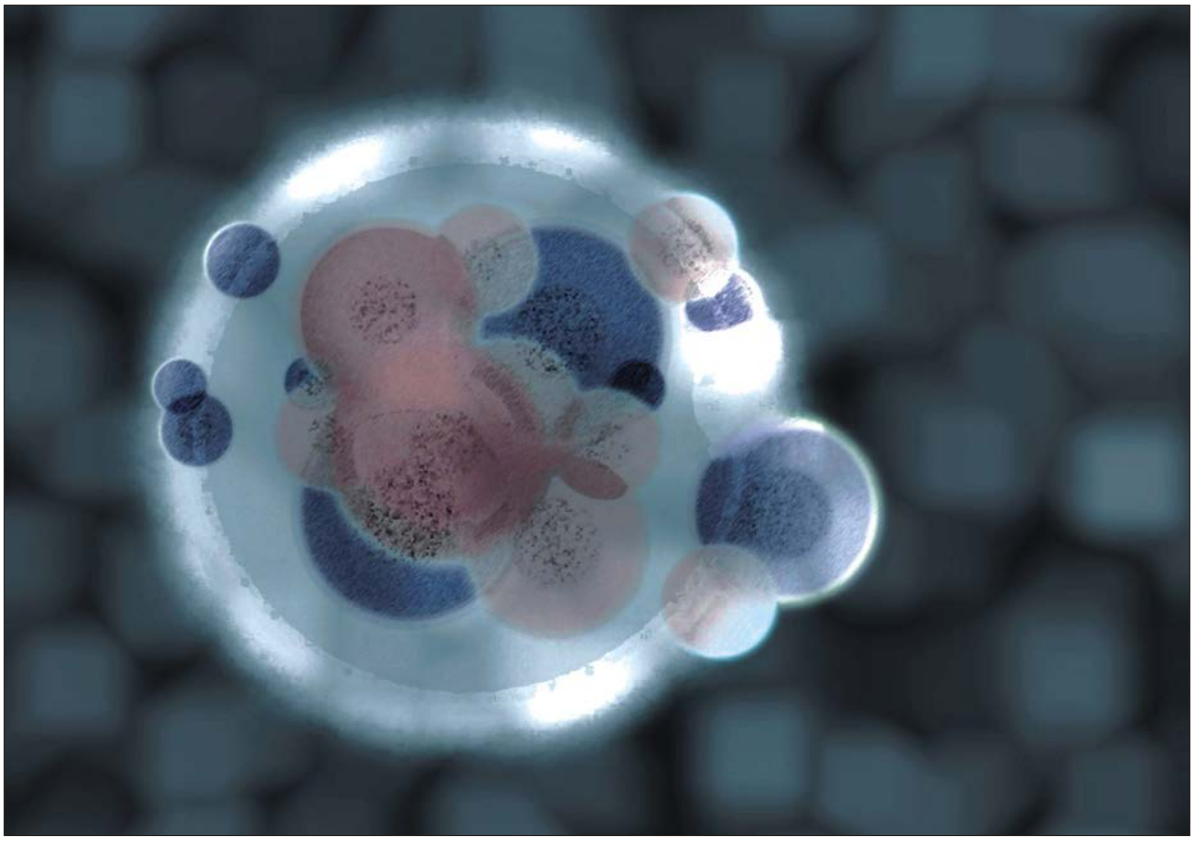

Journal of Biological Sciences

ISSN 1727-3048

science alert

ANSInet
an open access publisher
http://ansinet.com

Journal of Biological Sciences 10 (1): 43-47, 2010
ISSN 1727-3048

Pollen Characterisation of Honey Samples from North Central Nigeria

Ige O. Ebenezer and Modupe T. Olugbenga
Department of Plant Science and Biotechnology, Adekunle Ajasin University, Akungba-Akoko, Nigeria

Abstract: This study presents pollen contents of 20 honey samples collected from the North Central Zone of Nigeria. According to qualitative analysis, thirteen honey samples were unifloral and seven were multifloral. Dominant pollen types were *Parinari kerstigii*, *Lannea* sp., *Syzigium* sp., Poaceae, *Elaeis guineensis*, *Entanda abyssinica* and *Butyrospermum paradoxum.* Thirty-six pollen types were identified from the honey samples. The pollen spectra of the samples were indicated various plant species, visiting by honey bees in the area which reflect the vegetation type in North Central Nigeria. Other important taxa as sources of nectar by honey bees were also identified and listed. The numerous pollen types and their diversity showed that bees travel considerable distance collecting nectar and pollen for honey production.

