Reprinted from JOURNAL OF THE NEW YORK ENTOMOLOGICAL SOCIETY,
Vol. LXXI, September, 1963, pages 130–141.

SUBTERRANEAN NESTS OF TWO AFRICAN STINGLESS BEES (HYMENOPTERA: APIDAE)[1]

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RECEIVED FOR PUBLICATION SEPTEMBER 7, 1962

ABSTRACT

Descriptions of the nests of two African subterranean meliponid species, namely, *Meliplebeia tanganyikae medionigra* (Cockerell) and *Plebeiella lendliana* (Friese) are given. In both species, the nest proper consisted of **brood area, area of old cerumen layers, and of pollen and honey pots.** The combs are horizontal in both species, the mode of building is concentric in *M. t. medionigra* while clockwise-spiral in *P. lendliana.* In both species, the nests are connected to the exterior by means of an entrance burrow, of which the uppermost section forms a turret protruding above the soil surface. An interesting lower blind burrow was observed in *M. t. medionigra* apparently for the drainage of excess moisture. Both species can be transported to artificial hives, but the maintenance of the colonies under this condition is difficult.

While subterranean stingless bees have been studied in Brazil since von Ihering (1903), African species of similar habit have received little attention until recently (Smith 1954). The present paper deals with the subterranean nests of two species observed in Angola.

MATERIAL AND METHODS

All nests observed, seven colonies of *Meliplebeia tanganyikae medionigra* (Cockerell 1934) and four of *Plebeiella lendliana* (Friese 1900),[4] were collected in the plateau areas of Districts

[1] The present work was made under the financial aid of the Direção de Agricultura de Florestas de Angola and of the Rockefeller Foundation.

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[3] Submitted for inclusion in the **Herbert F. Schwarz Memorial Volume** (1962) but delayed in publication due to lack of space, cf, 70 p. 214.

[4] The scientific names were used according to the system of Moure (1961). In a more conservative treatment, these would be written as *Trigona (Meliplebiea) tanganyikae medionigra* and *Trigona (Plebeiella) lendliana*, respectively.

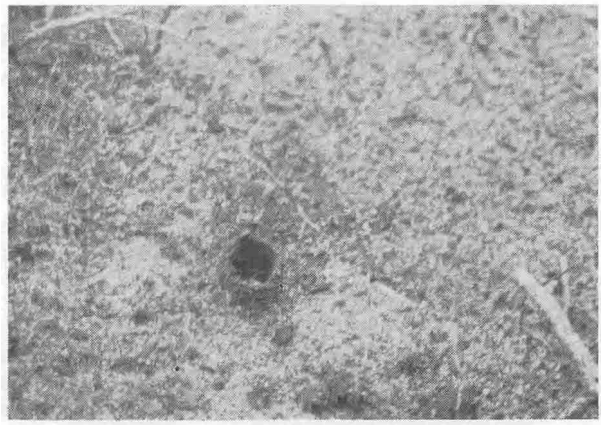


Fig. 1—Entrance of a nest of *Meliplebeia tanganyika medionigra* (entrance of nests of *Plebeiella lendliana* have a similar structure).

Moxico and Huila, Angola, where the dominant soil types are arenaceous or argilo-arenaceous. All were discovered in grassland areas but never within forests. Except for one colony of *P. lendliana* recovered from a termitarium, all nests examined were found in subterranean cavities. One nest was sent by air from Huila (2.000 m alt.) to my laboratory in Luanda (sea level) where it lived from 1956 to 1958 in a wooden box.

Fig. 2—Excavation of subterraneous nest; (notice vertical straw introduced through entrance burrow).

The entrances are usually so well hidden under grasses and weeds (Fig. 1) that they are discovered only by chance. Hence, information brought by the natives is indispendable for collecting the nests. After the discovery, a flexible stick is introduced through the nest entrance, then, the nest is dug out (Figs. 2 and 3).

