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ORIGINAL ARTICLE

Caputitermes, a new genus of soldierless termite (Blattaria: Isoptera: Termitidae) with dimorphic workers from the Amazon rainforest

Rayssa ALMEIDA-AZEVEDO[1]*, Agno Nonato Serrão ACIOLI[2], José Wellington de MORAIS[1], Renato Almeida de AZEVEDO[1]

[1] Instituto Nacional de Pesquisas da Amazônia - INPA, Coordenação de Biodiversidade - COBIO, Av. André Araújo 2936, Petrópolis, 69083-000 Manaus, AM, Brazil

[2] Universidade Federal do Amazonas – UFAM, Faculdade de Ciências Agrárias - FCA, Av. Rodrigo Otávio Jordão Ramos 3000, Campus Universitário, Coroado, Manaus, AM, Brazil

* Corresponding author: rayssa.a.azevedo@gmail.com; https://orcid.org/0000-0003-2045-3878

ABSTRACT

Soldierless termites (Blattodea: Isoptera: Apicotermitinae) are a small and taxonomically poorly known group, especially in the Neotropical region. In this paper we describe a new monotypic genus *Caputitermes* gen. nov. with a straight mesenteron-P1 junction, and absence of mixed segment. The species *Caputitermes dimorphus* sp. nov., which stands out for having two types of workers.

KEYWORDS: taxonomy, worker gut, enteric valve, Apicotermitinae

Caputitermes, um novo gênero de cupim sem soldado (Blattaria: Isoptera: Termitidae) da floresta amazônica com dimorfismo na casta operário

RESUMO

Os cupins sem soldados (Blattodea: Isoptera: Apicotermitinae) são um grupo pequeno e taxonomicamente pouco conhecido, principalmente na região neotropical. Neste artigo descrevemos um novo gênero monotípico *Caputitermes* gen. nov., que possui a junção mesênetero-P1 reta e ausência de segmento misto. A espécie *Caputitermes dimorphus* sp. nov., se destaca por ter dois tipos de operários.

PALAVRAS-CHAVE: taxonomia, intestino de operário, válvula entérica, Apicotermitinae

INTRODUCTION

Apicotermitinae (Blattodea: Isoptera) are known for being soldierless termites, however, some basal species still have the soldier caste and are only found in Africa and Asia (Bourguignon *et al*. 2016; Romero Arias *et al*. 2020). In the Neotropical Apicotermitinae, the solider caste is not present (Constantino 2022). One possible explanation for this caste loss may be an energy-cost reduction to the colony, motivated by the low efficacy of soldiers in defending the colony or by the adoption of behaviors which diminish the risk of predation (Higashi *et al*. 2000), such as living undersoil in small, diffuse colonies. Additionally, the workers are often able to defend the colony, not only by biting, but also by using chemical defense expelled by the labial gland, and by defecating a sticky fluid during combat (Bourguignon *et al*. 2016). This caste loss in the Apicotermitinae can be seen as a simplification of polymorphism (Noirot 1982) and may have allowed new defensive adaptations of the colony.

In tropical forest soils, the Apicotermitinae have high diversity and abundance and can represent about 30% of all sampled termites (Donovan 2002; Bourguignon *et al*. 2010). They feed upon soil organic matter or litter (Donovan 2002; Acioli and Constantino 2015). Despite their high diversity and abundance in tropical forests, it was only in the last decades that new genera and species of soldierless termites have been described, e.g., *Longustitermes* (Bourguignon *et al*. 2010), *Compositermes* (Scheffrahn 2013), *Tonsuritermes* (Constantini *et al*. 2018) and *Chasitermes* (Scheffrahn and Carrijo 2023). This was possible due to the improvement of the description of the digestive tubes of Apicotermitinae, which allowed better visualization of internal structures such as the Malpighian tubules and enteric valve ornamentation (Noirot 2001). Furthermore, recent studies have described the gizzard, until then a structure that was neglected in Apicotermitinae species description, as it is an underdeveloped structure in soil termites (Romero Arias *et al*. 2020).

