

**NOTES ON GRALLATOTERMES GRALLATOR
(DESNEUX) AND THE TAXONOMIC STATUS OF
THE GENUS GRALLATOTERMES (Isoptera :
Termitidae : Nasutitermitinae)**

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Abstract : The alate caste of *Grallatotermes grallator* (Desneux) from New Guinea is described, and additional data are presented on the soldier and worker castes, as well as on the biology and distribution of this species. The taxonomic status of the genus *Grallatotermes* is examined and it is concluded that, on present evidence, the concept that it is a complex of 4 genera is untenable.

In 1905 Desneux described a number of termites collected in New Guinea by L. Biró, and made special reference to 1 species, *Termes grallator*, as "representing a parallel type to the group of long-legged nasute-species of the Indo-malayan fauna (*T. monoceros* Kön. etc.): like the latter, this species travels in the day-time, and possesses long legs and antennae." This species, which was known only from soldiers and workers, was placed in a new subgenus, *Grallatotermes*, of the genus "*Eutermes*" by Holmgren in 1912, and this subgenus was elevated to full generic rank by Light in 1930 when he described all castes of a second species, *G. admirabilis*.

The only reproductive castes of *Grallatotermes* that have been described so far are the winged adults of *G. admirabilis* and *G. africanus* Harris and a dealated queen of *G. weyeri* Kemner. A recent collection of all castes of *G. grallator* from the Bululo area of New Guinea has provided material for the description of the winged adult of this species. This is given below, together with additional information on the soldier and worker castes, biology and distribution of *G. grallator*, as well as comments on the taxonomic status of the species ascribed to this genus.

Grallatotermes grallator (Desneux)

IMAGO (previously undescribed): A very large, dark brown species with dusky brown wings. Head capsule almost black, shining; pronotum very dark brown, abdominal tergites somewhat darker; abdominal sternites becoming progressively dark posteriorly (from pale to medium brown), all sternites much darker laterally; basal 2 or 3 segments of antennae dark brown, remainder yellowish brown; postclypeus lighter in color than remainder of head capsule; anteclypeus whitish tinged with yellow; labrum brownish yellow.

Head evenly rounded and almost hemispherical behind eyes, depressed in frontal region between ocelli; fontanelle narrow, linear, with faint indication of anterior forking, shorter than ocelli. Postclypeus almost 4 × as wide as long, with convex posterior margin and almost straight anterior margin. Compound eyes very large and prominent; ocelli oval, large and prominent, situated much less than their short diameter from the eyes. Antennae 15-segmented;

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1st and 2nd segments cylindrical, 3rd clavate and narrowest of all, 4th-6th semi-globose and shorter than remainder, following segments increasingly clavate, terminal segment obovate (fig. 1A).

Mandibles with apical and 1st marginal teeth almost equal in size; on left mandible, posterior margin of fused 1st and 2nd marginal tooth sinuous, broad rounded notch in front of 3rd marginal tooth, left mandible index 0.4; on right mandible, 2nd marginal tooth smaller than 1st marginal with posterior margin more than $3 \times$ as long as anterior margin, molar area very long, convex in profile, about equal to rest of mandible, with 15-16 transverse ridges (fig. 1B).

Pronotum with anterior margin almost straight, anterolateral corners very broadly rounded, sides evenly narrowed to biconvex posterior margin; dark medium crease line extending about $1/2$ way back from anterior margin, anterior portion of pronotum only moderately elevated. Posterior margins of meso- and metanotum widely and deeply concave; posterolateral corners broadly rounded.

Head, thorax, and abdomen with abundant short and long golden hairs.