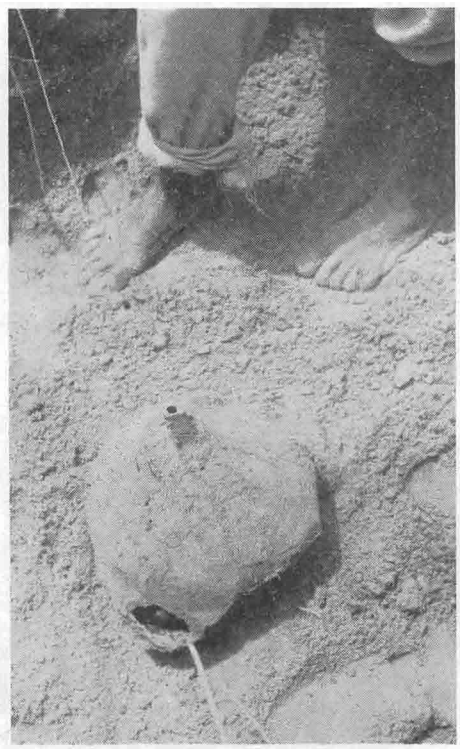


Fig. 3—A colony of *Meliplebeia tanganyikae medionigra* entirely exposed (1.80m in depth). The upper part of the entrance burrow was damaged during excavation.

OBSERVATIONS ON *M. tanganyikae medionigra*

The nest structure of *Meliplebeia* was already described by Smith (D.C.) in *M. beccarii.* But the architecture of *M. tanganyikae medionigra* (called Uky in Kioko dialect) observed by me showed some differences from that in *M. beccarii,* so that it deserves a description here.

The nests are usually found between 0.5 to 1.0 m below soil surface and connected to the exterior by a vertical or slightly inclined burrow. The nest is pear, calabash or fig-shaped, 25 to 35 cm high by 30 cm in diameter (Figs. 4, 5 and 6). The

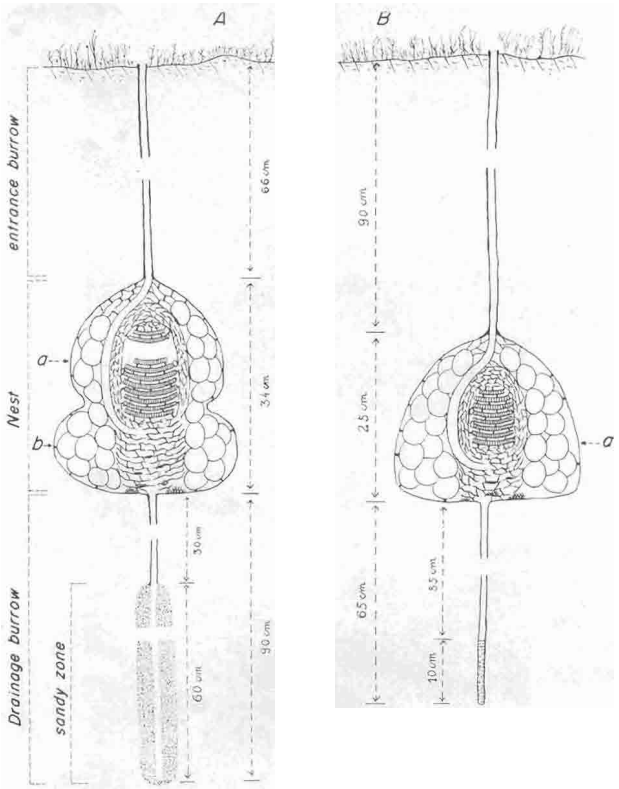


Fig. 4—Two nests of *M. tanganyikae medionigra*. Vertical entrance burrow in both A and B.

A = Calabash shape nest with drainage burrow opening into sandy zone.

