**Preliminary Identification of Poisonous Honeybee Plantsin Western Amhara, Ethiopia**

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**ABSTRACTS**

The knowledge about poisonous honeybee plants in Amhara regional state in general and in Western Amhara, in particular, is inadequate. The survey study was conducted in western Amhara: Awi, East Gojam, and South Gondar of western Amhara with an objective of identifying and determining the distribution of major poisonous honeybee plants. A total of 186 respondents who have knowledge and experiences on poisonous honeybee plants were used to collect the primary data through interviewed using semi-structured questionnaire. Twenty plants were identified as poisonous plants against honeybees among which Coroton macrostachyus, Vernonia amygdalina, Justicia schemperina, and Euphorbia abyssinica are the major and widely distributed one in all study areas. About 65% of these poisonous plants are flowering during scarcity of nectar and pollen (December to February, and June to August) and thus there might be a high chance to be visited by honeybees and honeybees get poisoned. Therefore, it is important to feed colonies during the dearth period and plant the non-poisonous major honey plants flowering during the dearth period to minimize the poisoning of honeybees by these poisoning honeybee plants.

**Keywords:** Dearth Period, Flowering, Honeybee, Poison Plants

**INTRODUCTION**

In Ethiopia, the diversified ecological situations create conducive environment for the growth of 7000 species of flowering plants. High proportions of these flowering plants are endemic to the country (Edwards, 1976) and are also honeybee forage plants. Naturally, there are certain species of honey plants whose pollens, nectars or honeydews are toxic to honeybees and humans (Vansell and Wntliins, 1933; Adler, 2000; Adler and Irwin, 2005; Praz et al., 2008). Some plants that are usually considered as excellent source of nectars have been shown poisonous to honeybees under certain specific stress conditions. The stress conditions also affect the dose of poison the bees receive. When environmental conditions, especially soil moisture stress, reduces the nectars of honeybee plants, and the bees are forced to forage from the toxic source plants as it is the only food available. On the other hand, when soil moisture is under normal condition, nectars are available and dilute the toxic substances to a level below the threshold of a toxic response (Adler, 2000).

In different countries, honey plants which are toxic to honeybees and humanswere identified and important cautions have been put in place. These exercises were also conducted in our country (Alemayehu Gela & Taye Negara, 2017; Hassen & Muche, 2020). However, it is in its infant stagewhich isnot exhaustively described and the knowledge we have in this respect is minimal in Ethiopia in general and Amhara Regional State in particular. Moreover, beekeepers in Amhara Regional States in general and Western Amhara region in particular are claiming that considerable honeybee colonies are dying from poisoning plants. Therefore, this study was aimed to identify and determine the distribution of major poison honeybee plants existing in the study area.

**MATERIALS AND METHODS**

**Study sites and Methods of data collection**

The survey data was collected from representative zones of Western Amhara region (Awi, East Gojjam and South Gondar). Purposive sampling technique was used for the selection of representative zones, *woredas* and *kebeles* based on the accessibility, beekeeping potential and claims from beekeepers. Pre-structured questionnaire was used to collect the necessary data. A total of 186 beekeeping farmers (respondents) were selected purposively for primary data collection through interview. Data were collected from the respondents on the presence of the problem, honeybee poisoning plant types, the time where the problem is occurring, flowering time of those blamed poisonous plants, and the possible effects they are causing.

**Data management and statistical analysis**

The data collected from the survey were coded and organized in SPSS version 20 software, and cleaned for consistency and accurateness. Descriptive statistical analysis was applied to summarize the basic data sets. Summarized data were presented in the form of tables and figures.

**RESULTS AND DISCUSSIONS**

**Household Characteristics of the Respondents**

From the total of 186 sample households interviewed to generate qualitative and quantitative  
data on beekeeping, all the respondents (100%) were male headed. This is in agreement with the findings of many authors (Tessega Belie, 2009; Solomon Bogale, 2009; Assemu Tesfa et al., 2013; Sisay Fikruet al*.*, 2015; Dereje Shibru et al., 2016) who have indicated that agricultural activities in general and beekeeping in particular are mainly duties of male and females are mainly engaged in house activities. The majority of the respondents (83.3%) do have an adequate working experience (more than 10 years) in beekeeping. This result shows that respondents have long experience in honey production and have rich knowledge in identifying the problems they encounter in beekeeping practice.