Key words: Pollen, apiculture, mellisopalynology, unifloral, dominant

INTRODUCTION

In recent years, mellisopalynology has attained a topic of global status. This is borne out of the fact that not only is honey useful as a food supplement; it is now increasingly being used in the treatment of various diseases (Molan, 1985, 2001).

Melissopalynology as a branch of palynology studies pollen and spores in honey. It analyses the pollen contents of honey and this provides reliable information of the floral components of honey thereby identifying the source plants used by bees in the production of honey. Analysis of pollen contents of honey is also useful in the determination of the geographical and botanical origin of a particular type of honey. According to Jones and Bryant (2004), pollen found in honey is used to determine the honey's type. Different geographical areas present particular floral associations and the greater the climatic difference the more conspicuous the variation in the floral association. The determination of geographical origin is generally based on the entire pollen spectrum being consistent with the flora of a particular region (Louveaux *et al*., 1978) or the presence of a combination of pollen typical of that particular area.

Pollen analysis of honey is also of great importance for quality control and helps to ascertain whether honey is adulterated or not (Maurizio, 1951; Deans, 1957; Louveaux *et al*., 1978; Lieux, 1981; Feller-Demalsy *et al*., 1989; Barth, 1990; Kerkvliet *et al*., 1995; Terrab *et al*., 2003; Ohe *et al*., 2004).

The first Melissopalynological study in Africa is reported by Smith in year 1956 (Sowunmi, 1976) but the study of pollen in honey is becoming more popular in Nigeria only recently due to its application in Nigeria economy (Sowunmi, 2001). In spite of this, very few mellisopalynological studies have been carried out in Nigeria (Agwu and Okeke, 1997; Adesina, 1999; Sowunmi, 2001; Agwu and Njokuocha, 2004; Ige and Olunloyo, 2007; Ige and Apo, 2007). Elsewhere around the world, several mellisopalynological studies have been carried out and reported (Maurizio, 1951; Deans, 1957; Amoaka, 1977; Louveaux *et al*., 1978; Nair, 1964; Chaturvedi, 1989; Molan, 1985, 2001; Kerkvliet *et al*., 1995; Terrab *et al*., 2001, 2003; Alanni *et al*., 2003; Jones and Bryant, 2004; Ohe *et al*., 2004; Diez *et al*., 2004). This present study is a further contribution to the melissopalynological investigations of honey samples in Nigeria.

MATERIALS AND METHODS

Twenty honey samples (100 mL) were obtained between April and July (2007) from honey dealers with different localities in two different states of North Central Nigeria. It consisted of 12 and 8 samples each from Kaduna and Abuja, respectively (Fig. 1).

Phytogeographically, this zone falls under the savanna vegetation belt of Nigeria and the vegetation features sandy soil with scattered rocks, steepy topography and exposed, low species density. Scattered trees and shrubs with layers of grasses characterize the zone, the climate is sunny and the trees are about 3-8 m tall. Species in this zone include *Parinari kerstingii*, *Entada abyssinica*, *Butyrospermum*

Corresponding Author: Modupe T. Olugbenga, Department of Plant Science and Biotechnology, Adekunle Ajasin University, Akungba-Akoko, Nigeria Tel: +2348054733004

Fig. 1: Map of Nigeria showing the sample sites

paradoxum, *Kigellia africana*, *Blighia sapida*, *Hymenocardia acida*, *Ceiba pentadra* etc., which confirms this zone as guinea savanna.

The laboratory method used is the standard procedure as recommended by Louveaux *et al.* (1970, 1978) and modified by Jones and Bryant (2004) and the samples were subsequently subjected to acetolysis following standard method (Erdtman, 1968). For microscopic study, three slides were prepared for each sample and examined for pollen content under the light microscope. Two-hundred pollen grains per sample were counted to consider the geographical identities of the honey types (Jones and Bryant, 2004). Identification of the pollen in the honey samples was made possible with the aid of reference slides in the herbarium of the Department of Plant Science and Biotechnology, Adekunle Ajasin University, Akungba-Akoko and photomicrographs. Relevant literature such as, Legoux (1978), Moore and Webb (1978) and Sowunmi (1973, 1995) were also consulted.

Qualitative pollen analysis was based on the method recommended by Louveaux *et al.* (1970). Honey samples containing more than 45% of a single type of pollen were considered as uniflora honey. Frequency classes were determined as predominant pollen types (>45%), secondary pollen types (>16-44%), important minor pollen types (>3-15%) and minor pollen types (<3%) (Jones and Bryant, 2004).

