ADVANCES IN BIORESEARCH, Vol 1 [1] JUNE 2010: 101 - 105

Society of Education, India
http://www.soeagra.com
ISSN 0976-4585

RESEARCH ARTICLE

Characteristics of Honey Produced by Different Plant Species in Ethiopia

S. K. Gangwar, H. Gebremariam, A. Ebrahim & S. Tajebe
Department of Animal Science and Ecotourism, College of Agriculture and Rural development, Aksum University, P.O. Box 287, Aksum, ETHIOPIA

ABSTRACT
The aim of this study was to find to close relations exist between the results of microscopic analysis, electrical conductivity (ms/cm), Moisture (%), Ash (g%), pH, Diastase activity (Schade), Free acids (meq/kg), Lactones (meq/kg) and total acidity (meq/ kg) in 9 honey samples from the Ethiopia. The obtained results were to be interpreted in relation to the classification of honey samples according to their origin of plant species. The relations were positive, very close (r > 0.80) and very highly significant (P< 0.003). The experimental results showed that Rosa abyssinica of cold zone was found better among the selected samples.

INTRODUCTION

Ethiopia is distinguished by 3 zones of climate, "Kolla", "Wonia" & "Dega". The "Kolla" or hot zone, where there are Acacia, Albizzia, Combretum, Citrus Commiphora, Eucalyptus and Croton. The "Wonia" or cool-warm zone, where there are Acacia, Eucalyptus, Citrus, Coffea, Combretum, Croton, Guizotia, Trifolium, Olea, Veronia. The "Dega" or cold zone, where there are Olea, Rosa abyssinica, Citrus Albizzia, Gizotia. Swarming takes place in September and April. In "Dega", flowering throughout the year, and bees have fewer enemies. While, In "Kolla", flowering period is short and bees are very productive and aggressive. In "Wonia " bees are very active productive of swarms were caught in the low lands "Kolla"; or those un-productive swarms from "Dega". Honey production is estimated to be 26.547 tons/year. About 2/3 goes into "tej" making. Ethiopia ranks as third exporter of wax in Africa, after Tanzania and Angola. European Honey Directive [1] and Codex Alimentarius Standard for Honey [2, 3] specify criteria for honey quality and its classification. Physical parameters belong to the main basis of honey classification because their measuring is comparatively simple and they have a good information value. The most important honey characteristics are electrical conductivity. Optical rotation is a parameter that shows the botanical origin and adulteration of honey [4-9]. In some countries the rotation is applied to differentiation of honey. Microscopic analysis is another analytical method for the identification of botanical origin. Namely quantitative and also qualitative content of honeydew particles and pollen grains is studied for the identification of honey group origin, respectively. On this account, the microscopic analysis is able to detect the botanical origin much more exactly than other analytical methods. However, it is difficult to correctly interpret results of melissopalynology and it needs a lot of experiences [10, 11]. The aim of this study was to find how exactly it is possible to classify honey in relation to its botanical origin if pollen analysis and optical rotation are used. Therefore, it was needful to find how close relations exist between the results of microscopic analysis (*i.e.* pollen analysis), and the optical rotation, electrical conductivity and further physical parameters in 9 honey samples from the Ethiopia.

MATERIAL AND METHODS

Samples of honey that came from the Ethiopian (Addis and Aksum) market and different suppliers (n = 9) and samples directly from beekeepers, taken in the same year (2010), were used as the material. All of the honey samples were obtained by extraction. The samples were stored with authentic labels in eclipse at a laboratory temperature

(22 ± 2°C) until the time of analysis. Moisture was determined measuring the refractive indices at 20 °C by a Carl Zeiss 16531 refractometer and the corresponding moisture content (%) was calculated according to AOAC [12].

Electrical conductivity was measured at 20 °C in a 20% (w/v) solution (dry matter basis) in deionised water [13] by a Delta Ohm HD 8706 conductivity meter.

Ash was indirectly determined using the measured electrical conductivity and applying the following equation: X1 (X2-0.143)/=1.743 were: X1 = ash value; X2 = electrical conductivity in µS/cm at 20 °C [4].

Free acids, lactones, total acidity and pH were measured using a Mettler Toledo MP 220 pH meter according to Official Method [14].

Diastase determinations were conducted by an enzymatic- spectrophotometric method, using a kit Phadebas Amylase Test [15].

