

Record of *Amitermes* (Blattodea, Termitidae) Species in Togo West Africa †

Toblie Quashie Effowe¹, Boris Dodji Kassene^{1*}, Abdoulaye Baïla Ndiaye², Bassan Banibea Sanbena¹, Adolé Isabelle Glitho¹

¹ Laboratoire d'Entomologie Appliquée, Département de Zoologie, Université de Lomé, 01 BP 1515, Lomé 01, Togo.; q.effowe@gmail.com; borisdodji@gmail.com, sanbenab@gmail.com, iglitho@yahoo.fr

² Laboratoire de Zoologie des Invertébrés terrestres, Département de Biologie Animale, Institut Fondamental d'Afrique Noire, Université Cheikh Anta Diop de Dakar, BP : 206, Dakar, Sénégal; abdoulaye.ndiaye@ucad.edu.sn

* borisdodji@gmail.com, Phone: 00228 90 61 56 74

† Presented at the 1st International Electronic Conference on Entomology (IECE 2021), 1–15 July 2021; Available online: <https://iece.sciforum.net/>.

Abstract: This study combined morphological traits with morphometric measurements to identify *Amitermes* species collected inside transects laid in three parks: Fosse aux Lions, Galangashie and Fazao Malfakassa. Samples were grouped by morphospecies and measurements of body parts (length/width of head, mandible, pronotum, gula and hind tibia) were taken. Four *Amitermes* species were identified: *Amitermes evuncifer*, *A. guineensis*, *A. spinifer* and *A. truncatidens*. Among the four species, *A. guineensis* had the longest head (1.225±0.031mm) while *Amitermes spinifer* had the shortest (0.933±0.018mm) one.

Keywords: Termites systematic; morphometric measurements; *Amitermes* species

Citation: Effowe, T.Q.; Kassene, B.D.; Ndiaye, A.B.; Sanbena, B.B.; Glitho, A.I. Record of *Amitermes* (Blattodea, Termitidae) Species in Togo West Africa, in Proceedings of the 1st International Electronic Conference on Entomology, 1–15 July 2021, MDPI: Basel, Switzerland, doi:10.3390/IECE-10497

Published: 1 July 2021

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Copyright: © 2021 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0/>).

1. Introduction

In most of the African countries, termites systematic is hampered by the confusion in the identification of many species [1–4]. One of the most common way to identify termites is the comparison of samples with reference species which most of the time are not correctly identified. Several reference works done by famous taxonomists [5–11] are also used in the identification of termite. Although these reference works were published several decades ago, they are actually useful and are still widely used by many researchers for termite's identification.

Most of the reference works combine morphological traits (shape, color of different part of the body) and morphometric measurements (length, width and depth of certain part of the body of termites). For *Amitermes* species of African and Arabian countries, these features were deeply described and illustrated by Sands [11]. In this study, both morphological features and morphometric measurements were used to sort out *Amitermes* species collected in central and northern part of Togo.

2. Material and methods

2.1. Study sites

Termites were collected from three different parks (Figure 1) including: Fosse aux lions (10°46' – 10°49'N and 0° 11' – 0°14'E), Galangashie (10°19' – 20°28'N and 0°14' – 0°27'E) both located in the northern part of Togo, and Fazao-Malfakassa (8°20' – 9°35'N and 0°35' – 1°02'E) located in the centre of the country.