B = Fig-shape nest with blind drainage burrow, filled with milky dirty water. It may be that this is a nest with just the *a* part built, and that latter on the bees would construct the *b* part.

walls are not smooth, lined with dark propolis 1 to 2mm in thickness. Within the nest three distinct areas are observed: the brood area, the area of old cerumen layers and the area of pollen and honey pots. The brood area is cylindrical with round

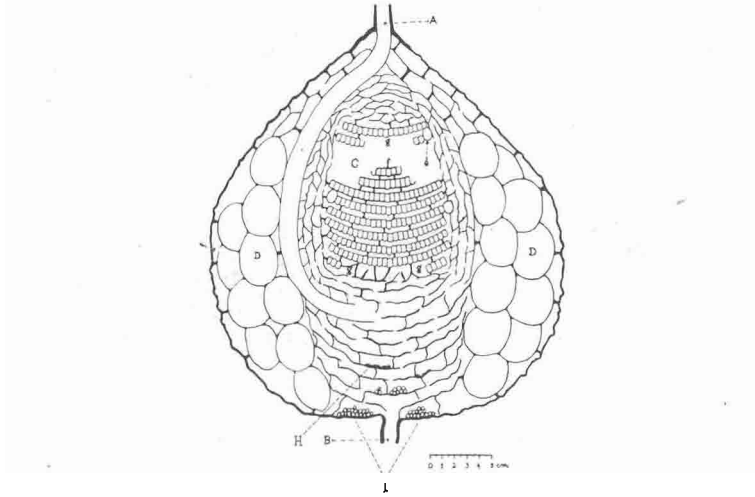


Fig. 5—Nest of *M. tanganyikae medionigra*. A = entrance burrow; B = drainage burrow; C = brood area; D = honey and pots; e = royal cell; f = combs being built; G = brood combs, in the central area young bees are emerging; H = resin; I = garbage area.

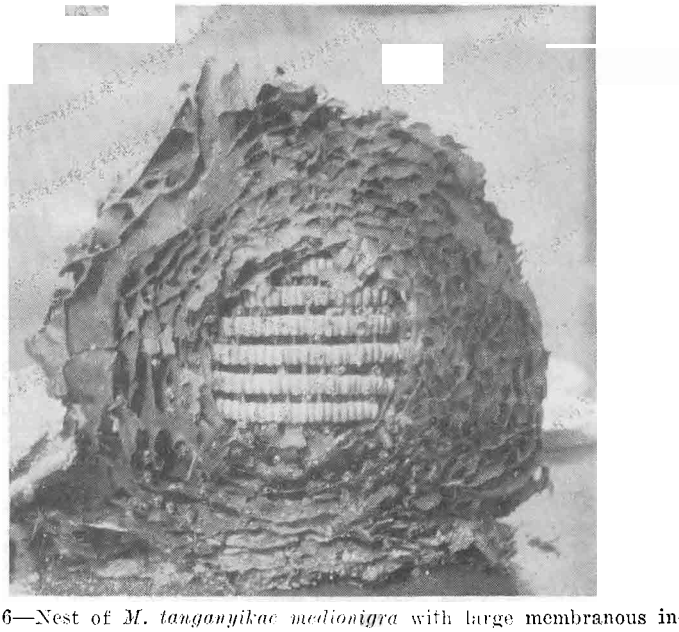


Fig. 6—Nest of *M. tanganyikae medionigra* with large membranous involucrum. Note entrance tube opening below the brood area. Brood combs are intact but pots were removed before photographing.

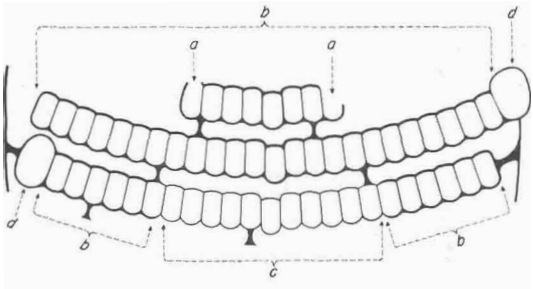


Fig. 7—Three brood combs of *M. tanganyikae medionigra*, side view, showing: a = cells in construction; b = cells with larvae; c = cells with prepupae and pupae, in which wax was removed at the tops; d = royal cells.

bottom, waxy above but hard below, externally about 18cm high by 14cm in diameter while internally 12cm by 9cm. These differences are caused by the occurrence of the involucrum, consisting of 4 to 10 waxy sheets. The outer sheet is almost completely smooth, leaving only small holes which serve as pathways for bees. Within the involucrum, 8 to 12 horizontal brood combs