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In the Amazon region, new genera and species were described, revealing a part of this group's diversity, such as *Compositermes* (Scheffrahn 2013), *Aparatermes* (Florian *et al*. 2019), *Tonsuritermes* (Constantini *et al*. 2018) and *Patawatermes* (Bourguignon *et al*. 2016). Species of soldierless termites possess a dimorphic worker caste, as in *Tonsuritermes*, in which the main difference of the phenotypes is the fontanelle size (Constantini *et al*. 2018). In this paper, we describe a new soldierless termite genus and species from the Amazon rainforest, which has dimorphism in the size of the head. We also describe a functional gizzard and the ornamentation of the first proctodeal segment.

MATERIAL AND METHODS

We found two colonies of *Caputitermes dimorphus* gen. nov. separated in time and space in two localities in the municipality of Manaus, Amazonas state, Brazil. The first colony was found at the experimental farm of Universidade Federal do Amazonas - UFAM in 2012 in an area of primary forest. Both worker phenotypes were foraging and there were no other termite species nearby. The second colony was collected at Ducke Reserve in 2014, in an area of terra firme primary forest. There are no biological records regarding the second colony.

External and internal characters from the worker caste were described. The terminology follows Fontes (1987) for mandibles and Noirot (2001) for the digestive tube. The following morphometric characters were measured for workers (the numbers in parentheses correspond to the character measurement codes established by Roonwal 1970), when applicable (Roonwal 1970): LH, length of the cephalic capsule until the apical end of the clypeus; WH, maximum width of head (17); LT, length of hind tibiae (85); WP, median pronotum width (68).

Termites were sampled from portions of soil using pickaxes. When the termites were found in the upturned soil, the sample was placed in a white tray, where termites were collected with featherweight tweezers and stored in Vacutainer® tubes filled with alcohol 80%. Specimens were photographed with a Leica DFC295 camera attached to a M205 stereo microscope. To examine the gut, sclerites and sternites were removed from preserved specimens using a teasing needle. The enteric valve was removed and placed in a drop of PVA mounting medium to remove the musculature. Later, the enteric valve was fixed on a glass slide and was photographed with a Leica DFC295 camera attached to a CTR5000 microscope. Drawings were made using Inkscape software and measurements were made with an ocular micrometer. All specimens are deposited in the entomological collection of Instituto Nacional de Pesquisas na Amazônia - INPA. The distribution map of the species was made using SimpleMappr according to Shorthouse (2010).

RESULTS

***Caputitermes*, gen. nov.**

ZooBank register: https://zoobank.org/NomenclaturalActs/8FE72891-1004-4C2C-A441-B66F48BF6B31

Type species: *Caputitermes dimorphus* Almeida-Azevedo & Azevedo sp. nov.

Etymology: From Latin *Caput* (head). "*Caputitermes*" refers to the head of the major worker, as it is the most remarkable characteristic among the workers.

Description

Imago. Unknown.

Genus diagnosis. *Caputitermes* possess a dimorphic worker caste (major worker and minor worker) (Figures 1a,b). M-P1 junction straight, without mixed segment. Region of molar plate and molar prominence with hair and scale-like texture. Gizzard slightly developed. Internal region of first proctodeal segment (P1) densely covered by short robust spines directed toward the enteric valve. P3 forming an S-shaped projection before connecting to P2.

Genus description. Both types of workers are abundant, with a proportion of major workers to minor workers of approximately 1:2. Both workers have a visible fontanelle, post-clypeus slightly inflated and thin short bristles on head. Both workers have mandibles with hair and scale-like texture in the regions of the molar plate and molar prominence; mandibles with modest anterolateral depressions; left mandible with apical teeth of same size as first marginal tooth + second marginal tooth; right mandible with apical teeth larger than first marginal tooth + second marginal tooth (Figures 2e,f). Major worker with square-shaped cephalic capsule with around 34 bristles distributed mainly in the anterolateral and posterior regions; head with anterolateral depressions (Figure 2a, arrows). Minor worker with round-shaped cephalic capsule with around 14 bristles equally distributed in the lateral regions of the cephalic capsule (Figures 2b,d). In both types of workers the digestive tube is globose and similar in relation to size and position of structures (Figures 3a,d); M-P1 junction straight, without mixed segment (Figure 3c). Gizzard without armature, with six first-order pulvilli; pulvilli surface scaly, posteriorly with minute spines; enteric valve with thin musculature and with six symmetrical cushions (Figure 3e); four independent insertion points of Malpighian tubules, without nodules (Figure 4a); internal region of P1 with short robust spines, with high density of spines at the regions of connection with mesenteron and P2, spines directed towards the enteric valve (Figures 4b,d). P3 forming an S-shaped projection before connecting to P2 (Figure 5c).

