Honey, Beeswax and Pollen Yields in Composite Colonies of *Trigona Carbonaria* (Stingless Honeybee) in the Southeastern Nigeria

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ABSTRACT

This study assesses the honey, beeswax and pollen yields of colonies of a stingless honeybee species, namely Trigona carbonaria in Egbelu Uvuru in Aboh Mbaise Local Government Area of Imo State, Nigeria. Twenty-five colonies of Trigona carbonaria were randomly selected on the walls, doors and windows of a building. The honeycombs and pollen of each colony were collected separately. The honey was processed using dripping method that involved the use of muslin clothes. The weight of the honey, beeswax (residue) and pollen harvested from each colony were weighed and volume of honey determined. The result shows that there were variations in honey, beeswax and pollen weight and volume of the honey in the colonies. Colony 17 produces the highest quantity of honey while colony 11 produces the least quantity. Colony 17 produces the highest quantity of beeswax and colonies 1 and 9 produce the least quantity respectively. Colony 16 produces the highest quantity of pollen while colonies 4 and 18 produce the least quantity respectively. The average quantities of Trigona carbonaria colonies contents showed honey weight (g) forming 53%, beeswax 36% and pollen 11% in the pie-chart. Meliponiculture should be popularized and practised like apiculture by both the government institutions and individuals so as to ensure adequate production of Trigona carbonaria honey, beeswax and pollen production.

***Key words**: Honey, Beeswax, Pollen, Trigona carbonaria, colonies*

INTRODUCTION

Bees belong to the third largest insect order (*Hymenoptera*) which also includes wasps and ants. The tribe *Meliponini* belongs to the group of corbiculate bees and encompasses all the bees known as "stingless bees" found throughout the tropical and subtropical ecosystem (Nates-perra, 2001 cited in N.R.C.R.I., 2008). There are about 400 stingless bee species in the world; out of which about 20 species have been identified in Nigeria. It includes Trigona carbonaria which is among the commonest ones found in south-eastern Nigeria. Stingless honeybees live in cavities like the stinging bees and produce only 1 - 4 litres of honey per year which explains why meliponiculture is not common. However, honey produced by stingless honeybees is said to be highly medicinal and of very pleasing aroma. Honey has been defined as the natural sweet

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substance produced by honeybees from the nectar of blossoms and/or from the secretion of living parts of plants which honey bees collect, transform and combine with specific substances of their own, store and leave in the honey comb to ripen and mature (Codex Alimentarius Commission, 1989 cited in Joseph *et al* 2007). Honey is a complex mixture and presents very great variations in composition and characteristics due to geographical and botanical origin of nectar foraged by bees (Crane, 1980). Honeybees make honey to use and store as food. This trait is exploited by humans of all strata for their nutritional and health enhancements. A honeybee's colony is made up of the queen, the drones, the broods and the workers. The productivity and efficiency of honey bees being social insects depend on the availability of their food, division of labour apart from weather conditions of their existing environment (Crane, 1992).

Stingless honeybees produce beeswax. This forms an important honeybees product apart from the honey, pollen and royal jelly. There abounds information on the ancient use of beeswax. Egyptians used it in ship building. In the Roman period, beeswax was used as waterproof agent for painted walls and as medium for mummy portraits. In the Middle Ages beeswax was considered valuable enough to become a form of currency. It has recently found use as modeling material, as a component of sealing wax and in cosmetics industry (Root, 1962; Coulston, 2000).

The beeswax is generally used as emulsifying agent for nearly all our modern cold creams, shoes polish production, wood polish, ointment, lipstick, pomade and rouges. Other industries using beeswax include textile, ink, candle, crayon and pharmaceutical. It is also used in food industries. It is used in cooling food such as cheese. Beeswax is produced by honeybees of certain age in form of thin scales. The scales are produced by honeybee-wax producing glands. The worker honeybees normally suck honey that is equal to one third of her body size. This creates pressure and increase the body temperature which then leads to secretion of beeswax. The size of the wax gland depends on the age of the worker bee. Wax is usually produced from abdominal segments 4-7 and is secreted in form of small, irregularly shaped, oval flakes or scales which project from between the overlapped portions of the last four abdominal segments visible on the underside of the bees (Dadant, 1975 cited in Crane, 1980). The amount of beeswax secreted may exceed that required for extending the cell walls and capping the combs. Bees secrete beeswax in proportion to their needs. Honeybees use beeswax to build honey combs which are made up of cells in which the broods are raised and honey and pollen are stored. For the worker bees to secrete wax the ambient temperature in the hive has to be 33 to 36^{o}C (91-97^{o}F).

