

A New *Zacryptocerus* from Brazil, with Remarks on the Generic Classification of the Tribe Cephalotini (Hymenoptera: Formicidae)

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(With 8 text-figures)

A rich and varied collection of ants taken during a general survey of the insect fauna of Pedra Azul, northeastern State of Minas Gerais, Brazil, was given me by the collectors and generous friends, Dr. Carlos Alberto Campos Seabra and Lt.-Cel. Moacyr Alvarenga. The most surprising catch contained in this lot was an unexpected new species in the Cephalotine ant genus *Zacryptocerus*, the study of which not only led me to revise the specific classification of this small group, but also to take a second look at the genus-level classification of the tribe.

I gratefully acknowledge the gift by the above-named friends, and also the help received from the "Conselho Nacional de Pesquisa" of Brazil by means of a research fellowship, and to the "Fundação do Amparo à Pesquisa do Estado de São Paulo", for financing a noticeable improvement of my laboratory equipment.

Genus *Zacryptocerus* Wheeler

Because of their bizarre shape in the worker caste, the species of *Zacryptocerus* constitute an easily recognizable group and generic distinction seems to be no problem at the first glance. But a study of their diagnostic characters, especially if compared with those of the many and varied species of genus *Paracryptocerus*, shows that the generic separation between the two groups has become precarious, if not completely inexistent. The novelties presented in this paper, a new, black species from eastern Brazil, and the discovery of a truly dimorphic worker caste in *membranaceus* push the problem to a highly critical point and will be discussed in the second section of this study.

Notwithstanding the doubt concerning the generic status of *Zacryptocerus* (as distinct from *Paracryptocerus*), the *clypeatus*-group (as I shall call henceforth the small assembly of species which so far make up the genus *Zacryptocerus* in the traditional sense) is most certainly very closely knit and monophyletic in origin. The most primitive form seems to be *ustus*, the new species

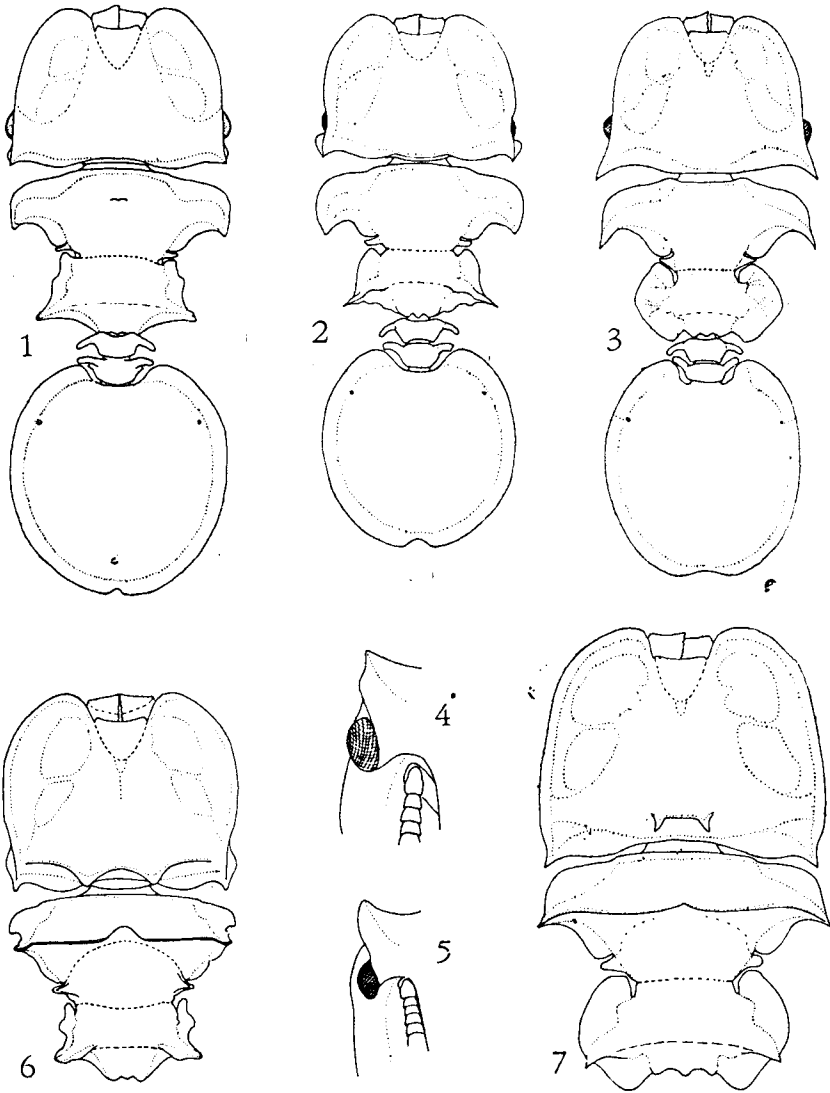
described below, because it conserves the heavily sculptured integument and the black color; *membranaceus* could be derived directly from *ustus*, whereas *clypeatus* is more advanced and has successfully conquered a vast territory between Trinidad and northern Argentina in cis-andean South America (cf. Fig. 8). The fact that both *ustus* and *membranaceus* are apparently rare and confined to the western, respectively eastern slope of the Serra do Mar range in eastern Brazil, where *clypeatus* apparently does not occur, might lead us to consider this territory as the center of speciation for the group, if our assumptions based on a very incomplete collecting record will survive the test of further evidence.