RESULTS AND DISCUSSION

Thirty six different pollen types were identified in the honey samples. Twenty six were identified to species level, five identified to generic level and five to family level. These revealed that the honey samples contained numerous pollen grains. Among the twenty honey samples analyzed, thirteen samples were found to be unifloral while seven samples were multiflora. Quantitatively, the samples from Abuja contained more varied pollen types (30) than those from Kaduna (24). Pollen analytical data of the samples was given in Table 1. These honey samples, generally rich in pollen display a vivid landscape of the bee forage plants growing in the area surrounding the source of the honey samples. This was also a clear indication of the wide range of collection of pollen grains from many flowering plants.

Table 1: Pollen analytical data of honey samples from north central NIGERIA

Location	Sample	Dominant pollen type (%)	Other important taxa (%)
Abuja	A1	*Parinari kerstigii* (44%)	*Alchornea cordifolia* (2.5%), Poaceae (14.7%), *Annunidium nanni* (2.8%), Asteraceae (1.4%), *Borassns* sp. (1.6%),*Blighia sapida* (0.7%), *Elaeis guineensis* (12.3%), *Ceiba pentandra* (2.5%), *Daniella oliveri* (3.7%), *Dichrostachy cinera* (2.3%), *Lannea* sp. (9.7%), Combretaceae,(2.0%)
	A2	*Elaeis guineensis* (50.2%)	*Cassia fistula* (3.6%), *Ceiba pentandra* (1.3%), Combretaceae (6.2%), *Borassns* sp. (1.4%), *Alchornea cordifolia* (2.4%), *Daniellia oliveri* (2.5%), *Parinari kerstigii*(17.4%), *Syzigium* sp.(12.3%), *Lannea* sp.(3.0%)
	A3	*Elaeis guineensis*. (63.2%)	*Ixora* sp. (10.2%), *Delonix regia* (1.5%), *Alchornea cordifolia* (7.2%), *Butyrospermum paradoxum* (1.6%), *Cassia fistula* (2.4%), *Borreria* sp. (1.3%), *Lannea* sp.(10.2%), Poaceae (2.7%)
	A4	*Syzigium* sp. (41.6%)	Poaceae (12.5%), *Blighia sapida* (1.8%), *Elaeis guineensis* (9.0%), *Dichrostachys cinera* (1.1%), *Entanda abyssinica* (8.2%), *Khaya senegalensis* 4.6%, *Phyllanthus* sp. (3.4%), *Parkia biglobosa* (2.8%), *Ceiba pentandra* (2.6%), *Butyrospermum paradoxum* (1.8%), Asteraceae (1.6%), *Borreria* sp. (2.2%), *Daniella oliveri* (1.4%), Lannea sp.(2.0%)
	A5	Poaceae (44.7%)	*Parkia biglobosa* (8.2%), *Parinari kerstingii* (8.6%), *Syzigium* sp. (17.4%), *Daniella oliveri* (12.8%), *Ixora* sp. 4.8%, Lannea sp. (4.0%)
	A6	*Lannea* sp. (54.2%)	*Elaeis guineensis* (12.3%), *Parkia biglobosa* (8.2%), Poaceae, (7.5%), *Syzigium* sp. (15.5%), *Triumfetta cordifolia* (1.3%), *Vernonia amygdalina* (1.3%)
	A7	*Syzigium* sp. (48.8%)	*Phyllanthus* sp.(2.5%), Poaceae(9.5%), *Elaeis guineensis* (10.8%), *Spondiathns prensii* (2.4%), *Lannea* sp. (15.7%), *Parkia biglobosa* (2.7%), *Borreria* sp. (1.6%), Asteraceae (2.7%), *Parinari kerstigii* (4.0%)
	A8	*Butyrospermum paradoxum* (52.3%)	*Daniellia oliveri* (3.8%), *Delonix regia* (2.5%), *Ceiba pentandra* (9.6%), *Annonidium manni* (10.2%), *Oldeuladia corymbosa* (1.2%), Pappillionaceae(2.4%) *Paullinia pinnata* (1.2%), *Triumfetta cordifolia* (1.3%), Poaceae (3.2%), Asteraceae (2.8%), *Elaeis guineensis* (5.0%), Combretaceae (6.0%)