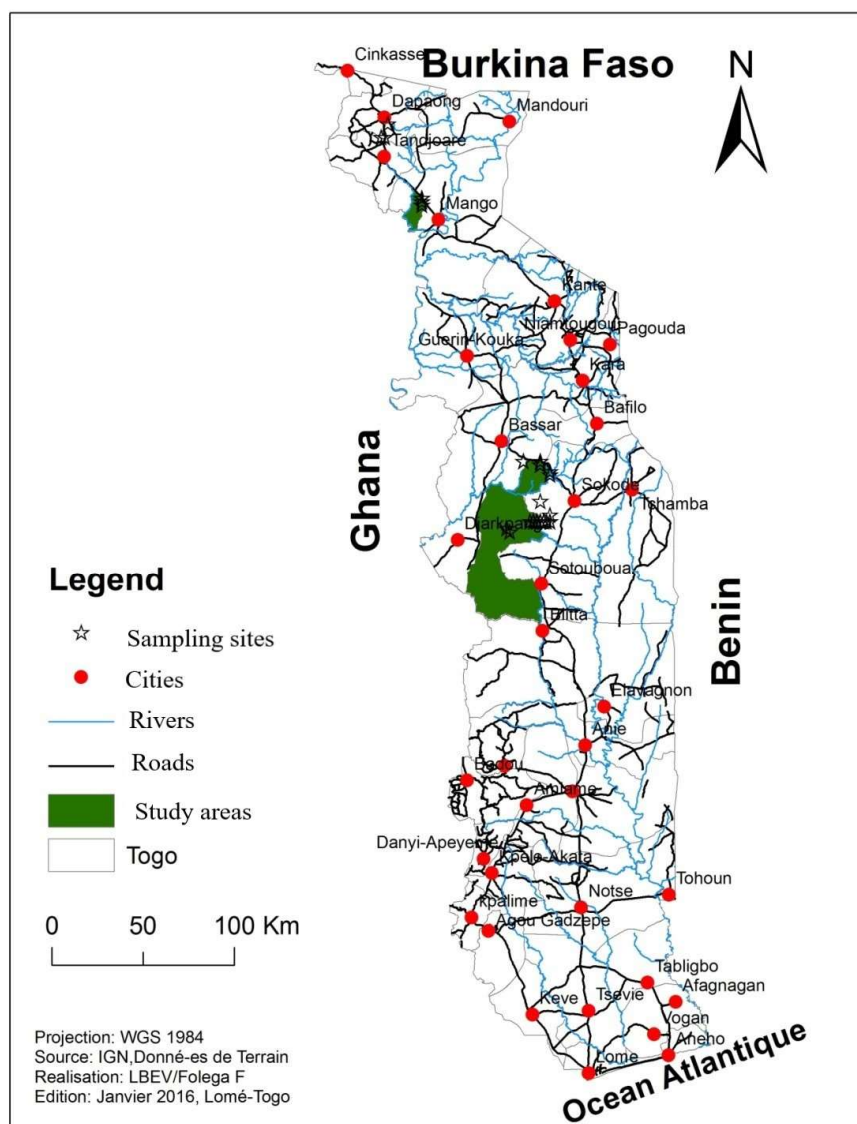


Figure 1: Map of Togo with prospected parks

The first two parks (Fosse aux lions and Galangashi) are characterized by a sudanian tropical climate with a long dry season (November to May) and a long raining season (June to October). In these two parks, the mean temperatures range from $29 \pm 2^\circ\text{C}$ during the raining season and $30 \pm 3^\circ\text{C}$ during dry season. The annual rainfall is 986 mm and the landscape is a shrubby savanna. Fazaou-Malfakassa is characterized by a semi-humid tropical climate with a long rainy season (from April to October) and a long dry season (from November to March). The mean temperatures range from $27,5 \pm 1,5^\circ\text{C}$ during dry season and $27 \pm 2^\circ\text{C}$ during rainy season. The annual rainfall is 120mm and the landscapes is composed of dry forests, gallery forests, shrubby savanna and fallows.

2.2. Termites sampling

Belt transects were used to sample termites in each of the identified landscape found in the three study areas. The standard protocol [12] adapted to the savanna ecosystem [13-14] was used in our study. A total of 81 transects were laid in three mentioned parks and surrounding fallows. Each transect of 100×5 m was divided into 20 sampling units of 5×2 m which were sampled for 15 minutes [15-16]. Termite were searched within the frame of each sampling unit inside mounds, litter, wood, and grasses on trees by a well-trained collector. After this searching on the surface, termites were also searched throughout eight soil

scrapes of 15 × 15 × 10 m [15-16]. Sampled termites were kept in 95% ethanol inside labeled vials and brought to the laboratory for identification.