Specific rotation of a clear filtered aqueous solution was measured. The measurement was done on circular polarimeter 1000 (A-Kruss Optronic GmbH, Hamburg, Germany). Specific rotation was calculated from angular rotation, ray circuit length and grams of taken dry matter [5]. Honey origin was verified by qualitative and quantitative microscopic pollen analysis by melissopalynology.

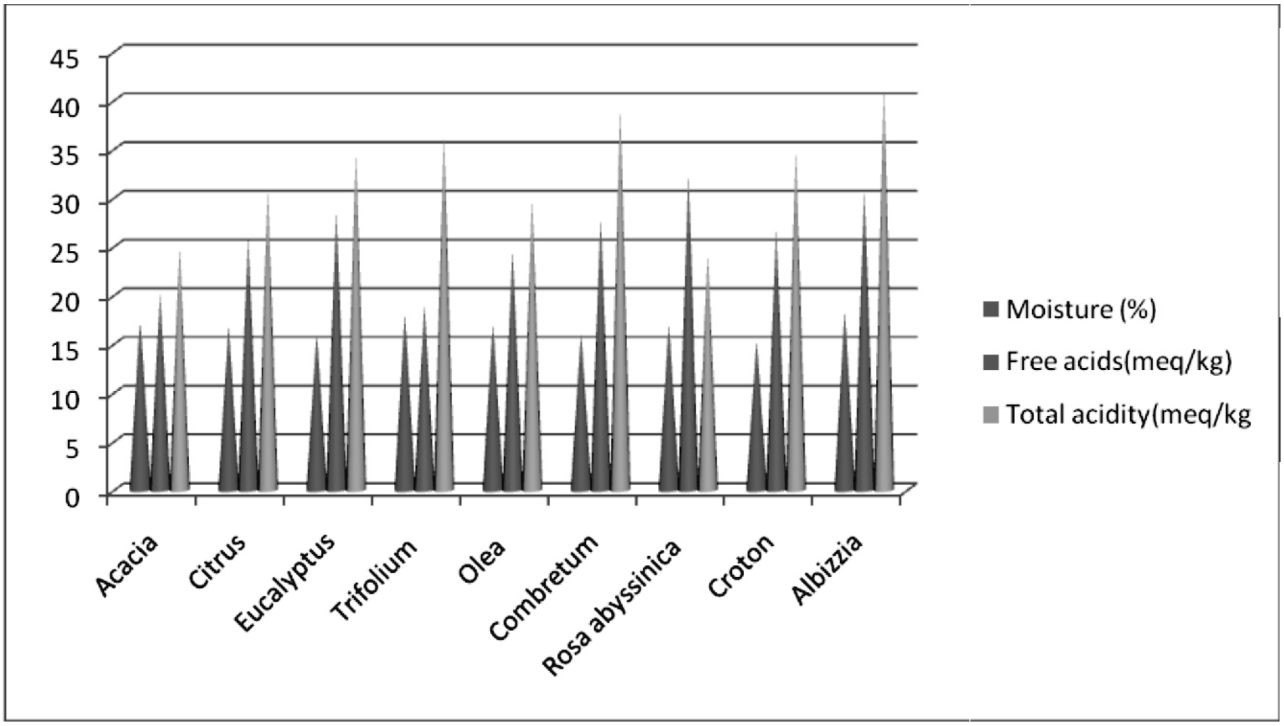
RESULT AND DISCUSSION

Table 1 Characterization of the different honey samples

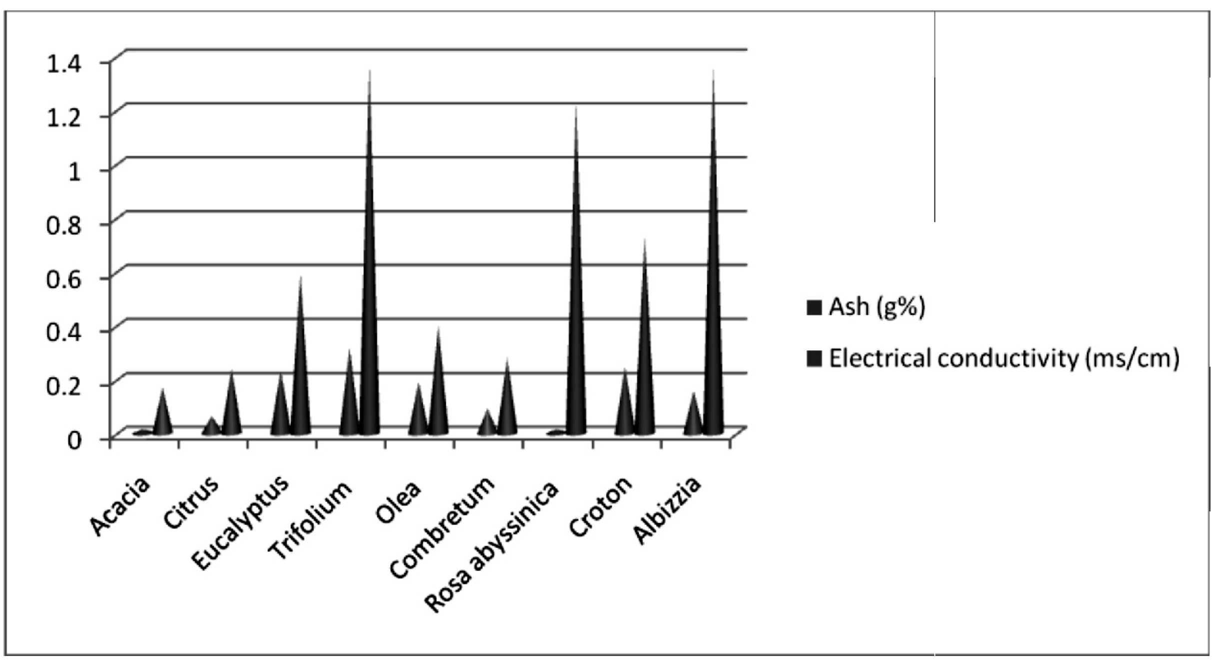
S.L	Samples	Moisture (%)	Ash (g%)	Electrical conductivity (ms/cm)	pH	Diastase activity (Schade)	Free acids (meq/kg)	Lactones (meq/kg)	Total acidity (meq/kg	Rotation (α)20
1	***Acacia***	17.1±0.05	0.015±0.001	0.17±0.002	3.37±0.02	7.9±0.42	20.2±0.52	4.4±0.32	24.8±0.51	–15.9
