

A NEW SPECIES OF *CAREBARA* FROM THE PHILIPPINES WITH NOTES AND COMMENTS ON THE SYSTEMATICS OF THE *CAREBARA* GENUS GROUP (HYMENOPTERA: FORMICIDAE: MYRMICINAE)

Una especie nueva de *Carebara* de Filipinas con notas y comentarios sobre la sistemática del grupo *Carebara* (Hymenoptera: Formicidae: Myrmicinae)

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ABSTRACT

A new myrmicine ant species from the Philippines, *Carebara alperti* n. sp., is described with taxonomic notes about the genus. The new species is congruent with the genus definition proposed recently by Fernández (2004). The myrmicine ant genus *Parvimyrmica* is synonymized under *Carebara* (n. syn.), and the new combination *Carebara sangi* (Eguchi & Bui 2007) is proposed. Reinterpretation of *Carebara villiersi*, originally described in the genus *Nimbamyrmica*, suggests that *Pheidologeton* should probably be synonymized within *Carebara*. A synoptic sketch of the systematic of the *Carebara* genus group is provided to show probable phylogenetic relationships. *Carebara arabara* is proposed as a **new name** for *Carebara striata* Fernández, 2004:228.

Key words. Ants, *Parvimyrmica*, synonymy, taxonomy

RESUMEN

Se describe una hormiga nueva de la subfamilia Myrmicinae de Filipinas, *Carebara alperti*, n. sp., y se ofrecen notas taxonómicas sobre el género. La especie nueva es congruente con la delimitación propuesta por Fernández (2004). El género *Parvimyrmica* es puesto en sinonimia con *Carebara*, proponiéndose la nueva combinación *Carebara sangi* (Eguchi & Bui 2007). Se reinterpreta *Carebara villiersi*, descrita originalmente como *Nimbamyrmica*, con la sugerencia de poner en sinonimia *Pheidologeton* con *Carebara*. Se ofrece una sinopsis de la sistemática de las hormigas del grupo de géneros *Carebara* junto con sus posibles relaciones filogenéticas. *Carebara arabara* se propone como nuevo nombre para *Carebara striata* Fernández, 2004:228.

Palabras clave. Hormigas, *Parvimyrmica*, sinonimia, taxonomía

INTRODUCTION

Among the myrmicine ants in need of phylogenetic studies are those grouped around the *Solenopsis* Westwood and *Carebara* Westwood genus group. Bolton

(2003) proposed the solenopsidine tribe group to cover the tribes Solenopsidini and Stenammini, and divided the Solenopsidini tribe into the *Solenopsis* and *Carebara* genus groups. The former corresponds to the Solenopsidini tribe *sensu* Bolton

(1987), and the latter to the Pheidologetini tribe in its original sense (e.g. Ettershank 1966). Currently, there are no published phylogenetic studies that can corroborate or reject this proposal, although ongoing studies suggest that the Solenopsidini tribe is not a natural group (Rodríguez *et al.*, in preparation) and further suggest a tendency towards parallel evolution in some traits in these ants, including clypeal reduction between antenar lobes, reduction of the eyes to entirely absent or with few ommatidia, reduction in the number of antennal and palpal segments, and perhaps, simplification in sculpture. Part of this can be due to adaptation to similar habits (e.g. underground habits) or to miniaturization (as in several *Solenopsis* species or in the *Carebara lignata* group), perhaps associated in part with lestoproctotic (opportunistic thievery) habits.

Moreover, members of the *Carebara* genus group exhibit complex biology that has not been studied. Subjects requiring further investigation include the intercastes, the disappearance of the intermediate caste, major workers of exaggerated size (and big queens) occurring with very small blind minor workers (some less than 1mm in total length). The genetic and physiological bases of some of these attributes are not understood, as well as the natural history of most of the species.

The *Carebara* group includes dimorphic and secondarily monomorphic ants with some species displaying an acute dimorphism of size between the female and the worker (Hölldobler & Wilson 1990). Around this genus have been described others like *Erebomyrma* Wheeler or *Oligomyrmex* Mayr. Although characters used for inclusion of species in these genera seemed consistent, the discovery of new species and the reinterpretation of others force a broader circumscription of *Carebara*, including *Oligomyrmex* and other genera as junior synonyms (Fernández 2004). In the generic

proposal of Fernández (2004:196), *Carebara* appears broader and probably monophyletic. In this publication a new species of *Carebara* from the Philippines is described. This species has mixed attributes that recall ants of the *Carebara escherichi* and *Carebara concinna* groups, and is consistent with the *Carebara* generic concept proposed in Fernández (2004).

Additional notes about *Parvomyrma* Eguchi & Bui and *Pheidologeton* Mayr are also provided. The recently described genus *Parvomyrma* is hereto merged with *Carebara*. *Parvomyrma sangi* is a *Carebara* species with central clypeal hair, an attribute sporadically present in other *Carebara* workers (see below).

