hamulatus: Kempf, 1966:197–8.

Although *C. r. trinitatis* has strict page priority over *C. r. hamulatus*, we have chosen to use the latter name for this species under the 'first reviser' principle, for three reasons: (1) the species is not confined to Trinidad, as the name would imply; (2) the name *hamulatus* is descriptively meaningful; (3) Kempf (1965) recognized the distinctiveness of this taxon (as *C. hamulatus*) and so the name has acquired a sense of validity that *C. r. trinitatis* lacks. A name change would only add unnecessary confusion.

The range of *C. hamulatus* extends from Trinidad to Venezuela and north to Costa Rica.

Cyphomyrmex major Forel NEW STATUS (Figs. 30.5, 30.13)

Cyphomyrmex rimosus var. *major* Forel, 1901:125; ♀.

This form is based on worker specimens from an unknown locality in Guatemala. Specimens subsequently recorded by Forel (1912) under this name from the State of São Paulo, Brazil, are probably not conspecific. The only specimens of *C. major* that we have seen are three cotypes from the Forel collection (MHNG). The three workers are mounted on a single card; the right-hand specimen is the best preserved of the three and is here designated as the Lectotype and has been appropriately marked and labelled.

Although similar to *C. vorticis* and *C. salvini*, *C. major* differs from both in the shape of the prolonged portion of the occipital corners. In *C. vorticis* and *C. salvini* the occipital corner is distinctly spine-like, especially in lateral view; in *C. major* the occipital corner projects upward as a broad lobe (Fig. 30.5). The body hairs are slender and not at all scale-like in *C. vorticis*; in both *C. major* and *C. salvini* they are broadly scale-like. *C. major* is further distinguished from *C. salvini*, by the broader, more obtuse mesosomal tubercles (Fig. 30.13), rather than acutely conical (see Kempf, 1966, Fig. 16).

Cyphomyrmex minutus Mayr NEW STATUS (Figs. 30.6, 30.14, 30.22, 30.24)

Cyphomyrmex minutus Mayr, 1862:691; ♂.

Cyphomyrmex steinheili Forel, 1884:368; ♀.

Cyphomyrmex rimosus var. *comalensis* Wheeler, 1907:719–21; ♀ = ♂.

Cyphomyrmex rimosus var. *minutus*: Wheeler, 1907:722; .
Atta (*Cyphomyrmex*) *rimosa* race *atrata* Forel, 1912:188–9; ♀ = ♂. NEW SYNONYMY.

Cyphomyrmex rimosus var. *arnoldi* Aguayo, 1932:223–4; .
NEW SYNONYMY.

Cyphomyrmex rimosus subsp. *minutus* var. *flavidus* Wheeler, 1936:204; ♀. Preoccupied, NEW SYNONYMY.

Cyphomyrmex rimosus var. *venezuelensis* Weber, 1938:188; .
NEW SYNONYMY.

Cyphomyrmex rimosus subsp. *flavescens* Weber, 1940:411; New name for *flavidus* Wheeler, 1936, not Pergande, 1895. NEW SYNONYMY.

Cyphomyrmex rimosus subsp. *breviscapus* Weber, 1940:412; ♀ = ♂. NEW SYNONYMY.

This is the most widespread and commonly encountered of all the species of *Cyphomyrmex*. In the United States it ranges from Texas to Florida, but is abundant only from central Texas eastward. The range extends southward through Central America to northern South America and *C. minutus* is common through the islands of the Caribbean. The type locality is Cuba.

Although the species generally maintains a monotonous morphological integrity, there are exceptional populations that have, not surprisingly, been named as distinctive forms. For example, specimens from Jamaica tend to possess mesosomal tubercles that are more acute than in samples from other areas. Aguayo's var. *arnoldi* is based on a very dark example of this form; no types of this form are known to exist in either the AMNH or MCZ Wheeler material. Presumably, the more conspicuous tubercles mentioned in the original description led Kempf (1966) to surmise that this might prove to be *C. foxi*.