In the following I present the diagnosis of the new species, the differential characters and distribution of *membranaceus* and *clypeatus* with special emphasis upon the degree of dimorphism of the worker caste. A key for the identification of the three species is given at the end.

Zacryptocerus ustus sp. n.

(Figs. 1, 4)

Worker (holotype). Total length 7.7 (6.9) mm; maximum head length 2.08 (1.89) mm; maximum head width (eyes included) 2.98 (2.79) mm; maximum diameter of eyes 0.38 (0.37) mm; Weber's length of thorax 2.24 (2.00) mm; maximum width of thorax across pronotum 2.87 (2.71) mm. Deeply fuscous brown, almost black; gaster and tarsomeres black; membranaceous laminate borders of head, thorax, gaster and spines of petiole and postpetiole testaceous. Integument opaque, finely, densely punctulata, including the laminate borders which are not glassy nor hyaline. Dorsum of head, cheeks, dorsum of thorax, of petiole, postpetiole and gaster, apical half of extensor face of femora, tibiae densely and shallowly foveolate, each foveola being oblong and containing an appressed, canaliculate, golden hair. The same hairs are much more widely scattered, either canaliculate or simple, on gular surface of head, sides of thorax, sides of femora and tibiae, ventral surface of gaster, with the foveolae usually indistinct. Gaster, in addition, very finely reticulate-rugulose. Standing hairs absent.



Zacryptocerus Wheeler
 Figs. 1-3. Worker in dorsal aspect: 1. *ustus* sp. n.. 2. *membranaceus* (Klug). 3. *clypeatus* (Fabricius). — Figs. 4-5. Worker, gular aspect of end of antennal scrobe and eye stalk: 4. *ustus* sp. n. 5. *membranaceus* (Klug). — Figs. 6-7. Head and thorax of soldier in dorsal aspect: 6. *membranaceus* (Klug). 7. *clypeatus* (Fabricius). (Kempl del.).

Head (Fig. 1) distinctly transverse, sides slightly diverging caudad, occipital angles spinous, acute, the spine with a laterally projecting lobe, smaller yet similar to that of *membranaceus*. Frontal carinae and occipital borders membranaceous and somewhat upturned. Dorsum of head gently convex on disc in both directions, laterally transversely concave. Clypeal sutures vestigial. Frontal area obsolete. Cheeks immarginate below. Eye stalk (Fig. 4) entirely fused to the frontal carinae above, the apical part bearing the eye not free. Eyes relatively larger, their maximum diameter equal to the distance between their posterior orbit and the tip of the occipital spine. Thorax (Fig. 1) as in *membranaceus* except for the different sculpture already mentioned above; lateral expansions of the pronotum scarcely raised apicad, horizontal, those of propodeum obliquely upturned. Hind femora marginate above on apical half yet not sharply carinate, angulate above in side-view, the angle situated beyond the first third of the femur length. First tarsomere distinctly yet not strikingly longer than tarsomeres 2-5 combined. Petiole, postpetiole and gaster as in *membranaceus* except for the differences in sculpture, color and pilosity already mentioned above.

Types. 2 workers (holotype and paratype) from Pedra Azul, State of Minas Gerais, Brazil, alt. 800 m., November 1972, C. A. C. Seabra & M. Alvarenga leg., in my collection (WWK n. 8816).