2.3. Termites identification

Morphological traits of soldier including number of antennal segments, shape of mandibles and the position of the mandible tooth were used to sort out *Amitermes* species according to Sands [11]. Measurements were made with a stereomicroscope (Leica EZ4) equipped with an integrated camera. Voucher specimen are conserved in the “Laboratoire d’Entomologie” of the University of Lomé (Togo).

Factorial discriminant analysis (using morphometric data) was used to separate species with close measurements.

3. Results

Four species of *Amitermes* including *Amitermes evuncifer* Silvestri, 1912 (Table 1, Figure 2), *Amitermes guineensis* Sands, 1992 (Table 2, Figure 3), *Amitermes spinifer* Silvestri, 1914 (Table 3, Figure 4) and *Amitermes truncatidens* Sands, 1959 (Table 4, Figure 5) were unambiguously identified. The soldier of all the other four species have 14 antennal segments except *Amitermes spinifer* which have 13. The ranges and measurements of head length, head width, left mandible length, pronotum width, gula width and hind tibia length for each species are presented in below Tables (Table 1 – 4)..

3.1. *Amitermes evuncifer*

Table 1. The measurements (mm) of the soldiers of *Amitermes evuncifer*.

	Range (mm)	Mean ±SD
Head length	1.06 – 1.19	1.134±0.049
Head width	0.93 – 0.975	0.954±0.014
Left mandible length	0.594 – 0.709	0.660±0.038
Pronotum width	0.587 – 0.615	0.600±0.011
Gula width	0.252 – 0.3	0.279±0.016
Hind tibia length	0.828 – 1.2	0.970±0.126

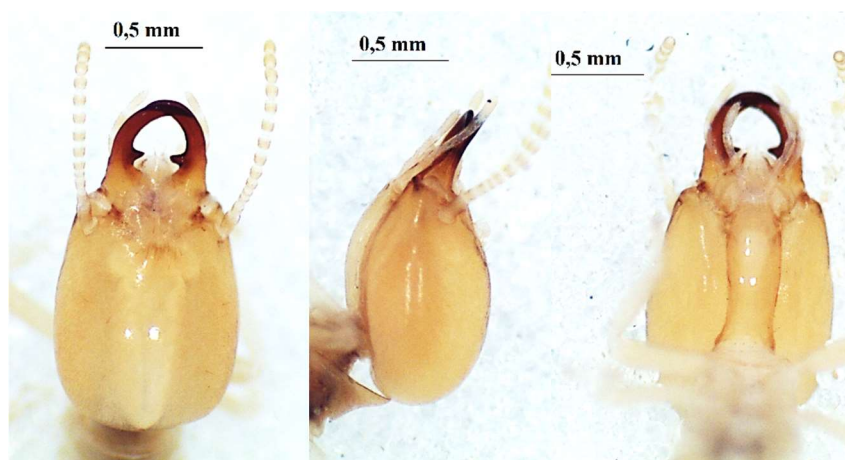


Figure 2. The head of *Amitermes evuncifer* soldier in dorsal view (left), lateral view (middle) and ventral view (right).

3.2. *Amitermes guineensis*

Table 2. The measurements (mm) of the soldiers of *Amitermes guineensis*.