Adjustments to the description of *Carebara* (= *Nimbamyрма*) *villiersi* are also given. The latter species seems to be a bridge between *Carebara* and *Pheidologeton*. The status of *Pheidologeton* is weak, because this genus does not have attributes that clearly separate it from *Carebara* (Fernández 2004). Further investigation is likely to show if that this genus should be merged under *Carebara* and reduced to a group of species within that genus.

Finally, I present a sketch of the taxonomy and hypothesis to test the phylogeny of the ants in the *Carebara* genus group, as a working synopsis to orient future investigations in the systematics of these ants.

MATERIALS AND METHODS

Measurements were made using a Leica stereomicroscope at 80X magnification and a fiber ring lamp. All measurements are in mm:

HL Head Length. The length of the head capsule excluding the mandibles; measured in full-face view, as a straight line from the mid-point of the anterior

- clypeal margin to the mid-point of the posterior margin.
- HW Head Width. The maximum width of the head behind the eyes, measured in full-face view.
- EL Eye Length (queen and male). Maximum diameter of compound eye.
- ML Mandible Length (queen and male). In full face view, the maximum length between anterior clypeal margin and mandible apex, with mandibles closed.
- SL Scape Length. The maximum length of the scape, excluding the basal constriction or neck that occurs just distal of the condyle bulb.
- PW Pronotal Width. The maximum width of the pronotum in dorsal view. Worker only.
- WL Weber's Length of Mesosoma. The diagonal length of the mesosoma in profile, from the anteriormost point of the pronotum to the posterior basal angle of the metapleuron.
- PL Petiole length, in lateral view.
- PPL Postpetiole length, in lateral view.
- GL Gaster length, in lateral view.
- TL Total Length. The total outstretched length of the ant from the mandibular apex to the gastral apex, that is, HL+ML+WL+PL+PPL+GL.
- CI Cephalic Index. $(HW/HL)*100$
- SI Scape Index. $(SL/HW)*100$.

Ants were mounted on black, archival quality paper points. Pictures of the ants were taken for the author in the Ant Room, MCZC. The imaging system consisted of Leica MZ16 stereo microscope, motor focus drive and JVC KY-F70B digital camera. Basic Apochromatic magnification range is 7.1x to 115x with a 10x eye piece correction for accurate color rendition. Lighting was via three fluorescent lights and a velum paper light box to create even lighting. Dell Windows computer with Auto-Montage Professional by Syncroscopy Final image

processing using Adobe Photoshop CS. Figures 1C and 1F were taken from the "Ants of Philippines" web page hosted by Gary Alpert, David General and Ven Samarita (www.discoverlife.org/mp). Figures 2A, B were taken from Fernández 2004:207.

Specimens studied and deposited in the following collections:

ICN. Insect Collection, Instituto de Ciencias Naturales, Universidad Nacional de Colombia, Bogotá D.C., Colombia.

MCZC. Museum of Comparative Zoology, Harvard University, Cambridge, USA.

SYSTEMATIC TREATMENT

Carebara alperti, **new species**

Figures 1A-1G

Worker measurements (holotype): HL 0.52 HW 0.48 SL 0.40 PW 0.30 WL 0.54 PL 0.19 PPL 0.10 GL 0.65 TL 2.04 CI 92 SI 83.

Head slightly longer than wide. Posterior cephalic border sinuous, lateral sides slightly convex. Mandibles conspicuous with four stout teeth. Median portion of clypeus bicarinate. Eyes with one ommatidium, situated anterior to cephalic midline. Antennae 11-segmented with a 2-segmented apical club. Scapes failing to reach the vertexal border in less than their maximum width.

Promesonotum, in profile, strongly convex. Propodeum convex and low, unarmed. Propodeal spiracle relatively small, circular, high and equidistant from propodeal border. Propodeal lobes small. Petiole with long peduncle and with a well-defined high node; petiolar spiracle half of petiolar length. Subpetiolar process absent. Postpetiole dorsally convex, lower than petiole. Postpetiole, in dorsal view, trapezoidal.