Discussion. The types represent the minor worker and are very close to the same caste of *membranaceus* but differing in the following features: Color black; integument not only punctulate but also densely foveolate, the foveolae with broad, canaliculate scales; gastric dorsum finely reticulate-rugulose between the foveolae; eye stalk fused with the frontal carinae in its entire length; maximum diameter of eyes subequal to distance between posterior orbit and tip of occipital spine; hind femora dorsally marginate not carinate on apical half; tarsomere I distinctly longer than tarsomeres 2-5 combined.

The differences that separate *ustus* from *clypeatus* are even more numerous and impressive, as follows: color black; integument opaque, entirely sculptured, also foveolate with canaliculate hairs; lateral pronotal expansion scarcely upturned; dorsal angle of hind femora situated beyond the first third of femur length, the apical half of extensor face marginate on both sides; eyes larger, the maximum diameter subequal to distance between posterior orbit and tip of occipital spine; tarsomere I only somewhat longer, not nearly twice as long, as tarsomeres 2-5 combined; dorsum of head much more convex on disc; lateral laminate border of gaster not upturned nor thickened anteriorly at both sides of the post-petiole insertion.

The paratype (besides the measurements already given in parenthesis in the description of the holotype) does not differ significantly from the holotype.

Zacryptocerus membranaceus (Klug)

(Figs. 2, 5, 6)

- Cryptocerus membranaceus* Klug, 1824: 208-10 (worker; Brazil, s. loc.). Fr. Smith, 1854: 227, pl. 21, fig. 4 (worker). Fr. Smith, 1862: 410, pl. 12, fig. 9 (worker; Brazil, Guanabara: Rio de Janeiro, Tijuca). Forel, 1912: 199 (Brazil, Guanabara: Rio de Janeiro, Corcovado).
- Cephalotes membranaceus*: Emery, 1914: 39.
- Zacryptocerus membranaceus*: Emery, 1915: 192. Emery, 1922: 305. Borgmeier, 1937: 244 (Brazil, Rio de Janeiro: Niterói; Espírito Santo: Santa Teresina). Kempf, 1951: 141-2, figs. 106, 110 (worker; Brazil, Rio de Janeiro: Niterói; Espírito Santo: Santa Teresina). Kempf, 1958: 135 (Syn.). Kempf, 1963: 438 (Syn.). Kempf, 1964: 254 (Brazil, Guanabara: Represa Rio Grande).
- Cryptocerus fervidus* Fr. Smith, 1876: 605, pl. 11, fig. 1 (female; Brazil, Guanabara: Rio de Janeiro).

So far this rare species has only been found on the Atlantic slopes of the Serra do Mar mountains, between Rio de Janeiro and Espírito Santo in eastern Brazil, where it apparently replaces the much more common and widely dispersed *clypeatus*. A second look at the long series of workers received several years ago from my friend C. A. C. Seabra, showed that this species possesses a fully developed soldier establishing for the first time a clear-cut dimorphism of the worker caste in this group.

Worker (Fig. 2). The unique feature of this caste consists in the apically detached eye stalk from the roofing frontal carinae, and the eye itself projecting anteriorly beyond its base (Fig. 5). The differences that separate *membranaceus* from *ustus* have already been given above under that species. The differences that distinguish it from *clypeatus* are the following: Integument opaque, finely granulate-punctulate throughout; membranaceous laminate borders of head, thorax, and gaster not glassy but granulate, that of gaster flat not upturned; occipital spine with a rounded lateral lobe projecting from its side; lateral expansions of pronotum flat, not upturned; apical half of mid and hind femora prismatic, extensor face sharply carinate on both sides; first tarsomere of hind leg not longer than tarsomeres 2-5 combined.