Distribution. Neotropical Region: Brazil: Amazonas (Figure 6).

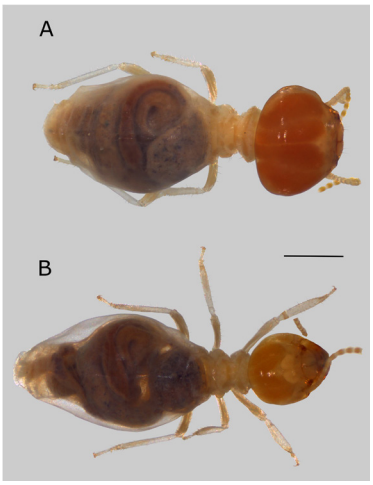

Figure 1. *Caputitermes* gen. nov., major and minor workers. A – Major worker of *Caputitermes dimorphus* sp. nov. in dorsal view; B – minor worker of *C. dimorphus* sp. nov. in dorsal view. Scale bar: A–B = 1 mm. This figure is in color in the electronic version.

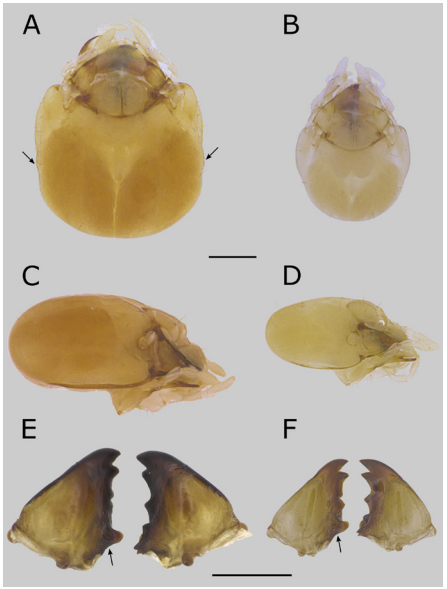

Figure 2. Head and mandibles of major and minor workers in *Caputitermes dimorphus* sp. nov. A – head of major worker in dorsal view, arrows indicate the lateral nodes of the head; B – head of minor worker in dorsal view; C – head of major worker in right lateral view; D –head of minor worker in right lateral view; E – mandible of major worker in dorsal view; F – mandible of minor worker in dorsal view; arrows on mandibles indicate hair and scale-like texture in regions of the plate and molar prominence. Scale bar: A–F = 0.5 mm. This figure is in color in the electronic version.