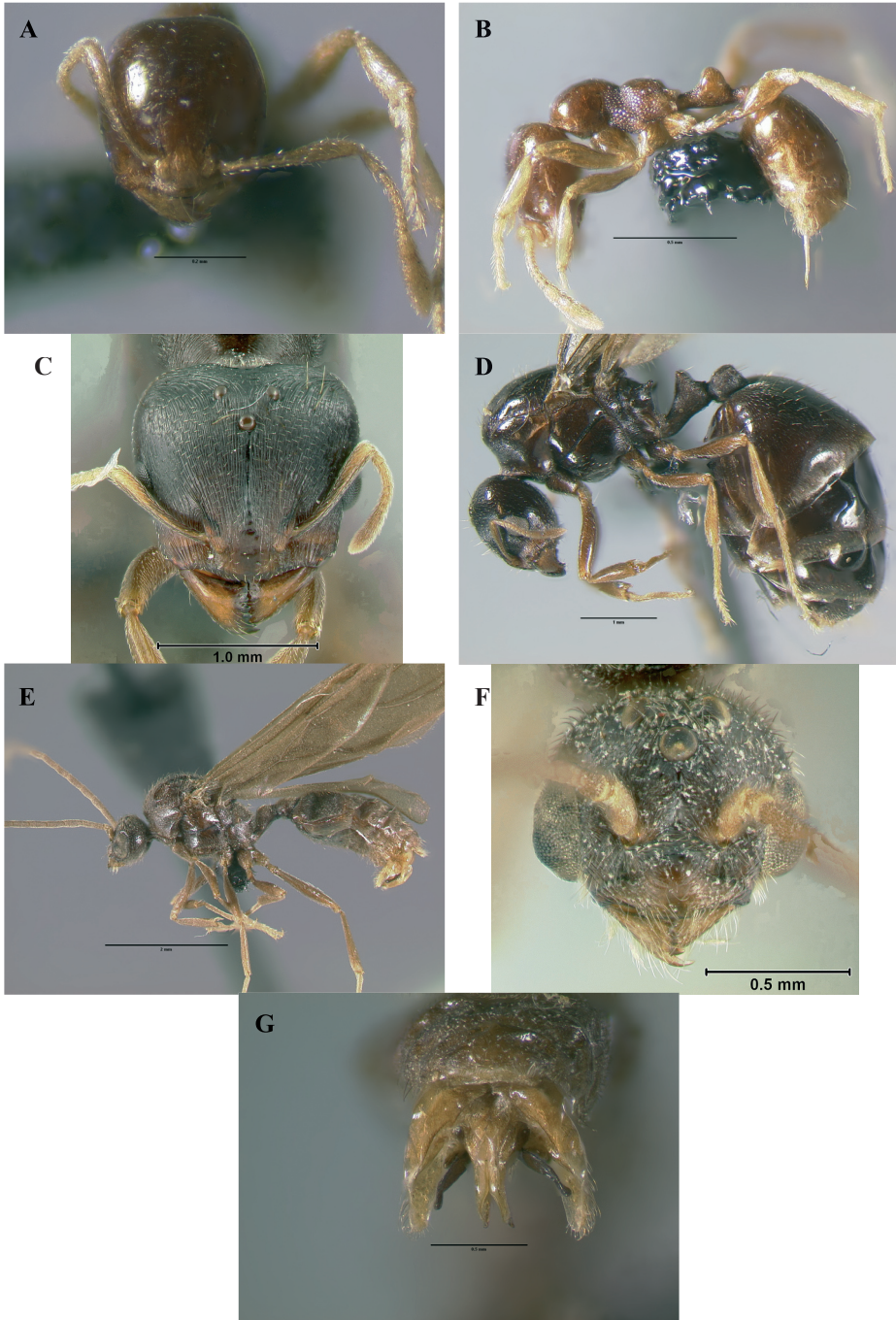


Figure 1. *Carebara alperti* new species. A. Holotype worker, head in frontal view. B. Holotype worker, lateral view. C. Queen paratype, head in full face view. D. Queen paratype in lateral view. E. Male paratype in lateral view. F. Male paratype, head in full face view. G. Male genitalia. Figures 1C and 1F from *Ants of Philippines Web Page*.

Sting well developed. Body smooth and shiny, except for mesopleura and sides of propodeum, which are foveated. Dorsum of petiole and postpetiole smooth and shining. Erect hairs absent, except for some few hairs in the last gastral tergum. Short appressed hairs sparse on body. Body dark brown, appendages lighter brown.

Female measurements. HL 1.35 HW 1.40 EL 0.38 ML 0.25 SL 0.75 WL 2.48 PL 0.73 PPL 0.55 GL 3.42 TL 8.78 CI 103 SI 54.

As typical myrmicine queen, although noticeable larger than worker (Figures 1C-D). Head wider posteriorly, widest point near to occipital corner. Vertexal border with median concavity. Clypeal border evenly convex. Antenna segmented. Scapes short, widening distally. Ocelli well defined. Propodeum with two well-defined, strong spiniform process. Most of body strongly smooth and shining. Head with conspicuous longitudinal rugulae, except the central clypeal area. Front wing with marginal, first submarginal and first discoidal cells present and closed. Vein M ending near to wing margin. Very few erect hairs on head frons, and dorsal masticatory border of mandibles, sparsely erect hairs on mesosoma, petiole, postpetiole, and gaster (especially first tergum). Body dark brown; appendages, antennae, and mandibles brown.

Male measurements. HL 0.80 HW 0.98 EL 0.38 ML 0.15 SL 0.18 WL 1.88 PL 0.60 PPL 0.38 GL 2.38 TL 6.19 CI 123 SI 18.

As typical myrmicine male (Figures 1E-G). Mandibles with 5 well-defined teeth, decreasing in size from apex. Promesonotum convex in lateral view. Propodeum angulated in lateral view. Gonostylus pale, with dense pilosity of curved withish hairs; volsellae dark, elongated, ending in a rounded apices. Abundant white erect hairs on mandibles, clypeus, and gena, dense black erect short

hairs on rest of head. Body dark brown, appendages, antennae, and mandibles brown.