Soldier (undescribed; Fig. 6). Total length 8.0 mm; head length 2.56 mm; maximum head width 2.97 mm; maximum diameter of eyes 0.34 mm; Weber's length of thorax 2.59 mm; maximum width of pronotum 3.03 mm; gaster length 3.08 mm; gaster width 2.84 mm. Differs from the respective worker in the ensuing characters: Cephalic disc with sides subparallel, scarcely converging in front except for the anterior curvature; integument only superficially punctulate, quite shining, and densely foveolate, each foveolae bearing a simple appressed hair; vertex with a mesially strongly bidentate, transverse carina that attains

the lateral margin at both sides; occiput vertically truncate behind this carina; eye stalk not detached from the head proper, yet between the upper orbit of eye and the rim of cephalic disc is a deeply excavated groove; thorax similarly sculptured as head on dorsum and sides of pronotum, the latter with a strongly elevated, foliaceous transverse carina on dorsum, which is semicircularly excised in the middle; in side-view, the anterior portion of the pronotum in front of the carina forms a right angle with the posterior portion behind the carina and the mesonotum; membranaceous borders of pronotum and propodeum narrower and the enclosed spines stronger, those of the propodeum shorter and more upturned; gaster relatively more elongate and membranaceous border laterally somewhat narrower.

Intermediates have the transverse pronotal carinae more or less developed and the thoracic dorsum foveolate, but the cephalic sculpture is unvariably as in the minor worker, and they also lack the bidentate carina on vertex.

Female. With the same features as the soldier, but the head is rather subquadrate than transverse; transverse carinae of vertex and pronotum much lower, the former bidentate in the middle; thorax and gaster lacking the encircling, semitransparent, laminate borders, except for the antero-lateral corners of tergum I of gaster. Differs from the female of *clypeatus* as follows: integument subopaque, finely and densely punctulate throughout; foveolae on cephalic disc and thoracic dorsum denser, crowded; vertex of head with a transverse carina besides the pair of teeth; transverse carina of pronotum more elevated and foliaceous; propodeal spines longer and subacute; first tarsomere of hind leg as long, not longer than, as tarsomeres 2-5 combined; lateral spines of postpetiole longer, about one half as long as length of postpetiole; tergum I of gaster antero-laterally narrowly crested but lacking the white spots encircled with black on each corner.

Material examined: Brazil, Guanabara State: Represa Rio Grande, March 15, 1961 and April 1961, F. M. Oliveira leg. 26 workers and 2 soldiers (received from C. A. C. Seabra), Rio de Janeiro, Corcovado, October 10, 1958, C. A. C. Seabra & M. Alvarenga leg. 1 female; Rio de Janeiro State: Niterói, 28 November 1932, Ajax leg. 1 worker; Espírito Santo State: Santa Teresa, May 1928, O. Conde leg. 1 worker (ex coll. Borgmeier). All this material is deposited in my collection (WWK).