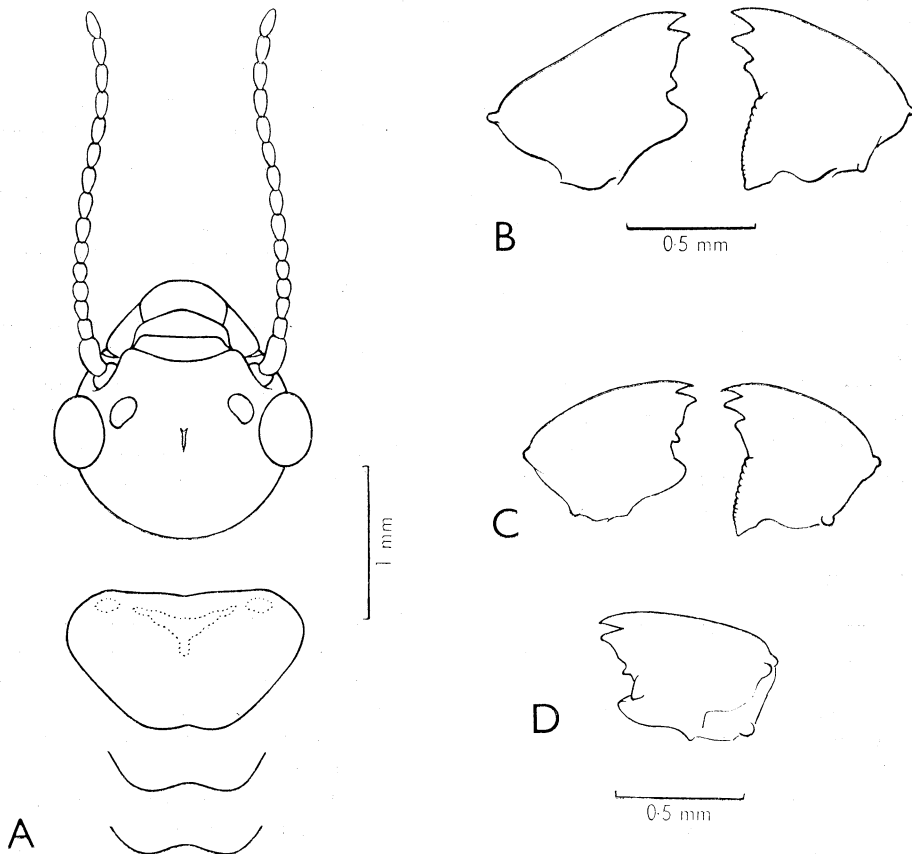


Fig. 1. *Grallatotermes gallator* (Desneux): A, head, pronotum and posterior margins of meso- and metanotum of imago; B, imago mandibles; C, worker mandibles, viewed dorsally; D, left worker mandible, viewed ventrally to show molar tooth. (Drawings by Mrs E. Rankin).

Wings very large, densely covered with micrasters, and with numerous hairs. Costal margin and radial sector dark brown basally, becoming yellowish distally; basal branches of cubitus thickened and dark brown. Venation variable; in fore wing *media* lies in anterior half of wing, at times imperfectly developed and disappearing before middle of wing or with 4-5 branches some of which are secondarily branched, cubitus with 8-14 branches with some secondary branching; hind wing with up to 4 branches of *media* and 6-10 of cubitus, with secondary branching of both.

Measurements : (6 specimens)

	<i>Range</i>	<i>Morphotype</i>
Length, with wings	18.40 - 24.40 mm	24.40 mm
Length, without wings	9.95 - 12.45 "	12.45 "
Head, to apex of rostrum, long	2.08 - 2.28 "	2.28 "
Head, to clypeofrontal suture, long	1.30 - 1.48 "	1.48 "
Head, wide	1.90 - 2.04 "	2.04 "
Eyes, maximum diameter	0.64 - 0.70 "	0.64 "
Ocelli, long	0.22 - 0.24 "	0.24 "
Pronotum, long	1.00 - 1.16 "	1.16 "
Pronotum, wide	1.76 - 1.92 "	1.92 "
Forewing, long	18.60 - 21.10 "	21.10 "
Forewing, wide	5.05 - 5.35 "	5.35 "

SOLDIER : The original description of the soldier by Desneux is given in full by Hill (1942), and needs only the following amplification :

Mandibles very variable, even within the same nest series, generally with well developed blade vestiges (=points, or lateral spinous processes) devoid of teeth, sometimes with a definite tooth towards the apex of the blade of either the left or right mandibular blades, or with blade vestiges greatly reduced (fig. 2).

Measurements : (25 specimens)

		<i>As given by Desneux</i>
Total length	4.50 - 5.20 mm	4.60 - 5.00 mm
Head, to apex of rostrum, long	1.70 - 1.98 "	1.90 - 2.10 "
Head, wide	1.12 - 1.28 "	1.20 - 1.40 "
Pronotum, wide	0.66 - 0.77 "	-
Pronotum, long	0.38 - 0.43 "	-
Tibia III, long	1.96 - 2.32 "	-

WORKER : Desneux's description of this caste is also given by Hill (loc. cit.), to which the following points are added : Postclypeus more than 3 × as wide as long. Antennae sometimes apparently 14-segmented due to imperfect separation of 3rd and 4th segments. Mandibles similar to those of imago, but with apical teeth relatively narrower at base than 1st marginals; left mandible index 0.3, well developed molar tooth on left mandible, and molar area of right mandible with only 12-13 transverse ridges (fig. 1C, D). Specimens collected recently at Bulolo showed the following range of measurements (5 specimens) :