Some Central American samples, ranging from Barro Colorado Island, Canal Zone, north to the State of Nuevo Leon, Mexico, have unusually short scapes in the females and workers. Generally, the apex of the scape extends beyond the occipital corner by an amount equal to, or slightly greater than, the apical breadth of the scape. In the short-scape form, equivalent to Weber's subsp. *breviscapus*, the scape exceeds the occipital corner by about one-half the breadth of the scape. In general, specimens with short scapes are among the smallest *C. minutus* seen (worker head width 0.50–0.55 mm), and slightly larger workers possess proportionately longer scapes.

Wheeler's var. *flavidus*, because the name was preoccupied, was renamed *flavescens* by Weber. This is a minor colour variant, described from Haiti. Throughout its range *C. minutus* varies considerably in colour, even within a local population, and the naming of these variants is pointless.

The var. *venezuelensis* was set up for specimens from the Orinoco River, Venezuela, on the basis of minor variations in the shape of the mesosomal tubercles and scape length. In our opinion these specimens are well within the range in variation shown for these features in other populations.

Aside from their slightly more prominent anterior mesosomal

tubercles and darker colour, the workers in the type series of Forel's race *atrata* hardly differ from most samples of *C. minutus*. The cotype series, consisting of all castes, from Dibulla, Guajira, Colombia, has been examined. As is true of the workers, the female cotypes are unusually dark, but seem otherwise like their counterparts from other areas.

Cyphomyrmex rimosus (Spinola) (Figs 30.9, 30.17, 30.21, 30.25)

Cryptocerus? *rimosus* Spinola, 1853:65; ♂.

Meranoplus difformis F. Smith, 1858:195; ♀.

Cataulacus deformis (sic!): Roger, 1863:210. NEW SYNONYMY.

Cyphomyrmex rimosus: Emery, 1893: 2. Emery, 1894:224, 225.

Cyphomyrmex rimosus var. *fuscus* Emery, 1894:225; ♀. NEW SYNONYMY.

Cyphomyrmex rimosus var. *fuscus* Emery, 1922:342.

Cyphomyrmex rimosus subsp. *curiapensis* Weber, 1938:190; ♀.

Cyphomyrmex rimosus subsp. *cochunae* Kuszenov, 1949:439-41. ♀. NEW SYNONYMY.

We have examined the syntypes of *C. rimosus*, a worker and three males, in the MIZS. Morphologically they are identical to the form described by Emery (1894) as var. *fuscus*. The worker syntype of *C. rimosus*, here designated the lectotype, is callow and it is probably for that reason that Emery described normally-coloured workers as var. *fuscus*. Emery had earlier (1893) examined the syntypes of *C. rimosus* and so had a clear idea of the appearance of the worker; the var. *fuscus* was distinguished only by its darker colour.

Cataulacus deformis is usually listed as a synonym of *C. minutus*. The name is a misspelling of F. Smith's *Meranoplus difformis*. Roger introduced this variant spelling when he declared that Mayr's *minutus* was the same as '*deformis*'. It is an arguable point, and a trivial one, but we believe that it is most appropriate to maintain the *difformis* - *deformis* link.

Weber (1958) established the synonymy of *C.r. curiapensis* with *C. fuscus*. Kusnezov's subspecies was described as a simple colour variant. Although we have seen no type material of this form, we find nothing in the original description to suggest that it is anything other than what it appears to be: an insignificant colour form not worthy of formal recognition. Previous records for *C. rimosus* are from Argentina, Brazil, the Guianas, and Venezuela.

This species has been introduced and is established in the south-eastern United States. We have seen the following specimens: ALABAMA: Baldwin Co, Gulf State Park, 16 Apr. 1950 (E. O. Wilson; USNM). Mobile Co, Mobile, 6 May 1950 (E. O. Wilson; LACM); Mobile, 26 Jan. 1950 (A. J. Graham; USNM), in abandoned fire ant mound. County unknown, Cottage Hill, 2 Dec. 1949 (J. M. Coarsell; USNM). FLORIDA: Alachua Co, near Gainesville airport, 11 Nov. 1981 (J. C. Trager; JCT, LACM), in disturbed flatwood; La Crosse, 1 July 1981 (J. C. Trager; JCT, LACM), in pasture; Archer Road Lab., Gainesville, 16 June 1984 (J. C. Trager; JCT, LACM), under boards