Holotype worker: Philippines, Negros Oriental, Dumaguete, Horns of Negros, Camp Lookout, 10 ix 1948, J. W. Chapman leg. No. JWC0002 (deposited in MCZC). Paratypes (same data): one worker (deposited in ICN), one queen and one male (deposited in MCZC).

Comments. This species can be differentiated from other *Carebara* by the combination of the following traits: eyes present, promesonotum strongly convex, propodeum unarmed and propodeal lobes small. The presence of eyes links this species with the *Carebara concinna* group and the propodeum with the *Carebara escherichi* group. The promesonotum clearly convex appears as unique in *Carebara*. This species is placed, provisionally, in his own species group (Fig. 5).

This species is dedicated in honor to the colleague Gary Alpert (MCZC), for their generosity and helping to the visiting myrmecologists in Cambridge, and for their kindly advice with the specimens collected and AutoMontage pictures.

TAXONOMIC NOTES IN *CAREBARA*

Parvimyrmica Eguchi & Bui, 2007, is **junior synonym** of *Carebara* (**n. syn.**), corresponding to the species *Carebara sangi* (**n. comb.**), from Vietnam. As pointed out by authors (Eguchi & Bui, 2007:42) "... the presence of mediate clypeal setae is the *only* characteristic separating *Parvimyrmica* from *Carebara*" (italics mine). In fact, *C. sangi* is a typical *Carebara* of the *lignata* group whose workers have a central hair as an apomorphic trait. It is true that the central hair is absent in the basic plan of *Carebara*, but the author has discovered several workers of *C. lignata* (two examples in Figs. 2D

& E) with central clypeal hair, in addition to the case of *C. peruviana* (Fernández 2004). Furthermore, the study of abundant material of *Carebara* in MCZC shows that the clypeal hairs can be variously displayed. We still do not know the genetic basis of this variation, but the observations suggest that is very inappropriate to create a new genus based only by a feeble trait. *Parvimyрма* does not have any other characteristic or set of attributes that allow it to be separated clearly from *Carebara*. The authors place this genus in the *Solenopsis* group, but, except the possession of the central clypeal hair, there are not strong arguments for such placement.

The internal taxonomy and phylogeny of *Carebara* have been partially explored (taxonomy) or remains practically unknown (phylogeny). The small size is one of the main factors that have discouraged researchers. To this we must add monotony in external traits in the smaller workers and, overall, the existence of isolated samples of workers without majors, females and associated males (e.g. nidotypes). The taxonomy of the American species has been studied (Fernández 2004) and the Malagasy and Ethiopian fauna is underway. Nevertheless, studies of the Asiatic and Australian faunas are needed. In total there are some 180 species described in the world, the majority in the Southern Hemisphere.

PHYLOGENY AND SYSTEMATICS IN CAREBARA GENUS GROUP

The proposed classification of the solenopsidine ants of Bolton (2003) has not been evaluated in phylogenetic studies. The tribe Solenopsidini seems to be non-monophyletic (Rodríguez *et al.*, in preparation) based on morphological grounds. We need morphological and molecular studies that evaluate the phylogenetic status of the *Solenopsis* and *Carebara* genus group.

The *Carebara* genus group, as proposed by Bolton (2003) includes the genera *Adlerzia* Forel, *Carebara* Westwood, *Machomyrma* Forel, *Mayriella* Forel, *Pheidologeton* Mayr and *Tranopelta* Mayr.

The *Carebara* genus group (except *Mayriella*, see below) can be defined by the following traits (based partially on Bolton 2003): clypeus constricted posteriorly, narrowly inserted between frontal lobes; antennae 9 to 11 (rarely 8) -segmented with antennal club 2 or 3- segmented; antennal sockets and inner margins of frontal lobes in close proximity; median portion of clypeus usually bicarinate; clypeus always with a pair of setae, commonly a second pair of setae ("paracarinal" in Eguchi & Bui 2007 terminology); clypeus usually without an isolated clypeal seta (sporadically present); major workers, when present, with long heads; polymorphic to monomorphic.

This proposal does not include *Mayriella*, a specialized ant that is probably not a member of the *Carebara* genus group. In this genus the antennae is 10-segmented with a 2-segmented club, palpal formula 4,3; the clypeus is concave in the middle and laterally bidentate; and the entire body is coarsely sculptured. In the carebarine ants the antennae+club combination 10 + 2 is very rare, and no other ant in this group has a palpal formula of 4,3 segments associated with this antennae configuration. Also, no carebarine has the clypeus so modified as in *Mayriella*, nor the coarse sculpture of the body, especially in the head.

Some traits in the *Carebara* genus group are discussed below.

Antennae. All members of the group have 8 to 11 segments on antennae (a reduction from the basic number of 12, which is probably plesiomorphic in Formicidae, see Bolton 2003:288). This reduction has occurred several

times in the Myrmicinae. On the one hand, all the carebarines have 2- or 3- segmented antennal clubs. It is difficult to determine if a 2- or a 3- segmented club is plesiomorphic. It is assumed that a multisegmented club is plesiomorphic by its presence in several lineages of Hymenoptera Apocrita. On the other hand, ants with specialized habits and morphology, like *Discothyrea* Roger, present a single segmented club. In Solenopsidini, *Solenopsis*, an apparently derived genus, has a 2-segmented club.