Total length	6.15 - 6.30 mm
Head, to apex of labrum, long	1.80 - 1.86 "
Head, wide	1.48 - 1.52 "
Pronotum, wide	0.96 - 1.00 "
Pronotum, long	0.56 - 0.60 "

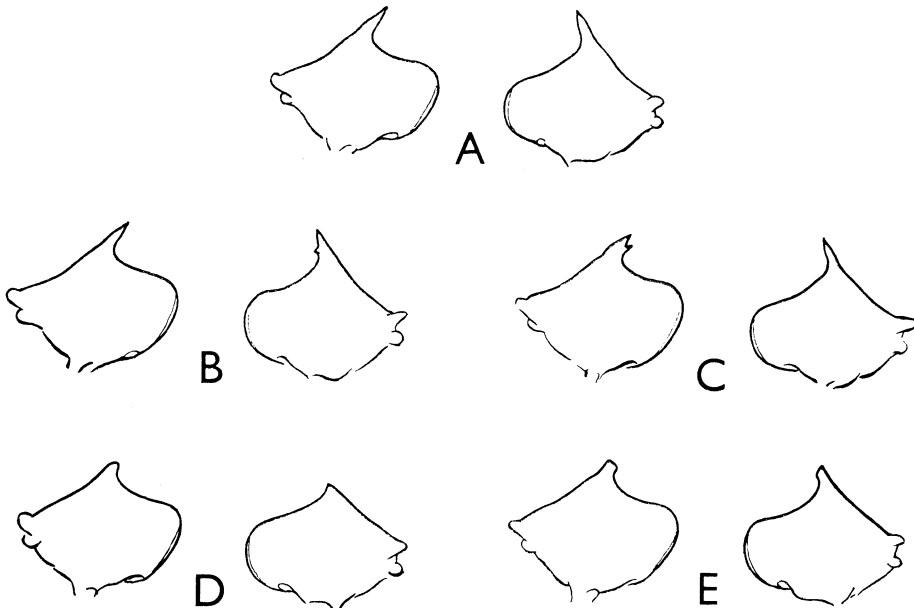


Fig. 2. *Grallatotermes grallator* (Desneux), soldier mandibles : A, normal form ; B-E, variant forms from same nest series. (Drawings by Mrs E. Rankin.)

LOCALITY RECORDS: This species appears to have a wide distribution in Papua and New Guinea. In addition to the original collection from Graget Island* in 1901 by L. Biró, on which the species is based, Sen-Sama (1966) refers to specimens identified by Holmgren as *Eutermes (Grallatotermes) grallator*, which had the following collection data: New Guinea, 20.VII.1912, Dr Burger. More recent collections comprise: NEW GUINEA: Bulolo, XII.1958, D. Halpin (soldiers & workers), 15.X.1967, L. T. Clifford (soldiers & workers); Heads Hump Logging Area, Bulolo, 6.XI.1969, Teng and Aton (all castes, TYPE series for winged adult). PAPUA: Oriomo River, 48 km (30 mi.) N of Daru I., 1.XI.1961, B. J. O'Hagan (2 series of soldiers and workers).

BIOLOGY: This species apparently moves in the open on the trunks of trees quite commonly. This habit, first recorded by the original collector (L. Biró), has been noted several times in more recent years. The termites travelling over the trunks appear to be in continual procession with soldiers spread out on each side to prevent interference with the column. Details of nest structure are unknown, but nests have been found in a staghorn fern (*Platynerium* sp.), and on the trunk of *Diospyros* sp. Observations accompanying the Oriomo River collections state that the species appears to cultivate a black sooty mold on sheltered areas of fallen logs and to transport this food back to the nest. It is likely, however, that the mold is not cultivated, but that this is simply adventitious feeding on an attractive food material, such as occurs in species of the closely allied genus *Hospitalitermes* as recorded by Sands (1969).

*Graget is evidently a misspelling of Gragat which in modern maps appears as Kranket. Kranket Island is about 6.4 km (4 mi.) NE of Madang.

AFFINITIES: The imago of *G. grallator* is larger, with bigger compound eyes, wider head, and 1 less segment in the antennae than *G. africanus*. On the basis of description only, it appears to be very similar in color and form to that of *G. admirabilus* but is generally somewhat larger and with much longer wings. Its larger size and quite distinct linear fontanelle distinguish it from the reproductive adult ♀ of *G. weyeri*, which Kemner describes as being smaller than that of *G. admirabilus* and with only a very small and barely distinguishable fontanelle.

