

## **Genomic data provide insights into the classification of extant termites**

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## **Content of Electronic Supplementary Information**

*(Available in this PDF file)*

**Supplementary Note 1:** Diagnoses for all families of Neoisoptera, updated from Krishna *et al.*<sup>1</sup>.

**Supplementary Note 2:** Key to extant families and subfamilies of Isoptera.

**Supplementary Note 3:** Key to subfamilies of Termitidae, revised from Krishna *et al.*<sup>1</sup>.

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## Supplementary Information

**Supplementary Note 1:** Diagnoses for all families in Neoisoptera, updated from Krishna *et al.*<sup>1</sup>. The descriptions are given following the order of the phylogenetic tree in Figure 1 of the main manuscript. Descriptions of imago-worker mandibles follow Sands<sup>2</sup>, while the ones of worker digestive tube follow Noirot<sup>3,4</sup>.

### Clade Neoisoptera Engel, Grimaldi, & Krishna

This monophyletic clade includes the families Stylotermitidae, Serritermitidae, Rhinotermitidae *sensu novo*, Termitogetonidae, Psammotermitidae, Heterotermitidae, and Termitidae. The most defining features of members in this lineage are the presence of a fontanelle (aperture of the frontal gland) on the frons and the absence of arolium between the pretarsal claws.

### Family Stylotermitidae Holmgren & Holmgren

Stylotermitinae Holmgren & Holmgren, 1917: 141. Type genus: *Stylotermes* Holmgren & Holmgren, 1917.

*Included genera* (3): †*Parastylotermes* Snyder & Emerson, †*Prostylotermes* Engel & Grimaldi, and *Stylotermes* Holmgren & Holmgren.

*Diagnosis* (modified after Krishna *et al.*<sup>1</sup>): Termites with pseudergates (without a true worker caste); endosymbiotic protists present; comparatively small colonies, with a relatively diffuse nest, in living and partially dead trees.

**Imago.** Head nearly circular; fontanelle exceptionally small, sometimes not visible; compound eyes small- to medium-sized; ocelli present; antennae with 16–22 articles; postclypeus quite short, faintly arched; pronotum flat. Imago-worker mandibles: left with one apical tooth (LAt) and three marginal teeth (LMt), second marginal tooth (LMt<sub>2</sub>) exceptionally small, shorter than first marginal (LMt<sub>1</sub>) or apical tooth (LAt); right with an apical tooth (RAt) and two marginal teeth (RMt), subsidiary tooth present at base of apical (RAt) and first marginal tooth (RMt<sub>1</sub>). Legs: tarsi trimerous; tibial spur formula 3:2:2 (*Stylotermes*) or 2:2:2 (†*Parastylotermes*, †*Prostylotermes*). Cerci dimerous. Sternal gland: one gland on sternum V. Wings reticulate, membrane without setae. Forewing scale not overlapping hindwing scale, almost touching margin of hindwing scale; all veins arising independently from inside scale; costa fused with Sc, C+Sc running along entire anterior margin of wing; Rs sclerotized, running close to costal margin; M present, weak, running closer to Cu than to Rs, typically simple and ending near wing apex; Cu weak, extending near to wing apex, with several branches extending to posterior margin; anal vein absent. Hindwing: C+Sc and Rs as in forewing; M arising from Rs immediately outside wing scale; Cu as in forewing.

**Soldier.** Head long and narrow; mandibles saber-shaped, with one or two, minute, toothlike crenulations at base; fontanelle small; mandibles without prominent teeth, crenulations at inner basal region; antennae with 13–19 articles; pronotum flat.

**Pseudergate (true worker caste absent).** Gut: esophagus distinct from the crop (as opposed to broadening into the crop as in Mastotermitidae, Teletisoptera, Serritermitidae, or Kalotermitidae); crop short, as in other Neoisoptera excluding Termitidae, ovoid or subspherical, asymmetrical, with muscle sheath strongly reduced (as in Serritermitidae, Rhinotermitidae, Termitogetonidae, Psammotermitidae, and Geoisoptera —defined below), cuticle with microsculptures (furrows and striations); gizzard elongated, nearly cylindrical, strongly muscular, with chitinized armature, folds divided into columns (sclerotized, with scaly surfaces) and pulvilli (non-sclerotized), columns I and II elongated, their length equal to that of pulvilli I, pulvilli II reduced, teeth in columns I and

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II; stomodeal valve long, cuticle with longitudinal striations (as in *Serritermitidae*, *Rhinotermitidae*, *Termitogetonidae*, *Psammotermitidae*, and *Geoisoptera* —defined below); midgut or mesenteron short, cylindrical, forming an anticlockwise, circular ring, first dorsally, then ventrally under gizzard, ending in hindgut, ring diameter narrow (as in *Serritermitidae*, *Rhinotermitidae*, *Termitogetonidae*, *Psammotermitidae*, and *Heterotermitidae*), no mixed segment, no anterior caecum at gizzard-midgut junction; Malpighian tubules 8, inserted at midgut-hindgut junction, long, following a tortuous course around gut; hindgut with first proctodeal segment (ileum; P1) short, narrow at base, well invaginated in paunch (P3); enteric valve (P2) wider than P1, cylindrical, enlarged posteriorly, cushions extending the entire length of P1 and P2 (as in *Kalotermitidae*, *Rhinotermitidae*, *Termitogetonidae*, *Psammotermitidae*, and *Heterotermitidae*, and likely symplesiomorphic for *Icoisoptera*), cuticular armature of cushions generally well-developed, cushion I on P2 more developed than that on P1; P3 dilated, containing symbiotic flagellates; P3–P4 loop untwisted (as in *Kalotermitidae*, *Rhinotermitidae*, *Termitogetonidae*, *Psammotermitidae*, and *Heterotermitidae*, and likely symplesiomorphic for *Icoisoptera*); colon (P4) a long tube, with an exceptionally short muscular rectal valve with folds near the junction with the rectum (P5), armature of valve reduced; P5 dilated.

*Remarks:* This group was long considered a subfamily of *Rhinotermitidae*. Engel *et al.*<sup>5</sup> elevated the lineage to family rank based on a phylogenetic analysis of morphological data from representative living and fossil termites, a decision confirmed with mitogenome sequencing by Wu *et al.*<sup>6</sup>; as well as in Bucek *et al.*<sup>7</sup> and Hellemans *et al.*<sup>8</sup> from transcriptomes and UCEs, respectively.

### Family *Serritermitidae* Holmgren

*Serritermitinae* Holmgren, 1910: 285. Type genus: *Serritermes* Wasmann, 1897.

*Glossotermitinae* Cancellato & DeSouza, 2005: 35. Type genus: *Glossotermes* Emerson, 1950.

*Included genera* (2): *Glossotermes* Emerson and *Serritermes* Wasmann.

*Diagnosis* (modified after Krishna *et al.*<sup>1</sup>): Termites with pseudergates (without a true worker caste); endosymbiotic protists present.

**Imago.** Fontanelle present, medium-sized; compound eyes medium-sized; Y-shaped ecdysial scar present; ocelli present; pronotum flat, narrower than head; antenna with 11–14 articles (13–14 in *Serritermes*; 11–13 in *Glossotermes*); postclypeus large, long, strongly arched, slightly shorter than half its width. Imago-worker mandibles: each with large apical tooth (At), marginal tooth (Mt) widely separated from apical tooth (At); left with one (*Serritermes*) or two (*Glossotermes*) marginal teeth (LMt), molar plate with ridges and toothlike projection at apical end; right with one marginal tooth (RMt), molar plate with ridges and toothlike projection at apical end. Legs: tarsi tetramorous; tibial spur formula 2:2:2; arolium absent. Cerci dimerous, styli absent in both sexes. Sternal gland: one gland on sternum V. Wings reticulate, without setae. Forewing: scale large, extending almost to base of hindwing scale, but not overlapping; Sc and R present; Rs sclerotized, running parallel and close to costal margin; M indistinct, possibly coalesced with Cu; Cu arising independently from inside wing scale (separating at suture), with 18–19 branches; anal vein absent. Hindwing: Sc, R, Rs, and Cu similar to forewing; M arising from Rs near suture.

**Soldier.** Monomorphic. Head long, somewhat flat (*Glossotermes*) to thick (*Serritermes*), with curved sides. Fontanelle present, small, below vestigial compound eyes; fontanelle is a blind end, not connected to the frontal gland; frontal gland instead opening at dorsal cervix during autothysis<sup>9</sup>. Antennae with 12–15 articles (12–13 in *Serritermes*; 13–15 in *Glossotermes*). Labrum large, longer than wide, with sides rounded, tip hyaline. Labrum covering up well over half the length of

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mandibles. Mandibles long, narrow, slightly (*Glossotermes*) to distinctly hooked (*Serritermes*) at tip; left mandible with inner margin with serrations of equal size, reaching almost to base (*Serritermes*) or fine serrations on apical half and coarser serrations proximally (*Glossotermes*), and a toothlike projection and a notch at base; right mandible with inner margin with serrations on apical half (*Serritermes*) or without serrations (*Glossotermes*) and a toothlike projection at base (+ a notch at base in *Glossotermes*). Pronotum saddle-shaped, indented in front, frontal lobe large. Legs: tibial spur formula 2:2:2; arolium absent. Cerci dimerous.

**Pseudergate (true worker caste absent).** Gut: esophagus broadening into the crop (while distinct in Rhinotermitidae, Termitogetonidae, Psammotermitidae, and Heterotermitidae); crop conical, reduced in size and musculature, with muscle sheath strongly reduced (as in Rhinotermitidae, Termitogetonidae, Psammotermitidae, and Geoisoptera), cuticle distinctly striated and with furrows; gizzard medium-sized, with reduced chitinized armature, columns I and II unsclerotized, without teeth, but with a few conical spines, pulvilli I about twice as long as columns, pulvilli II exceptionally reduced; stomodeal valve short (unique among non-termitids and a synapomorphy of family), cuticle with longitudinal striations (as in Rhinotermitidae, Termitogetonidae, Psammotermitidae, and Geoisoptera —defined below); midgut or mesenteron short, cylindrical, forming an anticlockwise, circular ring, first dorsally, then ventrally under gizzard, ending in hindgut, ring diameter narrow (as in Rhinotermitidae, Termitogetonidae, Psammotermitidae, and Heterotermitidae), no mixed segment, no anterior caecum at gizzard-midgut junction; Malpighian tubules 8, inserted at midgut-hindgut junction, long, following a tortuous course around gut; hindgut with P1 short, cylindrical, P1 and P2 poorly differentiated (characteristic of family), P2 invaginated in P3, P1 with 6 faint cushions, nearly unarmed; P2 cone-shaped, shorter than P1, with 6 short, prominent cushions, cuticle on cushions with tiny scales and short curved spines; P3 strongly dilated, containing symbiotic flagellates; P3–P4 loop untwisted (as in Rhinotermitidae, Termitogetonidae, Psammotermitidae, and Heterotermitidae), P4 a long tube, with exceedingly short muscular rectal valve with folds near junction with P5, rectal valve armature without scales; P5 dilated.

*Remarks:* *Serritermes* is an obligatory inquiline of *Cornitermes* (Termitidae: Syntermitinae). We have maintained the current universal usage in retaining Serritermitidae as a distinct family, owing to key morphological differences —*e.g.*, soldiers' labrum covering well over half the length of mandibles, defense by self-sacrifice through frontal gland autothysis; Imago/worker mandibles with distinct marginal tooth well separated from the apical one— and biologies. Nonetheless, the option to unify Serritermitidae with Rhinotermitidae *sensu novo* (as defined below) should continue to be evaluated by future generations of termitologists.

### **Family Rhinotermitidae Froggatt, *sensu novo***

Rhinotermitinae Froggatt, 1897: 518. Type genus: *Rhinotermes* Hagen, 1858.

*Included genera* (5): *Acorhinotermes* Emerson, *Dolichorhinotermes* Snyder & Emerson, *Parrhinotermes* Holmgren, *Rhinotermes* Hagen, and *Schedorhinotermes* Silvestri (*Macrorhinotermes* Holmgren, **syn. nov.**).

*Diagnosis:* Termites with a true worker caste; endosymbiotic protists present; nests in rotten logs, fence posts, or trunks of dead or living trees, or in deserted mounds of other species; not known to build specific mounds of their own; pests of crops and timber.

**Imago.** Head large, circular; fontanelle present, situated anteriorly, median groove running from fontanelle to clypeus; compound eyes large; ocelli present; antenna with 16–20 articles; Y-shaped ecdysial scar indistinct; inflated clypeus, slightly or not at all drawn out over the labrum —

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remescent of a “nose-like” projection; narrow medial groove running from the fontanelle to the anteclypeus. Pronotum rather flat (with anterior margin raised in the middle), slightly narrower than head. Imago-worker mandibles: left with an apical tooth (LAt) of varying size (e.g., LAt larger than LMt<sub>1</sub> in *S. lamanianus*, *S. reticulatus*; of equal size in *S. breinli*; equal or subequal in species of *Rhinotermes*; E. Canello, pers. obs.) followed by three (unequal) marginal teeth (LMt), second marginal (LMt<sub>2</sub>) shorter than first (LMt<sub>1</sub>); right with apical tooth (RAt) and two marginal teeth (RMt), subsidiary tooth present at base of RAt and RMt<sub>1</sub>. Legs: tibial spur formula 3:2:2 (e.g., *S. eleanorae*, *S. reticulatus*) or 2:2:2 (e.g., *R. nasutus*) (E. Canello, pers. obs.). Cerci dimerous, styli present in both sexes. Sternal gland: one gland, on sternum V. Wings reticulate, membrane with few setae. Forewing: scale large, overlapping hindwing scale; all veins arising independently from inside scale; C fused with Sc, C+Sc running along entire anterior margin of wing; Rs sclerotized, running close to C+Sc; M present, weak, running closer to Cu than to Rs, with branches extending to apex or posterior margin; Cu weak, with several branches extending to posterior margin; anal vein absent. Hindwing: C+Sc and Rs as in forewing; M arising from Rs, outside wing scale; Cu as in forewing.

**Soldier.** Mono- (*Acorhinotermes*, *Parrhinotermes*), di- (*Dolichorhinotermes*, *Rhinotermes*, *Schedorhinotermes*) or tri-morphic (*Schedorhinotermes* part.; based on mandible-to-labrum length ratio). Head oval or roundish. Fontanelle not surrounded by setae, small, situated anteriorly, deep, narrow groove running from fontanelle to base of clypeus (some major soldiers) or to tip of labrum (minor soldier, some major soldiers) (chemical secretion of frontal gland flows from fontanelle through medial groove to apex of labrum). Labrum in minor soldier elongated, typically narrow, in major soldier shorter and broader; apex hyaline, with a “brush” at tip, widened apically in minor soldiers. Mandibles generally with teeth —except in *Acorhinotermes*, whose monomorphic soldiers have reduced mandibles; in polymorphic species: major soldier with teeth, minor soldier with teeth or reduced mandibles. Antenna with 13–19 articles. Pronotum flat. Legs: tibial spur formula 3:2:2 (e.g., *S. eleanorae*, *S. reticulatus*) or 2:2:2 (e.g., *R. hispidus*, *R. marginalis*, *P. queenslandicus*) (E. Canello; R. Scheffrahn, pers. obs.).

**Worker (true worker caste present).** Gut: esophagus distinct from the crop (as opposed to broadening into the crop as in Mastotermitidae, Teletisoptera, Serritermitidae, or Kalotermitidae); crop shorter than in Mastotermitidae, Teletisoptera, or Kalotermitidae, ovoid or subspherical, asymmetrical, with muscle sheath strongly reduced, as in Serritermitidae, Termitogetonidae, Psammotermitidae, and Geoisoptera, cuticle with microsculpturing (furrows and striations); gizzard elongate, nearly cylindrical, strongly muscular, with chitinized armature, folds divided into columns (sclerotized, with scaly surface) and pulvilli (non-sclerotized), columns I and II elongated, their length equal to that of pulvilli I, pulvilli II reduced, teeth in columns I and II varying with genera (in *Rhinotermes* no teeth, but cuticle thickened and sclerotized front to back); stomodeal valve long, cuticle with longitudinal striations (Serritermitidae, Termitogetonidae, Psammotermitidae, and Geoisoptera); midgut or mesenteron short, cylindrical, forming an anticlockwise, circular ring, first dorsally, then ventrally under gizzard, ending in hindgut, ring diameter narrow (as in Serritermitidae, Termitogetonidae, Psammotermitidae, and Heterotermitidae), no mixed segment, no anterior caecum at gizzard-midgut junction; Malpighian tubules 8, inserted at midgut-hindgut junction, long, following a tortuous course around gut; hindgut with P1 short, narrow at base, well invaginated in P3; P2 wider than P1, cylindrical, enlarged posteriorly, cushions extending the entire length of P1 and P2 (as in Kalotermitidae), cuticular armature of cushions generally well developed, cushion I on P2 more developed than that on P1, inner pointed tip of cushion I on P2 (= eschutcheon) varying in shape and armature, cushion

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I on P1 rectangular, cushion II distinct in P1 and P2; P3 dilated, containing symbiotic flagellates; P3–P4 loop untwisted (as in Kalotermitidae, Serritermitidae, Termitogetonidae, Psammotermitidae, and Heterotermitidae), P4 a long tube, with an exceedingly short muscular rectal valve with folds near junction with P5, armature of valve reduced, epithelium smooth or with a few unsclerotized scales; P5 dilated.

*Remarks:* There is an interesting diversity of soldier morphologies among Rhinotermitidae depending on genera (see in the *Diagnosis* above), with one to three morphs originating from different larval instar. Some morphs are sometimes referred to as “*nasutoid*”, owing to their long nasus-like labrum. Hence, the monomorphic soldiers of *Acorhinotermes*, along with the minor soldiers of *Dolichorhinotermes*, *Rhinotermes*, and *Schedorhinotermes* can be referred to as nasutoids —although minors of *Schedorhinotermes* do have functional biting mandibles. On the contrary, monomorphic soldiers of *Parrhinotermes*, as the major soldiers of *Dolichorhinotermes*, *Rhinotermes*, and *Schedorhinotermes* have functional mandibles. Most interestingly, in the few species of *Dolichorhinotermes*, *Parrhinotermes*, and *Schedorhinotermes* investigated so far, all soldiers and workers were found to be female. This suggests that sexual specialization of neuters might be an autapomorphy of the Rhinotermitidae *sensu novo*.

### **Family Termitogetonidae Holmgren, stat. nov.**

Termitogetoninae Holmgren, 1910: 286. Type genus: *Termitogeton* Desneux, 1904.

*Included genus:* monogeneric.

*Diagnosis:* Termites with pseudergates (without a true worker caste); endosymbiotic protists present; nests in damp, decaying tree trunks and under bark (flattened body).

**Imago.** Body densely setose, dorsoventrally flattened. Head subtriangular, dorsoventrally flattened, posterior margin sinuate. Y-shaped ecdysial scar partially visible; fontanelle present; compound eyes small; ocelli present; antenna with 15 articles; postclypeus short and flat; pronotum small, narrower than head, anterior margin projected medially. Imago-worker mandibles: left with an apical tooth (LAt) and three marginal teeth (LMt), second marginal (LMt<sub>2</sub>) longer than apical (LAt) or first marginal (LMt<sub>1</sub>); right with apical tooth (RAt) and two marginal teeth (RMt), subsidiary tooth present at base of RAt and RMt<sub>1</sub>. Legs: tibial spur formula 2:2:2. Cerci dimerous. Sternal gland: one gland, on sternum V. Wings: reticulate, membrane densely setose. Forewing: scale not overlapping hindwing scale, just reaching its anterior tip (as in Psammotermitidae); all veins arising independently from inside scale; C fused with Sc, C+Sc running along entire anterior margin of wing; Rs sclerotized, running close to C+Sc; M absent or indistinct (spectral), running closer to Cu than to Rs; Cu weak, with several branches extending to posterior margin; anal vein absent. Hindwing: C+Sc and Rs as in forewing; M present but weak, arising from Rs, outside wing scale; Cu as in forewing.

**Soldier.** Body densely setose and dorsoventrally flattened as in imago. Head triangular, flattened dorsoventrally, posterior margin strongly sinuate, with medial projection; fontanelle small; mandibles elongated, without prominent teeth, small tooth and crenulations at basal region. Antenna with 13–15 articles. Pronotum flat, narrower than head, front margin with a medial projection. Legs: metacoxa incrassate, tibial spur formula 2:2:2, as in the imago.

**Pseudergate (true worker caste absent).** Body as in the imago. gut: esophagus separated from crop (unlike Mastotermitidae, Teletisoptera, Serritermitidae, or Kalotermitidae); crop shorter than in Mastotermitidae, Teletisoptera, or Kalotermitidae, ovoid or subspherical, asymmetrical, with muscle sheath strongly reduced, as in Serritermitidae, Rhinotermitidae, Psammotermitidae, and Geoisoptera, cuticle with microsculptures (furrows and striations); gizzard elongated, nearly

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cylindrical, strongly muscular, with chitinized armature, folds divided into columns (sclerotized, with scaly surface) and pulvilli (non-sclerotized), columns I and II elongated, their length equal to that of pulvilli I, pulvilli II reduced, teeth in columns I and II without sclerotization; stomodeal valve long, cuticle with longitudinal striations (Serritermitidae, Rhinotermitidae, Psammotermitidae, and Geoisoptera); midgut or mesenteron short, cylindrical, forming an anticlockwise, circular ring, first dorsally, then ventrally under gizzard, ending in hindgut, ring diameter narrow (as in Serritermitidae, Termitogetonidae, Psammotermitidae, and Heterotermitidae), no mixed segment, no anterior caecum at gizzard-midgut junction; Malpighian tubules 8, inserted at midgut-hindgut junction, long, following a tortuous course around gut; hindgut with P1 short, narrow at base, well invaginated in P3; P2 wider than P1, cylindrical, enlarged posteriorly, cushions extending the entire length of P1 and P2 (as in Kalotermitidae), cuticular armature of cushions generally well developed, cushion I on P2 more developed than that on P1, inner pointed tip of cushion I on P2 (= eschutcheon) varying in shape and armature, cushion I on P1 rectangular, cushion II distinct in P1, generally indistinct in P2; P3 dilated, containing symbiotic flagellates; P3–P4 loop untwisted (as in Kalotermitidae, Serritermitidae, Termitogetonidae, Psammotermitidae, and Heterotermitidae), P4 a long tube, with an exceedingly short muscular rectal valve with folds near junction with P5, armature of valve reduced, epithelium smooth or with a few unsclerotized scales; P5 dilated.