Palps. From the plesiomorphic number of 6,4 palps in Hymenoptera and other groups, reduction in the number of palpal segments have occurred several times in Formicidae, even to zero in some cases. *Adlerzia* show the most plesiomorphic number with palpal formula 4,3 for the *Carebara*-group. *Tranopelta* displays a reduction to 3,2 and the rest of the carebarines present a uniform reduction to 2,2.

Bicarinate clypeus. This it is an attribute common in the tribes Solenopsidini, Adelomyrmecini, and Stenammini (Bolton 2003). The great majority of the ants on these tribes have a median bicarinate clypeus. In Adelomyrmecini both carinae can merge forming a fused keel, as can be seen in *Cryptomyrmex* Fernández or *Baracidris* Bolton. This trait is present in all minor workers, and is faded or secondarily absent in major workers (in cases on which this caste is present) and workers of several species of *Pheidologeton*.

Clypeal hairs. In the workers of the *Carebara* genus group there is always a pair of setae in the central part of the clypeal anterior margin (Fig. 2 A,B,C). Occasionally there are workers with a central hair (*C. anophtalma*, *C. lignata* Fig. 2 D,E, *P. sangi*), but this must taken as an apomorphic attribute of these species. This pair of hairs are always conspicuous (rarely displaced from the center) and directed

upward and outward. In many workers of the *Carebara* group a second pair of hairs exists (called paracarinal setae in Eguchi & Buy 2007). In many workers of *Carebara* the central pair and paracarinal hairs are distinguished clearly from other clypeal hairs. As has been documented for other traits, these hairs attenuate or disappear in major workers and queens. For now, we lack comparative studies of the ontogeny and morphology of the median setae in ants. The median setae appears to be similar in position in solenopsidines, whereas in different position in attines (Brandão & Mayhe-Nunes 2001).

Caste. The carebarines include polymorphic, dimorphic, and monomorphic ants. Apparently the ancestral carebarine was di- or polymorphic, with an evolutionary trend of disappearance of the intermediate worker caste (Hölldobler & Wilson 1990) with tiny smaller workers (in contrast to very large queens) in the species groups *concinna*, *crigenis*, *lignata* and *escherichi*.

Eyes. From the most basal to the most derived groups there is a tendency towards reduction on the number of ommatidia in the eyes from few in *C. escherichi* and *C. crigeri* species groups or completely absent in *C. lignata* species group.

Elongated heads in major workers. With the exception of *Pheidologeton* and *Tranopelta*, all *Carebara* major workers have elongated heads, with CI greater than 130 (Figs. 3A,B). This trait is also present in other Myrmicinae including some *Pheidole* (especially in the *aberrans* groups) and one undescribed species of *Solenopsis* from Argentina. Because these latter taxa appear to be only distantly related to *Carebara*, the presence of an elongated head is here interpreted as a convergent trait. The presence of major workers with heads not so elongated in *Pheidologeton* (Fig. 3C), implies the retention of a plesiomorphic trait or the new acquisition of wide heads.