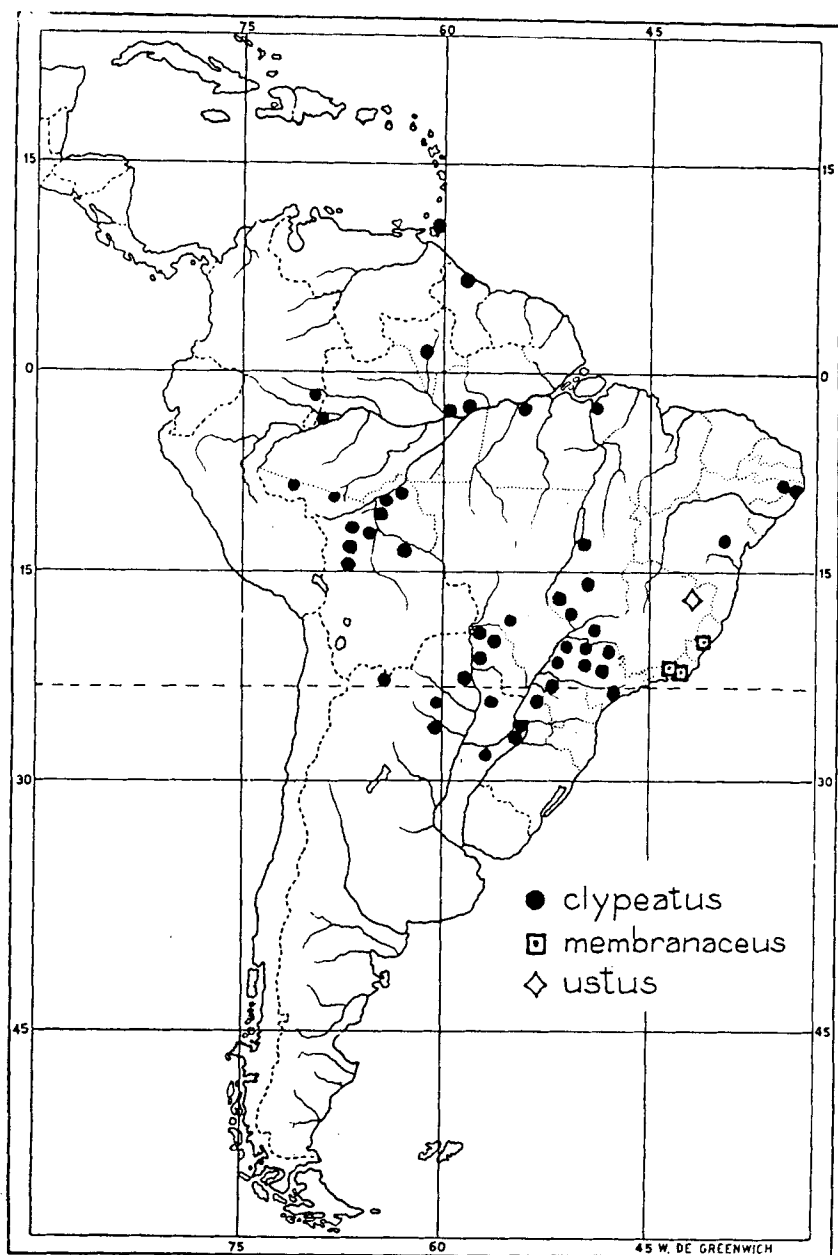


Fig. 8. Geographical distribution of the *clypeatus*-group in genus *Zacryptocerus*.

***Zacryptocerus clypeatus* (Fabricius)**

(Figs. 3, 7)

This species is not only common and wide-spread, but never became entangled in taxonomic confusion because of its yellow color, its smooth and glassy integument. I refrain from transcribing the pertinent literature which is reasonably complete in my former revision of the genus (Kempf, 1951: 136). This is the only species of which also the male sex is known.

Worker (Fig. 3). The diagnostic features for this caste have already been stated in the differential diagnoses of the two preceding species. The smallest workers lack distinct and solid propodeal spines within the hyaline border, which contains instead several to many loose strands of denser material.

Soldier (Fig. 7). This caste has the cephalic disc with the sides less diverging caudad, its surface more distinctly and densely foveolate; the vertex bears a pair of teeth the bases of which are connected by a low transverse carina, which is however lacking between each tooth and the lateral margin of head. Pronotum with a well-developed transverse carina, the anterior and posterior portion of thorax forming in sideview a blunt angle the vertex of which is the carina. Propodeal spines well-developed, solid and stout within the enclosing hyaline margin. Intermediates seem to be more frequent and differ from the minor worker only by the presence of a pair of unconnected teeth on vertex, a weak, often incomplete transverse pronotal carina, and the solid spine within the lateral propodeal margin.

The differences from the *membranaceus* soldier are the following: Integument smooth and shining throughout; transverse carina of vertex of head only between the paired teeth; occipital spine lacking a lateral lobe on base; no groove between upper orbit of eye and the rim of cephalic disc; thoracic angle formed by transverse pronotal carina rather blunt than rectangular, the latter not excised in the middle; hind femora not prismatic, the dorsal angle in front of the first third of femur length; tarsomere 1 of hind leg much longer than tarsomeres 2-5 combined.

New locality records: Brazil, Paraná State: Rondon, July 1952, F. Plaumann leg.; São Paulo State: Agudos, Oct. 1953, W. W. Kempf leg., Anhembi, Faz. Barreiro Rico, Febr. 1969, W. W. Kempf, leg., Caiuá, Faz. Sta. Lucília, Jan. 1971, C. da Cruz-Landim leg., Itápolis, February 1960, P. Schweitzer leg., José Bonifácio, July 1970, J. Diniz leg., Piracicaba, September 1967, coll. ESALQ; Minas Gerais State: Cana Brava, May 1966, V. P. da Silva; Goiás State: Jataí, November 1972, F. M. Oliveira leg.; Mato Grosso State: Chapada, May 1959, C. Amann leg., Poconé, June 1972, R. N. Williams leg., Rio Baía, November 1959, O. P. Forattini leg., Vila Bela, July 1972, R. N. Williams leg.; Pernambuco State: Recife, 1938, L. Lima Castro leg.; Acre territory: Cruzeiro do Sul, December 1959, L. Herbst leg., Rio Branco, 1972, coll. L. Travassos Fv.