*Remark:* *Termitogeton* is a genus of wood-feeding termites known from the Oriental and Papuan realms.

### **Family Psammotermitidae Holmgren, stat. nov.**

*Diagnosis:* Termites without a true worker caste; endosymbiotic protists present.

**Imago.** Head variable, nearly flat (*Psammotermes*) to roundish or oval (*Prorhinotermes*); fontanelle present, in middle of head, with weak groove running from fontanelle to clypeus in *Prorhinotermes*; compound eyes typically small, sometimes medium-sized (in some *Prorhinotermes*); ocelli present; antenna with 15–22 articles. Imago-worker mandibles: left with apical tooth (LAt) and three marginal teeth (LMt); right with apical tooth (RAt) and two marginal teeth (RMt), subsidiary tooth present at base of RAt and RMt<sub>1</sub>. Pronotum flat, narrower than head. Legs: tibial spur formula 3:2:2 (but 2:2:2 in the extinct †*Zophotermes*); tarsi tetramerous; arolium absent. Cerci dimerous. Sternal gland: one gland, on sternum V. Forewing: C fused with Sc, C+Sc running along entire anterior margin of wing; Rs sclerotized, running close to C+Sc; M weak, sometimes absent, when present arising from Cu outside of wing scale, running closer to Cu than to Rs, typically simple or incomplete; Cu weak, with several branches extending to posterior margin; anal vein absent. Hindwing: C+Sc and Rs as in forewing; Cu as in forewing.

**Soldier.** Polymorphic, due to their differentiation from the second larval instars onward. Pronotum flat. Legs: tibial spur formula as in the imago, 3:2:2. Cerci dimerous.

**Pseudergate.** Gut: esophagus distinct from the crop (as opposed to broadening into the crop as in Mastotermitidae, Teletisoptera, Serritermitidae, or Kalotermitidae); crop shorter than in Mastotermitidae, Teletisoptera, or Kalotermitidae, ovoid or subspherical, asymmetrical, with muscle sheath strongly reduced, as in Serritermitidae and Termitidae, cuticle with microsculptures (furrows and striations); gizzard elongated, nearly cylindrical, strongly muscular, with chitinized armature, folds divided into columns (sclerotized, with scaly surface) and pulvilli (non-sclerotized), columns I and II elongated, their length equal to that of pulvilli I, pulvilli II reduced, teeth in columns I and II varying with genera (in *Prorhinotermes* teeth conspicuous but not prominent, longer in II than I; in *Psammotermes* teeth absent, but cuticle thickened and sclerotized

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front to back); stomodeal valve long, cuticle with longitudinal striations (Serritermitidae, Termitogetonidae, and Geoisoptera); midgut or mesenteron short, cylindrical, forming an anticlockwise, circular ring, first dorsally, then ventrally under gizzard, ending in hindgut, ring diameter narrow (as in Serritermitidae, Rhinotermitidae, Termitogetonidae, and Heterotermitidae), no mixed segment, no anterior caecum at gizzard-midgut junction; Malpighian tubules 8, inserted at midgut-hindgut junction, long, following a tortuous course around gut; hindgut with P1 short, narrow at base, well invaginated in P3; P2 wider than P1, cylindrical, enlarged posteriorly, cushions extending the entire length of P1 and P2 (as in Kalotermitidae), cuticular armature of cushions generally well developed, cushion I on P2 more developed than that on P1, inner pointed tip of cushion I on P2 (= eschutcheon), cushion I on P1 rectangular, cushion II distinct in P1, generally indistinct in P2; P3 dilated, containing symbiotic flagellates; P3–P4 loop untwisted (as in Kalotermitidae, Serritermitidae, Rhinotermitidae, Termitogetonidae, and Heterotermitidae), P4 a long tube, with an exceptionally short muscular rectal valve with folds near junction with P5, armature of valve reduced, epithelium smooth or with a few unsclerotized scales; P5 dilated.

**Nymphs.** Wing buds terminally fused, forming two shield-like structures on meso- and meta-thorax<sup>10,11</sup>.

*Remarks:* Given the rather dramatic phenotypic differences between *Psammotermes*, *Prorhinotermes*, and †*Zophotermes*, the latter can be considered as a distinct subfamily within Psammotermitidae.

### Subfamily Psammotermitinae Holmgren

Psammotermitinae Holmgren, 1911: 64. Type genus: *Psammotermes* Desneux, 1902.

*Included genera:* monogeneric.

*Diagnosis:* Termites with pseudergates; endosymbiotic protists present; subterranean nests in sandy soil in arid regions; some pest species.

**Imago.** Head nearly flat; Y-suture not visible; fontanelle prominent; eyes small; antennae with 15–17 articles; postclypeus narrow, convex. Imago-worker mandibles:  $LA_t \gg LM_{t1} \ll LM_{t2} = LM_{t3}$ , with  $LM_{t2}$  subequal to  $LA_t$ . Styli in male only. Wings: membrane transparent, anterior margin without setae; forewing scale not overlapping hindwing scale, almost as long as hindwing scale; M, when present, arising proximally from Cu; hindwing M arising from within wing scale.

**Soldier.** Mono- or poly-morphic; head flat, almost rectangular; fontanelle small to fairly prominent. Mandibles slightly hooked at tip, inner margin with 5–9 marginal teeth or large number of prominent, variable serrations. Antenna with 12–17 articles.

### Subfamily Prorhinotermitinae Quennedey & Deligne

Prorhinotermitinae Quennedey & Deligne, 1975: 265. Type genus: *Prorhinotermes* Silvestri, 1909.

*Included genera* (2): *Prorhinotermes* Silvestri and †*Zophotermes* Engel.

*Diagnosis:* True worker caste absent; endosymbiotic protists present; nests in decaying and dead trees, stumps, logs, or damp, decaying wood, with no connection to soil; some pest species.

**Imago.** Head roundish to oval; eyes small to medium sized; antennae with 17–22 articles; postclypeus short relative to width, moderately arched. Imago-worker mandibles:  $LA_t \gg LM_{t1} \ll LM_{t2} < LM_{t3}$ , with  $LM_{t2}$  roughly the same size as  $LA_t$ . Wings: membrane with few setae; forewing scale overlapping hindwing scale; forewing M, when present, arising from Cu outside wing scale near or beyond wing midlength; hindwing M also arising from Cu or from Rs (as in Rhinotermitidae, Termitogetonidae, and Heterotermitidae).

**Soldier.** Dimorphic; head with sides rounded; fontanelle small, situated slightly beyond middle of head, groove present from fontanelle to clypeus; labrum without brush at tip; mandibles without teeth; antennae with 15–19 articles.

*Remarks:* The distribution of *Prorhinotermes* is mostly insular, with species rarely occurring on the mainland. This distribution, as their resistance to salinity<sup>12</sup>, has fueled speculation that colonies can be transported in driftwood by ocean currents, thus accounting for such a wide distribution on islands of the South Pacific.

## Clade Geoisoptera Engel, Helleman, & Bourguignon, nov.

### Family Heterotermitidae Froggatt, stat. nov.

Heterotermitinae Froggatt, 1897: 550. Type genus: *Heterotermes* Froggatt, 1897.

Leucotermitinae Holmgren, 1910: 285. Type genus: *Leucotermes* Silvestri, 1901 [= *Heterotermes* Froggatt, 1897].

Coptotermitinae Holmgren, 1910: 285. Type genus: *Coptotermes* Wasmann, 1896. **Syn. nov.**

Arrhinotermitinae Sjöstedt, 1926: 8. Type genus: *Arrhinotermes* Wasmann, 1902 [= *Coptotermes* Wasmann]. **Syn. nov.**

*Included genera* (5): *Coptotermes* Wasmann, *Heterotermes* Froggatt (= †*Lukotermes* Perkovsky & Nel, **syn. nov.**), *Reticulitermes* Holmgren.

*Diagnosis:* Termites with a true worker caste present; endosymbiotic protists present; subterranean, with no discrete nests (except for a few mound-building *Coptotermes* from Australia), in soil, colonies also in rotten logs or stumps of dead wood in contact with soil, or within hollow trees they fill with soft carton deposits (*Coptotermes*); some colonies found in mounds of other termites (*Heterotermes*); many serious pest species (particularly *Coptotermes*), and introduced to several areas of the world.

**Imago.** Head: sides parallel below compound eyes (*Heterotermes* and *Reticulitermes*) or almost semicircular (*Coptotermes*); Y-shaped ecdysial scar distinct or indistinct (*Coptotermes*); fontanelle exceptionally small, in middle of head; compound eyes small (*Heterotermes* and *Reticulitermes*) or medium-sized (*Coptotermes*); ocelli present, typically quite small, at times almost indistinct; antenna with 12–19 articles (*Heterotermes* and *Reticulitermes*) or 15–23 articles (*Coptotermes*); postclypeus flat to weakly arched, shorter than half its width, never with elongate, grooved projection (as present in Rhinotermitidae), although with a weak median groove in *Coptotermes*; pronotum flat, slightly narrower than head, without median projection on anterior margin. Imago-worker mandibles: left with apical tooth (LAt) and three marginal teeth (LMt), first marginal tooth (LMt<sub>1</sub>) equal to (*Reticulitermes*) or shorter (*Heterotermes*) apical tooth (LAt), sometimes LMt<sub>1</sub> also shorter than LMt<sub>2</sub> and LMt<sub>3</sub> (*Coptotermes*); right with apical tooth (RAt) and two marginal teeth (RMt), subsidiary tooth present at base of RAt and RMt<sub>1</sub>. Legs: tarsi tetramerous; tibial spur formula 3:2:2. Cerci dimerous, styli only in male. Sternal gland: one gland, on sternum V. Wings reticulate, densely setose (*Coptotermes*) or with few setae on membrane (*Heterotermes* and *Reticulitermes*). Forewing: scale large, overlapping hindwing scale; all veins arising independently from inside scale; C fused with Sc, C+Sc running along entire anterior margin of wing; Rs sclerotized, running close to C+Sc; M present, weak, sometimes almost spectral, running closer to Cu than to Rs, with branches extending to apex or posterior margin; Cu weak, with several branches extending to posterior margin; anal vein absent. Hindwing: C+Sc and Rs as in forewing; M arising from Rs, outside wing scale; Cu as in forewing.

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**Soldier.** Head long and narrow, with parallel sides (*Heterotermes* and *Reticulitermes*) to pear-shaped (*Coptotermes*), frons strongly inclined, with or without dorsolateral protuberances; fontanelle surrounded by setae, small (*Heterotermes* and *Reticulitermes*) to a prominent, large, roundish, opening in front at base of clypeus (*Coptotermes*). Mandibles long, katana-shaped, without teeth; left with a large basal projection and four to several serrations apical to it; right with one or two minute serrations (*Heterotermes* and *Reticulitermes*) or without serrations (*Coptotermes*). Antenna with 12–19 articles (*Heterotermes* and *Reticulitermes*) or 13–17 articles (*Coptotermes*). Labrum with tip pointed, needlelike, or blunt. Pronotum flat or faintly convex, narrower than head, with anterior margin slightly raised in *Coptotermes*. Legs: tibial spur formula as in the imago. Cerci as in the imago.

**Worker.** Gut: esophagus distinct from the crop (as opposed to broadening into the crop as in Mastotermitidae, Teletisoptera, Serritermitidae, and Kalotermitidae); crop shorter than in Mastotermitidae, Teletisoptera, and Kalotermitidae, ovoid or subspherical, asymmetrical, with muscle sheath strongly reduced (as in Neoisoptera excluding Stylotermitidae), cuticle with microsculptures (furrows and striations); gizzard elongated, nearly cylindrical, strongly muscular, with chitinized armature, folds divided into columns (sclerotized, with scaly surface) and pulvilli (non-sclerotized), columns I and II elongate, their length equal to that of pulvilli I, pulvilli II reduced, teeth in columns I and II varying with genera (in *Reticulitermes* teeth conspicuous but not prominent, longer in I than II, in *Coptotermes* and *Heterotermes* no teeth, but cuticle thickened and sclerotized front to back); stomodeal valve long, cuticle with longitudinal striations (as in Neoisoptera excluding Stylotermitidae); midgut or mesenteron short, cylindrical, forming an anticlockwise, circular ring, first dorsally, then ventrally under gizzard, ending in hindgut, ring diameter narrow (as in Neoisoptera excluding Stylotermitidae and Termitidae), no mixed segment, no anterior caecum at gizzard-midgut junction; Malpighian tubules 8, inserted at midgut-hindgut junction, long, following a tortuous course around gut; hindgut with P1 short, narrow at base, well invaginated in P3; P2 wider than P1, cylindrical, enlarged posteriorly, cushions extending entire length of P1 and P2 (as in Kalotermitidae), cuticular armature of cushions generally well developed, cushion I on P2 more developed than that on P1, inner pointed tip of cushion I on P2 (= eschutcheon), cushion I on P1 rectangular, cushion II distinct in P1 and P2; P3 dilated, containing symbiotic flagellates; P3–P4 loop untwisted (as in Kalotermitidae and all Neoisoptera excluding Stylotermitidae and Termitidae), P4 a long tube, with an exceedingly short muscular rectal valve with folds near junction with P5, armature of valve reduced, epithelium smooth or with a few unsclerotized scales; P5 dilated.

*Remarks:* Some distinctions among the constituent genera include: head round in *Coptotermes* and oval with even posterior margin in *Heterotermes* and *Reticulitermes*. Soldiers of *Coptotermes* have a pear-shaped head with a large fontanelle directed forward and, when active, oozing white latex. Conversely, soldiers of *Heterotermes* and *Reticulitermes* have a rectangular head with a small, almost indistinct, fontanelle. Note that the fossil genus †*Lukotermes* is a synonym of *Heterotermes* as evidenced by the characteristic dorsolateral protuberances found in some soldiers and in brachypterous neotenics, as is the case in the fossil. There remains an issue of paraphyly for *Heterotermes* as traditionally circumscribed, which will be addressed in the near future. Some species exhibit slightly dimorphic soldiers<sup>13</sup>.

## Family Termitidae Latreille

**Diagnosis:** Termites with a true worker caste; endosymbiotic protists absent, loss of proctodeal feeding.

**Imago.** Fontanelle present; Y-shaped ecdysial scar present or absent; compound eyes small to large; ocelli present; antennae with 14–23 antennomeres; postclypeus short to long, generally arched. Pronotum trapezoidal or sub-semicircular, slightly raised anteriorly; sometimes referred to as “somewhat saddle-shaped” by some authors in certain genera (*e.g.*, Emerson<sup>14</sup>). Imago-worker mandibles with apical tooth (At) and two marginal teeth (Mt), except in some Termitinae (*Cavitermes*), Crepitermitinae, and Nasutitermitinae (*Mimeutermes*); left mandible with apical tooth (LAt) shorter or longer than fused first plus second marginal tooth (LMt<sub>1+2</sub>), third (LMt<sub>3</sub>) sometimes greatly reduced and represented as a rounded edge (Amitermitinae: *Amitermes*, *Drepanotermes*); right mandible with two marginal teeth (RMt), second marginal (RMt<sub>2</sub>) reduced or absent (Apicotermitinae: *Jugositermes*; Cubitermitinae: *Euchilotermes*; Termitinae: *Tuberculitermes* and *Spinitermes*). Legs: tarsi tetramerous; tibial spur formula 3:2:2 or 2:2:2, mesotibia sometimes with additional spines. Cerci dimerous; styli present or absent. Forewing scale short, not overlapping hindwing scale; wing membranes weakly or not reticulated; venation as in Rhinotermitidae.

**Soldier.** Caste absent (Protohamitermitinae, most Apicotermitinae, Amitermitinae: *Invasitermes*) or present; head shape variable; monomorphic, dimorphic, or trimorphic; fontanelle present or rarely absent (*e.g.*, several Apicotermitinae; Amitermitinae: *Dentispicotermes*, *Globitermes*; Bordereau *et al.*<sup>15</sup>; Palma-Onetto<sup>16</sup>; E. Cancelli, pers. obs.); mandibles variable, short and stout, long and slender, or completely reduced as stubs (Nasutitermitinae), with or without teeth; biting or snapping type (symmetrical or asymmetrical). Antennae with 11–20 antennomeres. Pronotum saddle-shaped, narrower than head (or subequal to larger in Apicotermitinae: *Machadotermes*, Cubitermitinae: *Thoracotermes*), anterior margin bilobed.

**Worker (true worker caste).** Crop musculature greatly reduced; gizzard either regressed (without columnar region, in Apicotermitinae, Cubitermitinae and Engelitermitinae), or complete; gizzard without sclerotized tooth on columns I and II (unique to Termitidae); stomodeal valve with thin striations; midgut without caecum; four Malpighian tubules (two in Apicotermitinae: *Labidotermes*); no limiting groove between P1 and P2; enteric valve armature within lumen of valve or everted into P3.

**Remarks:** Termitid termites can be assigned to each of the 18 subfamilies using a combination of criteria from their imago, soldier and worker (see identification key in Supplementary Note 3). Imago-worker mandibles are most suggestive of their diet, of grinding type in wood-feeders and pounding type in soil-feeders<sup>17</sup>. However, they can also be of great taxonomic value, as extensively put forward by Ahmad<sup>18</sup>.

Assignment to a subfamily can be ascertained from the general conformation of workers' digestive tube (see synthesis presented in Figure 3 in the main text; and Supplementary Figs. 1–18). One important criterion is the occurrence of a mixed segment (the extension of the mesenteron over P1), generally present, but absent in Engelitermitinae, Foraminitermitinae, Forficulitermitinae, Macrotermitinae, Sphaerotermiteinae; or either present or absent depending on the species in Apicotermitinae and Nasutitermitinae. The junction between the mesenteron and P1 occurs ventrally and is elbowed (forming an acute angle) in both Microcerotermitinae and Neocapritermitinae (Supplementary Figs. 10d,f and 13c), while it is arched (or forming a right or obtuse angle) in other subfamilies. The shape of P1, although not synapomorphic for any subfamily, provides additional guidance. In Crepitermitinae, Cyndrotermitinae,

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Engelitermitinae, Forficulitermitinae, Macrotermitinae, Nasutitermitinae, Protohamitermitinae and Sphaerotermitinae, P1 is always tubular, with a caliber not much different from the mesenteron. In other subfamilies, the caliber varies depending on the species: it can be tubular or dilated, reaching a volume equal to or greater than that of the paunch.

One other main criterion is the insertion of P2 into P3 (*i.e.*, the enteric valve position), which is generally on the left side of the abdomen, but occurs on the right side in Amitermitinae, Cyldrotermitinae, Promirotermitinae and Protohamitermitinae; or on either side depending on species in Apicotermitinae and Nasutitermitinae. The enteric valve armature is generally of interest for species determination, although it may be of value for assigning them into their subfamily as well. For example, the valve of Foraminitermitinae is unarmed (Supplementary Fig. 7); the one of Mirocapritermitinae is formed of six folds (Supplementary Fig. 11), while the one of Neocapritermitinae exhibits only three folds (Supplementary Fig. 13).

Although arduous to observe, the insertion of the Malpighian tubules is relevant phylogenetically<sup>4</sup>. The four tubules are inserted equidistantly around the junction between the mesenteron and P1 in Macrotermitinae (see Supplementary Fig. 9d,e) and Sphaerotermitinae. In the Apicotermitinae, the tubules are located at the middle of the mesenteric tissue. In the other subfamilies, the tubules are united either in two pairs, or all four are (nearly-)united, at the boundary between the mesenteric tissue and the foregut. Of note, the Malpighian tubules of termitid termites are generally tangled in a “knot” *sensu* Sands<sup>2</sup> (Supplementary Fig. 17h). Such knot is absent in Macrotermitinae and Sphaerotermitinae, while a pseudo-Malpighian knot occurs in Foraminitermitinae (Supplementary Fig. 7d).

The occurrence of diverticulum or nodules is of peculiar taxonomic value. Both the Cubitermitinae and Crepititermitinae exhibit a characteristic diverticulum on P3 (Supplementary Figs. 3-4). The presence of a Malpighian nodule in Cubitermitinae and Termitinae may be considered as a synapomorphy, a feature which was secondarily lost in a few species of both subfamilies (*e.g.*, *Lophotermes*; <sup>19</sup>). This nodule has first been referred as such by Noirot & Kovoov<sup>20</sup>, as “Malpighian sac” by Bignell *et al.*<sup>21</sup>, or Malpighian “diverticulum” by Sands<sup>22</sup>. These nodules are distinct from “ampulla(e)”, which are dilatation of the proximal part of the Malpighian tubules. For instance, *Tuberculitermes* (Termitinae) exhibits four Malpighian tubules: they are tubular throughout, or can each dilate proximally into an ampulla; the tubules are attached in pairs, each with a united base, attached on either a true diverticulum (*i.e.*, the nodule) or not<sup>22</sup>. In *Prohamitermes hosei* (Amitermitinae), the tubules are not attached in pairs, and the four tubules each end into their own globular ampulla (Supplementary Fig. 1f); note, however, that these ampullae are referred to as “nodules” by Noirot<sup>4</sup>. On the other hand, *Angulitermes* (Promirotermitinae) either shows ampullae or none, and does not exhibit a nodule.

Diagnostic pictures of termite soldiers and enteric valve armatures are available at: <https://www.termitiversity.org> (Scheffrahn<sup>23</sup>).

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### ***Supplementary Note 2:*** Key to extant families and subfamilies of Isoptera.

Note that subfamilies of the more diverse Termitidae are keyed later under the account of that family (*vide infra*). Also, these keys are based on extant taxa only and will work for most, but not all, fossil genera as there are some extinct subfamilies that have additional character combinations that are not taken into account here (*e.g.*, †*Idanotermitinae* in *Mastotermitidae*, etc.). Thus, a fossil not keying out to a given family in these keys does not necessarily mean that it does not belong to one of these clades.