2	***Citrus***	16.8±0.07	0.063±0.002	0.24±0.004	3.44±0.01	7.6±0.22	25.9±0.38	4.3±0.41	30.7±0.11	–16.2
3	***Eucalyptus***	15.9±0.13	0.232±0.002	0.59±0.007	3.67±0.03	18.4±0.28	28.6±0.46	4.9±0.76	34.6±1.08	–14.7
4	***Trifolium***	17.9±0.10	0.314±0.002	1.37±0.009	4.18±0.02	12.5±0.46	18.9±0.34	5.6±0.67	36.4±0.60	–13.6
5	***Olea***	16.9±0.16	0.189±0.001	0.40±0.003	3.97±0.08	14.2±0.35	24.5±0.76	5.8±0.54	29.8±0.94	–15.6
6	***Combretum***	16.0±0.11	0.090±0.003	0.28±0.005	3.48±0.03	15.6±0.32	27.8±0.41	6.2±0.92	39.0±2.16	–16.1
7	***Rosa abyssinica***	16.9±0.02	0.014±0.004	1.23±0.001	4.89±0.01	18.9±0.27	32.3±0.23	4.2±0.23	24.1±1.04	–15.8
8	***Croton***	15.2±0.17	0.245±0.002	0.73±0.004	3.60±0.05	18.2±0.54	26.8±0.42	6.2±0.89	34.8±1.08	–15.2
9	***Albizzia***	18.2±0.15	0.156±0.002	1.35±0.003	3.72±0.04	13.7±0.24	30.7±0.28	6.1±0.65	41.4±0.76	–15.5