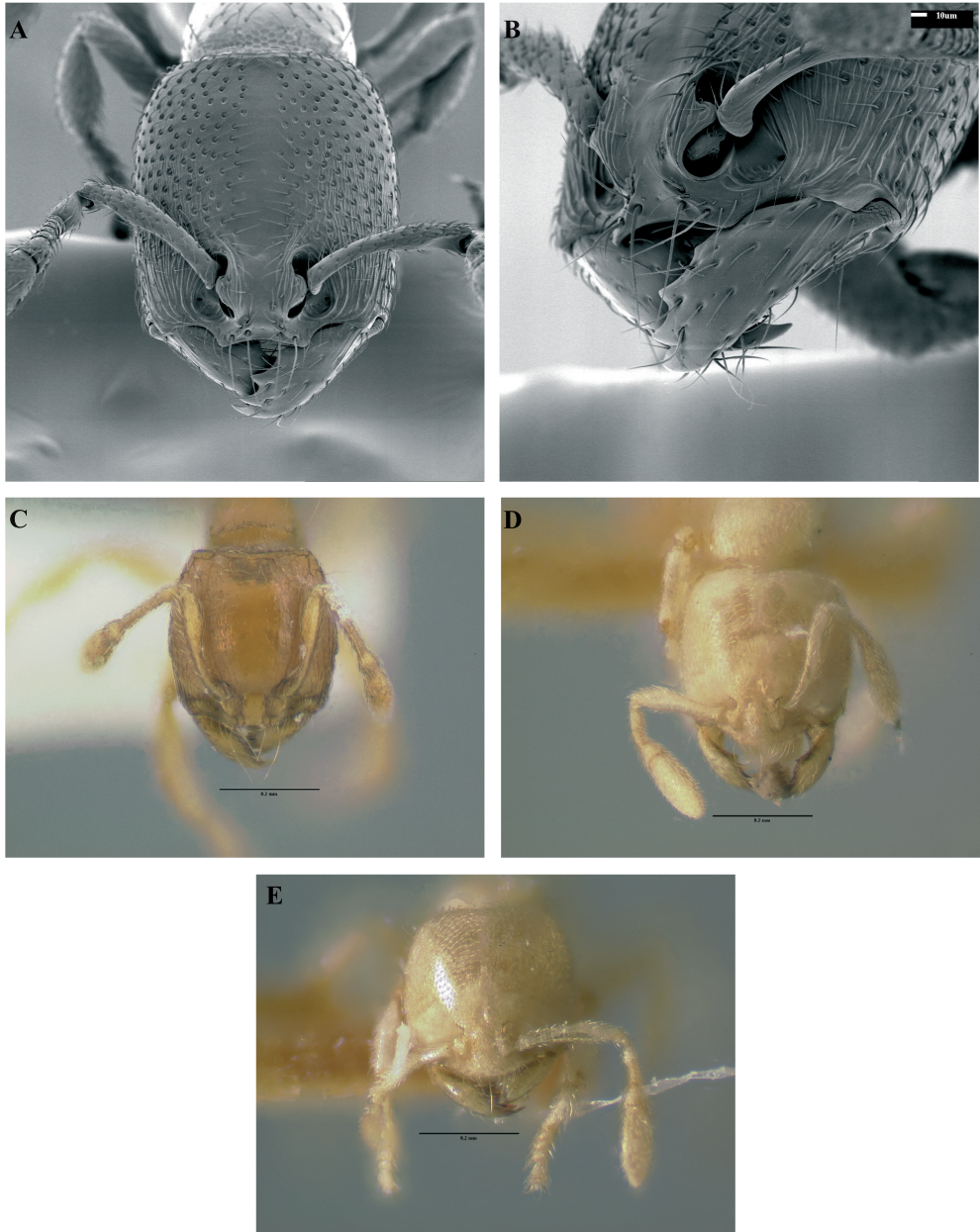


Figure 2. Clypeal setae in *Carebara* workers. A & B: *Carebara reticulata*. A. Head in full face view. B. Head in oblique frontal view. C. *Carebara urichi*. D & E. Central clypeal setae in some *Carebara lignata*. A & B from Fernández (2004:207).

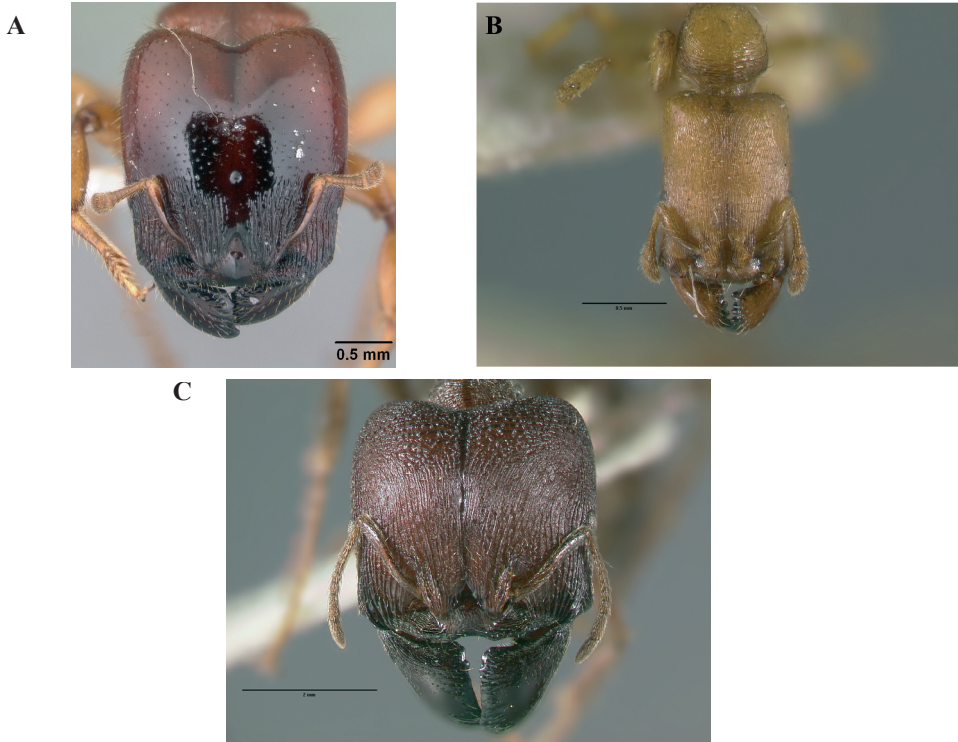


Figure 3. Head in major workers in some *Carebara* genus group. A. *Adlerzia froggati*. B. *Machomyrma dispar*. C. *Pheidologeton silenus*.