### ***Imagoes***

1. Tarsi tri-, tetra-, or indistinctly pentamerous; hindwing without anal lobe; ocelli present or absent; occipital sulcus absent (at most represented by angulation or line); procoxa without ventral carina ..... 2
- Tarsi distinctly pentamerous; hindwing with anal lobe; ocelli present; occipital sulcus present; procoxa with ventral carina ..... **Mastotermitidae**
- 2(1). Ocelli absent and left mandible with three marginal teeth (LMt); cerci mono- to octomerous [**Teletisoptera**] ..... 3
- Ocelli present; *or* ocelli absent and left mandible with two marginal teeth (LMt); cerci dimerous [**Icoisoptera**] ..... 7
- 3(2). Arolium present; tarsi pentamerous, sometimes indistinctly ..... 4
- Arolium absent; tarsi tetra- or pentamerous ..... 5
- 4(3). Right mandible with apical tooth (RAt) as long as or shorter than first marginal tooth (RMt<sub>1</sub>) ..... **Hodotermopsidae**
- Right mandible with apical tooth (RAt) longer than first marginal tooth (RMt<sub>1</sub>) ..... **Archotermopsidae**
- 5(3). Antenna with less than 20 articles; tarsi tetra- or pentamerous; right mandible with subsidiary tooth present [**Stolotermitidae**] ..... 6
- Antenna with more than 20 articles; tarsi tetramerous; right mandible with subsidiary tooth absent ..... **Hodotermitidae**
- 6(5). Tarsi tetramerous; femur incrassate; cerci tetra- or pentamerous; tibial spur formula 3:3:2 or 2:2:2 ..... **Stolotermitinae**
- Tarsi pentamerous; femur not incrassate; cerci pentamerous; tibial spur formula 3:3:3 or 3:3:4 ..... **Porotermitinae**
- 7(2). Fontanelle present; tarsi tri- or tetramerous; arolium absent; left mandible variable [**Neoisoptera**] ..... 8
- Fontanelle absent; tarsi tetramerous; left mandible with two marginal teeth (LMt) ..... **Kalotermitidae**
- 8(7). Forewing scale distinctly overlapping hindwing scale (except in *Psammotermitinae*); wings reticulate; pronotum flat ..... 9
- Forewing scale not overlapping hindwing scale; wings not reticulate; pronotum saddle-shaped ..... **Termitidae**
- 9(8). Tarsi tetramerous ..... 10
- Tarsi trimerous ..... **Stylotermitidae**
- 10(9). Left mandible with apical tooth (LAt) short, followed by three distinct marginal teeth (LMt) ..... 11
- Left mandible with apical tooth (LAt) long, followed by one distinct marginal tooth (LMt)..... **Serritermitidae**

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- 11(10). Forewing with M (when present) and Cu diverging outside of wing scale  
[**Psammotermitidae**] ..... 12
- Forewing with veins arising independently inside wing scale ..... 13
- 12(11). Fore- and hind-wing scales of about same size, not overlapping; hindwing M arising from  
Rs, or if from Cu, then inside wing scale; head without groove extending from fontanelle  
to epistomal sulcus ..... **Psammotermitinae**
- Fore- and hind-wing scales of differing sizes, overlapping; hindwing M arising outside of  
wing scale either from Cu or Rs; head with groove extending from fontanelle to epistomal  
sulcus ..... **Prorhinotermitinae**
- 13(11). Postclypeus without noselike projection, without groove from fontanelle to tip of  
labrum ..... 14
- Postclypeus with noselike projection, with narrow groove from fontanelle to  
clypeus ..... **Rhinotermitidae**
- 14(13). Head flattened, subtriangular, posterior margin sinuate; anterior margin of pronotum with  
medial projection; wings densely setose ..... **Termitogetonidae**
- Head not flattened, ovoid, posterior margin even; anterior margin of pronotum without  
medial projection; wings sparsely setose ..... **Heterotermitidae**

### ***Soldiers***

1. Tarsi pentamerous, sometimes cryptically (*i.e.*, tarsomere II sometimes reduced and only  
visible ventrally) ..... 2
- Tarsi tri- or tetra-merous ..... 4
- 2(1). Pronotum comparatively small, narrower than head, flat; cerci tetra- to octo-merous;  
antenna with 19–27 articles ..... 3
- Pronotum large, as wide as head, saddle-shaped; cerci tetramerous; antenna with 20–26  
articles ..... **Mastotermitidae**
- 3(2). All tibiae with lateral spines; posterior margin of head bilobed or evenly  
curved ..... **Archotermopsidae**
- Only metatibia with lateral spines, rarely mesotibia with one spine, protibia never with  
lateral spines; posterior margin of head evenly curved ..... **Hodotermopsidae**
- 4(1). Head without fontanelle ..... 5
- Head with fontanelle [**Neoisoptera**] ..... 8
- 5(4). Cerci long, mono- to penta-merous; antenna with 13–33 articles ..... 6
- Cerci short, dimerous; antenna with 10–21 articles ..... **Kalotermitidae**
- 6(5). Pronotum flat; head capsule somewhat or markedly flattened; metafemur incrassate; cerci  
tetra- to penta-merous; antenna with 13–19 articles [**Stolotermitidae**] ..... 7
- Pronotum weakly saddle-shaped (*i.e.*, anterior lobe slightly raised); head not flattened;  
metafemur not incrassate; cerci mono- to penta-merous; antenna with 22–33  
articles ..... **Hodotermitidae**
- 7(6). Mandible short, stout; head somewhat flattened; tibial spur formula variable:  
(2/3):(2/3/4):3 ..... **Porotermitinae**
- Mandible comparatively long, not stout; head markedly and distinctly flattened; tibial spur  
formula 3:3:2 or 2:2:2 ..... **Stolotermitinae**
- 8(7). Pronotum flat ..... 9
- Pronotum notably saddle-shaped ..... **Termitidae**

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|                                                                                                                                                                                                      |                                        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| 9(8). Mandible without serrations along mesal margins, except sometimes a few at base .....                                                                                                          | 10                                     |
| —. Mandible with serrations along entire mesal margins .....                                                                                                                                         | <b>Serritermitidae</b>                 |
| 10(9). Tarsi tetramerous .....                                                                                                                                                                       | 11                                     |
| —. Tarsi trimerous .....                                                                                                                                                                             | <b>Stylotermitidae</b>                 |
| 11(10). Head with small fontanelle, away from base of clypeus .....                                                                                                                                  | 12                                     |
| —. Head with large, rounded fontanelle at base of clypeus [ <i>Coptotermes</i> ] .....                                                                                                               | <b>Heterotermitidae, <i>partim</i></b> |
| 12(11). Groove extending from fontanelle to base of clypeus .....                                                                                                                                    | 13                                     |
| —. Groove absent .....                                                                                                                                                                               | 14                                     |
| 13(12). Tip of labrum with brush; mandibles with prominent marginal teeth .....                                                                                                                      | <b>Rhinotermitidae</b>                 |
| —. Tip of labrum without brush; mandibles without prominent marginal teeth [ <b>Psammotermitidae, <i>partim</i></b> ] .....                                                                          | <b>Prorhinotermitinae</b>              |
| 14(12). Head with sides rounded .....                                                                                                                                                                | 15                                     |
| —. Head with sides subparallel .....                                                                                                                                                                 | <b>Heterotermitidae, <i>partim</i></b> |
| 15(14). Head subtriangular, flattened, posterior margin sinuate; mandibles without prominent marginal teeth except as basal tooth a few crenulations; pronotum with anterior medial projection ..... | <b>Termitogetonidae</b>                |
| —. Head subrectangular, posterior margin even; mandibles with prominent marginal teeth; pronotum without anterior medial projection [ <b>Psammotermitidae, <i>partim</i></b> ] .....                 | <b>Psammotermitinae</b>                |

### **Workers**

|                                                                                                                                                                                                                           |                         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| 1. Wing buds and compound eyes either both present or both absent .....                                                                                                                                                   | 2                       |
| —. Wing buds absent; compound eyes present .....                                                                                                                                                                          | <b>Hodotermitidae</b>   |
| 2(1). Pronotum flat or slightly saddle-shaped; Malpighian tubules 8 or more .....                                                                                                                                         | 3                       |
| —. Pronotum distinctly saddle-shaped; Malpighian tubules 4 .....                                                                                                                                                          | <b>Termitidae</b>       |
| 3(2). Esophagus broadening into the crop .....                                                                                                                                                                            | 4                       |
| —. Esophagus fully or sometimes incompletely separated from crop .....                                                                                                                                                    | 9                       |
| 4(3). Right mandible without subsidiary tooth between RAt and RMt <sub>1</sub> ; left mandible with first two marginal teeth fused, as LMt <sub>1+2</sub> .....                                                           | 5                       |
| —. Right mandible with subsidiary tooth between RAt and RMt <sub>1</sub> ; left mandible with first two marginal distinct, as LMt <sub>1</sub> and LMt <sub>2</sub> .....                                                 | 6                       |
| 5(4). Tarsi distinctly pentamerous .....                                                                                                                                                                                  | <b>Mastotermitidae</b>  |
| —. Tarsi tetramerous .....                                                                                                                                                                                                | <b>Kalotermitidae</b>   |
| 6(5). Malpighian tubules 8 or 9 [ <b>Stolotermitidae</b> ] .....                                                                                                                                                          | 7                       |
| —. Malpighian tubules 10 .....                                                                                                                                                                                            | 8                       |
| 7(6). Malpighian tubules 8 .....                                                                                                                                                                                          | <b>Stolotermitinae</b>  |
| —. Malpighian tubules 9 .....                                                                                                                                                                                             | <b>Porotermitinae</b>   |
| 8(6). Right mandible with apical tooth (RAt) as long or slightly shorter than first marginal tooth (RMt <sub>1</sub> ); left mandible with apical tooth (LAt) shorter than first marginal tooth (LMt <sub>1</sub> ) ..... | <b>Hodotermopsidae</b>  |
| —. Right mandible with apical tooth (RAt) longer than first marginal tooth (RMt <sub>1</sub> ); left mandible with apical tooth (LAt) as long as or longer than first marginal tooth (LMt <sub>1</sub> ) .....            | <b>Archotermopsidae</b> |
| 9(3). Tarsi tetramerous .....                                                                                                                                                                                             | 10                      |

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|         |                                                                                                     |                           |
|---------|-----------------------------------------------------------------------------------------------------|---------------------------|
| —.      | Tarsi trimerous .....                                                                               | <b>Stylotermitidae</b>    |
| 10(9).  | Left mandible with an apical tooth (LAt), followed by three distinct marginal teeth (LMt) .....     | 11                        |
| —.      | Left and right mandibles each with long apical tooth, followed by one distinct marginal tooth ..... | <b>Serritermitidae</b>    |
| 11(10). | Secondary cushions of enteric valve (P2) indistinct or scarcely distinct.....                       | 12                        |
| —.      | Secondary cushions of enteric valve (P2) distinct .....                                             | 14                        |
| 12(11). | Secondary cushions of ileum (P1) well-developed [ <b>Psammotermitidae</b> ] .....                   | 13                        |
| —.      | Secondary cushions of ileum (P1) narrowed .....                                                     | <b>Termitogetonidae</b>   |
| 13(12). | Sclerotized columns I and II of gizzard without teeth .....                                         | <b>Psammotermitinae</b>   |
| —.      | Sclerotized columns I and II of gizzard with conspicuous, but not prominent, teeth .....            | <b>Prorhinotermitinae</b> |
| 14(11). | Anterior margin of postclypeus convex .....                                                         | <b>Rhinotermitidae</b>    |
| —.      | Anterior margin of postclypeus straight or concave .....                                            | <b>Heterotermitidae</b>   |

**Supplementary Note 3:** Key to subfamilies of Termitidae, revised from Krishna *et al.*<sup>1</sup>.

***Imagoes/Workers & Soldiers***

1. Worker gut: mixed segment absent; mesenteron well developed (both in length and diameter) visible in situ in dorsal view; mesentero-proctodeal junction with four lobes (less evident in some species); Malpighian knot or pseudo-Malpighian knot absent ..... 2
- Worker gut: mixed segment present or absent; without conspicuous backward-oriented bristles at paunch-colon (P3-P4) junction; Malpighian knot or pseudo-Malpighian knot present ..... 3
- 2(1). Imago/worker: labrum with dark, sclerotized transverse band; left mandible with anterior margin of third marginal tooth (LMt<sub>3</sub>) less than twice length of posterior margin ..... **Macrotermitinae**
- Imago/worker<sup>1</sup>: labrum without dark, sclerotized transverse band; left mandible with anterior margin of third marginal tooth (LMt<sub>3</sub>) twice or more length of posterior margin. Worker gut: conspicuous backward-oriented bristles at paunch-colon (P3-P4) junction ..... **Sphaerotermitinae**
- 3(2). Worker gut: P3b protruding portion at the dorsal region forming two loops, leaving the coil by the middle; pseudo-Malpighian knot present; mixed segment absent; enteric valve (P2) without spines ..... **Foraminitermitinae**
- Worker gut: P3b protruding portion at the dorsal region straight backward or forming a simple loop, leaving the coil bordering the mesenteron margin; Malpighian knot present; mixed segment present or absent; enteric valve (P2) with or without spines ..... 4
- 4(3). Worker gut: gizzard without columnar belt (regressed type); mixed segment absent; P1 cylindrical, running with an elongated S shape along the left side of the abdomen; enteric valve (P2) composed of six smooth elongate cushions, each bearing a terminal spine ..... **Engelitermitinae**
- Worker gut: Gizzard with (generalized type) or without columnar belt (regressed type); mixed segment present or absent; P1 shape variable; enteric valve (P2) variable ..... 5
- 5(4). Imago/worker: left mandible with third marginal tooth (LMt<sub>3</sub>) without distinct notch or indentation between third (LMt<sub>3</sub>) and fused first plus second marginal teeth (LMt<sub>1+2</sub>). Imago: fontanelle slit-like, oval or round. Worker gut: mixed segment, when present, located externally to the coil of the mesenteric arch ..... 6
- Imago/worker: left mandible with third marginal tooth (LMt<sub>3</sub>) with distinct notch or indentation between third (LMt<sub>3</sub>) and fused first plus second marginal teeth (LMt<sub>1+2</sub>). Imago: fontanelle not slit-like, obscure, oval, or round. Worker gut: mixed segment, if present, located internally to the coil of the mesenteric arch ..... **Apicotermitinae**
- 6(5). Worker gut: paunch (P3) with blind diverticulum or caecum (also in soldiers and imagoes) ..... 7
- Worker gut: paunch (P3) without blind diverticulum or caecum ..... 8
- 7(6). Worker gut: gizzard without columnar belt (regressed type); caecum in a ventral position; P1 inflated; enteric valve armature composed of six elongated cushions and six

<sup>1</sup> Some authors consider that the species of Sphaerotermitinae exhibit a “subsidiary tooth” at the base of the apical tooth on the right mandible. This “subsidiary tooth” is referred to as an “edge uniform at most slightly sinuate” by Sands (1998: 79).

## SUPPLEMENTARY INFORMATION

- intermediate cushions, smaller and with weaker armature; Malpighian nodule generally present (Ethiopian distribution) ..... **Cubitermitinae**
- Worker gut: gizzard with columnar belt (generalized type); caecum visible in right lateral view, at the protruded region of P3; P1 tubular, enteric valve armature composed of six cushions, without intermediate cushions; (Neotropical distribution) ..... **Crepititermitinae**
- 8(6). Worker gut: double mixed segment present or absent; soldier (always present): frontal pore at apex of prominence or nasus ..... 9
- Worker gut: double mixed segment absent; soldier (rarely absent): fontanelle at front of head or at base of frontal prominence (when present) ..... 10
- 9(8). Worker gut: double mixed segment present or absent; ileum (P1) dilated. Soldier: fontanelle wide, mandibles functional. (Neotropical distribution) ..... **Syntermitinae** (incl. *Genuotermes*)
- Worker gut: double mixed segment absent; ileum (P1) tubular. Soldier: fontanelle narrow, mandibles vestigial. (Worldwide distribution) ..... **Nasutitermitinae**
- 10(8). Worker gut: P1 tubular, long, forming a loop ventrally under P5; P1 inserted on P3 at right side of abdomen. Worker mandibles: molar region always with ridges ..... 11
- Worker gut: P1 shape variable (tubular or inflated), without ventral loop; P1 insertion at P3 variable; enteric valve position at the right or left side of abdomen. Worker mandibles: molar region with or without ridges ..... 12
- 11(10). Imago/worker: right mandible without subsidiary tooth at base of first marginal tooth (RMt<sub>1</sub>), second marginal tooth (RMt<sub>2</sub>) not as below. Soldier: present. Worker gut: P1 inserted dorsally on P3, Ethiopian and Neotropical region ..... **Cylindrotermitinae**
- Imago/worker: right mandible with subsidiary tooth at base of first marginal tooth (RMt<sub>1</sub>), second marginal tooth (RMt<sub>2</sub>) well-developed, with anterior margin angular and posterior margin curved. Soldier: absent. Worker gut: P1 inserted ventro-posteriorly on P3. (Oriental distribution) ..... **Protohamitermitinae**
- 12(10). Worker gut: Malpighian nodule generally present, located internally to the mesenteric arch, at the insertion of Malpighian tubules. Soldier: frontal prominence well-developed or much reduced ..... **Termitinae**
- Worker gut: Malpighian nodule absent (ampulla sometimes present). Soldier: variable ..... 13
- 13(12). Worker gut: P1 insertion in P3 (enteric valve position) at the left side of abdomen ..... 14
- Worker gut: P1 insertion in P3 (enteric valve position) at the right side of abdomen ..... 15
- 14(13). Worker gut: mixed segment absent. Soldier mandibles: not snapping ..... **Forficulitermitinae**
- Worker gut: mixed segment present ..... 16
- 15(13). Worker/Soldier gut: P1 inflated or tubular. Soldier mandibles: crushing, piercing, slashing or snapping symmetrical (\*only Neotropical genera have snapping symmetrical soldier mandibles); soldier head pear-shaped, without frontal projection (except *Eremotermes*, *Dentispicotermes*), labrum rounded or with slightly pointed tips ..... **Amitermitinae**
- Worker/Soldier gut: P1 always inflated. Soldier: mandibles with symmetrical snapping, head with notable frontal hump or projection; labrum bifurcate ..... **Promirotermitinae**

## SUPPLEMENTARY INFORMATION

- 16(14). Worker gut: junction between mixed segment and ileum (P1) constricted and elbowed ventrally, forming an acute angle with forward-oriented vertex. Imago/worker: RMt<sub>2</sub> forwardly-oriented, with elongate posterior margin; molar region with ridges ..... 17
- . Worker gut: junction between mixed segment and ileum (P1) arched. Soldier: asymmetrical snapping. Imago/worker: RMt<sub>2</sub> with both margins of near-equal length, and posterior margin slightly concave; molar region smooth or with very reduced ridges. (Distribution: Australian, Afrotropical, Palearctic (Sino-Japanese), and Papuan regions) ..... **Mirocapritermitinae**
- 17(16). Soldier mandibles: piercing (*Onkotermes*; Distribution: Neotropical), or slashing (*Microcerotermes*; Distribution: Australian, Papuan, Oriental, Ethiopian, and Neotropical regions)..... **Microcerotermatinae**
- . Soldier mandibles: asymmetrical, or nearly-symmetrical snapping. (Neotropical distribution) ..... **Neocapritermitinae**

## SUPPLEMENTARY INFORMATION

**Supplementary Note 4:** List of currently recognized genera of extant Isoptera.

### **Mastotermitidae ( $n = 1$ )**

*Mastotermes* Froggatt

### **Hodotermitidae ( $n = 3$ )**

*Anacanthotermes* Jacobson

*Hodotermes* Hagen

*Microhodotermes* Sjöstedt

### **Archotermopsidae ( $n = 2$ )**

*Archotermopsis* Desneux

*Zootermopsis* Emerson

### **Hodotermopsidae ( $n = 1$ )**

*Hodotermopsis* Holmgren

### **Stolotermitidae ( $n = 2$ )**

#### **Stolotermitidae: Porotermitinae**

*Porotermes* Hagen

#### **Stolotermitidae: Stolotermitinae**

*Stolotermes* Hagen

### **Kalotermitidae ( $n = 23$ )**

*Allotermes* Wasmann

*Bicornitermes* Krishna

*Bifiditermes* Krishna

*Calcaritermes* Snyder

*Ceratokalotermes* Krishna

*Comatermes* Krishna

*Cryptotermes* Banks

*Epicalotermes* Silvestri

*Eucryptotermes* Holmgren

*Glyptotermes* Froggatt

*Incisitermes* Krishna

*Kalotermes* Hagen

*Longicaputermes* Ghesini, Marini, & Simon

*Marginitermes* Krishna

*Neotermes* Holmgren

*Paraneotermes* Light

*Postelectrotermes* Krishna

*Procryptotermes* Holmgren

## SUPPLEMENTARY INFORMATION

|                      |            |
|----------------------|------------|
| <i>Proneotermes</i>  | Holmgren   |
| <i>Pterotermes</i>   | Holmgren   |
| <i>Roisinitermes</i> | Scheffrahn |
| <i>Rugitermes</i>    | Holmgren   |
| <i>Tauritermes</i>   | Krishna    |

### **Stylotermitidae ( $n = 1$ )**

|                    |                     |
|--------------------|---------------------|
| <i>Stylotermes</i> | Holmgren & Holmgren |
|--------------------|---------------------|

### **Serritermitidae ( $n = 2$ )**

|                     |         |
|---------------------|---------|
| <i>Glossotermes</i> | Emerson |
| <i>Serritermes</i>  | Wasmann |

### **Rhinotermitidae ( $n = 5$ )**

|                           |                  |
|---------------------------|------------------|
| <i>Acorhinotermes</i>     | Emerson          |
| <i>Dolichorhinotermes</i> | Snyder & Emerson |
| <i>Parrhinotermes</i>     | Holmgren         |
| <i>Rhinotermes</i>        | Hagen            |
| <i>Schedorhinotermes</i>  | Silvestri        |

### **Psammotermitidae ( $n = 2$ )**

#### **Psammotermitidae: Prorhinotermitinae**

|                       |           |
|-----------------------|-----------|
| <i>Prorhinotermes</i> | Silvestri |
|-----------------------|-----------|

#### **Psammotermitidae: Psammotermitinae**

|                     |         |
|---------------------|---------|
| <i>Psammotermes</i> | Desneux |
|---------------------|---------|