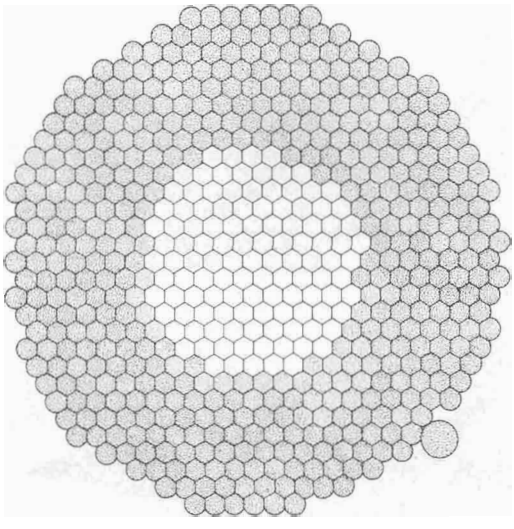


Fig. 8—Comb of *M. tanganyikae medionigra*, seen from above. Light central area are cells with prepupae and pupae from which wax was removed at the tops; dotted area represents region where young larvae and eggs (in the periphery) are found. **Left side indates royal cell.**

are found. Each comb is at first horizontal but later becomes concave, the central cells about 1mm lower than the peripheral ones (Fig. 6). Nothing is known about why the combs become concave although built horizontally. The maximum diameter of combs so far recorded was 13cm. A comb of 10cm in diameter may contain about 450 cells (Fig. 7). The mode of the construc-

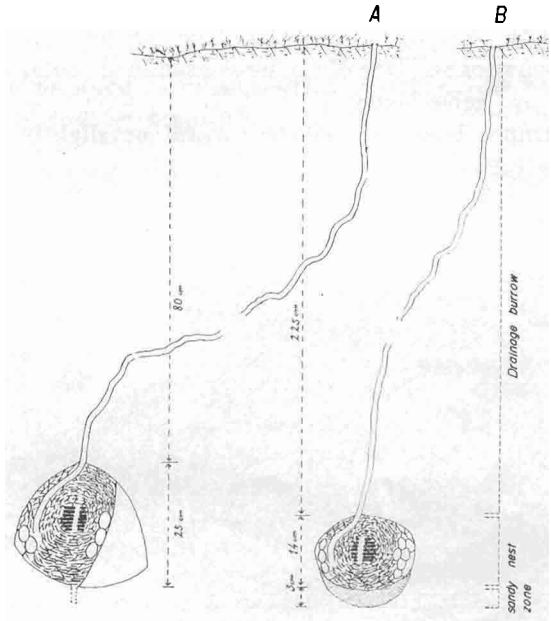


Fig. 9—Two nests of *Plebeiela lendliana*. Notice in both A and B nests the inclined irregular entrance burrow.

A = This nest was partially built in a termitarium pan and has a drainage burrow.

B = This nest was built directly on a sandy zone, with no drainage burrow.

tion is concentric, that is, each comb is made from center to periphery. Very often each comb is firmly connected to one another or with involucrum by means of waxy columns. Each cell is 7mm high by 3.8 to 4mm in diameter, rounded both at top and bottom, though the former is less convex. After the larvae spin the cocoons, the workers expose them by taking out the wax from the surface of cells, a trait well known in the bumblebees and, probably common to all stingless bees and described by Kerr (1949) in several stingless bees.

The area with old cerumen layers is immediately below the brood area, and of the same diameter. The entrance burrow opens into the upper part of this area. Garbage and resin deposits are found in the lower area. The opening to the lower blind burrow is found at the center of the bottom. The area **of pollen and honey pots cover the brood area laterally.** Each pot is an average 3 to 4cm high and 2.5 to 3.2 cm in diameter. In general the pollen pots are placed nearer to the brood area than the honey ones. One of the nests examined contained about 2 liters of agreeable honey.