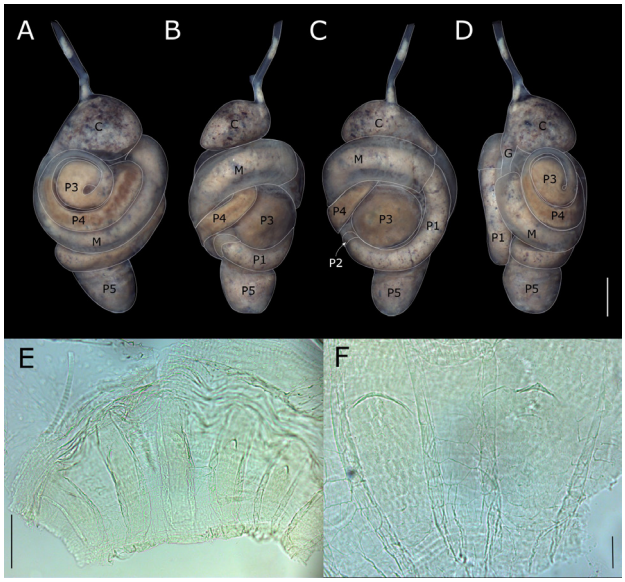

Figure 3. Digestive tube of minor worker in *Caputitermes dimorphus* sp. nov. A – dorsal view; B – right lateral view; C – ventral view; D – lateral left view. C = crop, M = mesenteron, G = gizzard, P1 = first proctodeal segment, P2 = enteric valve, P3 = paunch, P4 = colon, P5 = rectum; E – enteric valve ornamentation; H – view of an enteric valve lobe showing agglomerate of spines. Scale bar: A–D = 0.5 mm; E–F = mm; G = 0.1 mm H = 0.02 mm. This figure is in color in the electronic version.

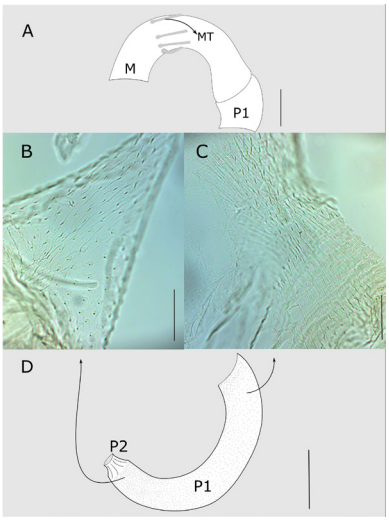

Figure 4. Malpighian tubules and ornamentation of P1 in *Caputitermes dimorphus* sp. nov. A – Insertion of Malpighian tubules, MT = Malpighian tubules, M = mesenteron, P1 = first proctodeal segment; B–C – photomicrograph showing spines; D – schematic drawing of P1 showing the spines, P2 = enteric valve. Scale bar: A–D = 0.5 mm; B–C = 0.1 mm. This figure is in color in the electronic version.

Caputitermes dimorphus Almeida-Azevedo & Azevedo sp. nov.

ZooBank register: https://zoobank.org/NomenclaturalActs/e4b304ad-a789-4889-8e1b-c0826da0aa2c

Holotype. Major worker. The holotype was deposited in the invertebarte collection at Instituto Nacional de Pesquisas da Amazônia – INPA (INPA-ISO 000010) (in a vial separate from remaining sample). Worker, in alcohol 80%, separated in a microvial. Original tag:"Brasil, Amazonas, Manaus, F. E. UFAM, L4 1500. (80-85), 2°37'57"S, 60°04'15"W. Coleta manual 20/31- vii-2012. Azevedo. R. A. col".

Type-locality. The colony of *Caputitermes dimorphus* sp. nov. was found at the experimental farm of Federal University of Amazonas (UFAM) located at km 38 of the BR-174 highway, which connects the cities of Manaus (Amazonas state) and Boa

Vista (Roraima state), Brazil. Another colony of *Caputitermes dimorphus* sp. nov. was found at Ducke Reserve, located on the outskirts of Manaus (Amazonas).

Paratypes. Therteen major workers and 28 minor workers with the same data of the holotype (INPA-ISO 000011); three major workers and 24 minor workers with the following data: "Brasil, Amazonas, Manaus, Res. Ducke, L6 4500 (180-185). 2º57'56.99"S 59º55'20.58"O. Coleta Manual 01/19.xii.2014. J.R.A. Oliveira col. The specimens was deposited in the invertebrate collection of INPA (INPA-ISO 000012).

Etymology: From the Greek *di* (meaning "two") and *morpho* (meaning "shape"), referring to the dimorphism of the workers.

Species diagnosis. Head of workers with distinct dimorphism. Cephalic capsule of major workers almost 2/3 larger than cephalic capsule of minor workers. M-P1 junction straight, mixed segment absent (Figure 3c). Enteric valve disarmed, with six symmetrical and developed cushions, each cushion with a row of spines pointing to P1 (Figures 3e,f). P1 with inner spines directed towards the enteric valve (Figures 4b-d).

