International Journal of Research in Agricultural Sciences
Volume 3, Issue 6, ISSN (Online): 2348 – 3997

Nest Architecture of *Dactylurina Staudingeri* (Hymenoptera, Apidae, Meliponini) in Cameroon

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***Abstract* – Stingless bees (Meliponini) are a group of small to medium-sized bees with vestigial (non functional) stings. They store honey and pollen and occur in perennial colonies. Meliponiculture is still very poorly developed in Cameroon and often results in destruction of colonies after harvest due poor understanding of the nest architecture. *Dactylurina staudingeri* is the only stingless bee (Apidae-Meliponini) found with exposed nests in Cameroon. The nests are often fixed on tree branches at a height above 4m. Combs are vertically constructed with doubled layer cells. The batumen layer is exceptionally constructed with many hard sheets. The workers bite as a defense mechanism against predators. More than 80% of honey pots are located underneath directly below the lower portion of the brood area. Harvesting of honey from *D. staudingeri* can be facilitated using a syringe on the honey pots to avoid colony destruction and destruction of bees.**

***Keywords* – Stingless Bees, Apinae, Meliponini, Dactylurina Staudingeri, Nest Architecture, Cameroon.**

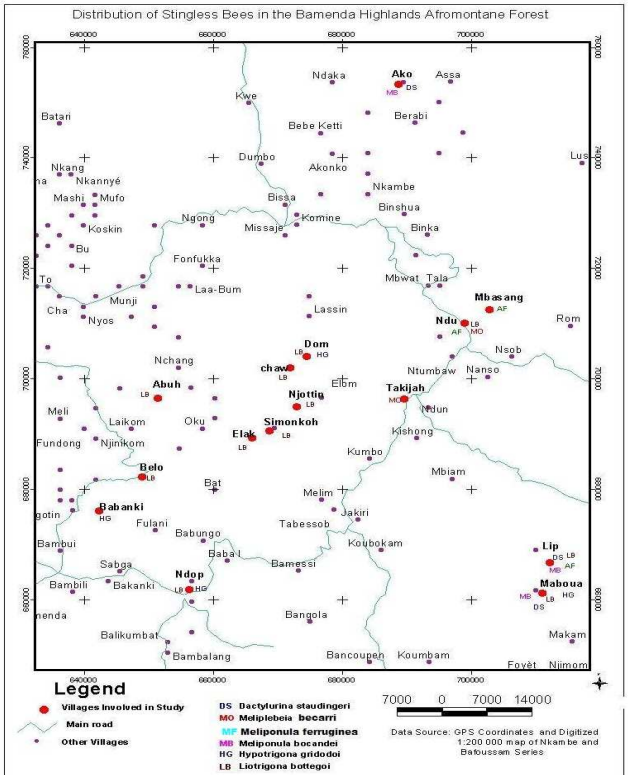
I. INTRODUCTION

Stingless bees are a group of small- to medium-sized bees with vestigial (non functional) stings. They store honey and pollen and occur in perennial colonies. Stingless have attained the most advanced level of social organization which can only be comparable to that of honeybees (Sakagami, 1982). There are several hundred of species existing worldwide, which differ significantly in colour, body and colony size (Roubik 1992, Michener 2000). In Africa stingless are distributed throughout the tropical and subtropical parts where they occur sympatrically with the honeybees (Kajobe, 2007). They are often stated as generalist flower visitors (visits many different flowers) and important pollinators of crops though with little or no review on this assertion. Meliponiculture is still very poorly developed in Cameroon. Generally, the number of existing colonies of stingless bees in this area appears to be on a decline. Due to recent scarcity in the number of colonies of the stingless bees' colonies, fewer people are interested in meliponiculture nowadays compared to years ago. Harvesting of stingless bee honey is still done using very primitive methods which results in destruction of the nests, killing of the brood and spilling of honey. Though stingless bees are not as productive as honey bees in terms of honey quantity, meliponiculture could help in poverty alleviation in the rural areas if developed and practice in large scale as is the case with apiculture.

II. MATERIALS AND METHODS

This study was done in Lip, Mbiame Subdivision, Bui Division in 2008 in Cameroon. Prior to this study a preliminary survey of bees was carried out in 2007, during which time stingless bees where collected and identified. A sample collection was used as a guide to ease understanding and recognition of *D. staudingeri* when talking to people in the community. The sample collection was presented to local farmers, hunters and beekeepers that assisted in locating nesting sites of stingless bees' species and new colonies. Nests were found both by chance and from information provided by the hunters, farmers and beekeepers. Four nests of *D. staudingeri* were studied.

Study Area



III. RESULTS

3.1. *Nesting Sites*

All the nests of *D. staudingeri* were located on fruit tree with some lateral branches used as support through the nest cavity.