**Key to the species of clypeatus-group
(workers and soldiers)**

1. Vertex bidentate; pronotum with a transverse carina well-developed (soldiers) 2
 — Vertex unarmed; pronotum without a transverse carina, or the latter is at best vestigial (workers) 3
2. Integument smooth and shining; transverse carina on vertex of head, if present, only between the paired teeth; no deep groove on sides of head between upper orbit of eye and rim of cephalic disc *clypeatus* (Fabricius)
 — Integument finely punctate and opaque; transverse carina on vertex of head well-developed not only between paired teeth but also between each tooth and lateral margin of head; a deeply excavated groove between upper orbit of eye and rim of cephalic disc *membranaceus* (Klug)
3. Integument smooth and shining; lateral expansions of pronotum apically raised; base of occipital spine without a projecting lateral lobe; apical half of hind femora rounded in cross-section, not prismatic *clypeatus* (Fabricius)
 — Integument finely punctate-granulate and opaque; lateral expansions of pronotum horizontal, not raised apically; base of occipital spine with a projecting lateral lobe; apical half of hind femora prismatic, the sides of extensor face marginate or carinate 4
4. Color fuscous brown to black; integument foveolate, each foveola with a broad, canaliculate, appressed scale; eye-stalk fused with the roofing frontal carina in its entire length, the eye not projecting over its underlying base *ustus* Kempf
 — Color light brown; integument lacking foveolae and scale-like hairs are narrow and simple; eye stalk detached from the frontal carinae at its apex, the eye projecting beyond its underlying base *membranaceus* (Klug)

Note on the generic classification of the Cephalotini

In a list of "Generic and Subgeneric Names Proposed in the Family Formicidae", W. L. Brown, Jr. (1973: 177-185) suggests to maintain in the tribe Cephalotini only two genera: *Procryptocerus* and *Cephalotes*, the latter including as synonyms all other hitherto recognized genera, namely *Eucryptocerus*, *Zacryptocerus*, *Hypocryptocerus*, and *Paracryptocerus*.

From the beginning it should be clearly stated that indeed the last five genera, from *Cephalotes* to *Paracryptocerus* i. e. the "higher" Cephalotini, are much closer to each other than to the quite discrepant genus *Procryptocerus*. I also agree totally with Brown in his all-out effort to maintain as valid only well-defined genera that can be readily separated by good key characters.

Cephalotes. Nevertheless, I believe that Brown's suggestion in this case is far too sweeping. While there exist real doubts about the generic distinction of the four genera slated for synonymy under *Cephalotes*, they may not collectively be lumped under this genus which differs strikingly from them all by the situation and length of the antennal scrobe on the sides of the head, extending all the way back to the occipital corner, with the eyes located below the scrobe which terminates at the level of the posterior orbit of the former. In all other "higher" Cephalotine ants (*Eucryptocerus*, *Zacryptocerus*, *Hypocryptocerus*, *Paracryptocerus*) the antennal scrobes terminate in front or even slightly below the eyes, never reaching the level of the posterior orbit of the latter which are situated at the same level of the scrobe and "behind" it, just in front of the occipital corner. This combination of characters, already pointed out in my previous key (Kempf, 1951: 13) gives a clear-cut separation between *Cephalotes* and the other higher Cephalotini. Consequently, to my mind, *Cephalotes* should be kept in its present, restricted sense, containing only three species: *atratus*, *decemspinus* and *serraticeps*. The question of synonymy must of necessity center upon the remaining genera of which *Zacryptocerus* is nomenclatorially the oldest.

Zacryptocerus. The genus-group name *Zacryptocerus* entered the Cephalotini classification almost by contraband, and was saved from oblivion by Wheeler (1911: 175) who gave it a valid type (cf. Kempf, 1951: 133) and later (1922: 665) presented the following key characters for the genus:

2. Much flattened. Sides of the head, the thorax, the epinotum and the first tergite of the gaster excessively expanded into broad, translucent lamellae; the eyes almost stalked above the very deep scrobes. Monomorphic..... *Zacryptocerus* Ashmead
- Sides of the body not with extremely expanded, translucent lamellae 3 (= *Cephalotes* *Paracryptocerus* *Hypocryptocerus*)

None of the characters cited for *Zacryptocerus* in the first lug of the couplet is conclusive: most *Paracryptocerus* and even *Hypocryptocerus* are similarly flattened; the "excessively" expanded lamellae on sides of head, thorax and gaster are likewise found in *Paracryptocerus foliaceus* Em. (cf. Kempf, 1952: 7-10, figs. 2, 9) which also has the eyes "stalked above the very deep scrobes"; finally, as shown in the preceding part, *Zacryptocerus* is by no means monomorphic in the worker caste.