	Range (mm)	Mean \pm SD
Head length	1.17 – 1.27	1.225 \pm 0.031
Head width	0.677 – 0.979	0.871 \pm 0.008
Left mandible length	0.611 – 0.795	0.722 \pm 0.058
Pronotum width	0.139 – 0.287	0.438 \pm 0.013
Gula width	0.139 – 0.287	0.213 \pm 0.041
Hind tibia length	0.503 – 0.519	0.509 \pm 0.005

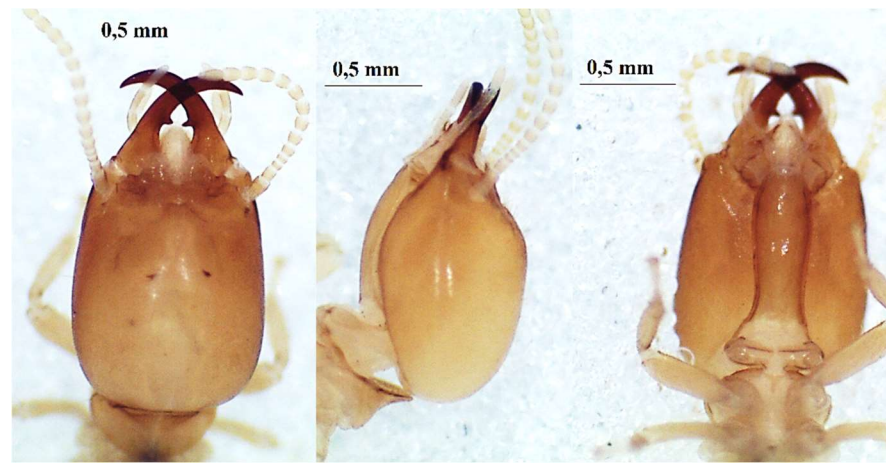


Figure 3. The head of *Amitermes guineensis* soldier in dorsal view (left), lateral view (middle) and ventral view (right)..

3.4. *Amitermes spinifer*

Table 3. The measurements (mm) of the soldiers of *Amitermes spinifer*.

	Range (mm)	Mean \pm SD
Head length	0.865 – 0.954	0.933 \pm 0.018
Head width	0.681 – 0.742	0.726 \pm 0.027
Left mandible length	0.585 – 0.624	0.613 \pm 0.017
Pronotum width	0.472 – 0.492	0.486 \pm 0.009
Gula width	0.257 – 0.26	0.288 \pm 0.020
Hind tibia length	0.642 – 0.65	0.643 \pm 0.017



Figure 5. The head of *Amitermes spinifer* soldier in dorsal view (left), lateral view (middle) and ventral view (right).

3.5. *Amitermes truncatidens*

Table 4. The measurements (mm) of the soldiers of *Amitermes truncatidens*.

	Range (mm)	Mean ±SD
Head length	1.01 – 1.13	1.064±0.037
Head width	0.943 – 0.992	0.966±0.016
Left mandible length	0.522 – 0.577	0.547±0.023
Pronotum width	0.564 – 0.576	0.575±0.007
Gula width	0.27 – 0.314	0.284±0.021
Hind tibia length	0.756 – 0.816	0.785±0.025

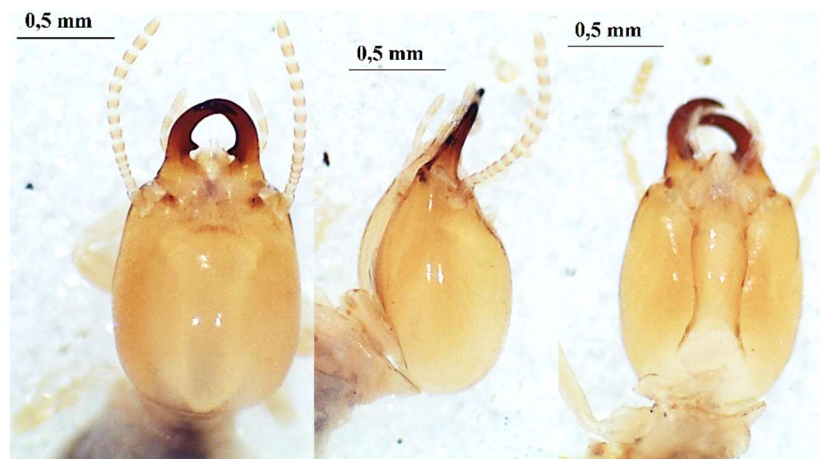


Figure 5. The head of *Amitermes truncatidens* soldier in dorsal view (left), lateral view (middle) and ventral view (right).

