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# *Anochetus madagascarensis* Forel, 1887 found in Madagascan copal (Hymenoptera: Formicidae)

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**Abstract**

So far, eight fossil *Anochetus* species have been described, all of them found in Dominican amber. From the collection of the second author we investigated three sub-fossil ant specimens from Madagascan copal and identify them as the extant species *Anochetus madagascarensis*.

**Keywords**: Formicidae, Madagascan copal, sub-fossil ant, *Anochetus madagascarensis*

## Introduction

Until now, fossil records of eight species of the genus *Anochetus* have been known and all of them have been found in Dominican amber. BARONI URBANI (1980) described the first fossil Odontomachiti as *Anochetus corayi* and later MACKAY (1991) described a second one: *Anochetus brevidentatus*. Three years later six other fossil species belonging to the genus *Anochetus*: *Anochetus ambiguous, Anochetus conisquamis, Anochetus dubius, Anochetus exstinctus, Anochetus intermedius* and *Anochetus lucidus* were described by de Andrade (DE ANDRADE, 1994).

Three specimens of the same ant species included in Madagascan copal from the collection of the second author were investigated. The specimens are included in three separated pieces of copal that were found at the same locality in Madagascar. The age of Madagascan copal is uncertain and varies with the depth of mining, but the fauna included in the copal pieces differs from the recent fauna, which suggests that at least a part was formed several thousand years ago (PENNEY *et al.* 2005; POINAR 1992, 1999; WUNDERLICH 2004). Fossil records of the genus *Anochetus* are only known from Dominican amber and so far no description of *Anochetus* found in Madagascan copal has been published.

In a revision of Madagascan species of *Anochetus*, FISHER & SMITH (2008) mention five extant species. Two species, *Anochetus boltoni* FISHER, 2008 and *Anochetus goodmani* FISHER, 2008 are distinguished from the other three by inner mandibular blades with preapical teeth and denticles. The other three species, *Anochetus grandidieri* FOREL, 1891, *Anochetus madagascarensis* FOREL, 1887 and *Anochetus pattersoni* FISHER, 2008 have mesial borders of mandibles without teeth. In this paper, we compare the characters of our copal-embedded specimens with those of the Madagascar-endemic extant species of the genus *Anochetus*.

## Material and methods

### Description of the samples

The copal pieces (labelled as An1, An2 and An3) were well grounded and polished to optimise viewing prior to examination. Immersing in a 66% sugar solution or in transparent honey was applied to reduce the visibility of surface aberrations. After examination the copal with the material was coated with epoxy to prevent deterioration and to avoid escape of volatiles according to the technique described in HENDERICKX et al. (2006).

Fig. 1. Total view of the specimen An1 embedded in Madagascan copal. (photo François Vankerkhoven).

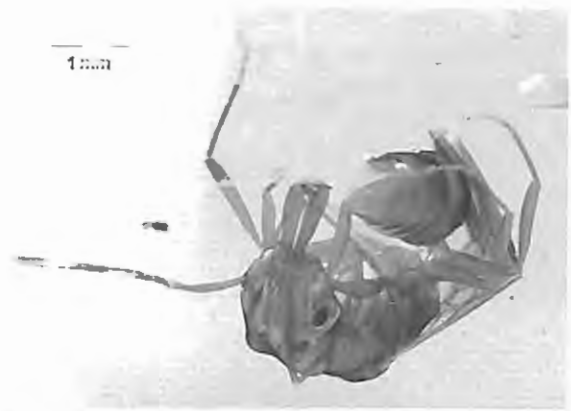

Fig. 2. View of the specimen An1 (photo Hans Henderickx). This is a composite image from several layers manipulated with special software for enhancing depth of field.

**An1** : This specimen is embedded in an oval piece (38 mm by 24 mm see Fig. 1) of Madagascan copal or alpha-amyrine resin from *Hymenaea verrucosa* GAERTNER, 1791, a tree native to East Africa and Madagascar. The sample was collected in the region of Sambava, in the Antsirarana Province in north-eastern Madagascar. This copal sample contains an intact alate female of the genus *Anochetus* and a few tiny other insects (Hymenoptera, Diptera and Coleoptera). The ant is clearly visible and most parts of the habitus can be studied relatively easily as there are no air bubbles close to the ant. The little distortion of the head results in an asymmetric position of the head and makes it impossible to observe an exact value of the head width (HW). Due to this restriction we could not calculate the cephalic index (HW / HL x 100) nor the scape index (SL / HW x 100) for this specimen.