(2 colonies). Highlands Co, Archbold Biological Station, Price Tract, 10 Oct. 1981 (J. C. Trager; JCT, LACM), in rotting branch on ground; Highlands Hammock State Park, 7 Sept. 1981 (R. R. Snelling; LACM), in mowed grass area adjacent to forest. Leon Co, Tallahassee, 10 Jan. 1983 (G. B. Marshall; LACM), hardwood litter berlesate. MISSISSIPPI: Harrison Co, 10 miles N. Gulfport, Nov. 1957 (H. T. Vanderford; USNM); Lyman, 24 Mar. 1970 (C. H. Craig; USNM), ex fire ant mound. Alates have been taken within nests between 6 May and 1 July.

In addition to the differences cited in the above key, workers of *C. rimosus* may be further differentiated from those of *C. minutus* by the more prominent dorsal mesosomal tubercles; in particular, the anterior mesonotal tubercle is bluntly triangular in *C. rimosus*, rather than very low and obtuse as in *C. minutus*. In *C. rimosus* the metafemur is sometimes angulate at the basal one-third of the ventral surface, but often it is broadly rounded, and there is, at most, a very weak ridge extended distally from the angulation. The metafemur is distinctly angulate in *C. minutus* and an often lamella-like carina extends distally from the angulation.

Females of the two species differ in many of the same features as do their workers, except, of course, those of mesosomal contour. The head width of *C. rimosus* females is 0.75 mm or more; that of *C. minutus* is less than 0.70 mm, usually about 0.67 mm. Males of *C. rimosus* are a little larger than those of *C. minutus* (head width, across eyes, 0.73 vs. 0.68 mm), the lateral ocelli are elevated, the occipital tubercle is bluntly spine-like, and the propodeal teeth, although short, are definitely spine-like.

The following biological information has been provided by J. C. Trager for two samples collected 16 June, 1984 in Gainesville:

These ... were under boards in a weedy lot next to my lab. The brood and fungus gardens of the colonies were kept apart but adjacent on grass stolons or compacted grass blades near the center of single nearly round 5-8 cm-diam. chambers, 1-2 cm deep. Males were clustered on the underside of the board (the warmest, driest part of the nest). The insect fragments, grasshopper feces, etc. collected with one series were heaped separately at opposite sides of the periphery of the nest chamber. This rigid compartmentalization of castes and materials is typical of ... this ant. [Queens are usually] associated with the brood [and] most often there are 1 or 2 queens per nest, but I've seen 3 or 4 on occasion. Mating flights take place at the first faint light of dawn, following heavy rains after a dry spell during the summer months.

Cyphomyrmex longiscapus Weber

Cyphomyrmex longiscapus Weber, 1940:410; ♀. Kempf, 1966:163, 165-7; ♀.

This species, previously known only from the type series from Rio Porce, Cordillera Central, 3400 ft. elev., Colombia, is known only with certainty from Colombia. The following are new records for *C. longiscapus*, all from COLOMBIA: Quebrada Bolindrama, Cholo, (P. A. Silverstone; LACM), ex stomach contents of *Phyllobates aurotaenia* (Amphibia); between Quebrada

Bachorama and Rio Tadocito, Choco (P. A. Silverstone; LACM); ex stomach contents of *Dendrobates histrionicus* (Amphibia); Anchicaya, Municipio Buenaventura, 2000 m elev., Valle (W. L. Brown; MCZ), rain forest, under rock in canyon.

salvini subgroup

Species in this subgroup are similar to those of the preceding, the *rimosus* subgroup. They differ in having the occipital lobes prolonged into a short, spine-like process, and the anterior mesonotal tubercles high and conical.

Cyphomyrmex salvini Forel

Cyphomyrmex rimosus subsp. *salvini* Forel, 1899:40; -. Wheeler, 1907: 724; -. Weber, 1940:412; ♀ = ♂.

Cyphomyrmex championi Forel, 1899:41; ♀. NEW SYNONYMY.

Cyphomyrmex acutus Weber, 1940:409; -.

Cyphomyrmex salvini: Weber, 1958:261; -. Kempf, 1966:190-2; ♀ = ♂.