3.5. Result of factorial discriminant analysis

Although *A. evuncifer* and *A. truncatidens* measurements were close (Table 1 and 4) the factorial discriminant analysis showed that they are separate species (Figure 6), as well as the other two species (*A. guineensis* and *A. spinifer*).

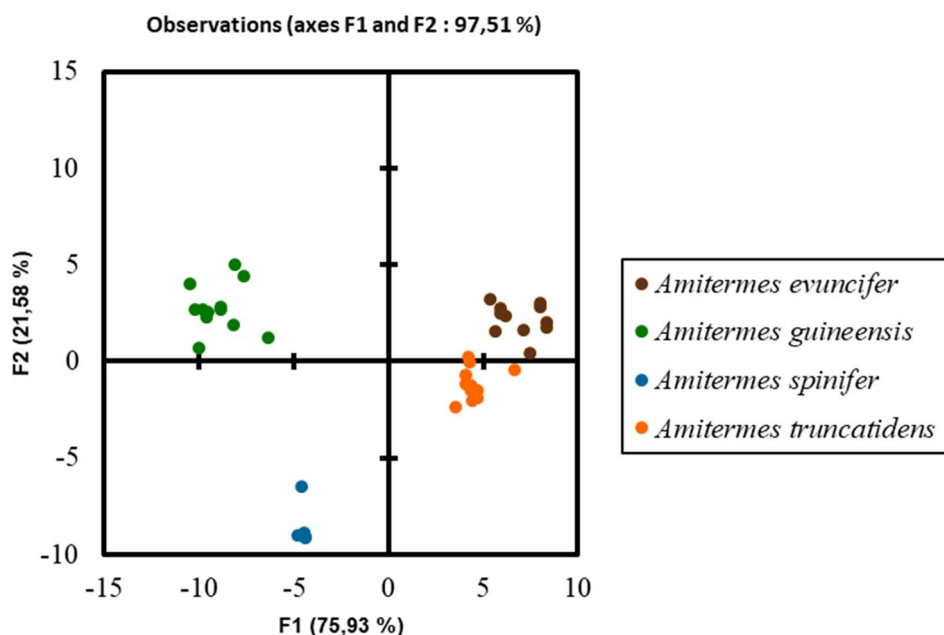


Figure 6. Separation of *Amitermes* species

4. Discussion

All the representative caste (Imago, soldiers and workers) of the four *Amitermes* species were already described [11]. In our study, the ranges and means of the measurements of soldiers fall within the ranges and means of respective species described by Sands [11]. *Amitermes spinifer* had the shorter and the smaller head of all while *A. guineensis* had the longer and the larger one.

5. Conclusion

Based on the measurements of parts of the heads and also the shape of mandible, we believe that there are at least four different species of *Amitermes* species in Togo. This study was the first in Togo to present *Amitermes* species with their respective measurements and pictures. It could be used as illustrated reference work for future taxonomic researches.

Author Contributions: Conceptualization, B.D.K., A.B.N. and A.I.G.; methodology, T.Q.E., B.D.K., A.B.N. and A.I.G.; software, B.D.K. and A.B.N.; validation, T.Q.E., B.D.K., A.B.N., B.B.S., and A.I.G.; formal analysis, T.Q.E., B.D.K., A.B.N.; investigation, T.Q.E., B.D.K., and B.B.S.; data curation, T.Q.E., B.D.K. and A.B.N.; writing—original draft preparation, B.D.K.; writing—review and editing, T.Q.E., B.D.K., A.B.N., B.B.S., and A.I.G.; visualization, T.Q.E., B.D.K., A.B.N., B.B.S., and A.I.G.; supervision, B.D.K., and A.B.N.; project administration, A.B.N. and A.I.G.; funding acquisition, A.B.N. All authors have read and agreed to the published version of the manuscript.

