Morphological Analysis of the Dolichoderine Ants of Madagascar

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Summary

Mouthpart and petiole mophology was used to distinguish between the four genera of the Dolichoderinae of Madagascar, as well as to construct a key for these genera.

Abstract

Although systematics research is increasingly reliant on molecular data to define relationships, morphological analysis remains essential for identifying characters to diagnose and identify lineages. In ants, mouthpart and petiole structures are useful for these purposes. Ant mouthpart structures are highly variable because they reflect adaptations to different diets for different ant species, and may provide reliable characters for differentiating between genera and species. Petiole shape and structure are also variable among species and genera, and may be informative in the identification of lineages. However, little research has involved creating a permanent, online accessible record of ant mouthpart and petiole morphology. The main goals of this project were to create such a record, and to identify mouthpart and petiole characters to differentiate between the genera of Malagasy ants within the subfamily Dolichoderinae.

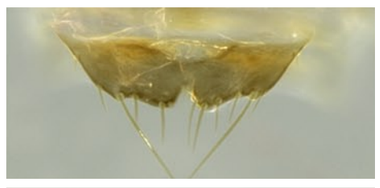
The Dolichoderinae of Madagascar include 12 species of *Technomyrmex*, 8 *Tapinoma*, 2 *Aptinoma*, and 2 *Ravavy*. Petioles and mouthparts from multiple individuals of the 24 species were dissected and imaged using an auto montage camera. Mouthparts were first removed from the ant, stained using eosin Y, and permanently fixed on slides with Euparal mounting medium. Characters scored include maxillary and labial palp segment counts, mandibular denticle pattern, mandible shape, labrum shape, and petiole shape. Images of the mouthparts and petioles are publicly accessible online at AntWeb.org. These characters were used to create a key to the Dolichoderine genera of Madagascar.

Below are example images of the structures considered in this study.

Maxillae and Labium

Mandible

Labrum



Petiole

Methods

Mouthparts

• Ants stored in 95% ethanol were dissected using fine forceps to remove the mandibles, labrum, and maxillae/labium. Care was taken not to damage the mandibular denticles or maxillary and labial palps.

• To improve the visibility of maxilary and labial palps, these parts were stained before imaging. They were immersed for several minutes in aqueous 3% eosin y stain, then thoroughly rinsed in 95% ethanol. All parts were then placed in essence of euparal in preparation for slide mounting.

• Mouthparts were placed, arranged, and correctly oriented on a glass microscope slide in a small amount of essence of euparal. The slide then dried overnight. Soon before imaging, a drop of euparal was deposited over the mouthparts, on top of which was placed a 12mm circular glass coverslip.

Petioles

• Gasters were removed from ants stored in 95% ethanol. Removal of the gaster is necessary in the Dolichoderinae because it often obscures view of the petiole. The ants were then point mounted with petioles exposed.

Imaging

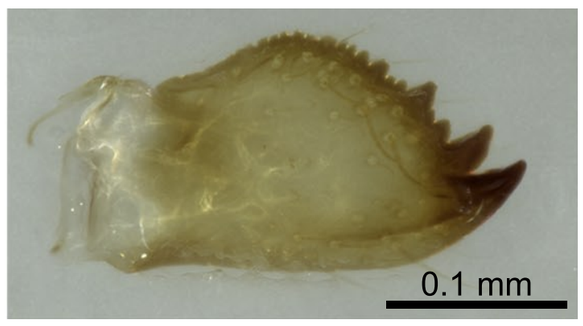
• Labra, maxillae and labia, both mandibles, and petioles were imaged using a Leica DFC450 auto montage camera with a Leica Z16 optics carrier and 5.0x objective lens.

• Image stacks were captured and compiled into multifocus montages using Leica Application Suite (LAS) v3.8.

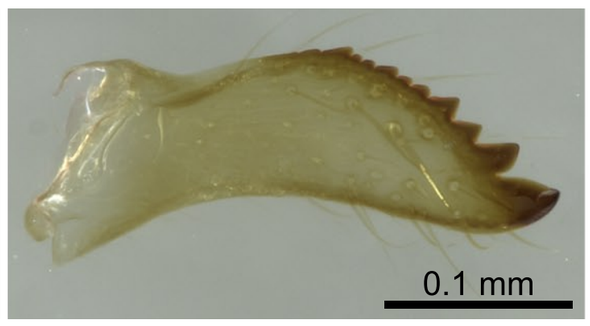
• Full procedures can be found in the Imaging Manual on Antweb.org.

Results

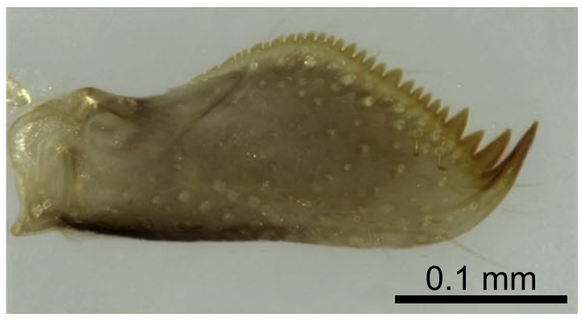
Mandibular structures, especially the size and distribution of denticles, proved to be the most useful characters for differentiating between the four Dolichoderine genera of Madagascar. Below are examples from four species, one from each genus, illustrating the typical mandible structure for each.