**An2** : Cylindrical piece of Madagascan copal (40 mm by 12 mm). Origin of this piece as for An1. This sample contains more than 20 Diptera, a few tiny wasps, three beetles and one ant. The ant of the genus *Anochetus* is an intact specimen of an alate female.

**An3** : Cylindrical piece of Madagascan copal (30 mm by 8 mm). Origin of this piece as for An1. Without manipulation of the sample the alate female is clearly visible from the ventral side due to the position of the specimen in the cylindrical piece of copal. Reducing the appearance of surface aberrations by submersing the sample in a 66 % sugar solution gives a rather good access to the dorsal side of the ant. Besides the ant, a spider, a mosquito, a fly and a lot of air bubbles are also enclosed in this piece of copal.

## Measurements and abbreviations

All three specimens have mesial borders of mandibles without teeth as is the case for the extant species *A. grandidieri* FOREL, 1891, *A. madagascarensis* FOREL, 1887 and *A. pattersoni* FISHER, 2008 and we therefore compared our specimens with these three species. All measurements were made with an Olympus SZX12 stereomicroscope equipped with a 1.2 x PF front lens at magnifications of 96-216 times.

The measurements were made following FISHER & SMITH (2008). The following characters were measured if possible: HL: maximum head length measured in full-face view, EL: maximum length of the eye, SL: maximum scape length, ML: mandible length, WL: Weber's length or mesosoma length, FL: maximum length of the hind femur; mandible index MI = ML / HL x 100.

## Resnlts

### Morphometric characters

Due to the positions of our samples we couldn't compare all the parameters of the studied specimens with the morphometric characteristics of FISHER & SMITH and as a consequence it was impossible to calculate the indices CI (cephalic index) and SI (scape index). In general, we noticed a great resemblance of the three studied fossil specimens with the extant species *A. madagascarensis* but observed some differences in the length of the compound eye (EL).

Table 1. Morphometric characters from FISHER & SMITH (2008) for three extant species and the values found for the three specimens embedded in Madagascan copal.

| | *A. grandidieri* | *A. madagascarensis* | *A. pattersoni* | An1 + An2 + An3 |
|---|---|---|---|---|
| | n = 5 | n = 5 | n = 1 | |
| HL | 0.88 - 1.15 | 1.52 - 1.66 | 1.31 | **1.45 – 1.78 (n = 2)** |
| EL | 0.17 - 0.23 | 0.32 - 0.36 | 0.30 | **0.24 - 0.27 (n = 3)** |
| ML | 0.39 - 0.56 | 0.81 - 0.89 | 0.64 | **0.86 - 1.06 (n = 3)** |
| MI | 44 - 49 | 53 – 55 | 49 | **60 – 68** |
| SL | 0.62 - 0.87 | 1.26 - 1.39 | 1.05 | **1.26 - 1.44 (n = 3)** |
| WL | 1.08 - 1.46 | 1.99 - 2.22 | 1.81 | **1.95 – 2.34 (n = 2)** |
| FL | 0.68 - 0.96 | 1.35 - 1.49 | 1.15 | **1.40 - 1.61 (n = 3)** |

## Diagnostic characters of the specimens

Blade of mandible without denticles or preapical teeth; apical end of inner blade with semicircular concavity followed by three large apical teeth rectangularly bent inward, middle tooth half as long as the other two. Posterodorsal side of the head with the nuchal carina forming an uninterrupted curve. Head, thorax and abdomen reddish brown; antennae, mandibles and legs light brown. Body with only a few standing hairs on the thorax. Apex of the petiole weakly convex. Propodeum armed with sharp angles and rear face of the propodeum nearly flat.

The combination of the characters show the most obvious similarity with *A. madagascarensis* as characterised by FISHER & SMITH (2008) and indicate that the three investigated females belong to this species.

## Discussion and conclusion

The description of these sub-fossil ant specimens from Madagascan copal is important and highlights new routes of biogeographic extension and evolution of the Odontomachiti ants from Madagascar and Africa in general. Like most of the species of the genus *Anochetus*, *A. madagascarensis is* a ground-dwelling ant nesting and foraging in a microhabitat of leaf litter, low vegetation and rotten logs (FISHER, 1996a;b; 1997). Thus, the three alate gynes we investigated may have been trapped in resin on a tree during their nuptial flight.


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