### **Termitogetonidae ( $n = 1$ )**

|                     |         |
|---------------------|---------|
| <i>Termitogeton</i> | Desneux |
|---------------------|---------|

### **Heterotermitidae ( $n = 3$ )**

|                       |          |
|-----------------------|----------|
| <i>Coptotermes</i>    | Wasmann  |
| <i>Heterotermes</i>   | Froggatt |
| <i>Reticulitermes</i> | Holmgren |

# SUPPLEMENTARY INFORMATION

## Termitidae (*n* = 275)

### Termitidae: Amitermitinae (*n* = 14)

|                          |           |
|--------------------------|-----------|
| <i>Ahamitermes</i>       | Mjöberg   |
| <i>Amitermes</i>         | Silvestri |
| <i>Dentispicotermes</i>  | Emerson   |
| <i>Drepanotermes</i>     | Silvestri |
| <i>Eremotermes</i>       | Silvestri |
| <i>Globitermes</i>       | Holmgren  |
| <i>Gnathamitermes</i>    | Light     |
| <i>Hoplotermes</i>       | Light     |
| <i>Incolitermes</i>      | Gay       |
| <i>Invasitermes</i>      | Miller    |
| <i>Orthognathotermes</i> | Holmgren  |
| <i>Prohamitermes</i>     | Holmgren  |
| <i>Pseudhamitermes</i>   | Noirot    |
| <i>Synhamitermes</i>     | Holmgren  |

### Termitidae: Apicotermitinae (*n* = 63)

|                         |                       |
|-------------------------|-----------------------|
| <i>Acholotermes</i>     | Sands                 |
| <i>Acidnotermes</i>     | Sands                 |
| <i>Acutidentitermes</i> | Emerson               |
| <i>Adaiphrotermes</i>   | Sands                 |
| <i>Aderitotermes</i>    | Sands                 |
| <i>Adynatotermes</i>    | Sands                 |
| <i>Aganotermes</i>      | Sands                 |
| <i>Allognathotermes</i> | Silvestri             |
| <i>Alyscotermes</i>     | Sands                 |
| <i>Amalotermes</i>      | Sands                 |
| <i>Amicotermes</i>      | Sands                 |
| <i>Amplucruterms</i>    | Bourguignon & Roisin  |
| <i>Anaorotermes</i>     | Sands                 |
| <i>Anenteotermes</i>    | Sands                 |
| <i>Anoplotermes</i>     | Müller                |
| <i>Apagotermes</i>      | Sands                 |
| <i>Aparatermes</i>      | Fontes                |
| <i>Apicotermes</i>      | Holmgren              |
| <i>Apolemotermes</i>    | Romero Arias & Roisin |
| <i>Asagarotermes</i>    | Sands                 |
| <i>Astalotermes</i>     | Sands                 |
| <i>Astratotermes</i>    | Sands                 |
| <i>Ateuchotermes</i>    | Sands                 |

## SUPPLEMENTARY INFORMATION

|                          |                                   |
|--------------------------|-----------------------------------|
| <i>Caputitermes</i>      | Almeida-Azevedo & Azevedo         |
| <i>Chasitermes</i>       | Scheffrahn & Carrijo              |
| <i>Compositermes</i>     | Scheffrahn                        |
| <i>Coxotermes</i>        | Grassé & Noirot                   |
| <i>Disjunctitermes</i>   | Scheffrahn                        |
| <i>Dissimulitermes</i>   | Constantini & Canello             |
| <i>Duplidentitermes</i>  | Emerson                           |
| <i>Ebogotermes</i>       | Scheffrahn & Roisin               |
| <i>Eburnitermes</i>      | Noirot                            |
| <i>Echinotermes</i>      | Castro & Scheffrahn               |
| <i>Euhamitermes</i>      | Holmgren                          |
| <i>Eurytermes</i>        | Wasmann                           |
| <i>Firmitermes</i>       | Sjöstedt                          |
| <i>Gastrotermes</i>      | Scheffrahn                        |
| <i>Grigiotermes</i>      | Mathews                           |
| <i>Heimitermes</i>       | Grassé                            |
| <i>Hirsutitermes</i>     | Scheffrahn, Carrijo, & Castro     |
| <i>Hoplognathotermes</i> | Silvestri                         |
| <i>Humitermes</i>        | Bourguignon & Roisin              |
| <i>Hydrecoitermes</i>    | Bourguignon & Roisin              |
| <i>Indotermes</i>        | Roonwal & Sen-Sarma               |
| <i>Jugositermes</i>      | Emerson                           |
| <i>Koutabatermes</i>     | Romero Arias & Roisin             |
| <i>Kreckitermes</i>      | Scheffrahn, Carrijo, & Castro     |
| <i>Labidotermes</i>      | Deligne & Pasteels                |
| <i>Longustitermes</i>    | Bourguignon & Roisin              |
| <i>Machadotermes</i>     | Weidner                           |
| <i>Mangolditermes</i>    | Scheffrahn, Carrijo, & Castro     |
| <i>Ourissotermes</i>     | Scheffrahn, Carrijo, & Castro     |
| <i>Patawatermes</i>      | Bourguignon & Roisin              |
| <i>Phoxotermes</i>       | Collins                           |
| <i>Rostrotermes</i>      | Grassé                            |
| <i>Rubeotermes</i>       | Bourguignon & Roisin              |
| <i>Ruptitermes</i>       | Mathews                           |
| <i>Rustitermes</i>       | Constantini, Castro, & Scheffrahn |
| <i>Skatitermes</i>       | Coaton                            |
| <i>Speculitermes</i>     | Wasmann                           |
| <i>Tetimatermes</i>      | Fontes                            |
| <i>Tonsuritermes</i>     | Canello & Constantini             |
| <i>Trichotermes</i>      | Sjöstedt                          |

## SUPPLEMENTARY INFORMATION

### **Termitidae: Crepititermitinae ( $n = 1$ )**

*Crepititermes* Emerson

### **Termitidae: Cubitermitinae ( $n = 28$ )**

*Apilitermes* Holmgren  
*Basidentitermes* Holmgren  
*Batillitermes* Uys  
*Crenetermes* Silvestri  
*Cubitermes* Wasmann  
*Euchilotermes* Silvestri  
*Fastigitermes* Sjöstedt  
*Furculitermes* Emerson  
*Isognathotermes* Sjöstedt  
*Lepidotermes* Sjöstedt  
*Megagnathotermes* Silvestri  
*Mucrotermes* Emerson  
*Nitiditermes* Emerson  
*Noditermes* Sjöstedt  
*Okavangotermes* Coaton  
*Ophiotermes* Sjöstedt  
*Orthotermes* Silvestri  
*Ovambotermes* Coaton  
*Pilotermes* Emerson  
*Polyspathotermes* Josens & Deligne  
*Proboscitermes* Sjöstedt  
*Procubitermes* Silvestri  
*Profastigitermes* Emerson  
*Ternicubitermes* Josens & Deligne  
*Thoracotermes* Wasmann  
*Trapellitermes* Sands  
*Unguitermes* Sjöstedt  
*Unicornitermes* Coaton

### **Termitidae: Cylindrotermitinae ( $n = 2$ )**

*Cephalotermes* Silvestri  
*Cylindrotermes* Holmgren

### **Termitidae: Engelitermitinae ( $n = 1$ )**

*Engelitermes* Romero Arias, Roisin, & Scheffrahn

## SUPPLEMENTARY INFORMATION

### **Termitidae: Foraminitermitinae ( $n = 3$ )**

|                          |          |
|--------------------------|----------|
| <i>Foraminitermes</i>    | Holmgren |
| <i>Labritermes</i>       | Holmgren |
| <i>Pseudomicrotermes</i> | Holmgren |

### **Termitidae: Forficulitermitinae ( $n = 1$ )**

|                        |         |
|------------------------|---------|
| <i>Forficulitermes</i> | Emerson |
|------------------------|---------|

### **Termitidae: Macrotermitinae ( $n = 12$ )**

|                           |           |
|---------------------------|-----------|
| <i>Acanthotermes</i>      | Sjöstedt  |
| <i>Allodontermes</i>      | Silvestri |
| <i>Ancistrotermes</i>     | Silvestri |
| <i>Euscaiotermes</i>      | Silvestri |
| <i>Hypotermes</i>         | Holmgren  |
| <i>Macrotermes</i>        | Holmgren  |
| <i>Megaprotermes</i>      | Ruelle    |
| <i>Microtermes</i>        | Wasmann   |
| <i>Odontotermes</i>       | Holmgren  |
| <i>Protermes</i>          | Holmgren  |
| <i>Pseudacanthotermes</i> | Sjöstedt  |
| <i>Synacanthotermes</i>   | Holmgren  |

### **Termitidae: Microcerotermitinae ( $n = 2$ )**

|                        |             |
|------------------------|-------------|
| <i>Microcerotermes</i> | Silvestri   |
| <i>Onkotermes</i>      | Constantino |

### **Termitidae: Mirocapritermitinae ( $n = 14$ )**

|                           |                   |
|---------------------------|-------------------|
| <i>Dicuspiditermes</i>    | Krishna           |
| <i>Homallotermes</i>      | John              |
| <i>Indocapritermes</i>    | Chhotani          |
| <i>Kemneritermes</i>      | Ahmad & Akhtar    |
| <i>Krishnacapritermes</i> | Chhotani          |
| <i>Labiocapritermes</i>   | Krishna           |
| <i>Mirocapritermes</i>    | Holmgren          |
| <i>Oriencapritermes</i>   | Ahmad & Akhtar    |
| <i>Pericapritermes</i>    | Silvestri         |
| <i>Procapritermes</i>     | Holmgren          |
| <i>Pseudocapritermes</i>  | Kemner            |
| <i>Rinacapritermes</i>    | Amina & Rajmohana |
| <i>Sinocapritermes</i>    | Ping & Xu         |
| <i>Syncapritermes</i>     | Ahmad & Akhtar    |

# SUPPLEMENTARY INFORMATION

## Termitidae: Nasutitermitinae (*n* = 82)

|                         |                                   |
|-------------------------|-----------------------------------|
| <i>Aciculitermes</i>    | Emerson                           |
| <i>Afrosubulitermes</i> | Emerson                           |
| <i>Agnathotermes</i>    | Snyder                            |
| <i>Ahmaditermes</i>     | Akhtar                            |
| <i>Ampoulitermes</i>    | Mathur & Thapa                    |
| <i>Angularitermes</i>   | Emerson                           |
| <i>Anhangatermes</i>    | Constantino                       |
| <i>Antillitermes</i>    | Roisin, Scheffrahn, & Křeček      |
| <i>Araujotermes</i>     | Fontes                            |
| <i>Arcotermes</i>       | Fan                               |
| <i>Atlantitermes</i>    | Fontes                            |
| <i>Australitermes</i>   | Emerson                           |
| <i>Baicalitermes</i>    | Sands                             |
| <i>Bulbitermes</i>      | Emerson                           |
| <i>Caetetermes</i>      | Fontes                            |
| <i>Caribitermes</i>     | Roisin, Scheffrahn, & Křeček      |
| <i>Ceylonitermellus</i> | Emerson                           |
| <i>Ceylonitermes</i>    | Holmgren                          |
| <i>Coarctotermes</i>    | Holmgren                          |
| <i>Coatitermes</i>      | Fontes                            |
| <i>Coendutermes</i>     | Fontes                            |
| <i>Constrictotermes</i> | Holmgren                          |
| <i>Convexitermes</i>    | Holmgren                          |
| <i>Cortaritermes</i>    | Mathews                           |
| <i>Cucurbitermes</i>    | Li & Ping                         |
| <i>Cyranotermes</i>     | Araujo                            |
| <i>Diversitermes</i>    | Holmgren                          |
| <i>Diwaitermes</i>      | Roisin & Pasteels                 |
| <i>Eleanoritermes</i>   | Ahmad                             |
| <i>Emersonitermes</i>   | Mathur & Sen-Sarma                |
| <i>Enetotermes</i>      | Sands                             |
| <i>Ereymatermes</i>     | Constantino                       |
| <i>Eutermellus</i>      | Silvestri                         |
| <i>Fulleritermes</i>    | Coaton                            |
| <i>Grallatotermes</i>   | Holmgren                          |
| <i>Hirtitermes</i>      | Holmgren                          |
| <i>Hospitalitermes</i>  | Holmgren                          |
| <i>Hyleotermes</i>      | Cuezzo, Scheffrahn, & Constantino |

# SUPPLEMENTARY INFORMATION

|                          |                              |
|--------------------------|------------------------------|
| <i>Kaudernitermes</i>    | Sands & Lamb                 |
| <i>Lacessititermes</i>   | Holmgren                     |
| <i>Leptomyxotermes</i>   | Sands                        |
| <i>Leucopitermes</i>     | Emerson                      |
| <i>Longipeditermes</i>   | Holmgren                     |
| <i>Macrosbulitermes</i>  | Emerson                      |
| <i>Malagasitermes</i>    | Emerson                      |
| <i>Malaysiotermes</i>    | Ahmad                        |
| <i>Mimeutermes</i>       | Silvestri                    |
| <i>Muelleritermes</i>    | Cancello, Oliveira, & Rocha  |
| <i>Mycterotermes</i>     | Sands                        |
| <i>Nasopilotermes</i>    | Gao, Lam, & Owen             |
| <i>Nasutitermes</i>      | Dudley                       |
| <i>Ngauratermes</i>      | Constantino & Acioli         |
| <i>Niuginitermes</i>     | Roisin & Pasteels            |
| <i>Obtusitermes</i>      | Snyder                       |
| <i>Occasitermes</i>      | Holmgren                     |
| <i>Occultitermes</i>     | Emerson                      |
| <i>Oriensbulitermes</i>  | Emerson                      |
| <i>Paraconvexitermes</i> | Cancello & Noirot            |
| <i>Parvitermes</i>       | Emerson                      |
| <i>Periaciculitermes</i> | Li                           |
| <i>Peribulbitermes</i>   | Li                           |
| <i>Postsubulitermes</i>  | Emerson                      |
| <i>Rhadinotermes</i>     | Sands                        |
| <i>Roonwalitermes</i>    | Bose                         |
| <i>Rotunditermes</i>     | Holmgren                     |
| <i>Rounditermes</i>      | Ensaf, Ponchel, & Nel        |
| <i>Sabahitermes</i>      | Thapa                        |
| <i>Sandsitermes</i>      | Cuezzo, Cancelllo, & Carrijo |
| <i>Sinonasutitermes</i>  | Li & Ping                    |
| <i>Singasapatermes</i>   | Cuezzo & Nickle              |
| <i>Spatulitermes</i>     | Coaton                       |
| <i>Subulioditermes</i>   | Ahmad                        |
| <i>Subulitermes</i>      | Holmgren                     |
| <i>Tarditermes</i>       | Emerson                      |
| <i>Tenuirostritermes</i> | Holmgren                     |
| <i>Tiunatermes</i>       | Carrijo, Cuezzo, & Santos    |
| <i>Triangularitermes</i> | Mathews                      |
| <i>Trinervitermes</i>    | Holmgren                     |

## SUPPLEMENTARY INFORMATION

|                        |          |
|------------------------|----------|
| <i>Tumulitermes</i>    | Holmgren |
| <i>Velocitermes</i>    | Holmgren |
| <i>Verrucositermes</i> | Emerson  |
| <i>Xiaitermes</i>      | Gao & He |

### **Termitidae: Neocapritermitinae (*n* = 3)**

|                         |          |
|-------------------------|----------|
| <i>Neocapritermes</i>   | Holmgren |
| <i>Planicapritermes</i> | Emerson  |
| <i>Schievitermes</i>    | Roisin   |

### **Termitidae: Promirotermitinae (*n* = 2)**

|                      |           |
|----------------------|-----------|
| <i>Angulitermes</i>  | Sjöstedt  |
| <i>Promirotermes</i> | Silvestri |

### **Termitidae: Protohamitermitinae (*n* = 2)**

|                        |          |
|------------------------|----------|
| <i>Orientotermes</i>   | Ahmad    |
| <i>Protohamitermes</i> | Holmgren |

### **Termitidae: Sphaerotermitinae (*n* = 1)**

|                      |          |
|----------------------|----------|
| <i>Sphaerotermes</i> | Holmgren |
|----------------------|----------|

### **Termitidae: Syntermitinae (*n* = 21)**

|                         |                        |
|-------------------------|------------------------|
| <i>Armitermes</i>       | Wasmann                |
| <i>Bandeiratermes</i>   | Rocha & Canello        |
| <i>Biratermes</i>       | Rocha & Canello        |
| <i>Cahuallitermes</i>   | Constantino            |
| <i>Cornitermes</i>      | Wasmann                |
| <i>Curvitermes</i>      | Holmgren               |
| <i>Cyrellitermes</i>    | Fontes                 |
| <i>Embiratermes</i>     | Fontes                 |
| <i>Genuotermes</i>      | Emerson                |
| <i>Ibitermes</i>        | Fontes                 |
| <i>Labiatermes</i>      | Holmgren               |
| <i>Macuxitermes</i>     | Canello & Bandeira     |
| <i>Mapinguaritermes</i> | Rocha & Canello        |
| <i>Noirotitermes</i>    | Canello & Myles        |
| <i>Paracurvitermes</i>  | Constantino & Carvalho |
| <i>Procornitermes</i>   | Emerson                |
| <i>Rhynchotermes</i>    | Holmgren               |
| <i>Silvestritermes</i>  | Rocha & Canello        |
| <i>Syntermes</i>        | Holmgren               |

## SUPPLEMENTARY INFORMATION

|                     |                 |
|---------------------|-----------------|
| <i>Uncitermes</i>   | Rocha & Canello |
| <i>Vaninitermes</i> | Rocha & Canello |

### **Termitidae: Termitinae (*n* = 23)**

|                          |                    |
|--------------------------|--------------------|
| <i>Apsenterotermes</i>   | Miller             |
| <i>Capritermes</i>       | Wasmann            |
| <i>Cavitermes</i>        | Emerson            |
| <i>Cornicapritermes</i>  | Emerson            |
| <i>Cristatitermes</i>    | Miller             |
| <i>Dihoploterme</i>      | Araujo             |
| <i>Divinotermes</i>      | Carrijo & Canello  |
| <i>Ekphysotermes</i>     | Gay                |
| <i>Ephelotermes</i>      | Miller             |
| <i>Hapsidotermes</i>     | Miller             |
| <i>Hesperotermes</i>     | Gay                |
| <i>Inquilinitermes</i>   | Mathews            |
| <i>Lophotermes</i>       | Miller             |
| <i>Macrognahtotermes</i> | Miller             |
| <i>Palmitermes</i>       | Hellemans & Roisin |
| <i>Paracapritermes</i>   | Hill               |
| <i>Protocapritermes</i>  | Holmgren           |
| <i>Quasitermes</i>       | Emerson            |
| <i>Saxatilitermes</i>    | Miller             |
| <i>Spinitermes</i>       | Wasmann            |
| <i>Termes</i>            | Linnaeus           |
| <i>Tuberculitermes</i>   | Holmgren           |
| <i>Xylochomitermes</i>   | Miller             |

## SUPPLEMENTARY INFORMATION

**Supplementary Figures:** Diagnostic features for each subfamily of Termitidae.

**Pictures credits:**

T. F. Carrijo: Supplementary Fig. 13(a);

P. Eggleton: Supplementary Fig. 15(a);

G. Ide: Supplementary Fig. 12(a);

G. Josens: Supplementary Fig. 4(a,b);

S. Hellemans: Supplementary Fig. 6(a), Supplementary Fig. 15(d);

C. M. Kalleshwaraswamy: Supplementary Fig. 14(a);

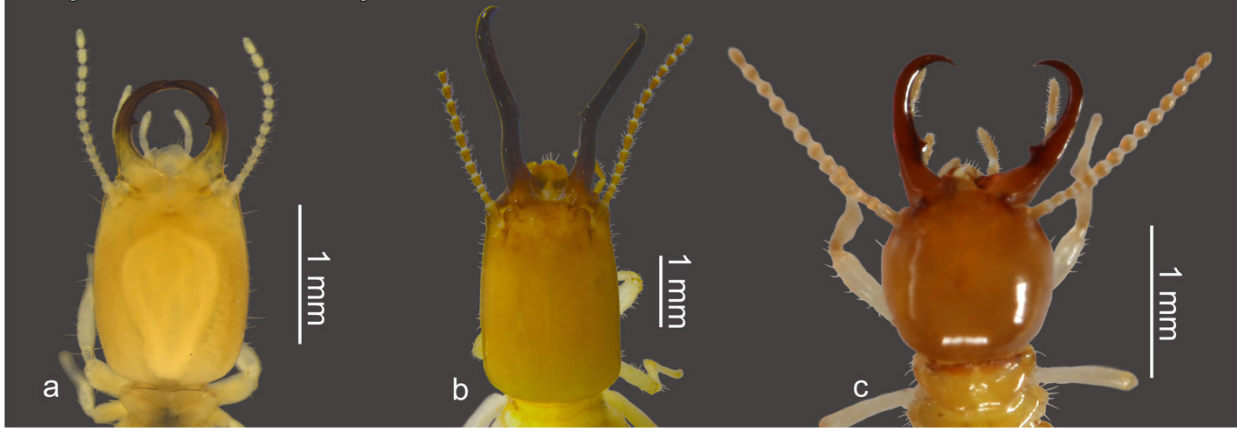
M. M. Rocha: Supplementary Fig. 1(a,b,k), Supplementary Fig. 2(c), Supplementary Fig. 3(a), Supplementary Fig. 5(b, f), Supplementary Fig. 10(b), Supplementary Fig. 12(i), Supplementary Fig. 13(b,h,i), Supplementary Fig. 14(b), Supplementary Fig. 17(a-d,k-m), Supplementary Fig. 18(a,b,l);

R. H. Scheffrahn: Supplementary Fig. 1(j,l), Supplementary Fig. 2(a,h-j), Supplementary Fig. 3(e), Supplementary Fig. 4(c,j,k), Supplementary Fig. 5(a,e), Supplementary Fig. 6(e), Supplementary Fig. 7(a,f), Supplementary Fig. 8(a,e), Supplementary Fig. 9(a-c,g-i), Supplementary Fig. 10(a,c,i,j), Supplementary Fig. 11(a-c,g-i), Supplementary Fig. 12(b,c,j,k), Supplementary Fig. 14(f), Supplementary Fig. 16(a,e), Supplementary Fig. 18(c,j,k);