Description

Major worker (Figures 1a, 2a,c,e; Table 1)**.** Cephalic capsule yellowish, square-shaped in dorsal view, rounded posterior margins, with about 34 short yellowish thin bristles, distributed in paired positions on dorsal region and more frequently on anterolateral margins and posterior region; lateral margins with irregular depressions extending to the base of mandibles and with a nodule at the median region, which surpasses the inferior line (Figures 2ac, arrow, 2c). Fontanelle whitish and inconspicuous. Post-clypeus of the same color of cephalic capsule, small and slightly inflated with few bristles. Labrum unilobular, slightly convex and with sparse rigid bristles of different sizes (Figures 2a,c). Antennae with 14 antennomeres. Antennomeres I, II and III of the same size and both smaller than the subsequent. Mandibles predominantly with worn teeth. Left mandible with a robust apical tooth with lightly rounded tip; tip of the apical tooth at the same height as the tip of M1+2 tooth; posterior margin of apical tooth larger than the margin of the M1+2 tooth; slight incision between M1+2 tooth and the M3 tooth; M3 apical tooth small and rounded; posterior margin between the M3 tooth and the molar prominence broad and slightly concave. Molar prominence proportionally small in relation to the size of mandible, ridge rounded, prominent and narrow, with hair and scale-like texture (Figure 2e, arrow). Right mandible with apical tooth robust, slightly rounded tip; tip of the apical tooth above the tip of the M1 tooth; M1 and M2 marginal teeth at the same height, margins forming a concavity. Molar plate with hair and scale-like texture. Molar plate concave, without grooves (Figure 2e). Thorax whitish, pronotal width half of head width, surrounded by few bristles on edges; meso- and metanotum with few bristles on lateral

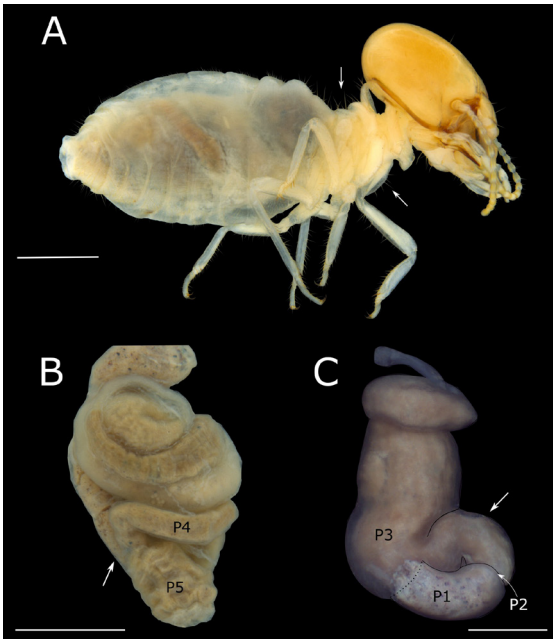

Figure 5. *Caputitermes dimorphus* sp. nov. A – setae at anterior portion of the coxae indicated by arrows; B – specimen positioned in the left ventrolateral view. Connection P4-P5 forming a V-shaped bend and constriction between connection P4 and P5; C – P3 forming an S-shaped projection until it connects to P2. Scale bar: A–B = 1 mm; C = 0.5mm. This figure is in color in the electronic version.

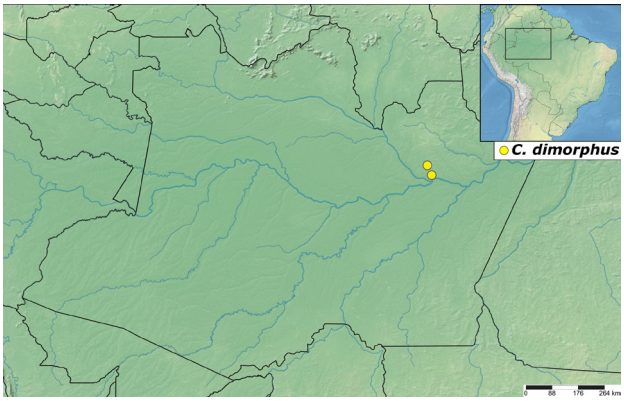

Figure 6. Location of the *Caputitermes dimorphus* sp. nov. collection sites in the central Brazilian Amazon. The points are 40 km apart from each other in full scale. This figure is in color in the electronic version.