Emery (1922) fared little better than Wheeler. In his key for the Cephalotini genera (p. 300) *Zacryptocerus* and *Cephalotes* (still including the species which presently belong to *Eucryptocerus*) are distinguished from "*Cryptocerus*" (= *Paracryptocerus*) by the lack of a strict dimorphism in the worker caste, minor and major workers, and females not offering any essential difference among themselves as regards the head form and sculpture. From the preceding pages (part I. of this study) it is evident that this is no longer true for *Zacryptocerus* (*clypeatus* and even more so *membranaceus* have a morphologically differentiated soldier caste). In *Cephalotes*, *atratus* workers could be said monomorphic in spite of considerable size variation, whereas *serraticeps* has already a somewhat differentiated soldier (cf. Kempf, 1951: 107, 11-114, figs. 98, 101).

In the following couplet (1922: 300) Emery goes on with the separation between *Zacryptocerus* and *Cephalotes* by using integument characters (opaque versus shiny) and color (yellow versus black) which really does not work at all. For *Z. membranaceus* and *ustus* are both opaque, and the latter is even black.

The more extensive generic diagnosis for *Zacryptocerus* given by Emery (1922: 304) is much better from a descriptive view-point, yet the only character left with some diagnostic value is the presence of solid pronotal and propodeal spines within the membranaceous lateral expansions of the thorax, well expressed in the worker but already precarious in the soldier (cf. Figs. 6 and 7 of this study with the figure of the soldier of *Paracryptocerus foliaceus* in Kempf, 1952: 13, fig. 9).

My own contribution (Kempf, 1951: 13, 134-135), while still ignoring the new evidence forwarded in the present paper, moves within the framework given by Emery, but uses the pronotal and propodeal spine character for a clearer separation between *Zacryptocerus* and *Paracryptocerus* in the presence of the troublesome *Paracryptocerus foliaceus*.

In short, on hand of presently known data it is impossible to separate generically between *Zacryptocerus* and *Paracryptocerus* (n. syn.), the latter falling as a junior synonym of the former. It is recognized that from the view-point of continuity this step is to be regretted, because the group presently known as *Paracryptocerus* (with over 60 valid species) is undergoing nomenclatorial change for the second time within 25 years (cf. M. R. Smith, 1949). Although this change does not involve any economically important species, I am willing to concur with fellow

students in securing for the present group the presently invalid name *Cryptocerus* (an isogenotypic synonym of *Cephalotes*) by means of a recourse to the International Commission on Zoological Nomenclature.

Eucryptocerus. A small group of three species confined to the Amazon and the Guianas combines the general habitus of a *Cephalotes* with the eye + scrobe character of *Zacryptocerus*. The species level taxonomy still is problematic: *placidus* from the upper Amazon and the Guianas might be a geographical race of *oculatus* of the lower Amazon, and *abdominalis* just a morph sporadically occurring within *placidus*-populations. The material at hand does not permit a solution. Generically, I prefer to let this group stand for the time being (any nomenclatorial change will mean only the minimum of upheaval), because the strictly monomorphic worker is distinct by the globose eyes, the unarmed sides of petiole and postpetiole and the bispinose occipital corner of head.

Hypocryptocerus. The scant material at hand speaks in favor of just one, highly variable species, apparently confined to the Island of Hispaniola, lacking a differentiated soldier caste. The configuration of the petiole and postpetiole of the worker is as in *Paracryptocerus wheeleri* and allies, whereas the strong and solid pronotal and propodeal spines scarcely help in establishing generic difference from *Paracryptocerus*, now *Zacryptocerus*. Inasmuch as the presence or absence of worker dimorphism may not longer be used as a genus-group character in Cephalotini, with the possibility of a soldier still to be discovered in *Hypocryptocerus* (n. syn.), I propose to relegate this genus to synonymy of *Zacryptocerus*.

Conspectus of the classification of Cephalotini

Procryptocerus Emery, 1887

Cephalotes Latreille, 1802

Eucryptocerus Kempf, 1951

Zacryptocerus Wheeler, 1911

= *Paracryptocerus* Emery, 1915, nov. syn.