OUTLINE OF EVOLUTION IN THE GROUP

An outline of evolution in the group is sketched, with the intention of start morphological and molecular phylogeny studies that can either confirm, reject or change the scheme proposed here. What follows is a “working hypothesis” (Fig. 5). The carebarine had 11- segmented antennae with 3- segmented club as probable plesiomorphic state; palpal formula 4,3; and dimorphic castes, the major workers with elongated heads. *Adlerzia*, the most probable plesiomorphic genus, appears as the sister group of *Machomyrma* + *Carebara* s.l. This is a monotypic taxon from Australia that retains an antennal club of 3 segments and palpal formula 4,3. *Tranopelta* (with two species confined to the Neotropics),

if a true member of the *Carebara* group, would represent a separate lineage, with the loss of the major worker and palpal reduction to 3,2. *Machomyrma* + *Carebara* s.l. present reduced palpal formula of 2,2. At this node two lineages can be differentiated, *Machomyrma* and *Carebara* sensu lato. *Machomyrma* (monotypic genus from Australia) would retain the plesiomorphic club of 3 segments. *Carebara* sensu lato (including *Pheidologeton*) is characterized by a 2-segmented antennal club.

In *Carebara* sensu lato some groups retain 11-segmented antennae (*Pheidologeton*), 11-9 (*C. concinna* group) and other present reduction to 10 segments (*C. crigenis* group), 9-8 (*C. escherichi* group) and 9 (*C. lignata* group); whereas *Pheidologeton* retains the major worker with wide heads (or this trait

maybe a novelty), the *C. concinna* group (probably paraphyletic) retains dimorphic castes (both major and minor workers with eyes) and the *C. lignata* group always with eyeless minor workers, a unique trait in the *Carebara* group. The other *Carebara* groups are united by the disappearance of the major worker: *C. crigenis* group (monotypic) with mandibles with 2 teeth and *C. escherichi* group (formerly *Paedalgus*) with narrow head and short propodeum.

The ants of the *lignata* group deserve separate mention. Members of this species group are in agreement with the concept of *Carebara* s. str. of earlier literature (Bolton 2003), that is, all minor workers lacking eyes. In Fernández (2004) it is clear that some of these *Carebara* have, in addition to blindness, small workers, eyed major workers (or at least with one ommatidium). Due to the difficulty in collecting these subterranean ants, there is a small quantity of major workers in museum collections. On the other hand, it is in this group that the smallest ants in the world are known, with some species barely approaching one millimeter in total length or 0.21 mm in head width.

As pointed out by Fernández (2004), the synonymy of the genera *Oligomyrmex* and *Paedalgus* with *Carebara* seems inadmissible at first view. Nevertheless, the existence of several “bridge” species obscures the limits between these genera and *Carebara*. Several species have major workers that belong to the generic concept of *Oligomyrmex* whereas their smaller workers are *Carebara* s.str. *Carebara intermedia*, from Trinidad, has attributes of both the *C. escherichi* and *C. concinna* groups. *Carebara alperti* (described above) has a mixture of traits of the *C. escherichi* group and *C. concinna* group. *Carebara villiersi* (see below) resembles *Pheidologeton*. The study of ant

stings by Kugler (1986) suggests that some *Pheidologeton* are more closely related to *Oligomyrmex* than to other *Pheidologeton*.

THE FATE OF *PHEIDOLOGETON*

The wide heads of the major workers and caste polymorphism puts *Pheidologeton* in a more difficult position in this scheme. This genus appears to be closely related to, but differentiated from, *Carebara*. However, *C. villiersi* (see below) could suggest the placement of *Pheidologeton* as member of the *Carebara* sensu lato (Fig. 5).

The antennal and palpal formula puts *Pheidologeton* within *Carebara*, although separated from *Carebara* by the presence of polymorphism in all his species. Also, the pair of clypeal setae in the smaller workers is absent in several species. The polymorphism can be interpreted as an independent acquisition in this lineage, from a dimorphic ancestor (ancestor of *Machomyrma* + *Carebara*), as well as the undifferentiated clypeal pair of setae in some species.

Nimbamyрма villiersi, described from workers of Guinea by Bernard (1953), plays an important role in the taxonomy of *Carebara*. The lack of observed material of this species prevented a definitive evaluation of the genus in Fernández (2004). Nevertheless, recent material sent to the author by Barry Bolton, and observation of workers at MCZC has allowed better study of the propodeal teeth and comparison to Bernard’s description. According to this author, the propodeum, in lateral view, has two kinds of strong teeth: the propodeal teeth and the “inferior ones”, which correspond to the metapleural process. Actually, the metapleural process forms an angulated process, but less conspicuous than was described and illustrated in Bernard (1953).

Bernard (1953:78) mentions that the worker has four obtuse teeth and three to four denticles in the mandible; observations by the author show there are two bigger teeth (apical and subapical) followed by two or three small ones, for a total number of teeth on masticatory margin of mandible, less than six. The palps are 2,2 (in situ). Finally, the clypeal configuration follows the general pattern for *Carebara*.

