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Assessment of Honey Bee Flora in Eastern Zone of Tigray, North Ethiopia

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Abstract
This study was conducted to evaluate the existing bee flora and develop floral calendar in Eastern Zone of Tigray. Data were collected by using semi-structured questionnaire as well as direct observation. The total number of household head respondents was 160. Accordingly, different plant species and habit of growth (herb, shrub and tree) were identified as major bee flora. High availability of honeybee shrubs and herb plants was found from September to November while the most important trees flowered in March and May in all the districts. The high scarcity of bee forage was observed in June. Therefore, it is to be noticed that, in order to increase the honey bee yield and quality, scaling up of the coverage and management honeybee floras and considering floral calendar is critically important to the study area.
Keywords: floral calendar, bee flora**,** honey production

Introduction

Ethiopia is endowed with diverse and unique flowering plants of 6000 to 7000 species thus making it highly suitable for large number of colonies and long practice in beekeeping (Gidey and Mekonen, 2010). The diversity of plants species comprises forest trees, bushes, grasses, and cultivated flowering plants that are actually and potentially useful for beekeeping. The ideal climatic conditions and diversity of floral resources allow the country to sustain around 10 million honeybee colonies, of which 7 million are kept in local beehives by farmers, and the remaining exist in the forests as wild colonies. This makes the country to have the highest bee density in Africa (Nuru, 2002). Ethiopia produces about 43,373 metric tons of crude honey per year, thus shares 23.5% of Africa and 2.35% of world's honey production.

Eastern part of Tigray region is also believed to have diversified type of vegetation and cultivated crops and potential for beekeeping activities. Livestock, poultry and honeybees are the major activities in addition to crop production of the farming communities. Beekeeping, which is a sustainable resource-based farming system without negative impact on the ecology and that, can be practiced without competing resources with other agricultural activities and resource conservation programs. However, investigation indicated that the number of the honeybee colonies in the country has been declining (CSA. 1995) and consequently the honey and beeswax production as well as export earnings fell down (Gezahegne, 2001). This is attributed to drought, ever-expanding population pressure and associated vegetation changes and indiscriminate applications of chemicals. The elimination of good nectar and pollen producing tree species in many areas makes it difficult to maintain bee colonies without feeding (Kerealem 2005). The deforestation rate is estimated to be 200,000 ha/year with most of the surviving forest in remnant patches in inaccessible and remote areas (Zerihun, 1999). Considering the above realities, it is necessary that providing information on the type, density and quality of bee flora and their effective management in the area in order to scale up and making sustainable the productivity of honeybee and other bee products. Therefore, this study was conducted to prepare an inventory of existing bee flora and develop floral calendar in Eastern Tigray.

Materials and Methods

Description of the study area

The study was conducted in eastern zone of Tigray, called Ganta- Afeshum, Gulomekeda, Erob and Atsbi-wonberta districts. The districts have different agro-ecological areas namely sub moist dry, sub moist cool and sub dega. The annual rain fall ranges from 400-600mm and the minimum and maximum temperature ranges from 6-21.8^{O}C with an altitude of 2000-3000 meter above sea level. In the study area the maximum rain fall occurs from mid-June up to September and between March and May but the minimum rain fall occurs from April to May.

Sampling Techniques and Sample Size

Prior to the actual survey, information was gathered from secondary data and informal survey from key

informants. Based on the information obtained from secondary data and informal survey, a semi-structured questionnaire was developed. Four districts and two peasant association (Tabias) from each district were selected for the study. By the help of bureau of agriculture and rural development of the districts, samples of modern beehive owning farmer respondents were selected from each Tabia by using simple random sampling. The total sample size was determined by the following two formulas (Bill, 204).

$$SSo = \frac{(1-P)(P)\,Z^2}{C^2} \ldots\ldots Eq1 \quad \text{And} \quad SS = \frac{SSo}{1+\frac{(SS-1)}{N}} \ldots\ldots Eq2$$

Where: - SS = Sample size finite population
Z = Constant Z-value (e.g., 1.96 for a 95 percent confidence level)
P = Percentage of population picking a choice, as decimal (5% b/s N may not be more than 5,000)
C = Confidence interval
SS_o= Sample size for infinite population
N= Total population the survey area

Data collection

Both primary and secondary sources of data were used in this study. Secondary data were obtained from reports of the district offices of Agriculture and Rural Development and other published and unpublished materials. Primary data were collected using questionnaire, informal discussion with groups and key informants. In addition, a direct observation was used.