Table 1. Measurements (mean ± standard deviation, followed by the range) of major and minor workers of *Caputitermes dimorphus* sp. nov.

Parameter	Major worker	Minor worker
Head width (mm)	1.89 ± 0.07 (1.78–2.00)	1.13 ±0.06 (1.07–1.19)
Head length (mm)	1.83 ±0.07 (1.85–1.99)	1.13 ±0.04 (1.03–1.22)
Hind tibia length (mm)	1.23 ±0.04 (1.19–1.31)	1.15 ±0.02 (1.12–1.19)
Pronotum width (mm)	0.86 ±0.06 (0.76–0.95)	0.62 ±0.07 (0.55–0.70)
Number of specimens	18	59

and posterior margins (Figure 1a). Legs with tibiae lighter than femora; pattern of four to six bristles on internal surface of coxae disposed circularly; femora with thin short bristles arranged in parallel on internal surface; tibiae densely covered by thin bristles. Tibiae with tibial spurs 2:2:2. Abdomen translucid, tergites, and sternites covered by a few bristles of different sizes (Figure 1a).

Minor worker (Figures 1b, 2b,d,f; Table 1). Cephalic capsule whitish and approximately round shaped, with anterior margins broadened in dorsal view, with 14 short thin whitish bristles on dorsal area of the head, with 7 bristles on each lateral margin of the cephalic capsule. Fontanelle whitish and barely perceptible. Post-clypeus of the same color of cephalic capsule, small and slightly inflated with few bristles. Labrum unilobular slightly convex and with sparse thick bristles of different sizes (Figures 2b,d). Antennae with 14 antennomeres. Antennomeres I<II and III < the subsequent. Left mandible with apical tooth acute and longer than the M1+2 tooth, but both aligned at the same height; posterior margin of apical tooth slightly larger than the anterior margin of M1+2 tooth; pronounced incision between M1+2 tooth and the M3 tooth; M3 marginal tooth acute; posterior margin between the M3 tooth and the molar prominence narrow and concave; molar prominence proportionally small in relation to the size of the mandible, ridge rounded, prominent and narrow, with hair and scale-like texture (Figure 2f, arrow). Right mandible with acute apical tooth; apical tooth longer than the M1 tooth; molar prominence narrow and concave; tip of apical tooth slightly above the tip of the M1 tooth; posterior margin of apical tooth larger than the anterior margin of the M1 tooth; M1 tooth larger than the M2 tooth; M2 tooth acute; tip of the M1 tooth above the tip of the M2 tooth, margins forming a strong concavity; molar plate concave, without grooves, with hair and scale-like texture (Figure 2f). Thorax whitish, pronotal width with half of head width, surrounded by few bristles on edges; meso- and metanotum with few bristles on lateral and posterior margins (Figure 1b). Thoraco-abdominal glands or dehiscent organs absent. Legs with tibiae thinner lighter than femora; pattern of four to six bristles on internal surface of coxae disposed circularly; femora with thin short bristles arranged in parallel on internal surface; tibiae densely covered by thin bristles. Tibiae with tibial spurs 2:2:2. Abdomen translucid, tergites and sternites covered by a few bristles of different sizes (Figure 1b).