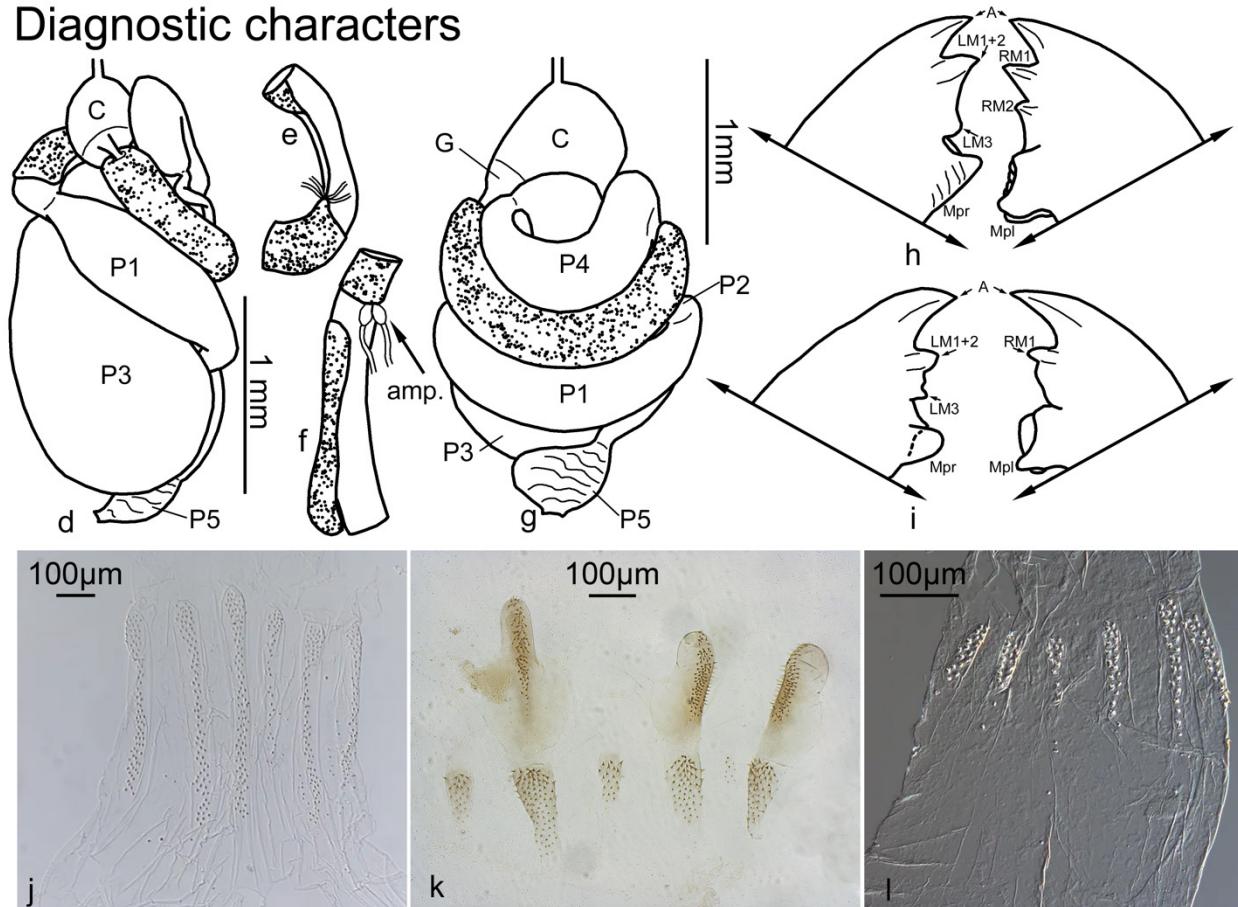
J. Šobotník: Supplementary Fig. 1(c), Supplementary Fig. 2(b), Supplementary Fig. 12(d).

# Amitermitinae

## Representative species



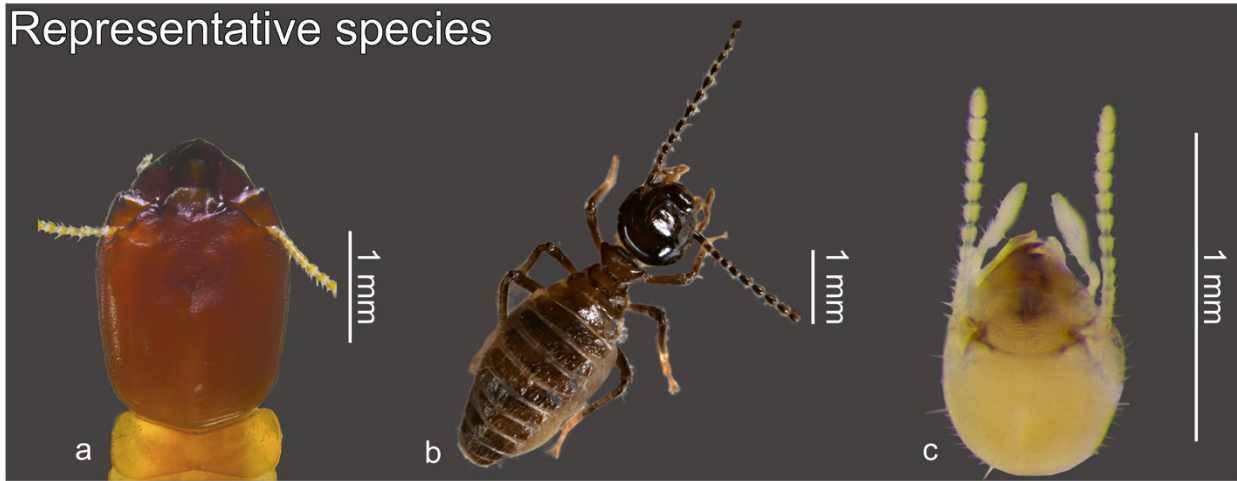
## Diagnostic characters



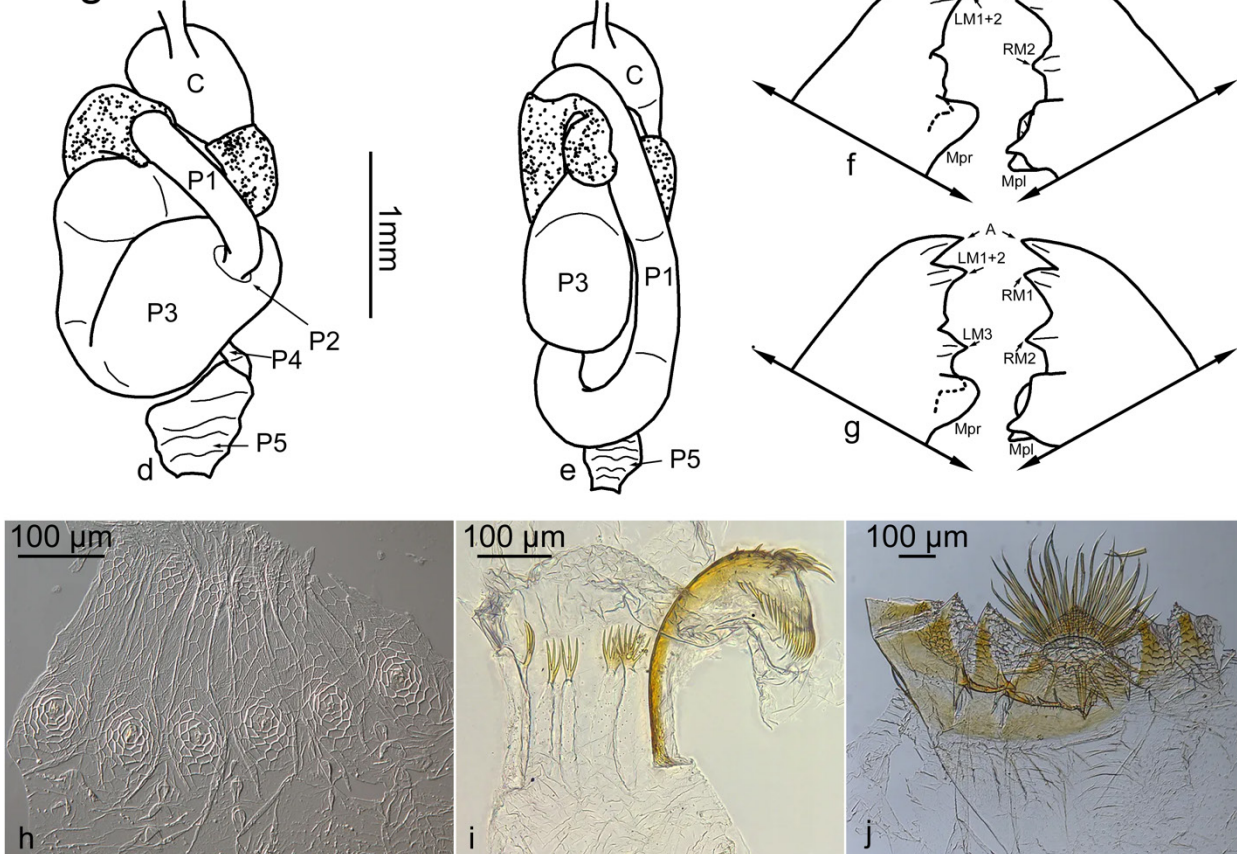
**Supplementary Figure 1:** Amitermitinae. Soldier heads, in dorsal view, of: (a) *Amitermes amifer*, (b) *Orthognathotermes humilis*, and (c) *Globitermes sulphureus*. Digestive tube: (d, e) in left view, and with detail of the Malpighian tubules insertion in *A. amifer* (adapted from Rocha & Cancellato<sup>24</sup>); (f) detail of the Malpighian tubules insertion in *Prohamitermes hosei* (adapted from Noirot<sup>4</sup>; Reproduced with permission of the Licensor through PLSclear) with an arrow indicating globular ampullae (amp.; four ampullae are present: two in front as drawn, and two on the opposite side), (g) *Dentispicotermes* sp. in dorsal view. Left and right worker mandibles (not to scale): (h) *A. lilloi* (adapted from Rocha & Cancellato<sup>24</sup>), (i) *Orthognathotermes insignis*. Enteric valve armatures: (j) *Drepanotermes rubriceps* (UF-AUS3), (k) *O. insignis* (MZUSP-3319), (l) *G. sulphureus* (UF-ASA15). Foregut: C, crop; G, gizzard. Midgut (stippled). Hindgut: P1, ileum; P2, enteric valve; P3, paunch; P4, colon; P5, rectum. Mandibles: A, apical tooth; LM, left marginal tooth; RM, right marginal tooth; Mpr, molar prominence; Mpl, molar plate.

# Apicotermatinae

## Representative species



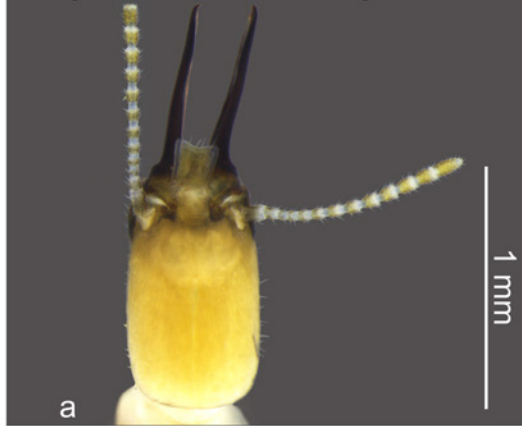
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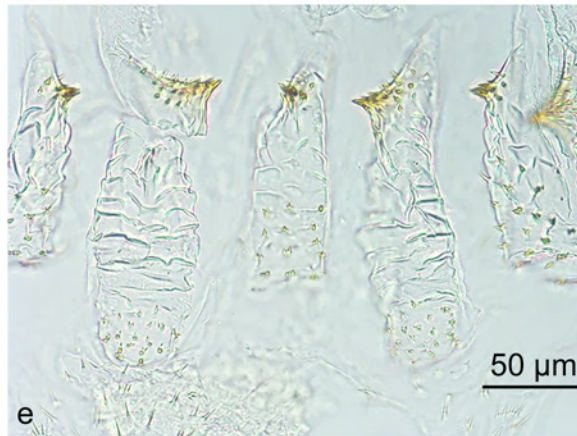
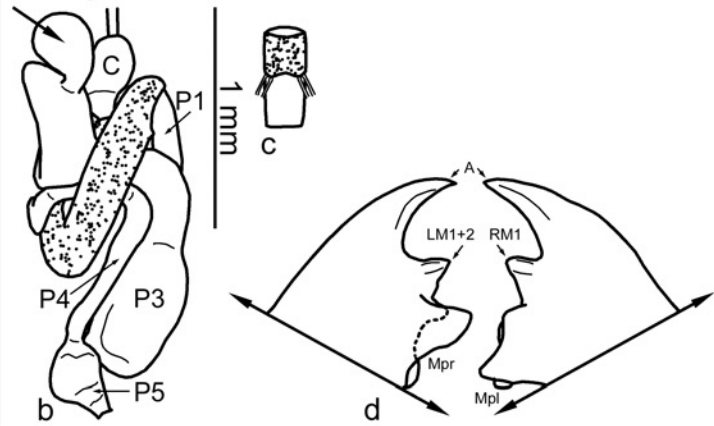
**Supplementary Figure 2:** Apicotermatinae. Dorsal views of (a) soldier of *Machadotermes rigidus*, and workers of (b) *Ruptitermes arboreus* and (c) *Anoplotermes pacificus*. Digestive tube (ventral view) of: (d) *Apicotermes gurgulifex* (MZUSP-224) and (e) *A. pacificus*. Left and right worker mandibles (not to scale): (f) *Ruptitermes arboreus* (adapted from Acioli & Constantino<sup>25</sup>), (g) *A. pacificus*. Enteric valve armatures: (h) *A. banksi* (UF-EC738), (i) *Ateuchotermes ctenophor* (UF-AFR1775), (j) *Duplidentitermes* sp. (UF-AFR1713). Foregut: C, crop; G, gizzard. Midgut (stippled). Hindgut: P1, ileum; P2, enteric valve; P3, paunch; P4, colon; P5, rectum. Mandibles: A, apical tooth; LM, left marginal tooth; RM, right marginal tooth; Mpr, molar prominence; Mpl, molar plate.

# Crepititermitinae

## Representative species



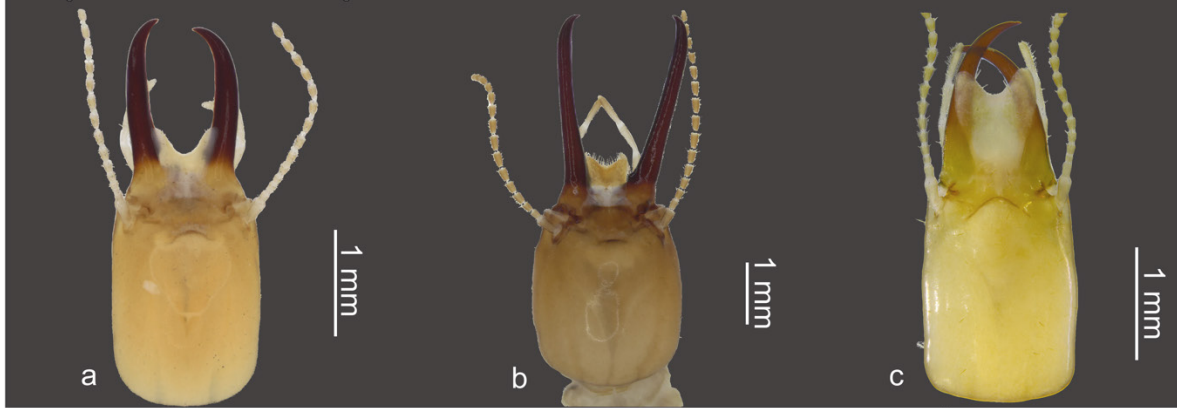
## Diagnostic characters



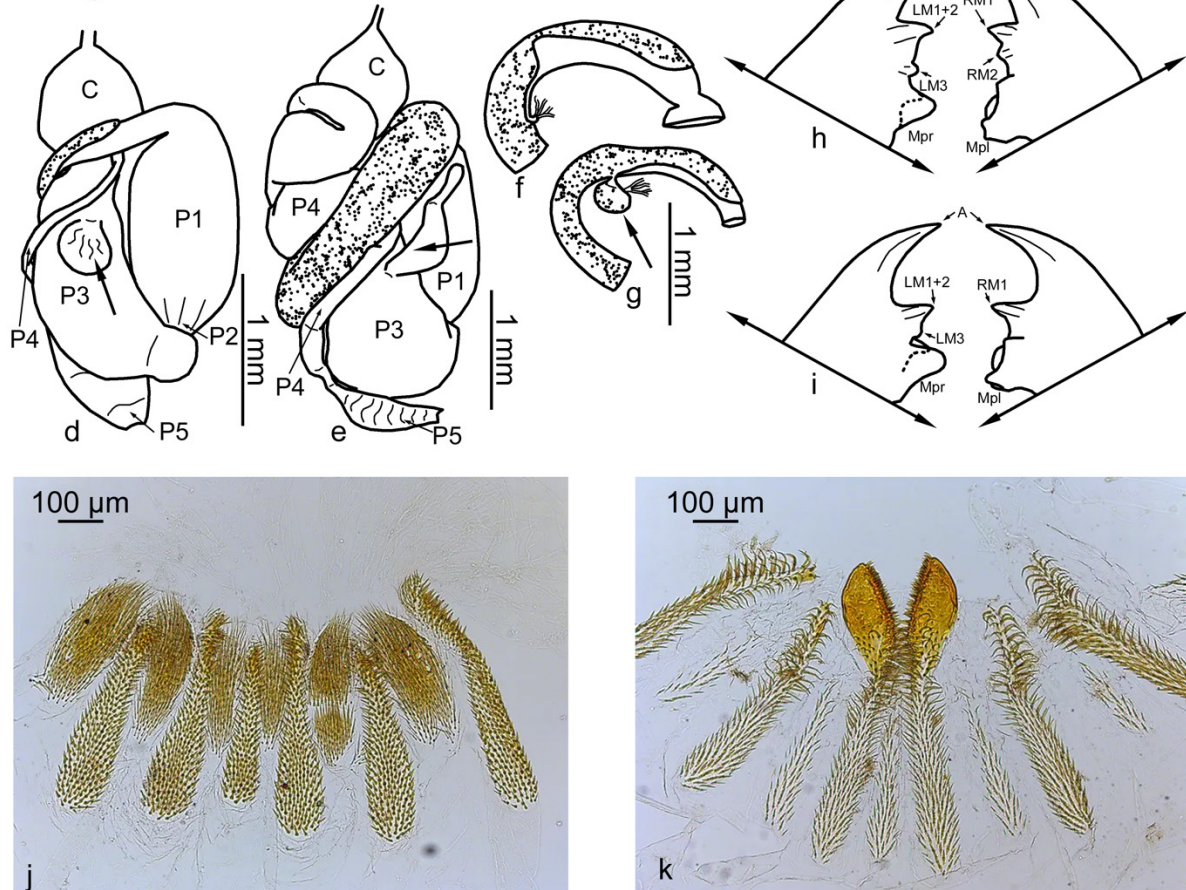
**Supplementary Figure 3:** Crepititermitinae, represented by its sole species, *Crepititermes verruculosus*. (a) Soldier's head, in dorsal view. (b) Digestive tube, in right view, with (c) detail of the Malpighian tubules insertion; the arrow indicates the P3 diverticulum (both adapted from Rocha & Cuezco<sup>26</sup>). (d) Left and right worker mandibles (not to scale; adapted from Rocha & Cuezco<sup>26</sup>). (e) Enteric valve armature (UF-PU715). Foregut: C, crop; G, gizzard. Midgut (stippled). Hindgut: P1, ileum; P2, enteric valve; P3, paunch; P4, colon; P5, rectum. Mandibles: A, apical tooth; LM, left marginal tooth; RM, right marginal tooth; Mpr, molar prominence; Mpl, molar plate.