TYPES: The location of the holotype soldier is uncertain but, in view of the fact that Desneux's original description was based on material submitted to him by the Director of the Hungarian National Museum, it is presumed that it was deposited there. Morphotype winged ♀ in the Australian National Insect Collection, paramorphotypes in the American Museum of Natural History and the British Museum (Nat. Hist.).

THE TAXONOMIC STATUS OF THE GENUS GRALLATOTERMES

Genus *Grallatotermes* Holmgren

- =Subgenus *Grallatotermes* (*Eutermes*) Holmg., 1912, *K. Sven. Vet. Akad. Handl.* **48**: 59-62, 65.
- =Genus *Grallatotermes*, Light, 1930, *Philipp. J. Sci.* **42**: 16-17, 19, 40-46. — Kemner, 1931, *Acta Univ. Lund. Adv.* **2**, **27**: 46-50. — Light & Wilson, 1936, *Philipp. J. Sci.* **60**: 476-79. — Snyder, 1949, *Smithson. Misc. Coll.* **112**: 314. — Harris, 1954, *Proc. R. Ent. Soc. Lond.* (B) **23**: 135-37. — Ahmad, 1958, *Biologia* **4**: 27. — Sands, 1965, *Bull. Br. Mus. Nat. Hist.* (B) **4**: 13, 14, 55.
- Genus *Grallatotermes*, Sen-Sarma, 1966, *J. Bombay Nat. Hist. Soc.* **63**: 167-84.

Type-species. *Grallatotermes grallator* (Desneux) (= *Termes grallator* Desneux, 1905).

In Snyder's catalog (1949), 5 species of *Grallatotermes* are listed: *G. admirabilus* Light, *G. grallator* (Desneux), *G. grallatoriformis* (Holmgren, K. & N.), *G. splendidus* Light & Wilson, and *G. weyeri* Kemner. Subsequent to the publication of this catalog, 2 more species have been described: *G. africanus* Harris, 1954, and *G. niger* Chatterjee & Thapa, 1963.

In 1966, Sen-Sarma examined material of *G. admirabilus*, *G. africanus*, *G. grallator*, *G. grallatoriformis* and *G. niger* and "On the basis of the structure of imago-worker mandibles and a constellation of other characters in soldiers and workers observed that in this complex more than one genus is involved." He designated 3 new genera: *Philippinitermes*, to which he assigned *G. admirabilus*; *Indograllatotermes*, to include *G. grallatoriformis* and *G. niger*; and *Afrograllatotermes*, to which he assigned *G. africanus*. No material of *G. splendidus* or *G. weyeri* was examined and, presumably, these species remain in the genus *Grallatotermes*. Furthermore, the genera were assigned to different branches of the subfamily Nasutitermitinae, with *Philippinitermes* placed on the *Procornitermes* branch, and *Grallatotermes*, *Indograllatotermes* and *Afrograllatotermes* on the *Paracornitermes* branch. Sands (1965a, b) has commented on the invalidity of the basis for this phylogenetic separation and further stated that "the subdivision of the genus *Grallatotermes* is moreover scarcely justified on taxonomic grounds."

Sen-Sarma examined only a single soldier and worker of *G. grallator*, so that his diagnosis of the genus *Grallatotermes*, based on *grallator* as the type species, makes no allowance for any variability within the genus. As indicated earlier, however, there is

variability in *G. grallator*, even within the same nest series, and this is particularly evident in the form of the mandibular blade vestige in the soldiers.

Among the characters used by Sen-Sarma to separate *Philippinitermes* from *Grallatitermes* are:

- (i) the nature of the blade vestige of the soldier mandible which, in *Philippinitermes*, he describes as "much longer than in *grallator*, non-dentate and thin." In the present study, an examination of more than 30 soldiers of *G. grallator* from 3 different nest series indicated that the majority had mandibles with a long, thin, non-dentate blade vestige; the commonest condition, therefore, is the same as in *Philippinitermes*.

In this connexion, it should also be noted that Light & Wilson (1936), in describing a 2nd species of *Grallatitermes*, *G. splendidus*, from the Philippines, refer to the soldier mandibles as ".....thornlike, distal portion bearing a faint vestige of a tooth just below the middle." Sen-Sarma was unable to examine material of *G. splendidus*, but the presence of a mandibular tooth vestige in a species which Light & Wilson considered sufficiently close to *admirabilis* to place in the same genus throws considerable doubt on the validity of this character for generic separation.

- (ii) the length of the antennae. The statement that the "Antennae of *Philippinitermes* are not unusually long" conflicts with his earlier statement, which says "Antennae long, considerably longer than head," and nullifies any value this character might have.