The entrance burrow is either vertical or slightly inclined,

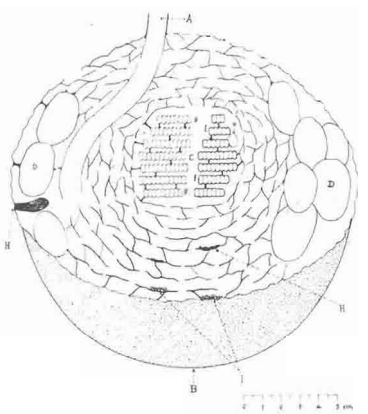


Fig. 10—Nest of *P. lendliana*, showing: A = entrance burrow; B = sandy area for drainage; C = brood area; D = honey and pollen pots; e = royal cell; f = cells in construction, cells with eggs and young larvae; g = cells with pupae and imago; H = resin and gum deposits; I = garbage area.

50 to 100cm in depth, protruding above the soil surface and forming a turret of about 1.0 to 1.5 cm in height: the internal diameter is 8 to 10mm and the walls are lined with dark and hard propolis 1 to 2mm in thickness though thicker near the nest proper.

At the center of the bottom of the nest proper, is found the entrance to a characteristic blind burrow, which is deep (95cm in one case), reaching to the sandy zone or opening to a cavity either empty or filled with sand. The walls of this burrow are lined with propolis in its upper section and easily distinguished from the lower section. But in one nest, the burrow was lined

with propolis throughout its extent and was filled with white liquid. When the blind burrow opened to the sandy zone, the sand was full of moisture. This burrow seems to be the result of the work of the bees for the drainage of excess moisture rather than the utilization of pre-existing construction. No bee was found in this blind burrow during the excavation of the nests.

The worker bees are laborious but gentle. The drones are similar to the workers in the outer appearance but can easily be distinguished when alighting outside the nest due to their inclined or almost erect posture.

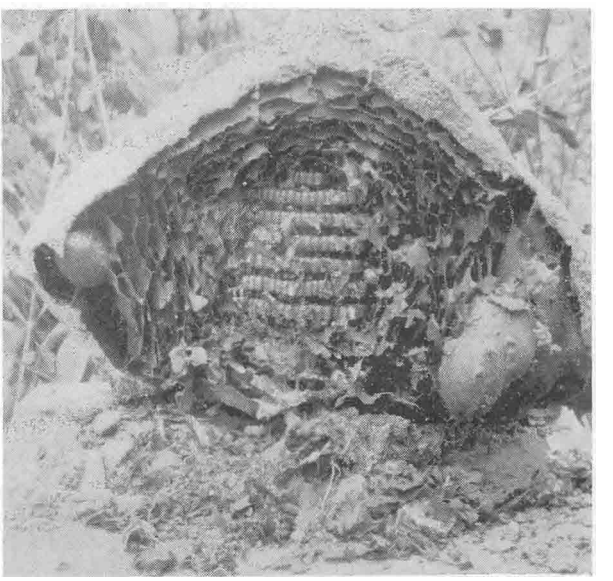


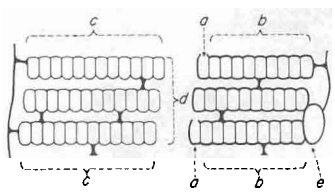
Fig. 11—Nest of *P. lendliana*, showing: brood combs, royal cells, membranous involucrum, region below brood area, pollen and honey pots, entrance burrow.

OBSERVATION ON *P. lendliana*

The four nests of *P. lendliana* (called ossongo in Kioko dialect) were found 1.5 to 2.5m below the soil surface. The nest opens to the exterior through an inclined and sinuous entrance burrow. The nest proper is round, slightly flattened above as well below, an average 20cm in horizontal diameter and 15cm in height. The nest walls are lined with propolis 0.4 to 1.0mm in thickness. As

in the species mentioned above, three areas are distinguished within the nest. The nest proper is 12cm in horizontal diameter and 7 to 8cm in height, when measured at outer surface of involucrum whereas it is 6cm in diameter and height at the inner surface of involucrum. The involucrum is made of 6 to 13 waxy sheets spaced at about 4mm intervals. The combs are horizontal, each 5 to 6cm in diameter, spaced 2mm and supported by thin columns of cerumen.