Digestive tube (Figures 3, 4)**.** There is no observable difference between the digestive tubes of the major and minor worker. Digestive tube forms a dense and globulous mass. Crop located right after thorax, slightly to the right side in dorsal view, narrowing towards the gizzard (Figure 3a). Gizzard visible only in the left lateral view (Figure 3d), without armature, and having six first order pulvilli; pulvilli surface scaly with scales alternating, posteriorly with minute spines; spacing between pulvilli smooth. Mesenteron uniform with a diameter larger than of P1, without mixed segment (Figure 3c); with four Malpighian tubules, with independent insertions, base slightly globose, without nodules and clustered at junction of mesenteron and P1 (Figure 4a). P1 with diameter uniform, concave to the longitudinal axis of the body, and shorter than mesenteron in ventral view, initiating from the left side of anterior region and ending at the right side of posterior region, where it connects to P2 (in right lateral view) (Figures 3b,c). Inner side of P1 with robust short spines, in higher concentration at the extremities of P1, at the regions of connection to the mesenteron and P2, spines directed towards P2 (Figures 4b,d). P2 visible only in ventral view and right lateral view; enteric valve with thin musculature; six symmetric and well-defined lobes (Figure 3e); proximal end of the enteric valve with an agglomeration of spines in each lobe, spines directed to P1 (Figure 3f). Enteric valve seating long, forming an S until it connects to P2, only visualized when P3 is removed with a piece of P1 (Figure 5c); paunch connecting to colon (P4) by the isthmus, visible in dorsal and lateral left view (Figures 3a,d). Isthmus forming a semicircle or arch above P3. In dorsal view, paunch C-shaped above the colon. Colon width smaller than mesenteron width in dorsal view (Figure 3a). Connection P4-P5 forming a V-shaped bend. Constriction between connection P4 and P5. The connection between P4 and P5 is only visible when the specimen is positioned in the left ventrolateral view (Figure 5b).

Distribution and habitat. The colony of *Caputitermes dimorphus* sp. nov. found at the experimental farm of UFAM was located under the ground, approximately 10 cm deep. Probably the nest is diffused and the two worker castes were foraging together. In addition, no other soil species were found in the same location. The soil is composed of 29% clay and 68% of grit. We have no biological information about the second colony. The climate is equatorial, hot, and humid, with high rainfall during wet season (Kottek *et al.* 2006).

Comparison with other Apicotermitinae

The new genus differs from the other Apicotermitinae mainly by the dimorphic worker caste. The only other genus of Apicotermitinae that has dimorphic workers is *Tonsuritermes*. However, both workers of *Caputitermes* gen. nov. do not have the diagnostic traits of *Tonsuritermes*, such as the double row of spines on the anterior tibiae and the fontanelle occupying ¼ to ¾ of the cephalic capsule size.

The yellowish to whitish color of the cephalic capsule resembles that of *Aparatermes*. However, it differs from this genus by having only long bristles on the head and by P1 shorter in relation to *Aparatermes*. In addition, the mandible of small workers resembles the left mandible of *Aparatermes abbreviatus*, but with M3 more pointed in *A. abbreviatus*. Furthermore, the gizzard of *A. abbreviatus* is vestigial, while *Caputitermes dimorphus* sp. nov. has a developed gizzard.

The internal morphology of the new genus is similar to *Grigiotermes*, with both genera having a gut morphology forming a globose, dense and large mass. They can be differentiated by the widened first proctodeal segment and the visible armature of the enteric valve in *Grigiotermes*, while in *Caputitermes* gen. nov. the first proctodeal segment is not widened and the armature of the enteric valve is not visible. In *Caputitermes* gen. nov., the connection of P4 and P5 forms a V, resembling *Tonsuritermes*, but the new genus differs from it by the fold only visible in the left ventrolateral view, mixed segment absent and enteric valve seating S-shaped starting from P3 to connect to P2.

Key to the genera of Apicotermitinae occurring in the Brazilian Amazon, based on workers

1. Mixed segment absent..... 2 (Figure 3c)
- Mixed segment globulous, long or short 3
2. Seating of enteric valve pectinated.....*Compositermes*
- Seating of enteric valve not pectinated ....*Caputitermes* (Figure 5a,c)
3. Connection P2-P3 visible in dorsal view 4
- Connection P2-P3 not visible in dorsal view 5
4. P1 distinctly long, bypassing P3 in ventral view; intestinal content clearly visible through sternites.....*Aparatermes*
- P1 moderately long; head yellowish to dark brown.....6
5. Fontanelle conspicuous 7
- Fontanelle inconspicuous 8
6. Anterior tibiae slender; presence of dehiscent organ occupying 1/3 of abdomen volume ..... *Ruptitermes*
- Anterior tibiae strongly widened, spoon-shaped ....*Tetimatermes*
7. P5 forming a V to the left of the body in dorsal view; fontanelle varying from ¼ to ¾ of diameter of cephalic capsule .....*Tonsuritermes*
- P5 not forming a V to the left of the body in dorsal view; fontanelle small, almost indistinct.....9
8. Enteric valve long with apical crown of spines .... *Longustitermes*
- Enteric valve with variable ornamentation, but not as above ..... *Anoplotermes**
9. P1 wide with more than one fold ..... *Grigiotermes*
- P1 slightly wide with only one fold ..... *Patawatermes*