- (iii) comparative features of the worker mandibles. Sen-Sarma's figure of the worker mandibles of *G. grallator* shows distinct differences from the present illustration of these parts (fig. 1C). This could simply indicate the variation to be expected within the species but, from a critical comparison of his figures with mandibles dissected from several specimens, it is more probable that the mandibles of the specimen he examined were old and worn. Additionally, there is a somewhat unusual feature of the mandibles of *G. grallator* which could lead to incorrect determinations of the left mandible index and the relative sizes of apical and 1st marginal teeth. This feature is the marked ventral deflexion of the apical teeth so that they lie slightly under, and in a lower plane than, the 1st marginal teeth. The effect, when viewed from the dorsal surface is (a) to make the apical tooth seem appreciably shorter than the 1st marginal and (b) by reducing the apparent distance between the tips of the apical and 1st marginal teeth, to result in a falsely low left mandible index. These anomalies disappear if the mandible is viewed from the ventral surface; the apical tooth is almost the same length as the 1st marginal, and the left mandible index lies between 0.30 and 0.33, just as in *Philippinitermes*. The relative lengths of the anterior and posterior margins of the 2nd marginal tooth of the right mandible of both *G. grallator* and *Philippinitermes* are substantially the same, about 1:3. Sen-Sarma's value of almost 1:5 for *G. grallator* is erroneous, and does not agree with his own illustration which shows the posterior margin to be only slightly more than $3 \times$ as long as the anterior.

The separation of *Indograllatitermes* from *Grallatitermes* is based on:

- (i) the non-dentate mandibular blade vestige in the soldier caste. The doubtful validity of this character has been referred to above in relation to *Philippinitermes*.

- (ii) 4 characters of the imago-worker mandibles. Of these, the differences in left mandible index (0.33 in *Indograllatotermes* and 0.25 in *Grallatotermes*) are invalid, as indicated in the discussion on *Philippinitermes*; the ratio of the length of the right molar area to the rest of the mandible (1.0 in *Indograllatotermes* and 0.95 in *Grallatotermes*) is doubtfully significant; and the proportions of the anterior and posterior margins of the 2nd marginal teeth of the right mandible are incorrectly stated, so that the difference between the 2 genera is exaggerated. The ratios in Sen-Sarma's own illustrations are approximately 1:3 for *Grallatotermes* and 1: >2 for *Indograllatotermes* (his values are 1:5 and 1: <2 respectively).

Two of the characters used to separate *Indograllatotermes* from *Philippinitermes* call for comment:

- (i) the mandibular blade vestige of the soldier is "shorter than in *Philippinitermes*." The variation in this character and its limited usefulness have already been noted.
- (ii) the "posterior margin of second marginal of right mandible almost twice the anterior margin in *Indograllatotermes* (five times in *Philippinitermes*)." In comparing *Philippinitermes* with *Grallatotermes*, however, Sen-Sarma states that the posterior margin of this tooth in *Philippinitermes* is "much less than $5 \times$ the anterior edge," and his illustration shows the ratio to be 1:3.

Afrograllatotermes is separated from the *Grallatotermes* complex largely on the slender basis of "having a pale hyaline cuticular patch at the distal part of the molar area of mandibles of the soldier caste." The differences between *Afrograllatotermes* and *Grallatotermes* s. str. again include the non-dentate mandibular blade vestige in the soldier and, in the worker, the left mandibular apical tooth equal in length to the first marginal tooth in *Afrograllatotermes*, but shorter in *Grallatotermes*, and, the right mandible with the posterior edge of the 2nd marginal tooth $3 \times$ as long as the anterior edge in *Afrograllatotermes*, but $5 \times$ in *Grallatotermes*. However, as noted previously, the apical and 1st marginal teeth in *Grallatotermes* are almost the same length, and the posterior margin of the 2nd marginal tooth of the right mandible is only $3 \times$ as long as the anterior margin.

It is clear from the foregoing comments that Sen-Sarma relied heavily on characters of the soldier and worker mandibles in erecting 3 new genera to accommodate 4 species originally assigned to the genus *Grallatotermes*. The limited amount of material on which he based his concept of the genus *Grallatotermes* s. str., the demonstrated variability of soldier mandibles, and the weight given to small variations in proportions or indices of imago-worker mandibles, despite obvious discrepancies between stated values and illustrated examples, offer no support for the contention that a complex of genera is involved. It is concluded, therefore, that on present evidence the genera *Philippinitermes*, *Indograllatotermes*, and *Afrograllatotermes* are based on inadequate grounds, and that the species assigned to these genera should be retained in their original genus, *Grallatotermes*.

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