The mode of comb-building is similar to species which make spiral combs. In this species, however, the combs are super-



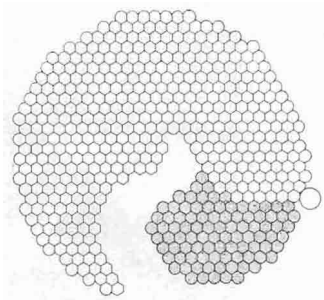


Fig. 12—Brood comb of *P. lendliana*, side view showing: a = cells in construction; b = cells with eggs or young larvae; c = cells with pupae or imago in which wax was removed; d = area with emerging bees; e = royal cell.

Fig. 13—Comb of *P. lendliana* seen from above. Construction front of new cells (dotted area) proceeds clockwise. Every comb has this design. At right a royal cell is seen.

imposed but independent of one another. Smith (1954) described a similar system in *Trigona denoitii* Vachal. The direction of the building front is, however, anticlockwise in his species while clockwise in *P. lendliana*. The building front of the combs follows the sector where bees are emerging (Fig. 12 and 13). Each cell is 4.5mm high by 2.0 to 2.3mm in diameter. Each comb contains about 600 cells. Royal cells are ovoid, about 7.5mm high 4.5mm wide.

The area of old cerumen layers has the same diameter as the brood area, situated immediately below the latter, receiving the entrance burrow at its upper part. This area consists of several irregular sheets made of hard but brittle cerumen, possessing numerous small cavities connected by canaliculi where bees are found. The garbage and resin deposits are found

at the bottom of this area. The resin stores are also found on the walls of the nests.

The area of pollen and honey pots surrounds the brood area except for its upper and lower parts. Each pot is usually spheric, averaging 2.5cm in diameter and height, though occasionally reaching 2cm wide and 4cm high. There is no difference in the localization of pollen and honey pots. Maximum honey storage seldom exceeds 1 liter. The honey is acid, somewhat sour, hence unpleasant.

The entrance burrow protrudes above the soil surface, forming a turret of 0.5 to 1.0cm in height. The transverse section of entrance burrow turret is in general round but was eliptical in one case. The diameter is about 8mm, but is constricted to 6mm at the uppermost part. The entrance is guarded by several bees at daytime but closed at night.

The drainage burrow was not always found. Usually the nests are built immediately above the sandy zone of 3 to 4cm, but in one case there was a drainage burrow and the general feature of its upper part was similar to that of *M. tanganyikae medionigra.*

The workers are gentle, not flying about when the nests are manipulated. The guards close the entrance with cerumen and resins rapidly, less than 30 seconds, when the nest is disturbed.

ADDITIONAL REMARKS

The colonies of the two species mentioned may be maintained in artificial hives. This is difficult however, because they lack adaptation to the marked oscillation of temperature and increased attack of enemies. In the subterranean nests of these species, a small inquilinous beetle, *Aecthina* sp., is found in the cerumen sheets below the brood area, which do no marked damage to the nest under normal conditions. But, in weak colonies introduced to the artificial hives, this beetle may increase and aggregate on and in the pollen pots. In this case, the hive can be damaged by *Aecthina* larvae within a few days.

M. tanganyikae medionigra usually begin a kind of absconding swarm if forced to live in the artificial hive. The workers transport wax, pollen and honey, the males stay outside the nest alighting less than 1m from the entrance. Within a few weeks

all bees disappear from the nest, leaving the mother queen alone. At this time, pillage to the abandoned nest may be performed by the same species.

Both species make use of old fungi-chambers of termite nests, especially those chambers distant from the center of the nests. My observations on the entrance burrow suggest that *M. tanganyikae medionigra,* builds its own entrance burrow while *P. lendliana* seems to use the pre-existing tunnel of termites which is adapted as the entrance burrow. It was not ascertained whether or not termite nests were made by the same species.

ACKNOWLEDGMENTS

I would like to express my sincere thanks to Prof. Warwick E. Kerr for his suggestions in preparing this paper; further to Prof. J. S. Moure and Dr. O. L. Cartwright for the identification of the stingless bees and the parasitic beetle respectively, and to Dr. S. Sakagami for correcting the English translation.

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