Table 1 shows the characterization of different honey samples results for analysed honey. The following parameters were measured in each sample: electrical conductivity (ms/cm), Moisture (%), Ash (g%), pH, Diastaseactivity (Schade), Free acids(meq/kg), Lactones(meq/kg) and total acidity (meq/ kg), specific optical rotation the results of analysis for individual honey groups (honeys divided according to the result of microscopic analysis) are analysed and characterized by descriptive statistical data. the conductivity of *Rosa abyssinica* is not higher than 1.23 ms/cm. It was also found in samples No. 4, 7, 8 & 9 with conductivity above 0.60 ms/cm did not crystallize either and their appearance was consistent with usual honey but the result of pollen analysis detected a greater portion of rape nectar this fact can cause difficulties during consecutive honey technology. One of these two samples also had a higher number of pollen grains per 1 g of honey (above 2000), which is not typical of pure Trifolium honeys. Samples of honeys No. 1, 2 and 6 had very low conductivity with respect to the result of pollen analysis called as compound honeys. Otherwise, these samples contained only a few honeydew particles but with reference to comparatively high rotation these samples were classified as a compound honey. *Trifolium* is a plant flowering usually during the period of honeydew appearance. Both sources are very attractive for foragers and according to our experience increasingly more honeys with higher portion of *Trifolium* nectar usually contain higher or lower amount honeydew. This sample contained a higher number of honeydew particles and, therefore, the sample was a compound honey in spite of low conductivity (under standard value 1.37 ms/cm). Sample No. 8 was another unusual honey by honeydew honey this once. Conductivity of this sample was rather low and lay in the transition interval between compound and honeydew honeys. However, the sample contained many honeydew particles and a very low number of pollen grains (only 923 pollen grains per 1 g of honey). Furthermore, a major part of these pollen grains was represented by anemophile pollen or pollen from plants without nectar production as it is typical of honeydew honeys. On the other hand, sample No. 5 would have been classified as a honeydew honey if it had been classified only on the basis of conductivity. However, very low content of honeydew particles and very high

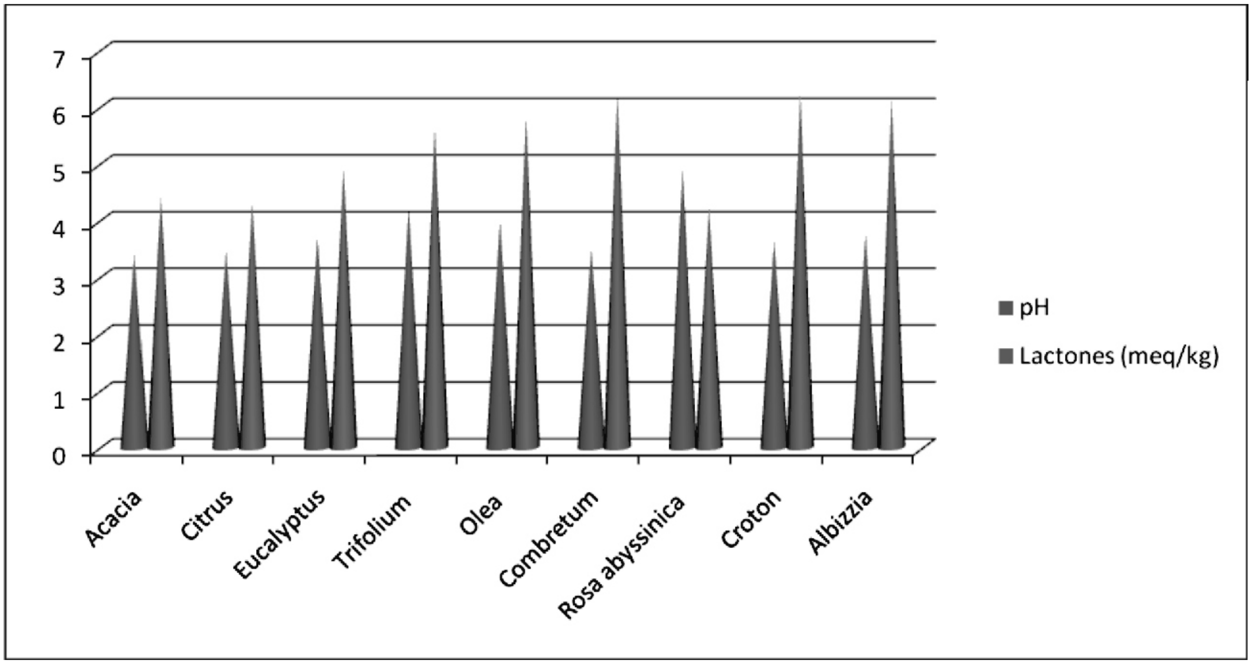
Graph-1 Showing moisture (%), free acids (meq/kg) and total acidity (meq/kg) in different honey samples



Graph-2 Showing ash (g %) and electrical conductivity (ms/cm) in different honey samples



Graph-3 Showing pH and lactones (meq/kg) in different honey samples



content of pollen was found in this sample (9476 PG/g typical of honey with great portion of nectar source at least).Therefore sample No. 3 is a compound honey and this result corresponds with negative rotation. Several closer relations were found between the physical attributes of analyzed samples (Table 1 and graph 1-3).These are the relations between electrical conductivity, optical rotation and microscopic analysis that are the most important for honey classification and sorting into the individual honey groups. All mentioned relations are positive, very close ($r > 0.80$) and very highly significant. This fact and high correlation coefficients evidence that exact classification of honey must be carried out not only by measuring the conductivity but also in relation to optical rotation and microscopic analysis namely in transition intervals of conductivity between the individual honey groups. Our study is similar to many scientists [16,17,15,19], which have also differentiate different honey samples on qualitative and quantitative basis.