# Cubitermitinae

## Representative species



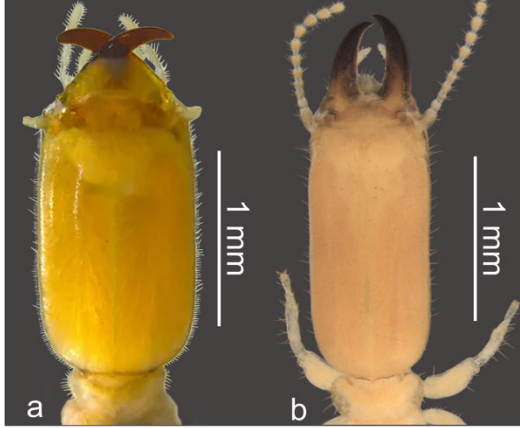
## Diagnostic characters



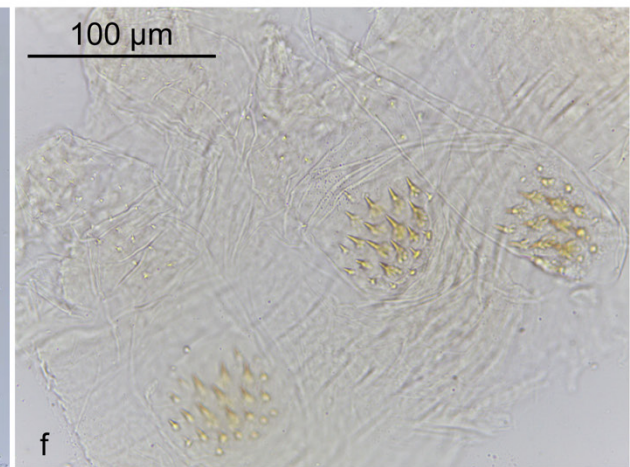
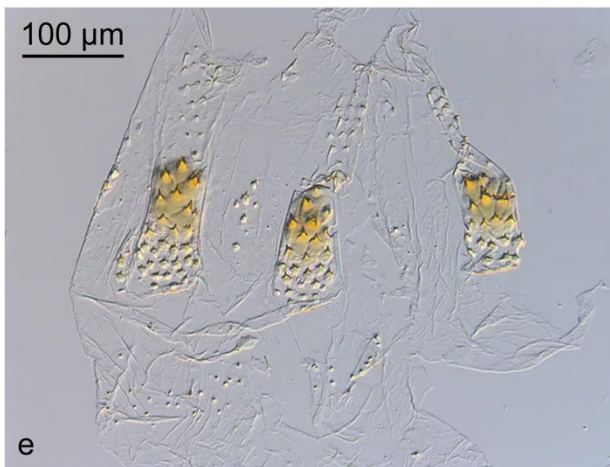
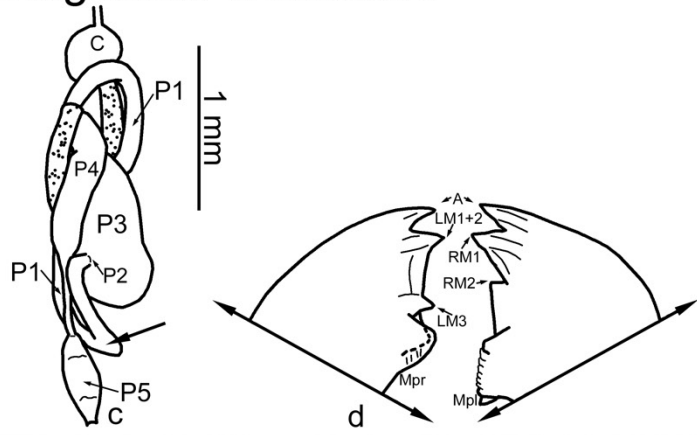
**Supplementary Figure 4:** Cubitermitinae. Soldier heads, in dorsal view, of: (a) *Cubitermes tenuiceps*, (b) *Megagnathotermes notandus*, and (c) *Euchilotermes tensus*. Digestive tube of (d) *C. exiguus* (DJ\_0152) in ventral view and (e) *Isognathotermes* sp. (MZUSP-13952) in right view (the arrows indicate the P3 diverticulum); detail of the mixed segment in (f) *I. ugandensis*, and (g) *Procubitermes sjostedti* (the arrow indicates the mesenteric nodule). Left and right worker mandibles: (h) *Isognathotermes* sp. (MZUSP-13952), (i) *Ophiotermes grandilabius* (DJ\_P210). Enteric valve armatures: (j) *O. grandilabius* (UF-AFR1315), and (k) *Nitiditermes schererii* (UF-AFR420). Foregut: C, crop; G, gizzard. Midgut (stippled). Hindgut: P1, ileum; P2, enteric valve; P3, paunch; P4, colon; P5, rectum. Mandibles: A, apical tooth; LM, left marginal tooth; RM, right marginal tooth; Mpr, molar prominence; Mpl, molar plate.

# Cylindrotermitinae

## Representative species



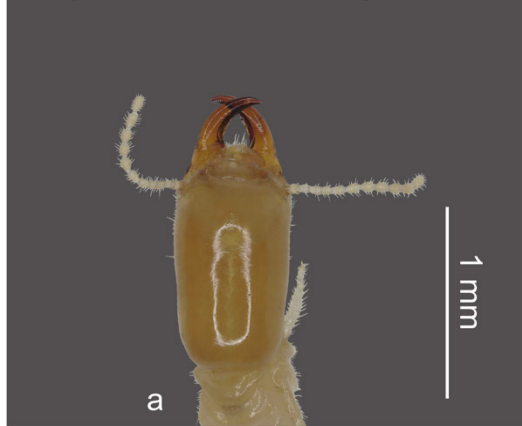
## Diagnostic characters



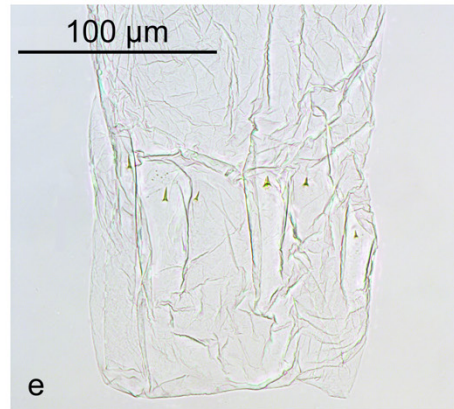
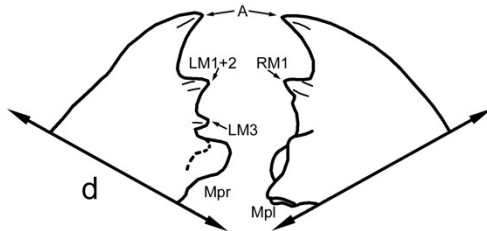
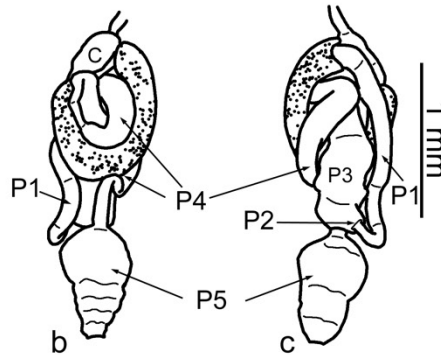
**Supplementary Figure 5:** Cylindrotermitinae. Soldier heads, in dorsal view, of (a) *Cephalotermes rectangularis* and (b) *Cylindrotermes parvignathus*. (c) Digestive tube of *C. parvignathus*, in right view, with arrow pointing to the P1 ventral loop (adapted from Rocha & Cuezco<sup>27</sup>). (d) Left and right worker mandibles (not to scale) of *C. parvignathus*. Enteric valve armatures: (e) *C. rectangularis* (UF-AFR1428) and (f) *Cylindrotermes brevipilosus* (MZUSP-24534). Foregut: C, crop; G, gizzard. Midgut (stippled). Hindgut: P1, ileum; P2, enteric valve; P3, paunch; P4, colon; P5, rectum. Mandibles: A, apical tooth; LM, left marginal tooth; RM, right marginal tooth; Mpr, molar prominence; Mpl, molar plate.

# Engelitermitinae

## Representative species



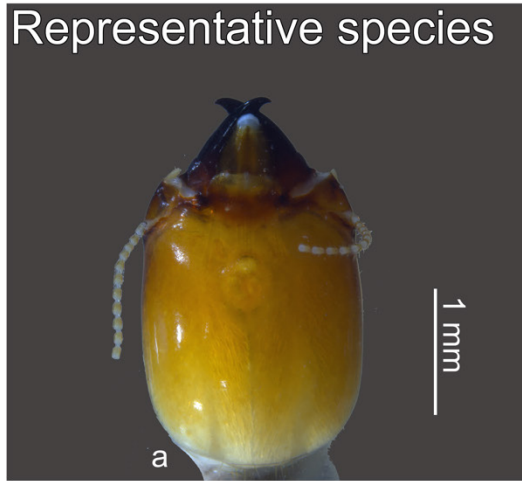
## Diagnostic characters



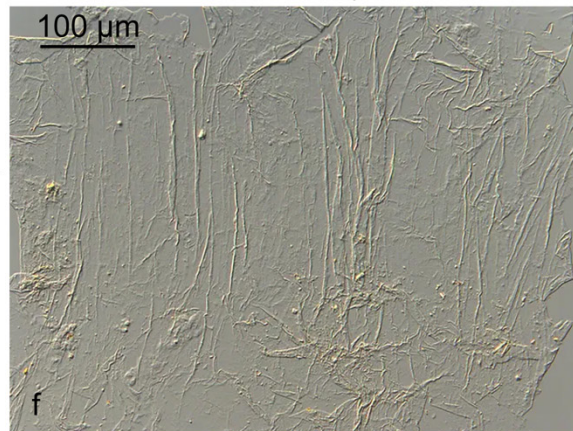
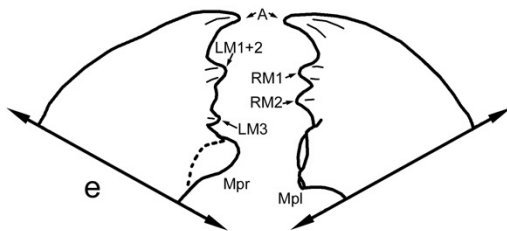
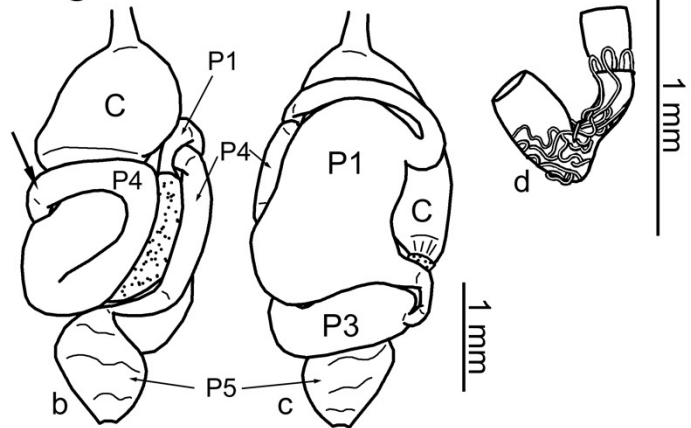
**Supplementary Figure 6:** Engelitermitinae, represented by its sole species, *Engelitermes zambo*. (a) Soldier's head, in dorsal view. Digestive tube in (b) dorsal view and (c) ventral view. (d) Left and right worker mandibles (not to scale). (e) Enteric valve armature. Foregut: C, crop; G, gizzard. Midgut (stippled). Hindgut: P1, ileum; P2, enteric valve; P3, paunch; P4, colon; P5, rectum. Mandibles: A, apical tooth; LM, left marginal tooth; RM, right marginal tooth; Mpr, molar prominence; Mpl, molar plate.

# Foraminitermitinae

## Representative species



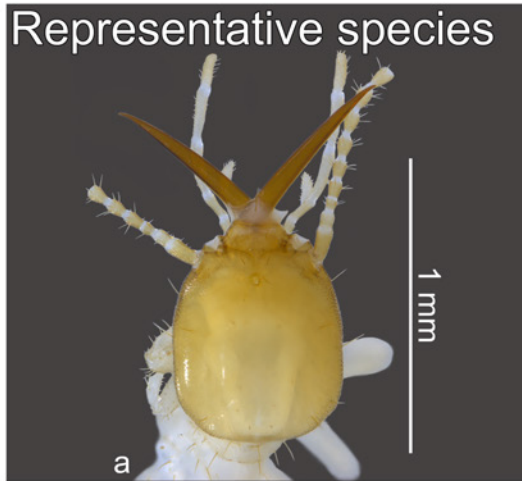
## Diagnostic characters



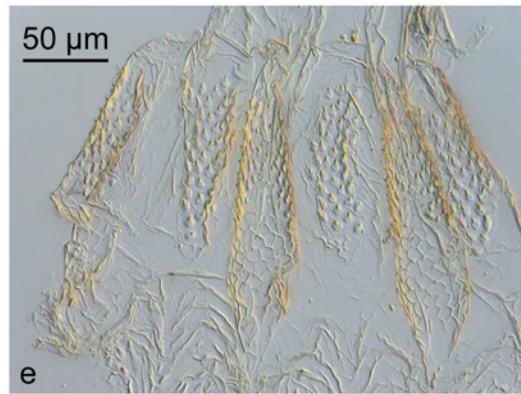
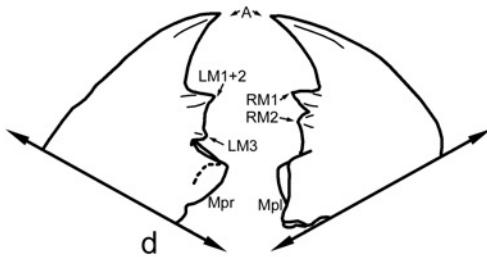
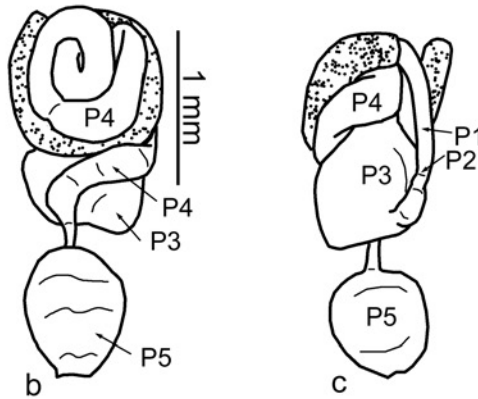
**Supplementary Figure 7:** Foraminitermitinae. Soldier's head, in dorsal view, of: (a) *Foraminitermes rhinoceros*. Digestive tube of *F. rhinoceros* (BDIT108), in (b) dorsal (with arrow pointing to the P4 U-turn, displaced to the left side of the body) and (c) ventral views. (d) *Labritermes kistneri* pseudo-Malpighian knot (adapted from Krishna & Adams<sup>28</sup>, with permission from the American Museum of Natural History). Left and right worker mandibles of (e) *F. rhinoceros* (not to scale). (f) (Unarmed) enteric valve armature of *Foraminitermes* sp. (UF-AFR1077). Foregut: C, crop; G, gizzard. Midgut (stippled). Hindgut: P1, ileum; P2, enteric valve; P3, paunch; P4, colon; P5, rectum. Mandibles: A, apical tooth; LM, left marginal tooth; RM, right marginal tooth; Mpr, molar prominence; Mpl, molar plate.

# Forficulitermitinae

## Representative species



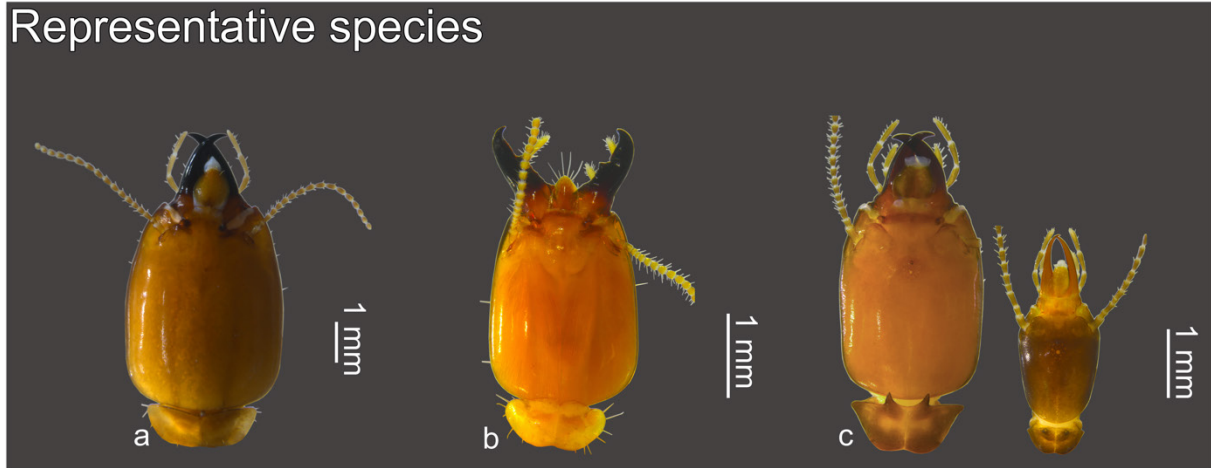
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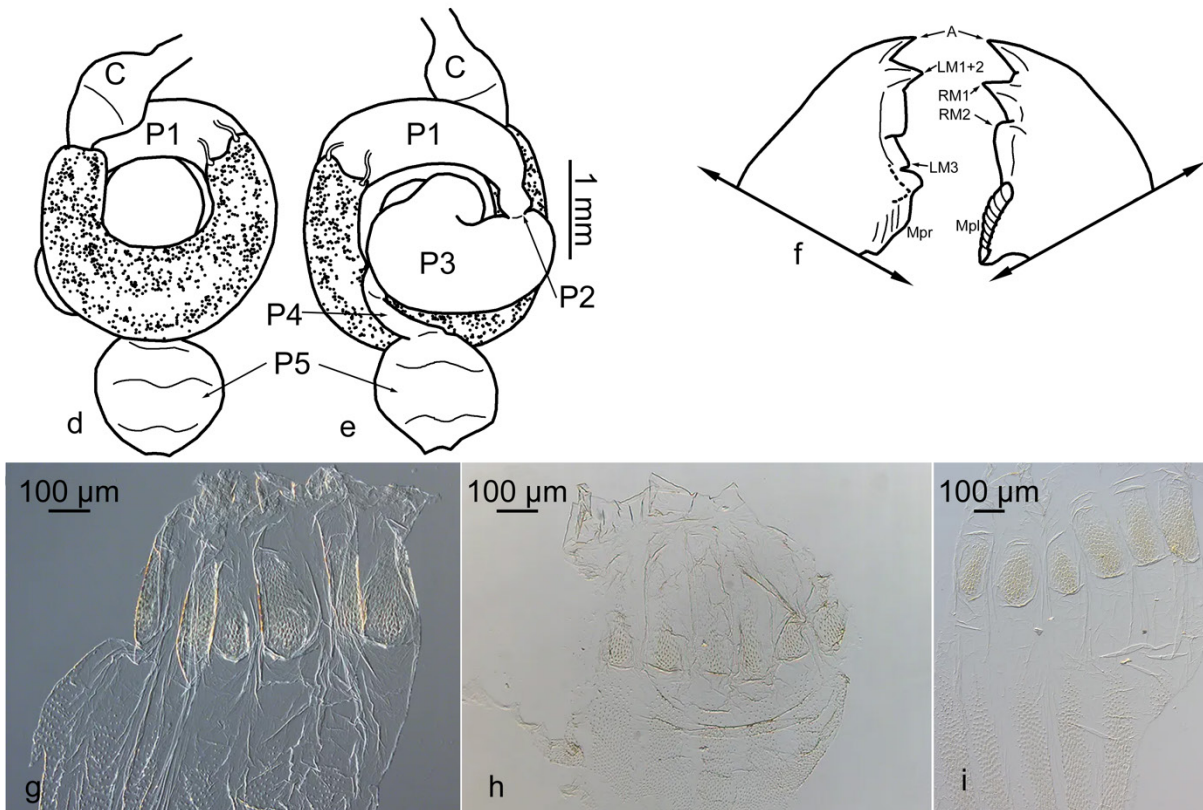
**Supplementary Figure 8:** Forficulitermitinae, represented by its sole species, *Forficulitermes planifrons*. (a) Soldier's head, in dorsal view. Digestive tube (with crop removed) in (b) dorsal and (c) ventral views (both adapted from Scheffrahn & Křeček<sup>29</sup>). (d) Left and right worker mandibles (not to scale, adapted from Scheffrahn & Křeček<sup>29</sup>). (e) Enteric valve armature (UF-AFR1664). Foregut: C, crop; G, gizzard. Midgut (stippled). Hindgut: P1, ileum; P2, enteric valve; P3, paunch; P4, colon; P5, rectum. Mandibles: A, apical tooth; LM, left marginal tooth; RM, right marginal tooth; Mpr, molar prominence; Mpl, molar plate.

# Macrotermitinae

## Representative species



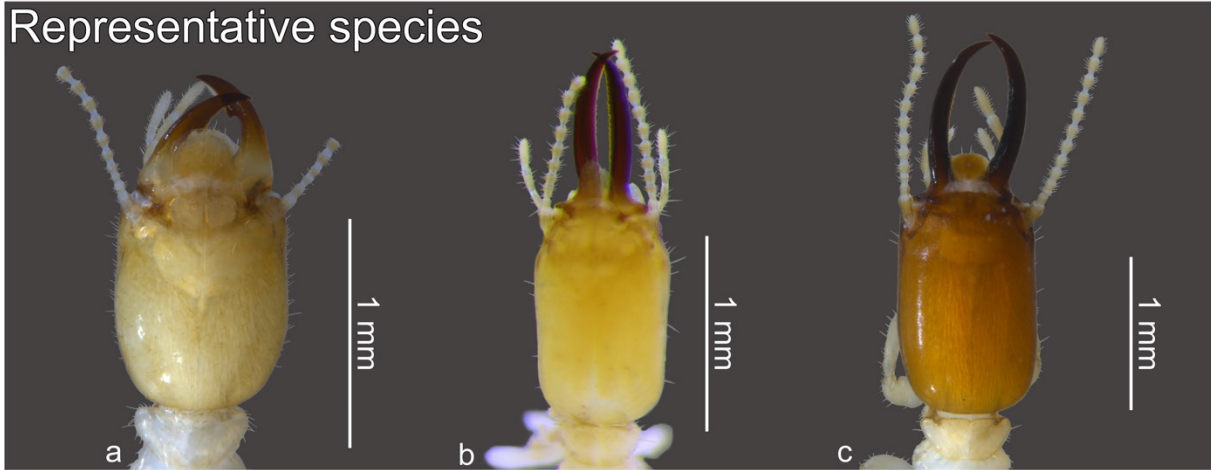
## Diagnostic characters



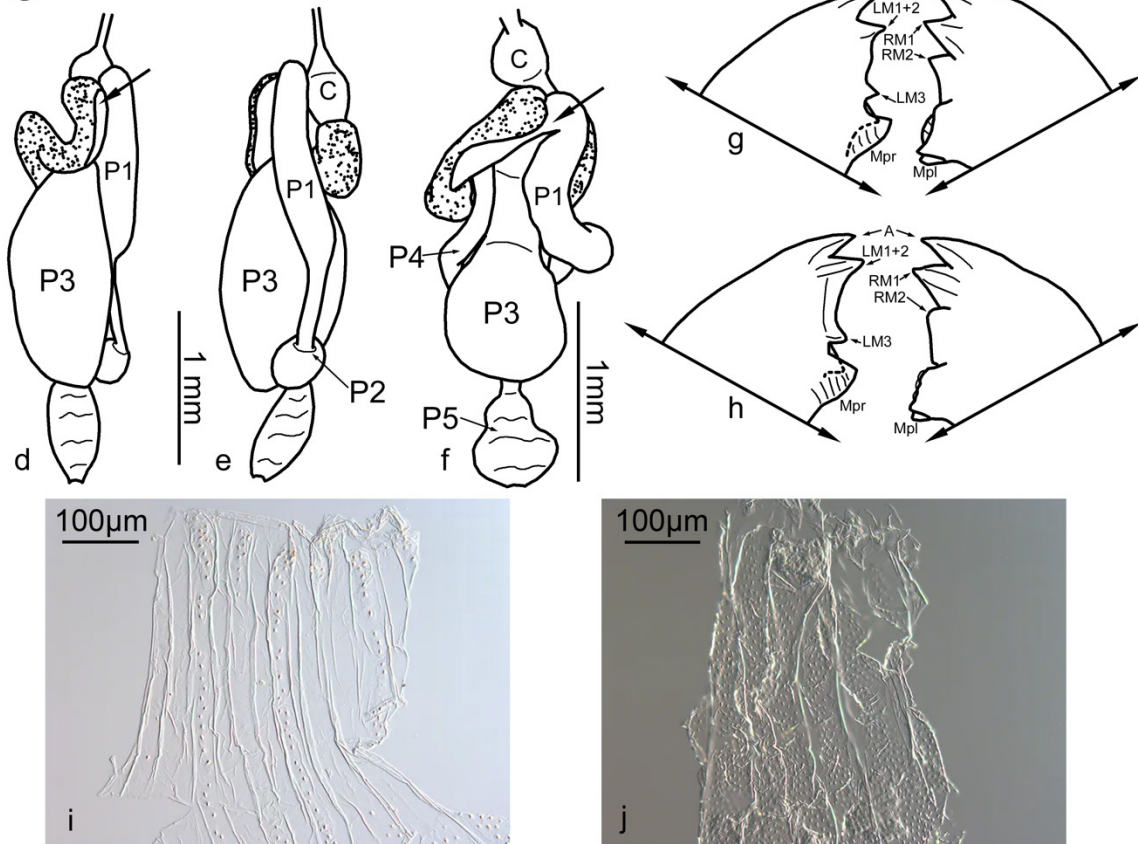
**Supplementary Figure 9:** Macrotermitinae. Soldier heads, in dorsal view, of (a) *Macrotermes bellicosus*, (b) *Odontotermes pauperans* and (c) *Pseudacanthotermes spiniger* (major, left; minor, right). Digestive tube of *Macrotermes gilvus* (PHP046), in (d) dorsal and (e) ventral views. Left and right worker mandibles of (f) a large worker of *Macrotermes natalensis* (not to scale, MZUSP-13960). Enteric valve armatures of: (g) *Macrotermes* sp. (UF-AFR1046), (h) *Allodontermes* sp. (UF-NGR-FWs002) and (i) *Pseudacanthotermes* sp. (UF-NRG-CL001). Foregut: C, crop; G, gizzard. Midgut (stippled). Hindgut: P1, ileum; P2, enteric valve; P3, paunch; P4, colon; P5, rectum. Mandibles: A, apical tooth; LM, left marginal tooth; RM, right marginal tooth; Mpr, molar prominence; Mpl, molar plate.