Funding: This study was part of a project financed by UEMOA (Union Economique et Monétaire Ouest Africaine).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Acknowledgments: The authors are grateful to the authorities of the “Ministère de l’Environnement et des Ressources Forestières” for the logistics and other facilities. We thank villagers in sampling localities for their help in the field.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Grassé, P.P. Recherches sur la biologie des termites champignonnistes (Macrotermitinae). *Annales des Sciences Naturelles* **1944**, *6*, 97–171.
2. Bouillon, A.; Mathot, G. Quel est ce termite africain? *Zooleo* **1965**, *1*, 1–115.
3. Josens, G. Etudes biologique et écologique des Termites (Isoptera) de la savane de Lamto-Pakobo (Côte d'Ivoire). Thèse de doctorat d'Etat, Université Libre de Bruxelles **1972**.
4. Ruelle, J.E. Isoptera. In *Biogeography and Ecology of Southern Africa*; Werger, M.J.A. ; van Bruggen, A.C. Publishers: Springer Netherlands, **1978**; pp. 748–762.
5. Silvestri, F. Termitidi raccolti da L. Fea alla Guinea Portoghese e alla Isole, S. Thomé, Annobon, Principe e Fernando Poo. *Annali Museo Civico di Storia Naturale di Genova* **1912**, *45*, 211–255.
6. Silvestri, F. Contribuzione alla conoscenza dei Termitidi e Termitophili dell'Africa occidentale. I. Termitidi. *Bolletino del Laboratorio di Zoologia Generale e Agraria della R Scuola Superiore d'Agricoltura* **1914**, *9*, 1–146.
7. Sjöstedt, Y. Revision der Termiten Afrikas. 3. Monographie. In *Kungl Svenska Vetenska Akademiens Handlingar; Almqvist & Wiksells Boktryckeri—A.-B.: Stockholm, Sweden*, **1925**; Volume 3, pp. 1–435.
8. Emerson, A.E. Termites of the Belgian Congo and the Cameroon. *Bull. Am. Mus. Nat. Hist.* **1928**, *57*, 212–222.
9. Grassé, P.P. Recherches sur la systématique et la biologie des termites de l'Afrique occidentale française. Première partie: Protermitidae, Mesotermitidae et Metatermitidae (Termitinae). *Annales de la Société Entomologique de France* **1937**, *106*, 1–100.
10. Roy-Noël, J. Le parc national du Niokolo-Koba. VIII. Isoptera. *Mémoire de l'IFAN* **1969**, *84*, 113–178.
11. Sands, W.A. The Termites Genus *Amitermes* in Africa and the Middle. *Nat. Resour. Inst. Bull.* **1992**, *51*, 1–140.
12. Jones, D.T.; Eggleton, P. Sampling termite assemblages in tropical forests: Testing a rapid biodiversity assessment protocol. *J. Appl. Ecol.* **2000**, *37*, 191–203.
13. Dosso, K. ; Konaté, S. ; Aïdara, D. ; Linsenmair, K.E. Termite diversity and abundance across fire-induced habitat variability in a tropical moist savanna (Lamto, central Côte d'Ivoire). *J. Trop. Ecol.* **2010**, *26* (3): 323–334.
14. Hausberger, B. ; Kimpel, D. ; van Neer, A. ; Korb, J. Uncovering cryptic species diversity of a community in a West African Savanna. *Mol. Phylogenet. Evol.* **2011**, *61*(3): 964–969.
15. Schyra, J. ; Korb, J. Termite Communities along A Disturbance Gradient in a West African Savanna. *Insects* **2019**, *10* (1): 1–17.
16. Effowe, TQ, Kasseney BD, Ndiaye AB, Sanbena BB, Amevoin K, Glitho IA. Termites' diversity in a protected park of the northern Sudanian savanna of Togo (West Africa). *Nat. Conserv.* **2021**, *43*: 79–91.