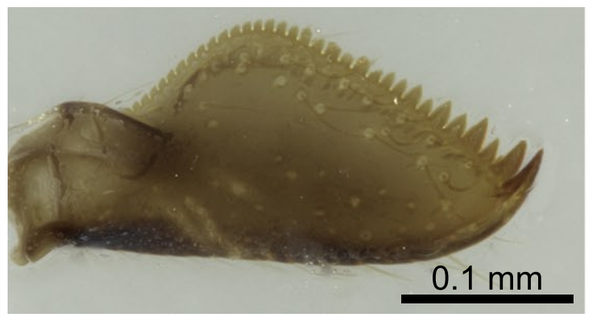
Aptinoma mangabe



Ravavy miafina



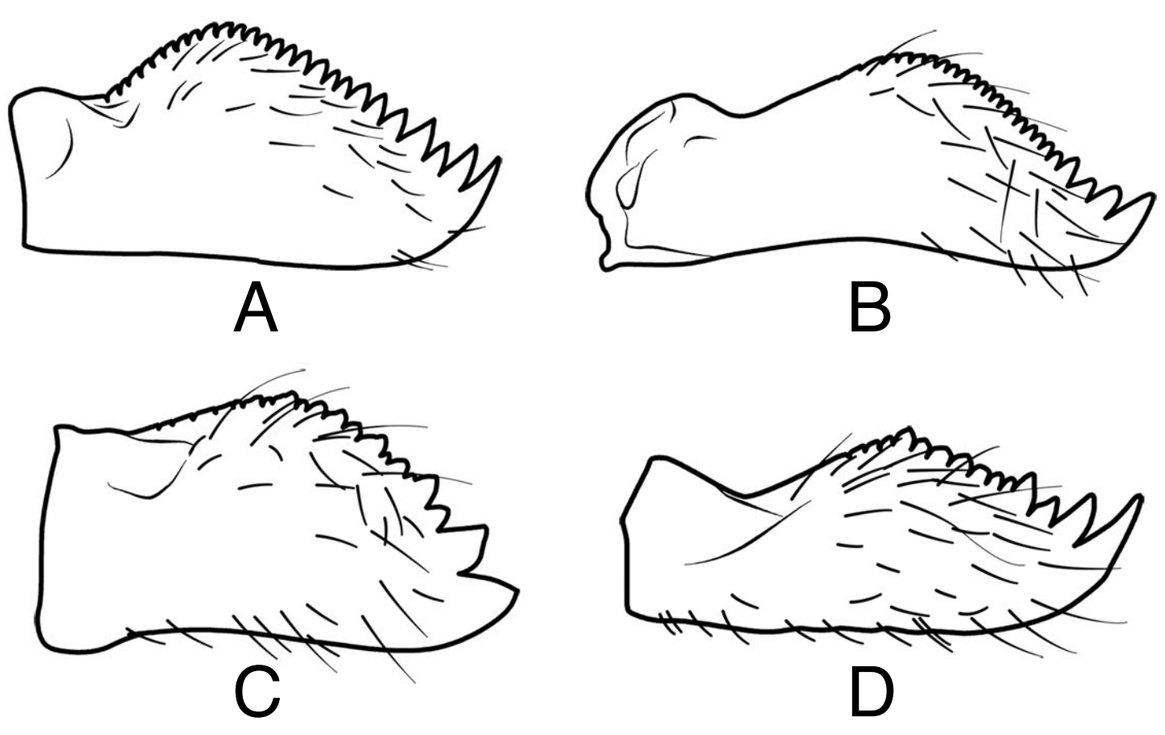
Tapinoma mg03



Technomyrmex vitiensis

Key

Mandible characters were used to construct this genus-level key for the Dolichoderinae of Madagascar.



1. Denticles reach at least 3/4 of the way along the basal margin of the mandible (**A**)……2
   - Denticles reach less than 3/4 of the way along the basal margin (**B**)……3
2. Denticles all along masticatory margin irregular, broadly triangular; mandible broad at base (**C**)……***Aptinoma***
   - Denticle shape variable; mandible narrowing at base (**A**)……***Technomyrmex***
3. Distinctly enlarged or protruding denticle at the junction of the basal and masticatory margins (**D**)……***Ravavy***
   - Denticles gradually and uniformly reduced in size from the apex to the base of the mandible (**B**)……***Tapinoma***

References

The methods for dissecting and staining mouthparts were modified from William Gotwald's paper on ant mouthpart morphology:

Gotwald, W. H. (1969) Comparative morphological studies of the ants, with particular reference to the mouthparts (Hymenoptera: Formicidae). Cornell University Agricultural Experiment Station.

More information about *Ravavy* and *Aptinoma*, two recently decribed Malagasy genera, can be found here:

Fisher, B. L. (2009) Two new dolichoderine ant genera from Madagascar: *Aptinoma* gen. n. and *Ravavy* gen. n. (Hymenoptera: Formicidae). *Zootaxa*, 2118, 37-52.

Acknowledgements

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