# Microcerotermitinae

## Representative species



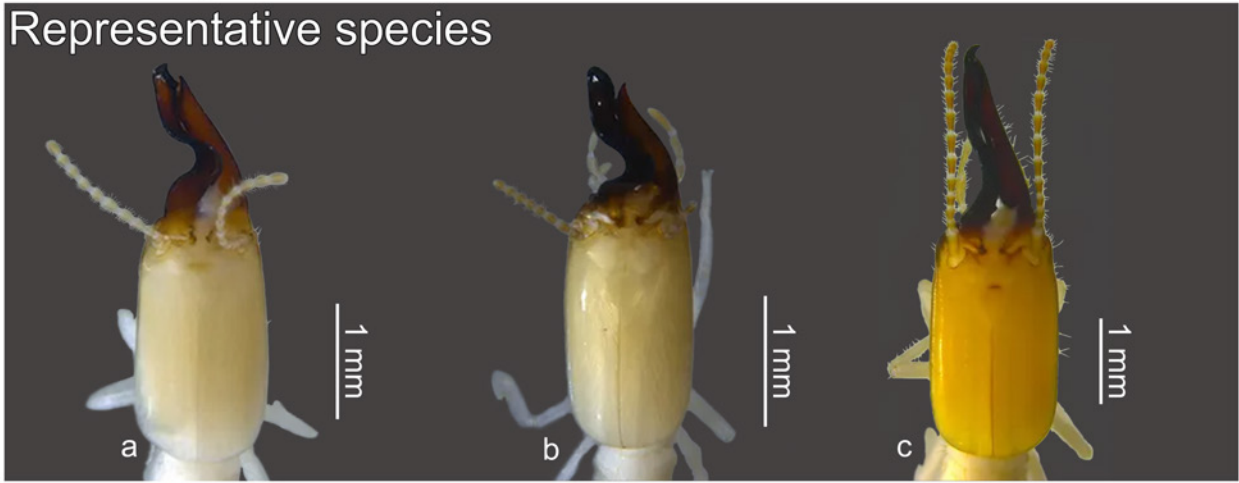
## Diagnostic characters



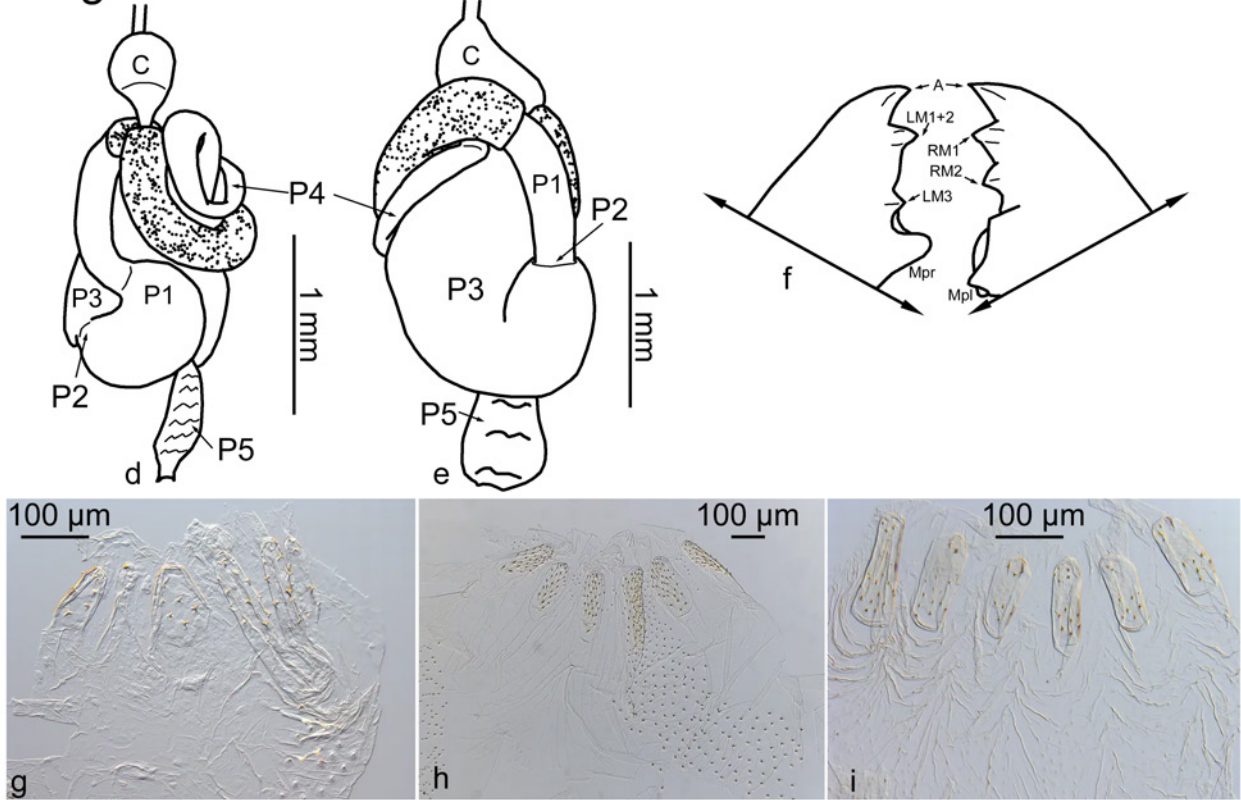
**Supplementary Figure 10:** Microcerotermitinae. Soldier heads, in dorsal view, of: (a) *Onkotermes* sp. (PA1019), (b) *Microcerotermes* sp., (c) *Microcerotermes cameroni*. Digestive tube of *Onkotermes brevicorniger* in (d) ventral and (e) left views (adapted from Constantino *et al.*<sup>30</sup>, with permission from the Editorial Office of Sociobiology); and (f) *Microcerotermes biroi*, in ventral view. The arrows in (d, f) indicate the characteristic elbowed midgut-ileum junction. Left and right worker mandibles (not to scale) of: (g) a large worker of *O. brevicorniger* (adapted from Constantino *et al.*<sup>30</sup>, with permission from the Editorial Office of Sociobiology); and (h) *M. papuanus*. Enteric valve armatures of (i) *Microcerotermes exiguus* (PA558) and (j) *Microcerotermes* sp. (AFR1046). Foregut: C, crop; G, gizzard. Midgut (stippled). Hindgut: P1, ileum; P2, enteric valve; P3, paunch; P4, colon; P5, rectum. Mandibles: A, apical tooth; LM, left marginal tooth; RM, right marginal tooth; Mpr, molar prominence; Mpl, molar plate.

# Mirocapritermitinae

## Representative species



## Diagnostic characters



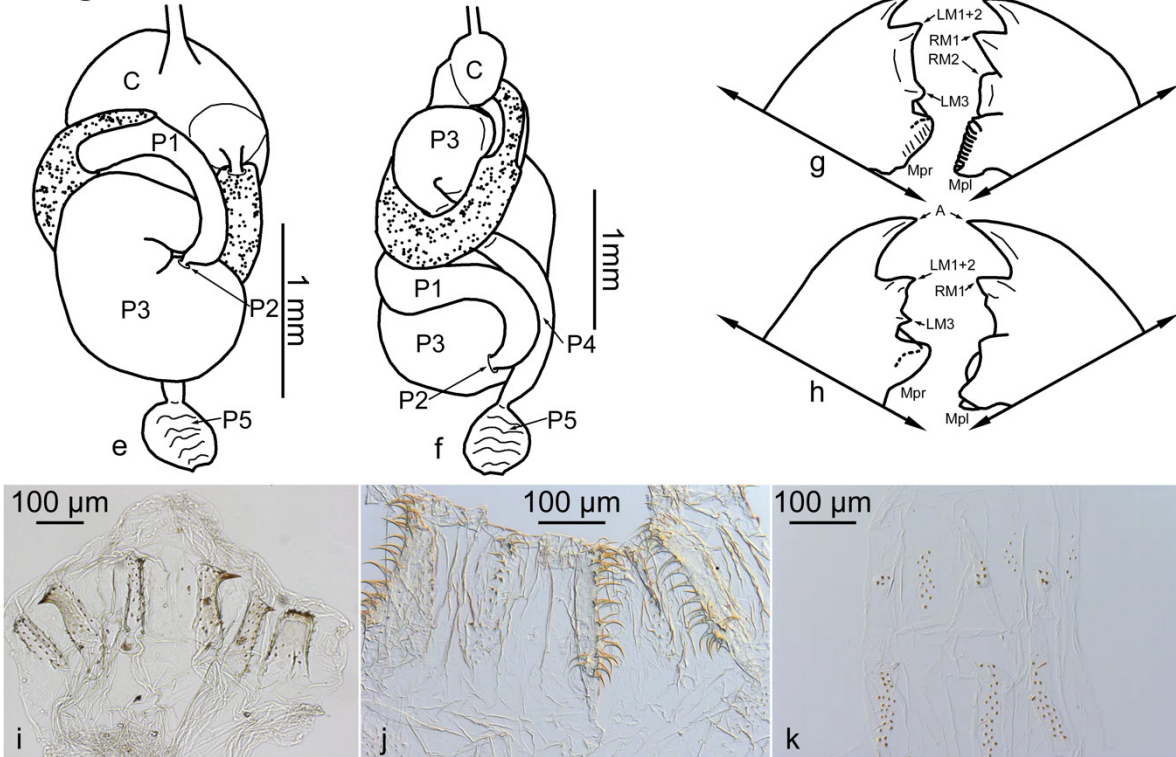
**Supplementary Figure 11:** Mirocapritermitinae. Soldier heads, in dorsal view, of: (a) *Dicuspiditermes nemorosus*, (b) *Pericapritermes* sp. (AFR671) and (c) *Pseudocapritermes* sp. (ASA343). Digestive tube of: (d) *Pericapritermes ceylonicus* in left view, and (e) *Pseudocapritermes fletcheri* in ventral view (adapted from Noirot<sup>4</sup>; Reproduced with permission of the Licensor through PLSclear). (f) Left and right worker mandibles (not to scale) of *D. obtusus* (adapted from Krishna<sup>31</sup>, with permission from the American Museum of Natural History). Enteric valve armatures: (g) *D. nemorosus* (UF-ASA109), (h) *Pericapritermes* sp. (UF-AFR1360) and (i) *Sinocapritermes mushae* (UF-ASA148). Foregut: C, crop; G, gizzard. Midgut (stippled). Hindgut: P1, ileum; P2, enteric valve; P3, paunch; P4, colon; P5, rectum. Mandibles: A, apical tooth; LM, left marginal tooth; RM, right marginal tooth; Mpr, molar prominence; Mpl, molar plate.

# Nasutitermitinae

## Representative species



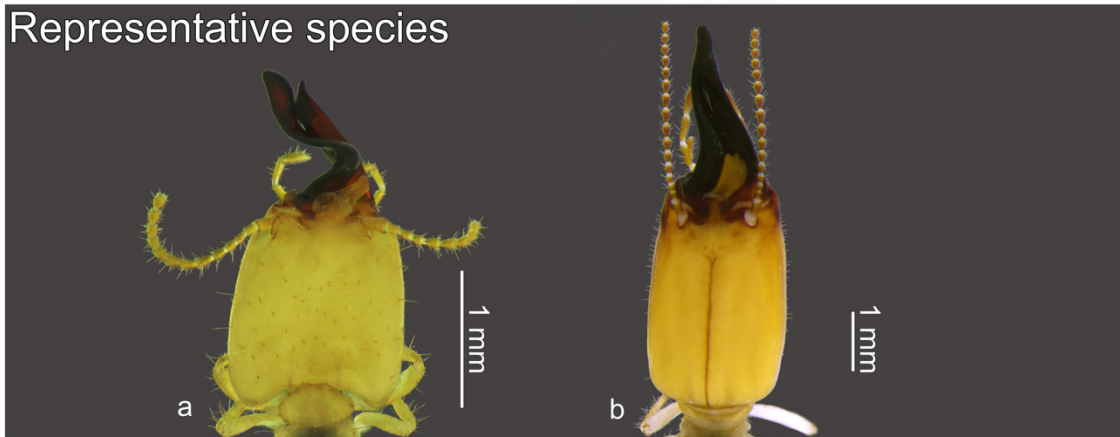
## Diagnostic characters



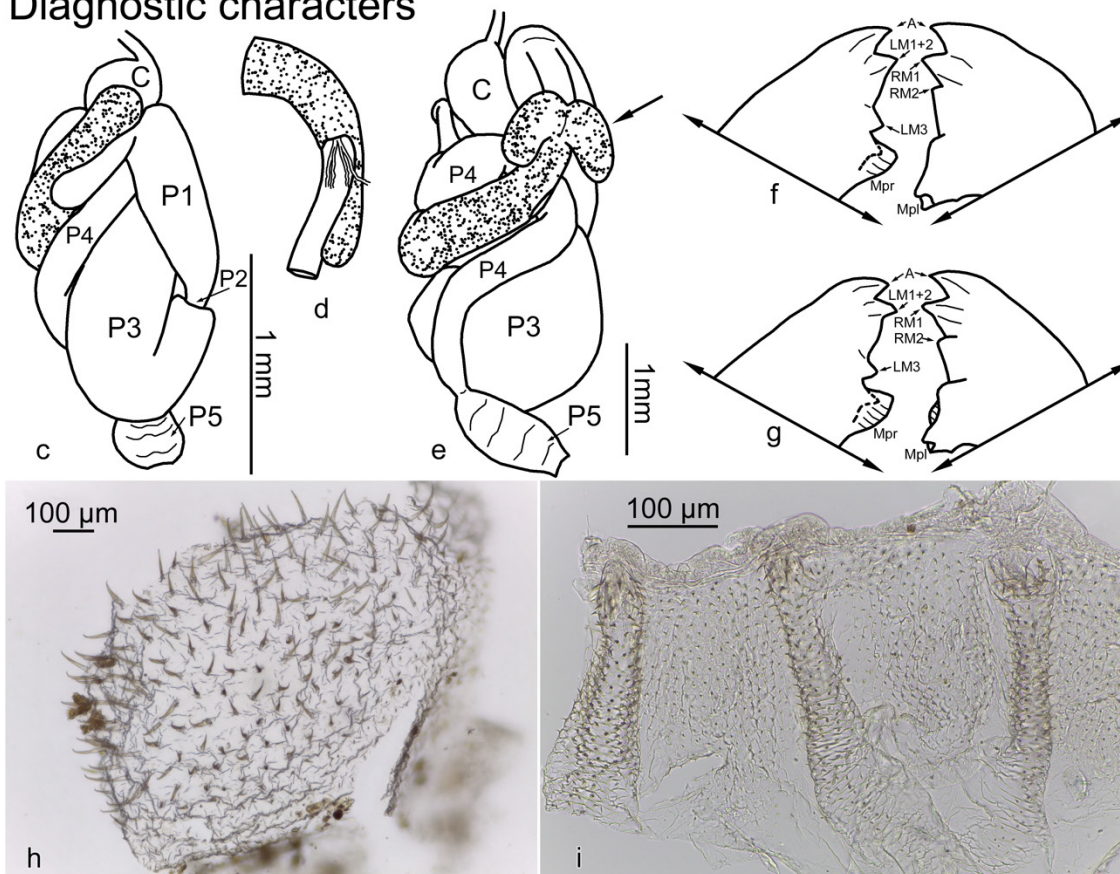
**Supplementary Figure 12:** Nasutitermitinae. Soldier heads (a) in lateral view of *Angularitermes pinocchio*; and in dorsal views of (b) *Tenuirostritermes* n. sp. (VZ8), (c) *Trinervitermes trinervius*, and (d) *Verrucositermes tuberosus*. Digestive tube (both adapted from Fontes<sup>32</sup>, with permission from the author) of: (e) *Constrictotermes cypergaster* in ventral view and (f) *Nasutitermes corniger* in dorsal view. Left and right worker mandibles (not to scale): (g) *N. corniger* (adapted from Fontes<sup>32</sup>, with permission from the author), and (h) *Ereymatermes piquira* (adapted from Cancellato & Cuezco<sup>33</sup>, with permission from the Editor of Papéis Avulsos de Zoologia). Enteric valve armatures: (i) *Angularitermes coninasus* (MZUSP-13445), (j) *Parvitermes antillarum* (UF-DR1518) and (k) *Nasutitermes* sp. (UF-NGR-T1002). Foregut: C, crop; G, gizzard. Midgut (stippled). Hindgut: P1, ileum; P2, enteric valve; P3, paunch; P4, colon; P5, rectum. Mandibles: A, apical tooth; LM, left marginal tooth; RM, right marginal tooth; Mpr, molar prominence; Mpl, molar plate.

# Neocapritermitinae

## Representative species



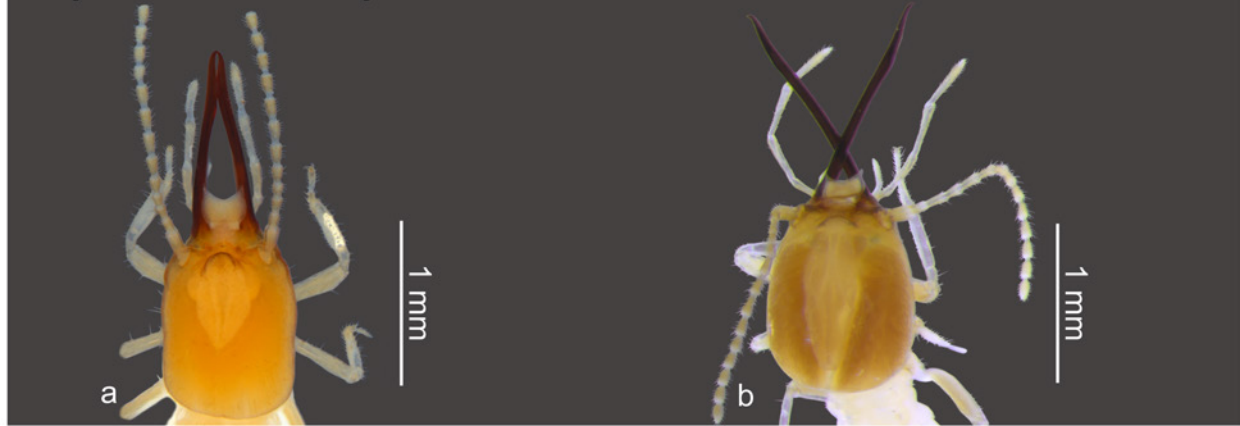
## Diagnostic characters



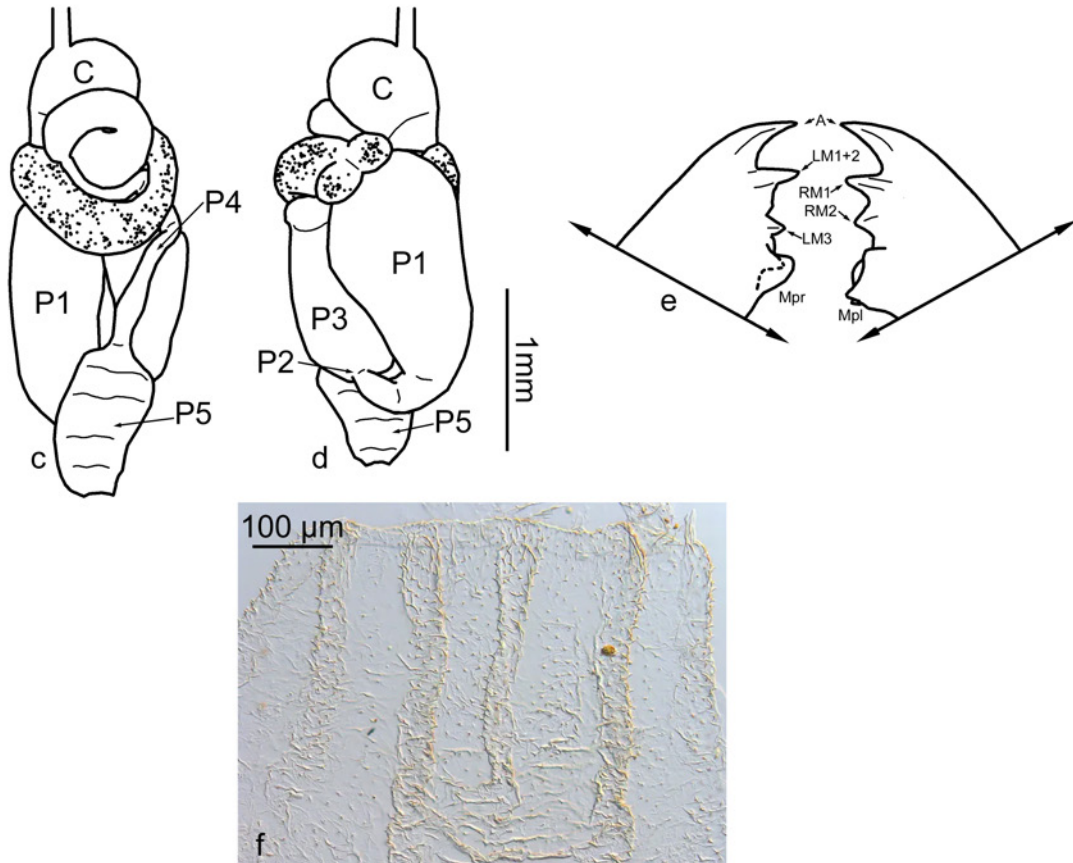
**Supplementary Figure 13:** Neocapritermitinae. Soldiers' head, in dorsal view, of (a) *Planicapritermes planiceps*, and (b) *Neocapritermes opacus*. Digestive tube of *P. planiceps*, in (c) ventral view (note the elbowed midgut-ileum junction as in the Microcerotermitinae), with (d) detail of the Malpighian tubules insertion (both adapted from Constantino<sup>34</sup>, with permission from the Editorial Office of Sociobiology); and (e) *N. opacus* in right view, with an arrow indicating the mesenteric sacs. Left and right worker mandibles (not to scale): (f) *P. planiceps* (adapted from Ahmad<sup>18</sup>, with permission from the American Museum of Natural History); and (g) *N. opacus* (adapted from Krishna & Araujo<sup>35</sup>, with permission from the American Museum of Natural History). (h) Paunch (inverted to expose its internal ornaments) and (i) enteric valve armature of *N. opacus* (MZUSP-10182). Foregut: C, crop; G, gizzard. Midgut (stippled). Hindgut: P1, ileum; P2, enteric valve; P3, paunch; P4, colon; P5, rectum. Mandibles: A, apical tooth; LM, left marginal tooth; RM, right marginal tooth; Mpr, molar prominence; Mpl, molar plate.