Fig. 1. A nest of *Dactylurina staudingeri* on the branch of a pear tree

Fig. 2. Nest of *Dactylurina staudingeri* from an orange tree

3.2. *Nest Entrance*

The nest entrance of *Dactylurina staudingeri* comprises 2 orifices a main entrance and many smaller entrances. The height of the main entrance is between 3-5cm high and the diameter between 3.5 – 5 cm wide. The small openings are very irregular in size and number, and can range from 16 – 27 in number (Fig. 3 & 4). The shape of the nest entrance is very irregular. The dimension of the orifices varies with the size of the nest. The nest entrance is always found at the lower quarter of the nest. The situation of the nest entrance is more or less constant in all the nests we studied no matter the size. Bees coming into the nest do not go directly into the storage pots as in other species. They are obliged to pass through the layers or batumen and involucrum before reaching the brood cell area. The entrances are covered by pale yellow and sticky resins.

A network of pillars that builds up the multi-entrance and exit area, serves rapid attack as many bees can take off when disturbed. The pillars serve as platforms that allow many more bees to take off at once and make their attack rather than a single opening.The guards and workers were always seen around the nest entrance, actively involved in construction works of the nest. The guards do not stay waiting for any enemies or intruder. The most import part of the nest consists of very hard and breakable layers. The inner involucrum is more rigid and soft. The thickness of this layer could be measure 6cm thick in some areas.

Fig. 3. Complete nest of *D. staudingeri* showing position of nest entrance

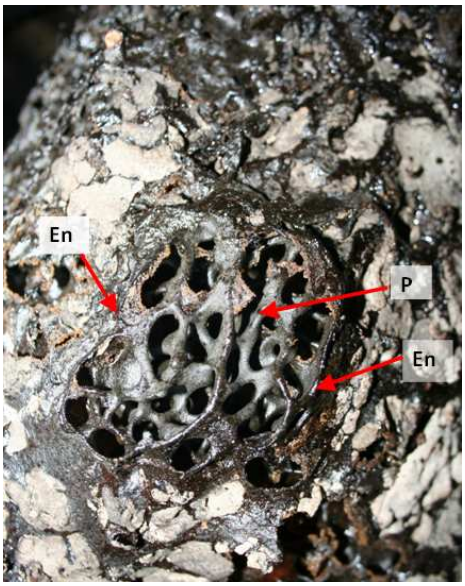


Fig. 4. Details of nest entrance of *D.staudingeri*. EN-entrance wall, P-pillar

3.4. *Batumen and Invulucrum Sheets*

The brood area is always covered with layers of resins mixed with other plant materials such as leaves which play an important function in its development, thermal

regulation and protection of nest against enemies and intruders. The batumen is a hard black thick structure made up of many linings (3-8) .The thickness of each batumen lining is about 1-2mm thick except for the main outer lining which is thicker. The outermost batumen lining covers the whole nest cavity leaving out just the openings at the nest entrance. They are usually 2-3 thin sticky involucrum layers. The involucrum lies between the batumen and the brood area. It covers the brood area completely.

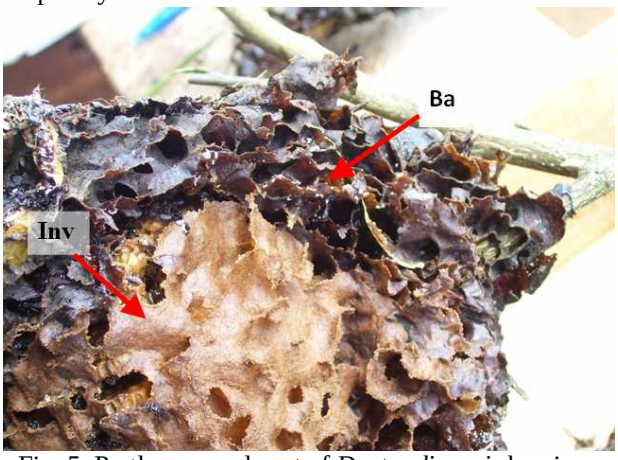


Fig. 5. Partly exposed nest of *D. staudingeri* showing; **Ba** - Batumen, **Inv**- Involucrum

3.5. *Storage Pots*

The storage pots (honey and pollen) are very irregular in shape ranging from spherical, oblong and conical. The honey pots and the pollen pots are very similar in size and shapes but differ in color. The honey pot is dark brown and the pollen pots are yellowish brow. The pots are 1.5-3cm high and 1.5-2cm in diameter.