REFERENCES

[1] European Honey Directive (1974): Council Directive of 22 July 1974 on the harmonisation of the Member States relating to honey, 74/409/EEC, *Official Journal of the European Communities,* No. L 221/14 1974.

[2] Codex Alimentarius Standard for Honey: Ref. Nr. CL 1993/14-SH FAO and WHO, Rome 1993.

[3] Codex Alimentarius draft revised for honey at step 6 of the Codex Procedure. CX 5/10.2, CL 1998/12-S 1998.

[4] Piazza M.G., Accorti M., Persano Oddo L. (1991): Electrical conductivity, ash, colour and specific rotatory power in Italian unifloral honeys. Apicultura, *7*, 5163.

[5] Bogdanov S., Martin P., Lüllman C. (1997): Harmonised methods of the European Honey Commission. Apidologie, Extra Issue, 159.

[6] Bogdanov S., Lüllmann C., Martin P., Von der Ohe W., Russmann H., Vorwohl G., Oddo L.P., Sabatini A.G., Marcazzan L., Piro R., Flamini C., Morlot M., Lheretier J., Borneck R., Marioleas P., Tsigouri A., Kerkvliet J., Ortiz A., Ivanov T., D'Arcy B., Mossel B., Vit P. (1999): Honey quality, methods of analysis and international regulatory standards: review of the work of the International Honey Commission. Mitt. Lebensm. Hyg., *90,* 108125.

[7] Shuster I., Puchtinger T., Taschan H. (1998): Prolingehalt verschiedener Honigsorten aus mittelhessischen Imkerbetrieben und dem Handel. Lebensm. Chem., *52*, 4243.

[8] Al-Khalifa A.S., Al-Arify I.A. (1999): Physicochemical characteristics and pollen spectrum of some Saudi honeys. Food Chem., *67,* 2125.

[9] Sanchez M.P., Huidobro J.F., Mato I., Muniategui S., Sancho T. (2001): Correlation Between Proline Content of Honeys and Botanical Origin. Dtsch. Lebensm. Rdsch., *97*, 171175.

[10] Demianowicz Z. (1961): Pollenkoeffizienten als Grundlage der quantitativen Pollenanalyse des Honigs. Pszczelnicze

Zesz. Nauk., *5,* 95107.
[11] Kropáčová S. (1969): Příspěvek k pylovým analýzám medů jihovýchodní Moravy. *Acta Univ. Agric. (A), Brno*, *17,* 793797.
[12] AOAC (1980). Official Methods of Analysis (13th ed.). Washington, DC: Association of Official Analytical Chemists, Method 31.111, p. 521.
[13] Loveaux, J., Pourtallier, J., & Vorwohl, G. (1973). Methodes d'analyses des miels. Conductivit_e (Analytical methods for honey conductivity). *Bull. Apic. Inf. Doc. Sci. Tech. Inf.*, 16, 7.
[14] Repubblica Italiana: G.U. no. 282, 12/10/1984, Official methods of honey analysis.
[15] Wood, R., Nilsson, A., & Wallin, H. (1998). Procedure for the estimation and expression of measurement uncertainty in chemical analysis developed by the Nordic Committee on Food analysis. In Quality in the food analysis laboratory (pp. 125147). UK: The Royal Society of Chemistry.
[16] Singh, N., Singh, S., Bawa, A. S., & Sekhon, K. S. (1988). Honeyits food uses. Indian Food Packer, 42, 1525.
[17] Singh, N., & Bath, P. K. (1998). Relationship between heating & hydroxymethylfurfural formation in different honey types. *Journal of Food Science and Technology*, 35, 154156.
[18] Bath, P. K., & Singh, N. (1999). A comparison between Helianthus annuus & Eucalyptus lanceolatus honey. Food Chemistry, 67, 389 397.