# Promirotomitinae

## Representative species



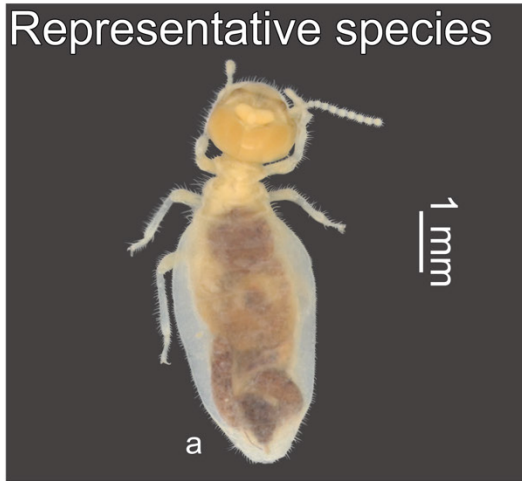
## Diagnostic characters



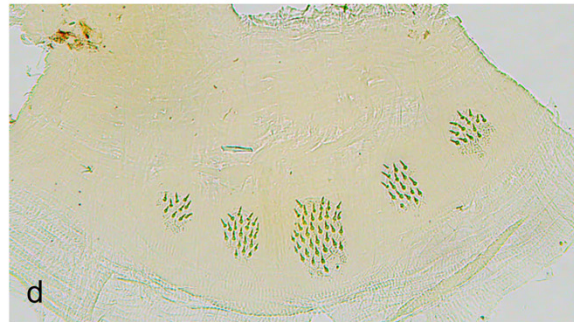
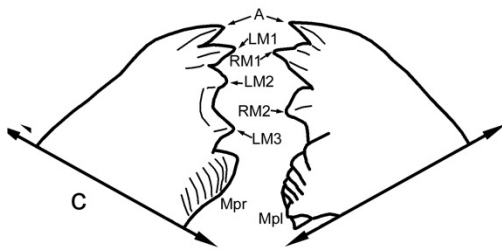
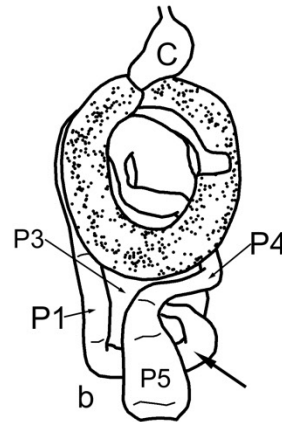
**Supplementary Figure 14:** Promirotomitinae. Soldier heads, in dorsal view, of (a) *Angulitermes keralai*, and (b) *Promirotitermes gracilipes*. Digestive tube of *P. holmgreni* (CIVT048) in (c) dorsal and (d) ventral views; (e) left and right worker mandibles (VIVT048). (f) Enteric valve armature of *Promirotitermes* sp. (UF-AFR1635). Foregut: C, crop; G, gizzard. Midgut (stippled). Hindgut: P1, ileum; P2, enteric valve; P3, paunch; P4, colon; P5, rectum. Mandibles: A, apical tooth; LM, left marginal tooth; RM, right marginal tooth; Mpr, molar prominence; Mpl, molar plate.

# Protohamitermitinae

## Representative species



## Diagnostic characters



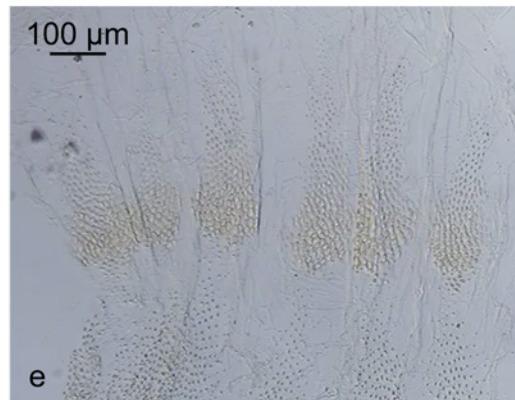
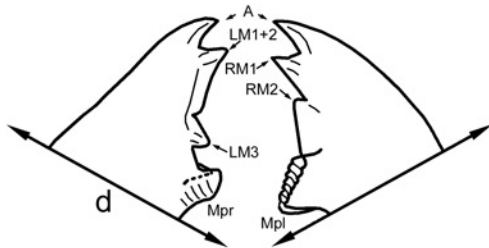
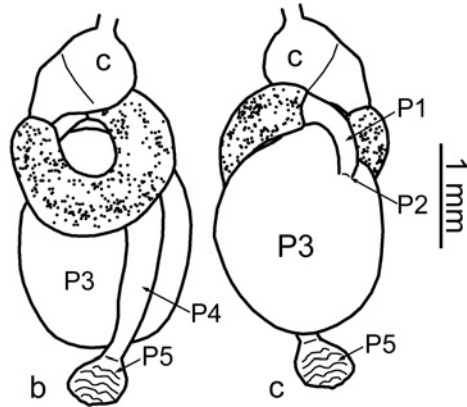
**Supplementary Figure 15:** Protohamitermitinae. represented by the species *Protohamitermes globiceps*. (a) Worker. (b) Digestive tube, in dorsal view (adapted from Noirot<sup>4</sup>; Reproduced with permission of the Licensor through PLSclear), with arrow pointing to the P1 ventral loop. (c) Left and right worker mandibles (not to scale). (d) Enteric valve armature. Foregut: C, crop; G, gizzard. Midgut (stippled). Hindgut: P1, ileum; P2, enteric valve; P3, paunch; P4, colon; P5, rectum. Mandibles: A, apical tooth; LM, left marginal tooth; RM, right marginal tooth; Mpr, molar prominence; Mpl, molar plate.

# Sphaerotermitinae

## Representative species



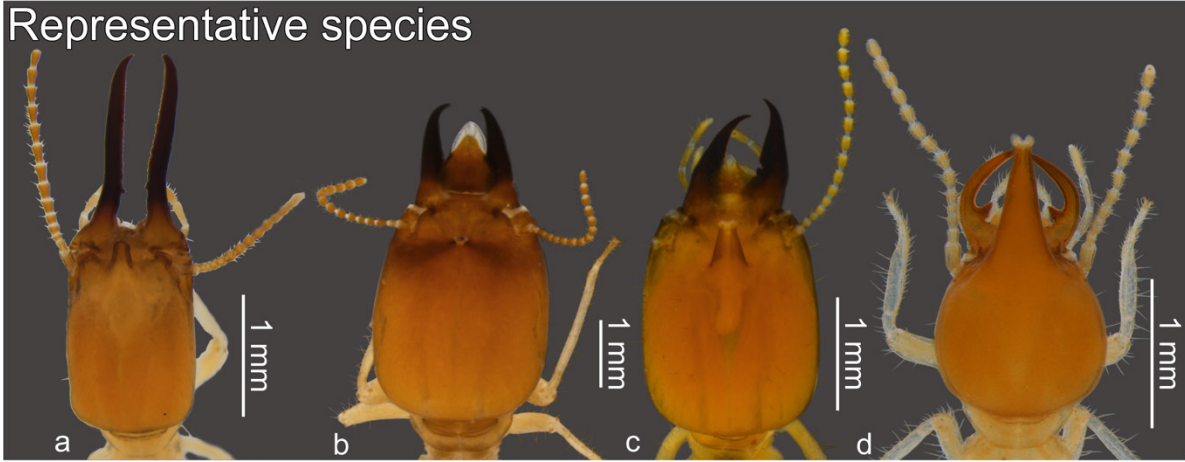
## Diagnostic characters



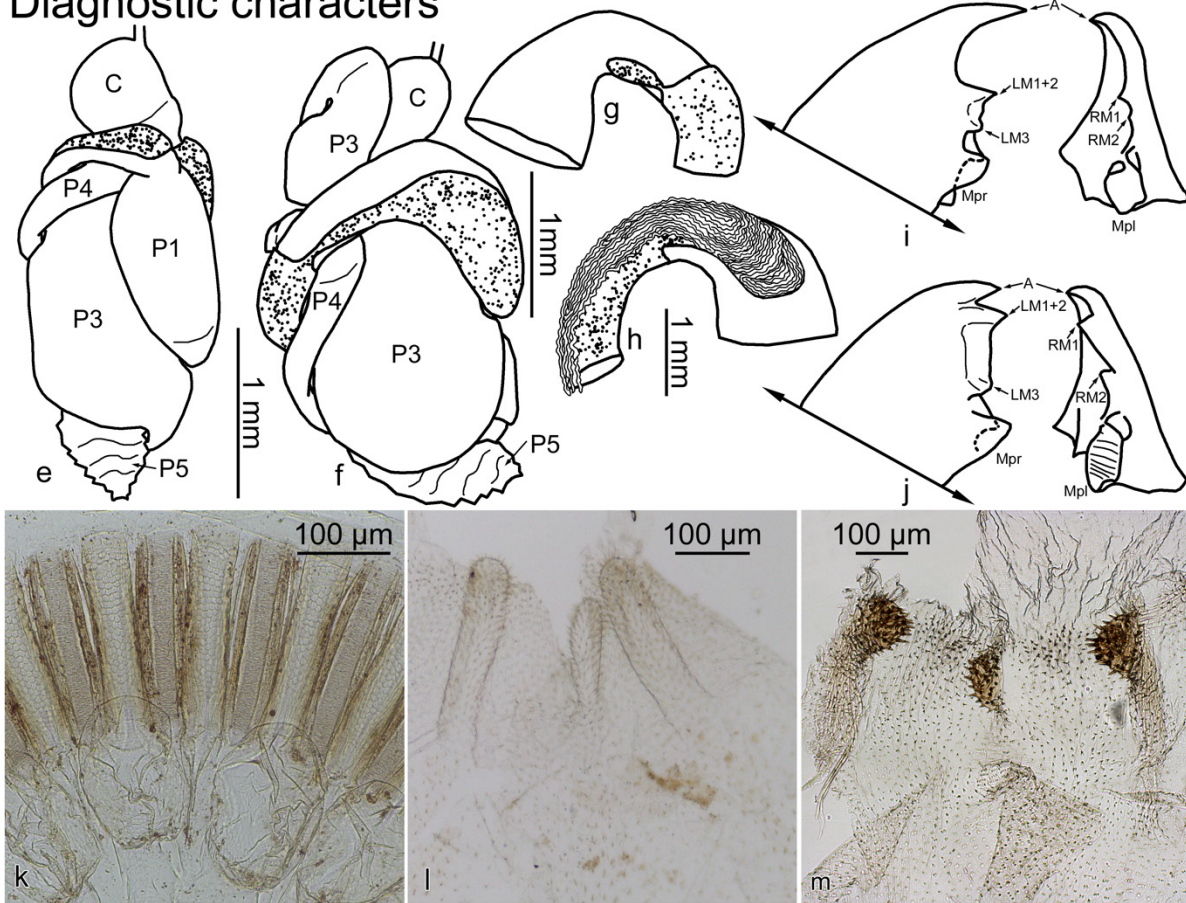
**Supplementary Figure 16:** Sphaerotermitinae, represented by the species *Sphaerotermites sphaerotherax*. (a) Soldier's head, in dorsal view. Digestive tube of *S. sphaerotherax* (CMRT042), in (b) dorsal view and (c) ventral view. (d) Left and right worker mandibles. (e) Enteric valve armature of *Sphaerotermites* sp. (UF-AFR1212). Foregut: C, crop; G, gizzard. Midgut (stippled). Hindgut: P1, ileum; P2, enteric valve; P3, paunch; P4, colon; P5, rectum. Mandibles: A, apical tooth; LM, left marginal tooth; RM, right marginal tooth; Mpr, molar prominence; Mpl, molar plate.

# Syntermitinae

## Representative species



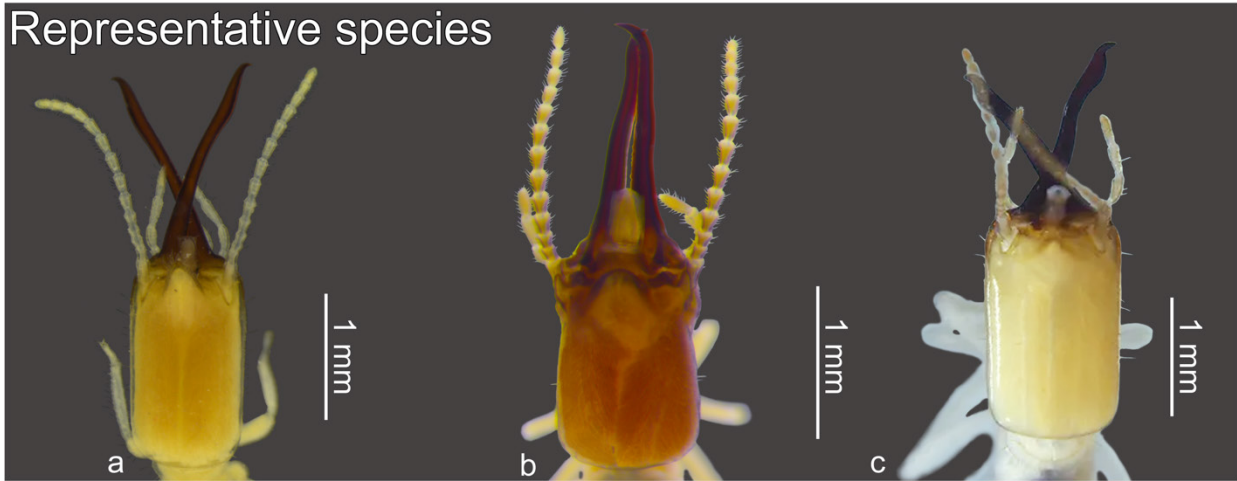
## Diagnostic characters



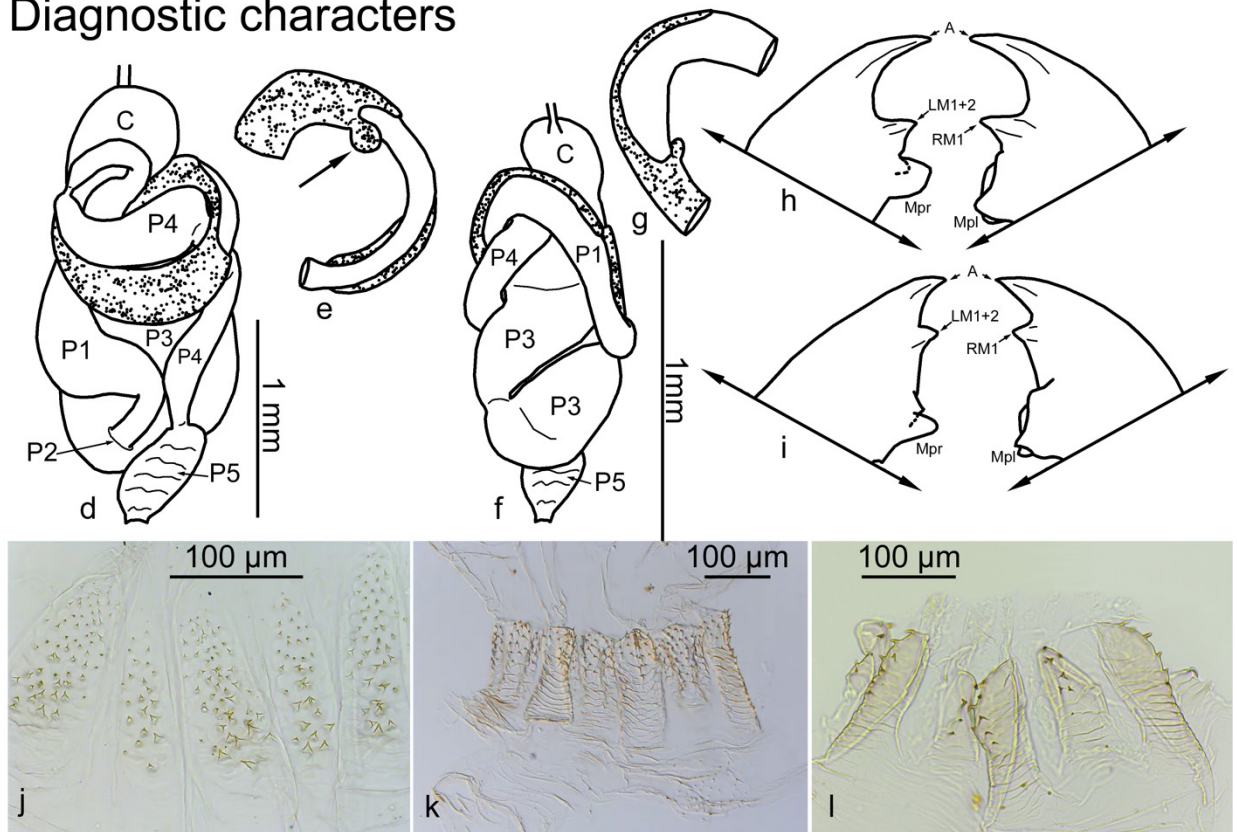
**Supplementary Figure 17:** Syntermitinae. Soldier heads, in dorsal view, of: (a) *Genuotermes spinifer*, (b) *Labiotermes labralis*, (c) *Procornitermes araujo* and (d) *Silvestritermes euamignathus*. Digestive tube of (e) *G. spinifer*, in ventral view (adapted from Rocha<sup>36</sup>); (f, g) *Cornitermes cumulans*, detail of the major and minor mesenteric tongues; (h) *Syntermes dirus*, mixed segment with Malpighian knot represented. Left worker mandible and right mandible internal face of (i) *Curvitermes odontognathus* and (j) *C. cumulans* (not to scale, both adapted from Fontes<sup>32</sup>, with permission from the author). (k) Gizzard armature of *C. cumulans*. Enteric valve armatures of: (l) *Embiratermes festivelus* (MZUSP-1215), (m) *C. cumulans* (MZUSP-14328). Foregut: C, crop; G, gizzard. Midgut (stippled). Hindgut: P1, ileum; P2, enteric valve; P3, paunch; P4, colon; P5, rectum. Mandibles: A, apical tooth; LM, left marginal tooth; RM, right marginal tooth; Mpr, molar prominence; Mpl, molar plate.

# Termitinae

## Representative species



## Diagnostic characters



**Supplementary Figure 18:** Termitinae. Soldier heads, in dorsal view, of: (a) *Termes fatalis*, (b) *Tuberculitermes* sp. (MZUSP-27659, Renato L. Araujo, 14 May 1964, Kwango River, Democratic Republic of the Congo) and (c) *Quasitermes incisus*. Digestive tube of *Termes fatalis* in (d) dorsal view with (e) detail of the mixed segment (the arrow indicates the mesenteric nodule); and *Divinotermes digitatus* (MZUSP-22502) in (f) ventral view with (g) detail of the mixed segment. Left and right worker mandibles (not to scale) of (h) *Divinotermes digitatus* (MZUSP-22502) and (i) *Cornicapritermes mucronatus* (adapted from Krishna<sup>31</sup>, with permission from the American Museum of Natural History). Enteric valve armatures of (j) *Termes fatalis* (UF-BO422), (k) *Tuberculitermes* sp. (UF-AFR1675) and (l) *Cavitermes tuberosus* (MZUSP-12224). Foregut: C, crop; G, gizzard. Midgut (stippled). Hindgut: P1, ileum; P2, enteric valve; P3, paunch; P4, colon; P5, rectum. Mandibles: A, apical tooth; LM, left marginal tooth; RM, right marginal tooth; Mpr, molar prominence; Mpl, molar plate.

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