Kaduna	B1	*Entanda abyssinica* (55.5%)	Combretaceae (24.2%), *Elaeis guineensis* (2.4%), *Cnssonia barteri* (1.2%), Asteraceae (2.4%), *Lannea* sp. (8.8%), *Ceiba pentandra* (1.2%), Poaceae (4.5%)
	B2	*Parinari kerstigii* (50.2%)	*Annonidium manni* (4.0%), Asteraceae (3.8%), *Blighia sapida* (2.9%), *Bridellia ferrnginea* (2.7%), *Bntrospermum paradoxum* (13.9%), *Elaeis guineensis* (2.5%), *Lannea* sp. (3.8%), *Entanda abyssinica* (2.7%), *Ceiba pentandra* (2.2%), Poaceae (3.2%), Combretaceae (8.8%)
	B3	*Lannea* sp. (57.8%)	*Elaeis guineensis* (10.8%), *Ceiba pentandra* (2.6%), *Blighia sapida* (1.9%), *Kigelia africana* (2.5%), Pappillionaceae (1.5%), *Entanda abyssinica* (12.2%), Poaceae (9.2%), Asteraceae (1.8%)
	B4	*Elaeis guineensis* (55.4%)	*Parkia biglobosa* (4.3%), *Parinari kerstingii* (16.6%), *Daniella oliveri* (2.1%), *Lannea* sp. (10.4%), *Morns mesozygia* (1.8%), Poaceae (5.2%), *Entanda abyssinica* (2.6%), Asteraceae (1.8%)
	B5	*Butyrospermum paradoxum* (50.0%)	Asteraceae (4.0%), *Hymenocardia acida* (7.1%), Poaceae (16.2%), *Vitex doniana* (3.0%), *Syzigium* sp. (8.5%), *Ceiba pentandra* (3.3%) Combretaceae (8.0%)
	B6	Poaceae (52.2%)	*Ceiba pentandra* (10.0%), *Cnssonia barteri* (6.0%), *Ixora* sp. (3.9%), *Lannea* sp. (7.2%), *Bntrospermum paradoxum* 8.6%, *Syzigium* sp. (2.7%), *Vitex doniana* (1.8%), Combretaceae (2.3%), *Entanda abyssinica* (5.4%)
	B7	*Lannea* sp. (40.5%)	Combretaceae (7.8%), *Bridelia ferrnginea* (7.0%), *Entanda abyssinica* (13.6%), Poaceae (13.6%), *Elaeis guineensis* (4.8%), Asteraceae 2.8%, *Entanda abyssinica* (3.3%), *Ixora* sp. (6.8%)
	B8	Poaceae (56.3%)	*Elaeis guineensis* (7.5%), *Ceiba pentandra* (4.8%), *Blighia sapida* (2.9%), *Bntrospermum paradoxum* (2.6%), *Kigelia africana* (1.0%), Asteraceae (10.2%), *Ixora* sp. (5.7%), *Hymenocardia acida* (1.3%), *Parkia biglobosa* (2.4%), Poaceae (5.4%)
	B9	*Syzigium* sp. (57.2%)	*Hymenocardia acida* (7.0%), *Lannea* sp. (8.8%), *Ceiba pentandra* (5.2%), *Elaeis guineensis* (4.2%), Asteraceae (2.2%), Poaceae (7.8%), *Butyrospermum paradoxum* (2.8%), *Blighia sapida* (2.9%), *Bridelia ferrnginea* (2.3%)
	B10	*Butyrospermum paradoxum* (43.2%)	*Elaeis guineensis* (12.5%), Combretaceae (8.7%), *Morns mesozygia* (2.8%), Papillonaceae (2.0%), Poaceae (8.8%), *Lannea* sp. (8.8%), *Cnssonia barteri* (2.4%), *Entanda abyssinica* (5.6%), *Parkia biglobosa* (5.3%)
	B11	*Entanda abyssinica* (41.2%)	*Parkia biglobosa* (4.3%), Poaceae (16.9%), *Vitex doniana* (2.3%), *Triumfetta cordifolia* (2.4%), Sterculiaceae (2.5%), *Syzigium* sp. (10.6%), *Elaeis guineensis* (9.2%), *Daniella oliveri* (2.7%), *Ixora* sp. (1.8%), *Kigelia africana* (2.5%), *Morns mesozygia* (1.7%), *Butyrospermum paradoxum* (2.0%)
	B12	*Elaeis guineensis* (44.3%)	Poaceae (14.8%), *Syzigium* sp.(16.5%), *Annonidium manni* (3.0%), Asteraceae (4.0%), *Bridellia ferrnginea* (2.5%), *Ceiba pentandra* (2.0%), *Parinari kerstingii* (1.3%), *Kigelia africana* (1.8%), Pappilonaceae (1.5%), *Cnssonia barteri* (2.4%), *Parkia biglobosa* (3.2%), *Butyrospermum paradoxum* (5.3%)