**Poisonous bee plants and their flowering periods in the study area**

Twenty plants were listed as poisonous plants against honeybees (). Some of these plants have been reported from the three zones while others are listed as poisonous honeybee plants either in one or two zones only. Among listed poisonous plants, *Coroton macrostachyus (Bisana)*, *Justicia schemperina (Simiza)* and *Euphorbia abyssinica (Kulkual)* were reported as poisonous honeybee plants in all the three zones, (East Gojjam, Awi, and south Gondar zones). About 46.43%, 45% and 41.43% of the respondents in East Gojjam, Awi and South Gondar have reported *Coroton macrostachyus (Bisana)* as a potential poisonous plant while 23.33%, 18.57% and 10.71% of the respondents from Awi, South Gondar and East Gojam have claimed that *Justicia schemperina (Simiza)* is a poisonous plant respectively. Although proportion of respondents in all levels were few, 13.33%, 5.71% and 1.79% of respondents also blamed *Euphorbia abyssinica (Kulkual)* to poison honeybees in Awi, South Gondar and East Gojjam zones respectively. On the other hand, *Vernonia amygdalina (Gerawa)*, *Clematis hirusta* *(Azo hareg)*, and *Junipurusprocera* *(Tsid)* were reported as poisonous honeybee plants only in East Gojjam and Awi zones. While the rest are listed as poisonous plant only in one zone ().

The present results are partially in agreement with findings of Nuru and Hepbern (2001) who indicated that *Coroton macrostachyus* (Bisana), *Euphorbia abyssinica* (Kulkual), *Justicia schemperina* *(Simiza)* and *Clematis hirusta* *(Azoareg)* cause poisonous to honeybees. Furthermore, except two plants *Jatropha Purrcaf (Mogno)* and *Ethulagracilis Del (Ashmuch)*, most of the identified honeybee poisonous plants were also reported as poisonous to honeybees in different previous studies (Adler, 2000; Nuru and Hepbern,2001; Keralem Ejigu, 2005; Tessega Belie, 2009; Awraris Getachew et al., 2012). Thus, as these two plants: *Jatropha Purrcaf* *(Mogno)* and *Ethulagracilis Del (Ashmuch)* were reported as poisonous plants for the first time at Awi and East Gojjam respectively; they need further works to confirm that these plants and their resources cause any abnormalities to honeybees.

Most of these plants considered as a poisonous plant to honeybees are the major honeybee plants providing nectar and pollen to honeybees. Though this seems a contradicting idea, it is normal phenomena and can happen in nature. Some plants that are usually considered as an excellent source of nectar have been shown poisonous to honeybees under certain specific stress conditions (Pushpa et al., 1963).The quantity of a chemical toxin from a poisonous plant at a low dose may be a valuable medicine or deadly at its higher dose.

These poisonous honeybee plants flower in different months of the year. About 40% and 30% of these plants flower during December to February and March to May respectively, while about 15%, 10% and 5% of the plants flower year-round, June to August and September to November respectively. These results indicate that about 65% of the poisonous plants are flowering during the times where there is scarcity of nectar and pollen (December to February, and June to August including those flowering year-round). In the absence of other potential bee plant flowers, bees are forced to visit the poisonous plants, and this may increase the chance of bees to get poisoned. Therefore, plants that blossom during these periods like *Coroton macrostachyus (Bisana)*, *Euphorbiaabyssinica (Kulkual*), *Vernoniaamygdalina (Grawa)*, *Justiciaschemperina (Simiza)* and others may have high potential to poison honeybees through diarrhea intoxication, and death (Hassen & Muche, 2020). This is because some toxins are produced by plants as a natural defense mechanism against predators, insects or microorganisms (WHO, 2018).