Beeswax varies from yellowish white to brownish colour depending on the type of flowers gathered by the bees as well as age of wax (Crane, 1980; Akachuku, 1995a). Wax from the brood comb of honeybee hive tends to be darker than wax from the comb containing honey. Impurities accumulate more quickly in the comb. And as a result of this the wax has to be rendered pure before further use and what then remain is referred to as slum gum. Beeswax is a tough wax and has high melting point range of 62 to 64^{o}C. It changes colour and its density at 15^{o}C is 0.958 to

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0.970g/cm^3. Wax is not chemically a fat or glycerin yet it is nearly allied to fats in atomic constitution and the physiological conditions favouring the formation of one are curiously similar to those aiding in the production of the other (Root, 1962). Pollen is a natural source of protein, fats, minerals and vitamins, which are necessary elements for normal development of a bee colony and likewise, are important for human nutrition (Cobo, 1984; Schmidt, J. and Schmidt, P. 1984; Abreu, 1984; Block Sinha and Gridley, 1994). According to FAO (1996), the major components of pollen are proteins and amino acids, lipids (fats, oils or their derivatives) and sugar. The minor components are more diverse, such as the flavonoids, minerals, terpenes. All amino acids essential to human (phynylamin, leucine, valine, isoleucine, arginine, histidine, lysine, methionin, threonine and trytophan) can be found in pollen with proline being the most abundant in stored pollen than in fresh pellets (FAO, 1996). Pollen is usually consumed in such small quantities that the daily requirements of vitamins, proteins and minerals cannot be taken up through the consumption of pollen alone. However, it can be a substantial source of essential nutrients where dietary uptake is chronically insufficient (Schmidt, Garza and Nalda, 1992).

Despite the high market for honey, beeswax and pollen in both local and international markets, their production and processing are not common in Nigeria and so these honeybees products are not much and readily available in the market. However, with the popularization efforts of the Federal Government and Non-Governmental Organizations (NGOs) meliponiculture will soon be better known as an alternative to apiculture; and practiced in Nigeria and more information will be made available on the production, processing and utilization of stingless honeybee honey, beeswax and pollen. Also high quality honey, beeswax and pollen will be provided for our teeming food and pharmaceutical industries; employment for the youths. The aim of this study therefore is to determine the honey, beeswax and pollen yields in composite colonies of *Trigona carbonaria* (stingless honeybee) in the South-Eastern Nigeria.

MATERIALS AND METHOD

The study was carried out in Egbelu Uvuru in Aboh Mbaise Local Government Area of Imo State, Nigeria. It lies within latitude $05^0 32^1$N and longitude $07^0 11^1$E in the South-Eastern Nigeria. The rainfall pattern of the area is that of bimodal distribution. Annual rainfall range from 1500-3000mm. The rainy season is from April to October while the dry season is from November to March. The area is characterized by heavy rainfall with a peak in July. Maximum rainfall value is 3000mm while the minimum value is 1500mm. Annual range of temperature is 20^{o}C (68^{o}F) to 30^{o}C (86^{o}C) while relative humidity is 60-80%; mean daily sunshine hours is between three to six hours and may sometimes fall to two hours in the wet season (N.R.C.R.I. 2008). The vegetation of the area is full blown rain forest with arable farming being the major occupation of the people. The area has lateritic soil, which is generally characterized by excessive leaching resulting in the removal of much of useful soil nutrients. The soil is mainly coarsed