Pre-testing of the questionnaire and record sheets were made as a pilot survey and on the basis of information obtained during pre-testing, modification were made on the questionnaire. Then, the primary data were collected from sample respondents through the questionnaire and direct discussion. The collection of information was made at household level. The researchers were adequately administer and supervised the data collection process and check the quality of the returns to avoid bias and errors. Checklists under major topics of the study were prepared well ahead of time to ensure the completeness of the discussion and other primary data.

Data Analysis

The survey results were analyzed using Excel software. Descriptive statistics (like frequency distribution percentage graphic and tabular presentations) were used to summarize information like supplementary feeding and other management activities. In addition, information obtained from group discussion was analyzed using qualitative analysis.

Result and discussions

Honey bee flora and their flowering season

Beekeepers reported that they depended on many kinds of flowering plants including trees, different kinds of flowering crops and weeds, shrubs and undergrowth ((Table 1). Some of the abundant honey plants, with their scientific and local names, habit and flowering seasons are given based on field observations and local knowledge of beekeepers. Some beekeepers practiced in the plantation and preservation of native bee flora found in their area and important for agro-forestry. This encourages beekeepers to be associated with the different efforts of watershed and agro-forestry conservation and rehabilitation (Tolera, 2014). Experienced beekeepers familiar with the plants that produce nectar or/and pollen, when it blooms and how long they remain in blooming. According to the beekeepers point of view, most important bee flowering shrubs, crops and weeds flowered between September and November and most important tree plants flowered in March and May and some in January. A good beekeeping area is one in which honey and pollen plants grow abundantly and with a relatively long blooming season. It requires the presence of appropriate crops and plants to favor foraging. Many agro-forestry tree species were found in gardens of farmers and were good sources of forage for the beekeepers (Kajobe, *et al*, 2009).

Table 1. Important bee forage plants, habits and flowering periods in study area.

Major bee flora	Local name	Plant Habit	Flowering season
Cirsium dender	Dander	shrub	October -November
Brassica rapa	Hamli	herb	September- October
Agave sisalana,	Eqa	shrub	September- October
Acacia spp	Lahay	Tree	February – March
Euphorbia abyssinica,	Qolqwal	Tree	October -November
Opuntia ficus indica	Beles	shrub	February –May
Ocimum basilicum	Sesseg	Herb	September-October
Ficus spp.	Sagla	tree	Year round
Acacia etbaica	Seraw	tree	October -November
Cordia africana	Awhi	tree	November- January
Carthamus tinctorius	Suf	herb	September-October
Dodonea angustifolia	Tahses	tree	Year round
Becium grandiflorum	Tebeb	shrub	August –September
Zea mays	Ifun	herb	August-September
Guizotia abyssinica	Nihug	Herb	September-October
Calpurnia aurea	Hitsawutse	tree	October -December
Croton macrostachyus	Tambuk	tree	November-December
Hypostusariculata	Grbia	herb	September-November
Linum vsitatissiumum	*Entatie*	herb	September
Sorghum bicolor	Meshela	herb	October -November
Pumpkin	Duba	herb	July- August
Oleo berhana	Ere	shrub	October -November
Rosa abissinica	*Kega*	Tree	February – May
Pisum sativum	*Ater*	herb	October -November
Vacia faba	*Balengau*	Herb	August- September
Sasbania	*Sasbania*	shrub	October -November
Bidensmacroptera	*Gelgelemeskel*	herb	September-October
Eucalyptus globulus	Bahr zaf	Tree	Year round

Conclusion

In this study different plant species and habit of growth (herb, shrub and tree) were identified as major bee flora. Some beekeepers practiced in the plantation and preservation of native bee flora found in their area and important for agro-forestry. This encourages beekeepers to be associated with the different efforts of watershed and agro-forestry conservation and rehabilitation. Further, this study identifies that there is a variation on seasonal availability of honeybee forages. High availability of honeybee shrubs and herbs plants was found from September to November while the most important trees flowered in March and May in all the districts. The high scarcity of bee forage was observed in June. Therefore, it is to be noticed that, in order to increase the honey bee yield and quality, scaling up of the coverage and management honeybee floras and considering floral calendar is critically important to the study area.

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