Cyphomyrmex salvini subsp. *acutus*: Weber, 1958:261; -.

Kempf (1966) first expressed the view that *C. championi* was probably the male caste of *C. salvini*. We have examined the type of *C. championi*, in the BMNH, and it is inseparable from males collected from nests of *C. salvini*, thus confirming Kempf's assumption.

This species has been previously reported from Panama and Costa Rica, including Isla de Cocos (Kempf 1966). We have seen numerous specimens from several Costa Rican localities. Two small series of specimens extend the range to GUATEMALA: Mixco, no date (W. M. Mann; USNM); and COLOMBIA: Anchicaya, Municipio Buenaventura, c. 200 m elev., Dept. Valle, 17-19 June 1971 (W. L. Brown; MCZ), under rock in canyon, rain forest. ECUADOR: Río Palenque (Univ. Miami Res. Sta.), 30 July 1978 (G. J. Umphrey; UMPH), nest in hollow 'bamboo' in forest.

Cyphomyrmex bicarinatus, new species (Figs. 30.1, 30.10, 30.19)

Diagnosis.

A member of the *salvini* subgroup in which the worker is separable from that of *C. salvini* by the lack of a supraocular tubercle, the prominent and slender posterior mesonotal tubercle, and the presence of a pair of sharp sublateral carinae on the propodeum that terminate in spine-like processes on the declivitous face. The presence of an occipital spine, the broad, scale-like hairs, and the presence of a distinct median groove at the base of the first gastral tergum will separate *C. bicarinatus* from *C. vorticis*. The female of *C. bicarinatus* is separable from those of *C. salvini* and *C. vorticis* by the same cephalic and gastral features as are the workers and, in addition differs from both in having more pronounced propodeal spines. The male of *C. bicarinatus* is unknown.

Description

Worker holotype. Measurements: Total length 3.1 (2.9-3.1); head length 0.79 (0.73-0.82); head width 0.62 (0.56-0.62); mesosomal length 1.04 (0.91-1.04); metafemur length 0.86 (0.81-0.88) mm.

Dull brownish ferruginous, carinae and tubercles darker; funiculus and legs mostly yellowish ferruginous; mandibles reddish. Integument opaque throughout, minutely granulose.

Head shape as in Fig. 30.1. Mandible subopaque and very finely longitudinally lineolate; basal tooth minute. Anterior margin of clypeus transverse or weakly emarginate in middle; parafrontal teeth prominent. Frontal area sharply, though shallowly, impressed. Frontal lobe 0.81 (0.76-0.81) times transocular distance; outer margin broadly curved, corner above parafrontal tooth narrowly and abruptly rounded; frontal carina strongly developed and attaining occipital corner and joining supraocular carina. Occipital margin deeply concave between occipital corners. Submedian carinae of vertex strong, subparallel anteriorly, posterior segment not reaching laterally to frontal carina. Supraocular tubercle absent. Occipital corner, at junction of frontal and supraocular carinae distinctly elevated, short-spiniform in lateral view. Posterior genal margin carinate to mandible base. Scape, in repose, extending beyond occipital corner by about its apical width; middle segments of funiculus a little longer than broad. Eye with about seven facets across greatest diameter; oculomandibular distance 1.00-1.25 times eye length.

Mesosoma as in Fig. 30.10. Submedian pronotal tubercles distinct; lateral tubercles short and subacute. Anterior mesonotal tubercles conical, acute; posterior pair slightly shorter, subacute to acute, compressed. Propodeum with high, compressed sublateral carina-like ridges that terminate on declivity as short, triangular teeth. Ventral margin of metafemur dilated at about basal one-third, with continuous carina from base to apex.

Petiole and post-petiole as in Fig. 30.19. Node of petiole about twice wider than long. Postero-median depression of post-petiole broad and clearly defined.

First gastral tergum with defined median, longitudinal impression that is usually completely apilose and several times longer than broad.

Pilosity flattened and scale-like, but several times longer than broad, with acute apices; narrowest on head; most hairs distinctly elevated above, but bent parallel to integument.

Female. Measurements: Total length 3.4; head length 0.82; head width 0.60; mesosoma length 1.08; metafemur length 0.86 mm.