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textured, unconsolidated coastal sediments of coastal plain sands (Enweuzor, Ohiri, Opuwariwo and Udo, 1990). Colonies of *Trigona carbonaria* were built on/and or in the cavities of walls, windows and doors of house. Twenty five colonies were randomly selected and opened. The contents (honey together with wax and pollen) were collected. The honey was processed using hand-pressing method that involved the use of the muslin cloth. The weight of the honey, wax (residue) and pollen were determined with the sensitive weighing balance while the volume of the honey was determined with the measuring cylinder. Water and brush were used to wash the measuring cylinder after each measurement. Table and pie chart were used to show the data collected.

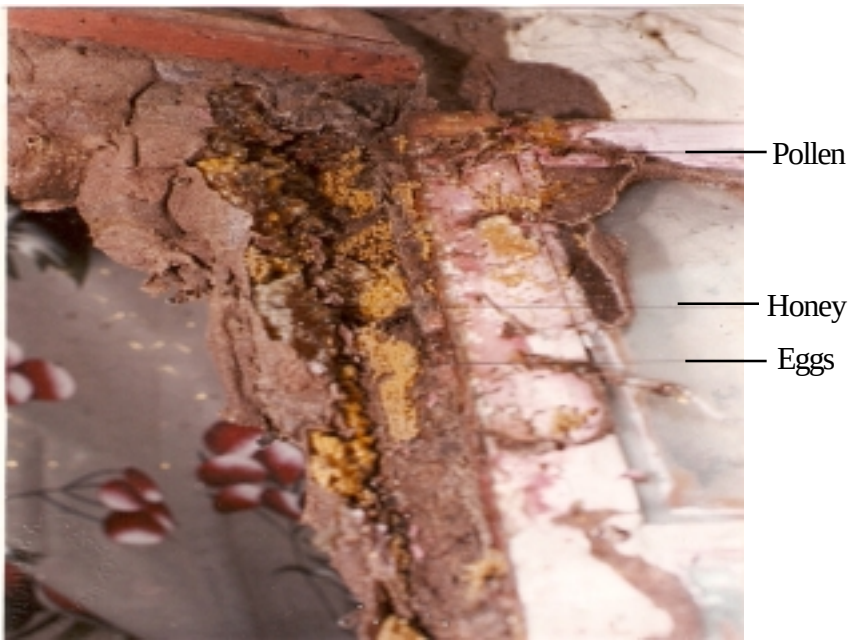

Fig. 1: Colony of *Trigona carbonaria* cut open to show clustered arrangement of honey, pollen and eggs.

RESULTS AND DISCUSSION

The result obtained from the composite colonies of *Trigona carbonaria* (stingless honeybee) shows that there was variation in quantity among honey, beeswax and pollen within and between colonies (table 1). The quantity and volume of honey produced from each of the 25 colonies varied (table 1). Colony 17 produced the highest quantity of honey (53.7g) while colony 11 produced the least quantity (0.2g). The variation could be due to the size and strength of the colonies. It might also be due to the availability of melliferous plants within the reach of the honeybees for collection of nectar used in the honey production. The quantity of beeswax obtained also varied among colonies. Colony 17 produced the highest quantity of beeswax (25.4g) and colony 1 and 9 produced the least quantity (1.6g each). The variation could be due to size and the strength of the colonies, that is, the number of worker bees in the colonies and their ability to secrete wax from the lower part of their abdominal segments. In

order to have sustained production of honey and wax, good management method should be employed to ensure sustained honey and wax yield. Pollen content among colonies also varied with colony 16 producing the highest pollen and colonies 4 producing the least. The variation in pollen content could be as a result of the prevailing season and availability of flowered melliferous plants from which honeybees collect pollens. The quantity and quality of honey and other honeybees products such as pollen, beeswax, propolis produced by honeybees is dependent on the floral composition blooming in different seasons. This agreed with the findings of Cordella, Antinelli, Aurieres, Faucon and Cabrol-Bass, 2002; Diego, Jose and Lourdes, 2005. Pollen is a natural source of protein, fats, minerals and vitamins, which are necessary elements for normal development of a bee colony and likewise, are important for human nutrition (Cobo, 1984; Schmidt, J. and Schmidt, P. 1984; Abreu, 1984; Block, Sinha and Gridley, 1994). On the average (Fig. 1), stingless honeybee (*Trigona* carbonaria) honey weight (g) formed 53% of the colonies contents. This is followed by beeswax weight (g) which formed 36%; pollen weight (g) formed 11%. Stingless honeybee (*Trigona carbonaria*) still produced reasonable quantity of honey, beeswax and pollen.

