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### ***Compositermes bani* sp.n. (Isoptera, Termitidae, Apicotermatinae), a new species of soldierless termite from Bolivia**

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Species of neotropical Apicotermatinae (Termitidae) are soldierless, restricting species identification in this group to workers or seasonally present winged imagos. All neotropical Apicotermatinae were placed in the genus *Anoplotermes*, until Mathews (1977) described two new genera, *Grigiotermes* and *Ruptitermes*. Fontes (1986) described two more genera, *Aparatermes* and *Tetimatermes*. Twenty years passed without any taxonomic advances in this group until Scheffrahn *et al.* 2006 described two new *Anoplotermes* species from the West Indies and Bourguignon *et al.* 2010 described *Longustitermes manni*, (= *Anoplotermes manni* Snyder), *Anoplotermes janus*, and placed six other species into synonymy. Finally, Scheffrahn 2013 described a new genus and species, *Compositermes vindai*, characterized by a ring of sclerotized paddles at the junction of the enteric valve seating (EVS) and paunch (P3).

Examination of the EVS/P3 junction in *Compositermes* colonies collected in Paraguay, Bolivia, Peru, French Guiana, Trinidad and Tobago, and Panama, yielded a unique Bolivian “ring” morphology. Herein we describe this new species based primarily on the sclerotized prominences at the EVS/P3 junction and confirmatory Barcode gene sequence analysis (cytochrome oxidase I (COI), Hebert *et al.* 2003).

Images of the head and digestive tube were taken using a Leica M205C stereomicroscope attached to a Leica DFC 425 digital camera. Specimens were placed in a plastic Petri dish containing 70% ethanol gel (Purell® hand sanitizer). A mirror was placed underneath the dish to highlight pilosity. Mandibles, enteric valves, and seating rings were mounted on slides with PVA Mounting Medium (BioQuip #6371A) and the images were taken with a Leica DM5500B compound microscope attached to a Leica DFC 425 camera. All images were composed of multiple photomicrographs taken at different focal planes that were merged with Helicon Focus 6 software. Measurements were taken with a micrometric reticule on the eyepiece of an Olympus SZX9 stereomicroscope. The following morphometric characters were measured, indicating, in parenthesis, the measurement as defined by Roonwal (1970): LH, length of head (9), WH, width of head (18); and LT, length of hind tibia (85). The distribution map (Fig. 1) was created using ArcGIS desktop ver. 10.1 (ESRI, Redlands, CA). DNA extraction, PCR and the sequencing of 12 specimens of *Compositermes vindai* (UF termite collection voucher number UF\_PA1138—GenBank accession number KM538641; UF\_PA247—KM538642; UF\_TT1136.1—KM538643; UF\_PA1139—KM538644; UF\_PA388—KM538645; UF\_PN1064—KM538646; UF\_PA1269—KM538648; UF\_BO978—KM538649; UF\_PN1065—KM538650; UF\_PU709—KM538652; UF\_TT620.1—KM538653; UF\_PA1138—KM538654), one of *Compositermes bani* sp.n. (UF\_BO842—KM538651), and one of *Ruptitermes reconditus* (UF\_PA1066—KM538647) were performed at the Canadian Centre for DNA Barcoding following standard high-throughput protocols (deWaard *et al.* 2008). Samples were collected and preserved at 85% ethanol. The head of a single individual of each sample was isolated for DNA extraction. The PCR employed the primers LepF1 and LepR1 (Hebert *et al.* 2003) which generated 586 to 658bp of the barcode region of the mitochondrial gene COI. The collection data of all *C. vindai* mentioned above can be found in Scheffrahn *et al.* (2013), except for the samples BO978, labeled as “Bolivia, Aguas Calientes, BO 978, SCCMNKM col. 01/Jun/13; -18.464 S, -59.477 W” and PU709, labeled as “Peru, Campo Verde, farm area, PU 709, CCCKKMMNS col. 29/May/14; -8.502 S, -74.846 W”. One additional COI sequence of *C. vindai* was retrieved from the GenBank (KF430145) and used in our analysis. In addition to *R. reconditus*, the following sequences of taxa were included as outgroups: *Heterotermes crinitus* (Rhinotermitidae, GenBank accession number: KF430191), *Macrotermes bellicosus* (Termitidae, Macrotermatinae, AY127702), *Termes hispaniolae* (Termitidae, Termitinae, FJ802753), *Syntermes grandis* (Termitidae, Syntermitinae, EU253863), *Nasutitermes octopilis* (Termitidae, Nasutitermitinae, KF430192), *Anoplotermes banksi* (Termitidae, Apicotermatinae, HQ398185), *A. jheringi* (Apicotermatinae, KF430151), *A. parvus* (Apicotermatinae, HQ398187), *Aparatermes cingulatus* (Apicotermatinae, KF430107), *Grigiotermes* sp. (Apicotermatinae, KF430117), *Longustitermes manni*