= *Hypocryptocerus* Wheeler, 1920, nov. syn.

Key to the genera of Cephalotini (Workers)

1. Frontal carinae very little expanded laterad, not covering the cheeks from above, strongly divergent behind; scape when lodged in the scrobe extending much beyond the posterior border of the eye *Procryptocerus* Emery
- Frontal carinae greatly expanded laterad, covering or nearly so the cheeks from above, subparallel to slightly divergent caudad; scape when lodged in the scrobe not extending beyond the posterior border of the eye 2
2. Eyes situated beneath the antennal scrobe which extends above it to the occipital corner *Cephalotes* Latreille
- Eyes situated at least in part behind or slightly above the scrobe which terminates in front of the eye, never reaching the occipital corner 3
3. Eyes subglobose and greatly protruding; sides of petiole and postpetiole unarmed; occipital angle bispinose *Eucryptocerus* Kempf
- Eyes gently convex or flat; sides of petiole and postpetiole always with projecting teeth, spines or lobes; occipital angle of head either rounded, or unispinose, or dentate, or laminate *Zacryptocerus* Wheeler

References

- Borgmeier, T., 1937. Formigas novas ou pouco conhecidas da América do Sul e Central, principalmente do Brasil. Arch. Inst. Biol. Veget. Rio de Janeiro, 3 (2): 217-255, 38 figs., 6 pls.
- Brown, Jr., W. L., 1973. A comparison of the Hylean and Congo-West African Rain Forest Ant Fauna, in: Tropical forest ecosystems: A comparative review. Eds. B. J. Meggers, E. S. Ayensu and W. D. Duckworth. Smithsonian Institution Press, Washington, pp. 161-185.
- Emery, C., 1914. *Cephalotes* et *Cryptocerus*. Le type du genre *Crematogaster*. Ann. Soc. Ent. Belg. 58: 37-39.
- 1915. Noms de sous-genres et de genres proposés pour la sous-famille Myrmicinae. Modification à la classification de ce group. Bull. Soc. Ent. France, pp. 189-192.
- 1922. Subfam. Myrmicinae. Gen. Insect. fasc. 174, pp. 1-397, 7 pls. (1921-1922).
- Forel, A., 1912. Formicides néotropiques. Part II. Attini, Dacetii, Cryptocerini. Part III. *Crematogaster* et *Pheidole*. Mém. Soc. Ent. Belg. 19: 179-237.
- Kempf, W. W., 1951. A taxonomic study on the ant tribe Cephalotini. Rev. de Ent. 22: 1-244, 157 figs.
- 1952. A synopsis of the *pinellii*-complex in the genus *Paracryptocerus*. Studia Ent., n. 1, pp. 1-30, 16 figs.
- 1958. New studies of the ant tribe Cephalotini. Studia Ent. (n. s.) 1 (1-2): 1-168, 28 figs., 8 pls.
- 1963. Nota sinônímica acerca de formigas da tribo Cephalotini. Rev. Brasil. Biol. 23 (4): 435-438 (1964).
- 1964. Additions to the knowledge of the Cephalotine ants. Pap. Avuls. Zool. S. Paulo, 16: 243-255, 14 figs.

- Klug, J. Ch. F., 1824. Entomologische Monographien, pp. 1-256.
- Smith, Fr., 1854. Monograph of the genus *Cryptocerus*, belonging to the group of Cryptoceridae. Trans. Ent. Soc. London (2) 2 (7): 214-228, 3 pls.
- 1862. A list of genera and species belonging to the family Cryptoceridae, with descriptions of new species; also a list of the species of *Echinopla*. Trans. Ent. Soc. London (3) 1: 407-416, 2 pls.
- 1876. Descriptions of new species of Cryptoceridae, belonging to the genera, *Cryptocerus*, *Meranoplus* and *Cataualacus*. Trans. Ent. Soc. London, pp. 603-612, 1 pl.
- Smith, M. R., 1949. On the status of *Cryptocerus* Latreille and *Cephalotes* Latreille. Psyche, 56 (1): 18-21.
- Wheeler, W. M., 1911. A list of the type species of the genera and subgenera of Formicidae. Ann. New York Acad. Sci. 21: 157-175.
- 1922. Keys to the genera and subgenera of ants. Bull. Amer. Mus. Nat. Hist. 45: 631-710.