Table 1: Quantity of contents in colonies of *Trigona carbonaria* (stingless honeybee)

Colony number	Pollen weight (g)	Wax weight (g)	Honey weight (g)	Honey (cm^3) volume
1	0.5	1.6	1.9	0.8
2	1.7	5.6	8.1	5.8
3	7.9	15.0	18.0	12.9
4	0.4	6.9	11.5	8.5
5	0.9	8.4	17.0	12.1
6	1.8	14.1	11.5	8.5
7	2.7	10.8	12.5	9.0
8	0.6	7.6	5.8	3.8
9	3.5	1.6	2.4	1.2
10	2.6	15.4	38.2	27.8
11	3.8	2.8	0.2	0.1
12	1.5	3.4	6.4	4.0
13	2.2	4.7	2.4	1.2
14	3.6	11.3	10.6	8.0
15	1.8	11.4	2.3	1.2
16	10.7	3.4	9.0	6.1
17	1.8	25.4	53.7	47.2
18	0.4	13.6	23.4	16.2
19	1.8	5.7	14.3	10.0
20	2.6	2.7	1.9	0.8
21	2.3	11.3	18.6	13.2
22	0.8	5.0	5.6	3.6
23	2.3	6.5	14.2	10.0
24	4.2	7.6	10.8	8.1
25	4.2	8.5	15.8	11.2
Mean	**2.63**	**8.41**	**12.64**	**9.25**

Source: Field Survey, 2013

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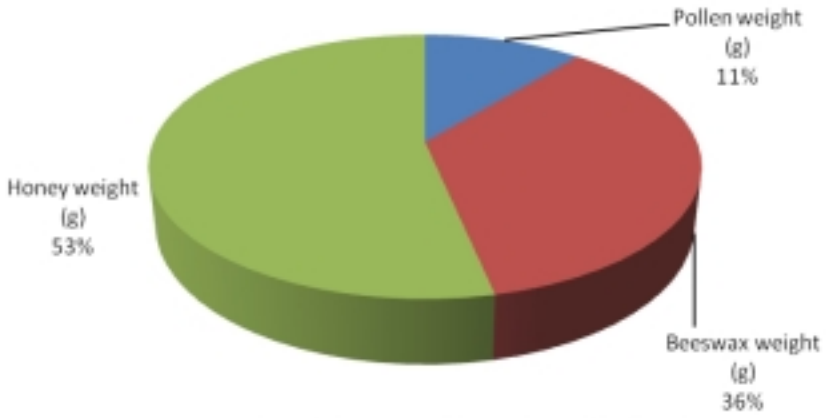

Fig. 1. Pie chart showing mean percentage distribution of honey, pollen and beeswax weights (g) in colonies of *Trigona carbonaria*

CONCLUSION AND RECOMMENDATIONS

It was evident from the study that colonies of *Trigona carbonaria* (stingless honeybee) yielded reasonable quantity of honey, beeswax and pollen comparable to stinging bee (*Apis melifera*) as shown on the pie-chart. These products apart from serving as food and nutrition to the body also provide adequate raw materials for food and pharmaceutical industries. Meliponiculture should be popularized by government institutions and private individuals as an alternative to apiculture so as to make honey and other honeybee products available in large quantity for both local consumption and export. Many people who opted out of beekeeping because of the highly aggressive behaviour of Africanized honey bees may be persuaded to take up meliponiculture. Further study should be carried out to determine the products yields of other stingless honeybees species in Nigeria.

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