Head as in worker except that minute ocelli are present; eye with about 12 facets across greatest diameter.

Lateral pronotal tooth prominent, subacute. Area between Mayrian furrows strongly raised on either side, deeply depressed along middle; notauli indistinct. Axilla elevated, triangular. Margins of scutellum strongly raised, posterior emargination

deep and rounded. Sublateral ridges of propodeum distinct, compressed; forming blunt, tooth like process on each side.

Petiole, post-petiole, and gaster as in worker.

Type material

Holotype worker: one dealate female and 45 worker *paratypes*: Cincinnati, c. 1300 m elev., Magdalena Province, COLOMBIA, Feb. 1924 (W. M. Mann); additional *paratypes* are from 2 km N.W. San Pedro, 1200 m elev., 10° 55'N, 74° 03'W, Magdalena, 16 Aug. 1985 (J. Longino). *Holotype* and most *paratypes* in USNM; *paratypes* also in LACM, LONG, and MCZ.

Etymology. Combines the Latin prefix, *bi-* (two or double), with *carina* (ridge), signifying the pair of strong propodeal ridges.

Discussion. Among those species of the *rimosus* group that possess the middle pair of pronotal tubercles, this can be confused only with *C. salvini*, the only other species with which it shares the spine-like occipital corners and scale-like pilosity. Particularly notable differences between the workers are the lack of supraocular tubercles and the strongly developed sublateral propodeal ridges in *C. bicarinatus*.

The pilosity is very similar to that of *C. salvini* but the hairs, especially on the gaster are narrower, with distinctly acute tips, and are less closely appressed to the surface. Both species differ from *C. vorticis*, the only other member of the subgroup, in which the hairs of the disc of the first gastral tergum are so closely appressed against the segment that they are not visible in profile. Other differences between *C. vorticis* and the other two species are set forth in the key.

Cyphomyrmex vorticis Weber

Cyphomyrmex vorticis Weber, 1940:409–10; ♂. Kempf, 1966:188–90.

Kempf (1966) reported this species only from Bolivia (Santa Helena, the type locality) and Brazil. We have seen a series of 9 workers, 2 females, and 1 male from Zent, COSTA RICA, collected in March, 1924 by W. M. Mann (USNM). The workers agree well with Kempf's redescription, and with cotypes in the LACM, in all particulars except the pilosity. The appressed pilosity of the head and body is fine and hair-like in the cotypes and is very inconspicuous. The Zent specimens differ in having more conspicuous, though no more abundant, pilosity because the individual hairs are broad and scale-like.

Whether or not these represent a variant of *C. vorticis*, or an undescribed species, is uncertain. More material of both forms, as well as samples from intervening localities, must be available before the status of the Costa Rican specimens is clear. For the present they are tentatively assigned to *C. vorticis*.

laevigatus subgroup

This subgroup includes only *C. laevigatus* and *C. bicornis*; it is immediately separable from all other subgroups by the strongly

auriculate occipital corners and the complete lack of pronotal tubercles or spines.

Cyphomyrmex laevigatus Weber (Figs. 30.4, 30.29)

Cyphomyrmex (*Cyphomannia*) *laevigatus* Weber, 1938:184; ♂.
Cyphomyrmex laevigatus: Kempf, 1966:164, 178–179; ♂.

The type locality of *C. laevigatus* is lower Río Madidi, Bolivia. Kempf (1966) recorded this species also from Dirkshoop, Surinam. We have seen specimens from the following additional localities. BOLIVIA: Caranavi, near radio, 800 m elev., 24–26 Jun. 1981 (Kugler and Lambert; LACM). BRAZIL: Museu Goeldi Botanical Garden, Belém, Pará, 3 Jan. 1985 (J. C. Trager; LACM, JCT), ex berlesate from bamboo litter. COLOMBIA, Meta: Puerto Lleras, 73° 22'W, 03° 18'N, c. 300 m, near Loma Linda, Jan. 1989 (V. Roth; LACM). PERU: Tingo Maria and vicinity, 9–12 Mar. 1967 (W. L. Brown and W. Sherbrooke; MCZ).

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