Based on these observations, there is no doubt about placing *Nimbamyрма* as a junior synonym in *Carebara*, as proposed by Fernández (2004). The general habitus of the worker (Fig. 4A,B) resembles the smaller workers of *Pheidologeton* (Fig. 4C,D), which remembers the statement in Kugler (1986): “*Pheidologeton* and *Oligomyrmex* [=

Carebara] are closely related, *Pheidologeton pygmaeus* is closer to *Oligomyrmex* than to *Pheidologeton*”. Like *Carebara panamensis*, *C. intermedia* or *C. alperti*, *C. villiersi* is yet another link in the chain of arguments for a new generic delimitation of *Carebara*, a genus with an interesting biology and in need of global revision.

CONCLUDING REMARKS

The possession of a pair of clypeal hairs (occasionally a central hair in some workers of some species), plus major workers with elongated heads (convergent in some *Pheidole* and *Solenopsis*) could be synapomorphic traits for the *Carebara* group. Within this putative clade, on one hand, reductions have occurred in the number of segments



Figure 4. *Carebara villiersi* and *Pheidologeton* workers. A & B. *C. villiersi*. A. Head in frontal view. B. Body in lateral view. C & D. *Pheidologeton silenus*. C. Head in frontal view. D. Body in lateral view.

of the antenna, in the number of segments of the antennal club, in the palps and the number of ommatidia (up to zero). On the other hand, the apparently derived lineages display miniature workers with reductions in eyes and sculpture, perhaps associated with subterranean habits. The major workers of *Carebara* show a mosaic of traits in the thoracic sclerites, eyes, and ocelli number and disposition; some major workers show female thoracic traits. The propodeal traits are consistent among all genera, although the location of *Tranopelta* is doubtful. *Mayriella*, proposed recently as a member the *Carebara* group, does not seem to belong and is here excluded.

NOTE

Carebara striata Fernández, 2004 is an unresolved junior primary homonym of *Carebara striata* Xu, 2003. The name *Carebara arabara* is proposed as a **new name**

for *Carebara striata* Fernández, 2004:228. Thanks to Kiko Gómez and Brian Fisher for point out this problem.

ACKNOWLEDGEMENTS

Special thanks are due to Edward O. Wilson (MCZC) and Brian Fisher (California Academy of Sciences) for the invitation to GAP Ant Meeting at Harvard University that provided me time to study the carebarines in the Ant Collection. Thanks to Stefan Cover (MCZC) for facilitating my work in the Ant Room and to Gary Alpert (MCZC) for advice and lodging in Cambridge, as well as to Christian Rabeling (University of Texas at Austin) for company and help. Lauren Raz (Universidad Nacional de Colombia) improved greatly the English. Jeffrey Sossa-Calvo (University of Maryland, Washington D.C.) and two anonymous reviewers made useful corrections and suggestions over the manuscript.

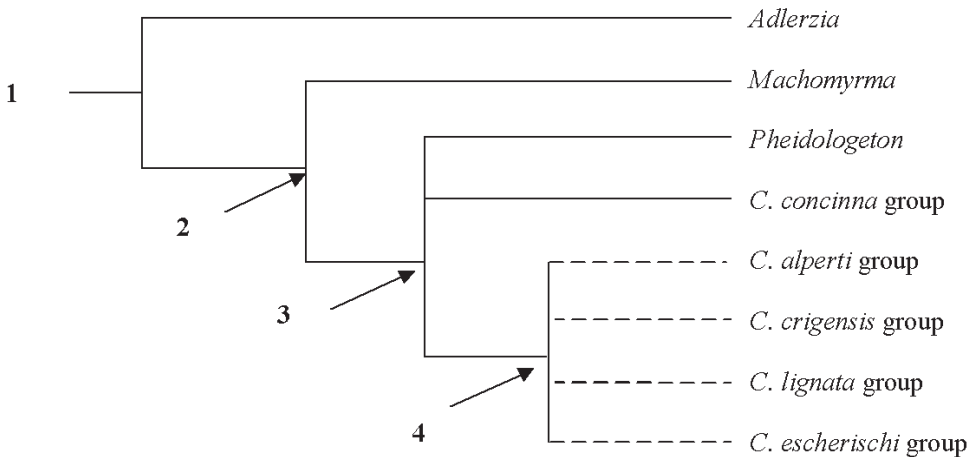


Figure 5. Proposed relationships between members of the *Carebara* genus group. *Mayriella* excluded (see text). Probable synapomorphies numbered: 1. *Carebara* genus group (antennae 11-segmented, clypeus with 4 hairs, heads of major workers elongated, workers dimorphic); 2. *Machomyrma* + *Carebara* sensu lato (Palps 2,2). 3. *Carebara* sensu lato (Antennae with 2-segmented club); 4 Major worker caste absent. *Tranopelta* (antennae 11 segmented with 3-segmented club, major worker absent), if true member of *Carebara* genus group, could be positioned as sister of *Machomyrma* + *Carebara* s. l.

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Recibido: 06/10/2009

Aceptado: 17/02/2010