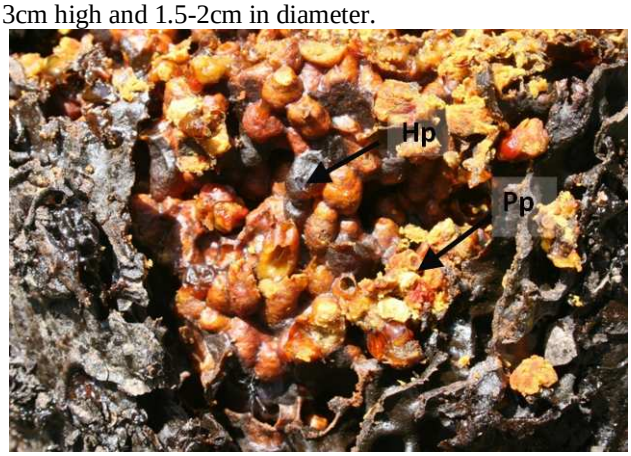


Fig. 6. Location and distribution of storage pots; **Hp**=Honey pot, **Pp**=Pollen pot

Pots are mostly located underneath directly below the lower portion of the brood area. A few pollen pots were also seen between the enormous batumen layers distributed unevenly all round the brood area (Figure 6).

3.6. *Brood Area*

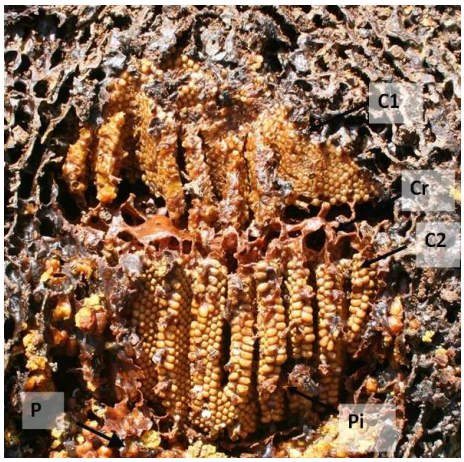


Fig. 7. Brood area; **C1**-upper half of comb, **C2**-lower half of comb, **Cr**-Cerumen**, Pi**-Pillar, **P**-storagepots

The combs of *Dactylurina staudingeri* are vertically arranged with double layers (two single combs combined together). The brood area is divided into two portions: an upper portion and lower portion. The two portions are separated by a cerumen sheets constructed to differentiate the two. The cerumen seems to be a part of the involucrum between the portions. Each portion contains 6-10 doubled layers of combs and the numbers are not always the same. The gap between the two portions can be between 1-2cm in some areas.

Fig. 8. Pillars separating combs are attached to on cells

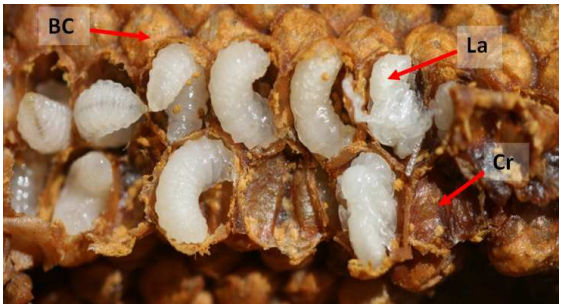


Fig. 9. Brood of *Dactylurina staudingeri*; **BC**- Brood cell, **La**-Larvae, Cr= cerumen linking gap cells to one another

3.7. *Defense Strategy*

As a defense strategy, *Dactylurina staudingeri* bites exposed parts of the body and enters into the hairs, nostrils, eyes and ears to create discomfort. They would attack any other enemies similarly and scare them from coming closer to the nests. Their main weapon used for vigorous attacks comes from the design of the nest entrance. With multiple pillars at the openings of the nest entrances, many bees line up at the entrance prepared to come out in their numbers to attack any intruder when disturbed. It is difficult to work with this species without protecting exposed body parts.

Table 1. Summary of measurements taken for *D. staudingeri*

	Parameters measured	Nest 1	Nest 2	Nest 3	Nest 4	Average	Shape	Color
Nest cavity	Height of nest (cm)	22	34	31	24	27.75		
	Diameter of nest(cm)	16	22	19	14	17.75		
Batumen	Number of batumen	3-4	3-8	4-7		6		Black
	Thickness of batumen (cm)	0.1	0.2	0.1		0.1		
Combs	Number of combs	6/6	9/10	7/8		9		
	Diameter of combs (cm)	12	13	11	12	12		
Involucrum	Number of involcrum	2	3	3	2	2.5	Light brown	
	Thickness of involucrum (cm)		<0.1					
Brood cells	Height of cell (cm)		0.3-0.5(5)					
	Diameter (cm)		0.20.3(5)					
Storage pots	Height of Honey pots (cm)		1.5 – 3 (14)		1.5 – 3 (14)	2.8	spherical, oblong and conical	Dark brown
	Diameter of honey pot (cm)		1.5 -2 (15)		1.5 -2 (25)	1.7		
	Height of pollen pot (cm)		1.5 – 3 (25)	1.4-3 (29)		2.6		Yellowish
	Diameter of pollen pot (cm)		1.5 -2	1.5 -2	1.5 -2			

IV. CONCLUSION

This study has brought to light the detail nest structure of *D. staudingeri* especially the location of the pots (honey and pollen) which those practicing meliponiculture can make use of to better extract honey without destroying the bees and the colonies.

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