*Digestive tube* (Figs. 6–10). Coiling gut *in situ* visible through the abdominal wall. Crop (C) well developed (Fig. 6), with spines covering inner surface. Gizzard (G) regressed, with cuticular armature greatly simplified (Fig. 7). Mesenteron (M) leaving the left side dorsally and passing through right side of the abdomen to join the first proctodeal segment (P1) ventrally, almost in medial line of body. Malpighian tubules attached in pairs, before the M-P1 junction. M-P1 junction swollen, but not bulging. P1 long and tubular, going through left side of body to form a loop between the rectum and paunch in ventral view and reaching the enteric valve seating (EVS) on right side of body. Enteric valve (P2) complete, with six inflated cushions in hexaradial arrangement; each cushion with a small basal projection covered with faint reticulate polygons; inter-cushion positions with larger and more robust reticulate polygons (Fig. 8). EVS long and cylindrical; the EVS/P3 junction is adorned with 16 heavily sclerotized coronate prominences, each covered with spikes of different shapes and sizes (Fig. 9–10). Distal part of P3 globose; isthmus conspicuous; colon (P4) forming a tubular “U-turn”, not dilated, forming a close loop before joining rectum (P5).

**Comparisons.** The workers of *C. bani* sp.n. and *C. vindai* are almost identical externally and internally. The clear distinction between these two species resides at the EVS/P3 junction. In *C. bani*, the paddles characteristic of *C. vindai* are replaced by a ring of coronate prominences from which are adorned with spines of great depth and curvature (Fig. 11). The EVS/P3 junction of *C. vindai* workers examined have flat paddles, with varying size and number of flat spines originating along the lengths of their free borders (Fig. 11; Scheffrahn 2013).

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## References

- Bourguignon, T., Scheffrahn, R.H., Křeček, J., Nagy, Z.T., Sonet, G. & Roisin, Y. (2010) Towards a revision of the Neotropical soldierless termites (Isoptera : Termitidae): redescription of the genus *Anoplotermes* and description of *Longustitermes*, gen. nov. *Invertebrate Systematics*, 24, 357–370.  
<http://dx.doi.org/10.1071/IS10012>
- Darriba, D., Taboada, G.L., Doallo, R. & Posada, D. (2012) jModelTest 2: more models, new heuristics and parallel computing. *Nature Methods*, 9, 772–772.  
<http://dx.doi.org/10.1038/nmeth.2109>
- deWaard, J.R., Ivanova, N.V., Hajibabaei, M. & Hebert, P.D.N. (2008) Assembling DNA Barcodes: analytical Protocols. In: Martin, C. (Ed.), *Methods in Molecular Biology: Environmental Genetics*. Humana Press Inc., Totowa, pp. 275–293. [USA]
- Drummond, A.J., Suchard, M.A., Xie, D. & Rambaut, A. (2012) Bayesian Phylogenetics with BEAUti and the BEAST 1.7. *Molecular Biology and Evolution*, 29, 1969–1973.  
<http://dx.doi.org/10.1093/molbev/mss075>
- Fontes, L.R. (1986) Two new genera of soldierless Apicotermitinae from the Neotropical region (Isoptera, Termitidae). *Sociobiology*, 12, 285–297.
- Hebert, P.D.N., Cywinska, A., Ball, S. & deWaard, J. (2003) Biological identifications through DNA barcodes. *Proceedings of the Royal Society of London series B—Biological Sciences*, 270, 313–321.  
<http://dx.doi.org/10.1098/rspb.2002.2218>
- Mathews, A.G.A. (1977) *Studies on Termites from the Mato Grosso State, Brazil*. Rio de Janeiro, Academia Brasileira de Ciências, 267 pp.
- Rambaut, A., Suchard, M.A., Xie, D. & Drummond, A.J. (2014) Tracer v1.6. Available from: <http://beast.bio.ed.ac.uk/Tracer> (accessed 15 August 2014)
- Roonwal, M.L. (1970) Measurements of termites (Isoptera) for taxonomic purposes. *Journal of Zoological Society of India*, 21, 9–66.
- Scheffrahn, R.H., Křeček, J., Chase, J.A., Maharajh, B. & Mangold, J.R. (2006) Taxonomy, Biogeography, and Notes on Termites (Isoptera: Kalotermitidae, Rhinotermitidae, Termitidae) of the Bahamas and Turks and Caicos Islands. *Annals of the Entomological Society of America*, 99, 463–486.  
[http://dx.doi.org/10.1603/0013-8746\(2006\)99\[463:TBANOT\]2.0.CO;2](http://dx.doi.org/10.1603/0013-8746(2006)99[463:TBANOT]2.0.CO;2)
- Scheffrahn, R.H. (2013) *Compositermes vindai* (Isoptera: Termitidae: Apicotermitinae), a new genus and species of soldierless termite from the Neotropics. *Zootaxa* 3652 (3), 381–391.  
<http://dx.doi.org/10.11646/zootaxa.3652.3.6>