**Anoplotermes* needs a revision, as recent studies have observed that many of its species have characteristics robust enough to be considered new genera (Bourguinon *et al.* 2010).

DISCUSSION

The new genus has highly dimorphic workers as its main identification trait. However, that is not its only diagnostic trait, as *Tonsuritermes*, another genus of Apicotermitinae, also has species with dimorphic workers (Constantini *et al.* 2018). *Caputitermes* gen. nov. has other unique characteristics not seen in any other Apicotermitinae, such as the straight connection between mesentheron and P1, with the mixed segment absent. That trait only can be observed in *Ruptitermes* and *Compositermes* (Scheffrahn 2013; Acioli and Constantino 2015). However, *Ruptitermes* has well developed dehiscent organs, and the seating of the enteric valve in *Compositermes* is long and pectinated (Scheffrahn 2013; Acioli and Constantino 2015).

Another specific trait of the new genus is the presence of an isthmus forming a semicircle or arch above P3, whereas in *Tonsuritermes* the isthmus is straight (Constantini *et al.* 2018). *Tonsuritermes* has two rows of spines on the anterior tibiae (Constantini *et al.* 2018), which are absent in *Caputitermes* gen. nov. Additionally, in *Tonsuritermes* the connection between P4 and P5 is visible in lateral view (Constantini *et al.* 2018), while in *Caputitermes* gen. nov. the connection is covered by P1 in all views.

The inner ornamentation of P1 in *Caputitermes* gen. nov., with the presence of similarly sized spines directed to the enteric valve, is barely investigate in Apicotermitinae (Rocha *et al.* 2015). However, that structure is well known in other subfamilies of Termitidae, as in Syntermitinae (Rocha *et al.* 2015; Rocha and Cancello 2022). The seating of the enteric valve in the new genus is long and S-shaped, which is unique among the Apicotermitinae.

The enteric valve of *Caputitermes* gen. nov. may have similar characteristics to *Aparatermes*, like the set of scales fusionated to a spine and the absence of armature (Florian *et al.* 2019). Yet *Caputiermes* gen. nov. does not have the diagnostic traits of *Aparatermes*, like the strongly inflated postclypeus, long P1, the presence of mixed segments and short mesenteric tongue (Fontes 1987). The presence of an inconspicuous postclypeus, short P1, absence of mixed segment and mesenteric tongue, combined with the dimorphism of the workers, support *Captutitermes* gen. nov. as a new taxon of Apicotermitinae.

CONCLUSIONS

The fact that we found two colonies of *Caputitermes dimorphus* at sites separated by time and space suggests that dimorphism is a constant feature of this species and not just an accidental event (eg. predation) or abnormal developmental pattern. We suggest that morphologic characters of the gizzard, mixed segment, P1, and the insertions of the Malpighian tubules be included in future descriptions of new Apicotermitinae taxa. Those structures may be essential to understanding the functional role of species and must not be neglected. We suggest new studies to investigate the reasons for worker dimorphism and the functional and phylogenetic position of this species.

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DATA AVAILABILITY

The data that support the findings of this study are available at the invertebrate collection of Instituto Nacional de Pesquisas da Amazônia – INPA with the identifying codes "Brasil, Amazonas, Manaus, F. E. UFAM, L4 1500. (80-85), 2°37'57"S, 60°04'15"W. Coleta manual 20/31- vii-2012. Azevedo. R. A. col" and "Brasil, Amazonas, Manaus, Res. Ducke, L6 4500 (180-185). 2º57'56.99"S 59º55'20.58"O. Coleta Manual 01/19.xii.2014. J.R.A. Oliveira col.".