Among the eight samples analyzed from Abuja, five samples contained pollen types found to be the dominant types (>45%) of total pollen counts, while nine samples from Kaduna contained pollen types which were found to be dominant. The dominant pollen types from Abuja were *Elaeis guineensis*, *Lannea* sp., *Syzigium* sp., *Butyrospermum paradoxum* with *Elaeis guineensis* as the most dominant having dominated in 2 samples. The dominant pollen types from Kaduna samples were *Entanda abyssinica*, *Parinari kerstigii*, *Lannea* sp.,

Elaeis guineensis, *Butyrospermum paradoxum*, Poaceae and *Syzigium* sp. The Poaceae and *Elaeis guineensis* played as the two most dominant types having dominated twice respectively in the samples. Secondary pollen types (>16-44%) identified from the samples were *Parinari kerstigii, Syzigium* sp. and Poaceae for Abuja and Combretaceae, *Parinari kerstigii*, Poaceae, *Lannea* sp., *Butyrospermum paradoxum*, *Entanda abyssinica*, *Elaeis guineensis* and *Syzigium* sp. for Kaduna, while the rest was categorized as important minor and minor pollen types. Among the samples studied, the highest number of pollen types identified from a single sample was fourteen (Sample, A4) while the lowest number of pollen types recorded was six (Sample, A5). The presence of this array of predominant and important pollen types in these samples confirm that the honey samples were of botanical origin and also a true indication of their geographical origin.

The two most dominant pollen types; *Elaeis guineensis* and Poaceae are generally common in honey samples from this zone, an indication that the pollen and nectar of these plant species are important bee foods. In earlier studies, Ige and Apo (2007) reported that these two plant groups produced abundant pollen grains which are widely dispersed, hence their abundance in honey samples. This study has similarly shown that their dominating influence as important and prevalent bee forage is remarkable.

The honey samples from Abuja locality were richer in pollen content than honey samples from Kaduna area. This indicated that the honey produced by bees in Abuja area will be richer in content than honey produced by bees around Kaduna localities. Furthermore, the pollen spectra of the samples displayed varied vegetation of plants visited by Bees for nectar collection in production of their honey. Ige and Apo (2007) reported that the more the pollen type/pollen content, the more the source of nectar collection and the more the richness of the honey.

This study has shown that bees do not respect plant habit. This confirms the conclusion of Adeonipekun (1989) in a study carried out in Southwest Nigeria. This is because of the presence of species like *Phyllantus discoides* (herb), *Hymmenocardia acida* (shrub) and *Parkia biglobosa* (tree) which represent the three categories of plant habits in these samples. The herb ranges from between 0.3-0.5 m, shrub from 1.5-3 m while trees are of 10 m and above high. In spite of this stratification, Bees visit the plants since they contained good nectar and/or floral attractiveness (Ige and Apo, 2007).

CONCLUSIONS

The pollen spectra of these honeys as shown from the quantitative pollen analysis in this study indicated that honeybees traversed considerable distance in search of suitable food materials e.g. nectar for their survival and production of honey. The presence of these large number of pollen types also indicated that the honey samples were pure and not adulterated.

This study has also led to the identification of major plants visited by bees in this area. There is therefore the possibility of utilizing this rich bee flora of this zone for the development of apiculture in Nigeria.

REFERENCES

Adeonipekun, P.A., 1989. A palynological study of an apiary in Ibadan, Nigeria. Report for B.Sc. (Hons). Department of Botany and Microbiology, University of Ibadan, Nigeria, pp: 57.

Adesina, O.A., 1999. The Practice of Bee-keeping. The Institute of Vocational Bee Craft Publishers, Agbeloba house, Abeokuta, Ogun State, Nigeria, pp: 78.

Agwu, C.O.C. and G.I. Okeke, 1997. Pollen analytical and thin-layer chromatographic study of honey from three Savanna zones of Northern Nigeria. Nig. J. Bot., 10: 25-36.

Agwu, C.O.C. and R.C. Njokuocha, 2004. Pollen analysis of honey and the biological effects of honey as a rooting medium. Nig. J. Bot., 17: 74-82.

Alanni, M.C., M. Cossu and F. Sanna, 2003. HPLC method of determination of oxalic, lactic and formic acid used as acaricides and persent as natural constituents honey. Rivista-discienza-dell Almentaziene, 39: 139-147.

Amoaka, J., 1977. Apiculture in Ghana and the Use of Palynology to Determine the Renewable Source Exploited by the Honey Bee, *Apis mellifera* Adansonii. University of Wales Publisher, Cardiff, UK., pp: 408.

Barth, O.M., 1990. Pollen in monofloral honeys from Brazil. J. Apicult. Res., 29: 89-94.

Chaturvedi, M., 1989. Pollen analysis of some spring honeys from the western Himalayan region of Uttar Pradesh, India. Proc. Indian Acad. Sci. (Plant Sci.), 99: 241-246.

Deans, A.S.C., 1957. Survey of British Honey Sources. Int. Bee Res. Assoc. Circ., London.

Diez, M.J., C. Andres and A. Terrab, 2004. Physiochemical parameters and pollen analysis of Moroccan honeydew honeys. Int. J. Food Sci. Technol., 39: 167-176.

Erdtman, G., 1968. Handbook of Palynology. An Introduction to the Study of Pollen Grain and Spore. Hafner Publishing Co. Inc., New York.

Feller-Demalsy, M.J., J. Parent and A. Strachan, 1989. Microscopic analysis of honey from Manitoba, Canada. J. Apic. Res., 28: 41-49.

Ige, O.E. and K.A. Apo, 2007. Pollen analysis of honey samples from two vegetation zones in Nigeria. Sci. Focus, 13: 36-43.

Ige, O.E. and M. Olunloyo, 2007. A chromatographic analysis of honey samples from Supare-Akoko, Nigeria. J. Applied Environ. Sci., 3: 44-47.

Jones, G.D. and V.M. Bryant, Jr. 2004. The use of ETOH for the dilution of honey. Grana, 43: 174-182.

Kerkvliet, J.D., M. Shrestha, K. Tuladhar and H. Manandhar, 1995. Microscopic detection of adulteration of honey with cane sugar and cane sugar products. Apidologie, 26: 131-139.

Legoux, O., 1978. Quelques especes de pollen characteriques du eogene du Nigeria. Bull. Cent. Rech. Explor Prod. Elf Aquitaine, 2: 265-317.

Lieux, M.H., 1981. An analysis of Mississippi USA honey: Pollen, colour and moisture. Apidologie, 12: 137-158.

Louveaux, J., A. Maurizio and G. Vorwohl, 1970. Methods of Mellissopalynology. Bee World, 51: 125-138.

Louveaux, J., A. Maurizio and G. Vorwohl, 1978. Methods of Melissopalynology. Bee world, 59: 139-157.

Maurizio, A., 1951. Pollen analysis of honey. Bee World, 32: 1-5.

Molan, P.C., 1985. Selection of honey for medicinal use. N. Z. Beekeeper, 184: 29-30.

Molan, P.C., 2001. Why honey is effective as a medicine 2. The scientific explanation of its effect. Bee world, 82: 22-40.

Moore, P.D. and J.A. Webb, 1978. An Illustrated Guide to Pollen Analysis. 1st Edn., Hodder and Stoughtonm, London, pp: 133.

Nair, P.K.K., 1964. A pollen analytical studies of Indian honeys. J. Indian Bot. Soc., 43: 179-191.

Ohe, W.V.D., L.P. Oddo, M.L. Piana, M. Morlot and P. Martin, 2004. Harmonised methods of mellisopalynology. Apidologie, 35: 18-25.

Sowunmi, M.A., 1973. Pollen grains of Nigerian plants I. woody species. Grana, 13: 145-186.

Sowunmi, M.A., 1976. The potential value of honey in palaeopalynology and archaeology. Rev. Palaeobot. Palynol., 21: 171-185.

Sowunmi, M.A., 1995. Pollen of Nigerian plants II. Woody species. Grana, 34: 120-141.

Sowunmi, M.A., 2001. Microscopic Analysis of Honey. The Nigerian Field, 66: 125-133.

Terrab, A., B. Valdes and D.M.J. Diez, 2001. Pollen analysis of honey from the Gharb region (NW Morocco). Grana, 40: 210-216.

Terrab, A., B. Valdes and D.M.J. Diez, 2003. Pollen analysis of honey from Mamora Forest region (NW Morocco). Grana, 42: 47-54.