Table 1 Preliminary survey result of poisonous bee plants and their flowering period across 3 zones

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Common Name** | **Scientific Name** | **% of respondents within the 3 zones** | | | **Overall**  **n=186** | **Flowering month** |
| E/ Gojjam  n=56 | S/Gondar  n=70 | Awi  n=60 |
| *Bisana* | *Coroton macrostachyus* | 46.43 | 41.43 | 45.00 | 44.09 | June-August |
| *Grawa* | *Vernonia amygdalina* | 39.29 | 0.00 | 25.00 | 19.89 | December-February |
| *Simiza* | *Justicia schemperina* | 10.71 | 18.57 | 23.33 | 17.74 | December-February |
| *Azo hareg* | *Clematis hirusta* | 17.86 | 0.00 | 8.33 | 8.06 | December-February |
| *Astenager* | *Daturastramonium L* | 7.14 | 0.00 | 0.00 | 2.15 | September-November |
| *Enboay* | *Solanium indicum* | 5.36 | 0.00 | 0.00 | 1.61 | March-May |
| *Degita* | *Calpurnia aurea* | 1.79 | 0.00 | 0.00 | 0.54 | March-May |
| *Qye Bair zaf* | *Eucalyptus camadulensis* | 5.36 | 1.43 | 5.00 | 3.76 | Year round |
| *Cheba* | *Acacia nilotica* | 1.79 | 0.00 | 0.00 | 0.54 | March-May |
| *Adisuanfar* | *Buddeia polystachya* | 3.57 | 0.00 | 0.00 | 1.08 | December-February |
| *Ashmuch* | *Ethulagracilis*Del | 7.14 | 0.00 | 0.00 | 2.15 | December-February |
| *kulkual* | *Euphorbia abyssinica* | 1.79 | 5.71 | 13.33 | 6.99 | March-May |
| *Gunguriti/dengorita* | *Vernonia biafrae* | 1.79 | 0.00 | 0.00 | 0.54 | March-May |
| *Tsid* | *Junipurus procera* | 1.79 | 0.00 | 1.67 | 1.08 | Year round |
| *Mirze* | *Acokanther aschimperi* | 0.00 | 4.29 | 0.00 | 1.61 | June-August |
| *Serkabeba* | *Sennadidymobotrya* | 0.00 | 8.57 | 0.00 | 3.23 | December-February |
| *Chiret* | *Sansevieriaerythraeae* | 0.00 | 4.29 | 0.00 | 1.61 | Year round |
| *Mogno* | *Jatropha Purrcaf* | 0.00 | 0.00 | 20.00 | 6.45 | December-February |
| *Dong* | *Apodytes dimidiate* | 0.00 | 0.00 | 3.33 | 1.08 | December-February |
| *Iret* | *Aloe brahana* | 0.00 | 0.00 | 1.67 | 0.54 | March-May |
| **Total=20** | **Average** | **9.89** | **7.35** | **9.84** | **14.80** |  |

**Distribution of identified poisonous bee plants**

Most of the poisonous honey plants identified (82%) were grown between 1500 to 2400 m.a.s.l. () indicating that these poisonous plants are frequently found in the midlands of the study areas and honeybees poisoning problems may mostly occur in midlands of the Amhara Regional State.

Figure 1 Distribution of identified poisonous bee plants

*Croton macrostachys* *(Bisana)*, *Eucalyptus camadulensis (Qey Bahirzaf), Senna didymobotrya  (Serkabeba)*, *Jatropha Purrcaf (Mogno)* plants have been reported to cause diarrhea to honeybees while, *Clematis hirusta* (Azo Areg) and *Vernonia amygdalina (Grawa)* are causing intoxication in honeybees (). *Croton macrostachyus (Bisana)* have been also reported to cause death of honeybees in Kaffa and Sheka Zone (Awraris et al., 2012).

Different plants have different poisoning effects on honeybees depending on the types of toxic substances they contain. The signs of abnormality caused by poisonous plants are the reflection of compositions of food offered. Respondents listed out about five major effects of poisonous plants on honeybees. These are diarrhea (31.76%), death (21.18%), intoxication (15.29%) crawling (14.12%) and colony dwindling (7%) (). These all entails the action of poisonous plants on honeybees.

Table 2 Major poison plant with their Effects

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Common name of poisonous plant** | **Scientific Name** | **Plant type** | **Total symptom frequency** | **Highest symptom Frequency** | **Percent (%)** | **Major identified symptom** |
| *Bisana* | *Coroton macrostachyus* | Tree | 70 | 38 | 54.3 | Diarrhea |
| *Grawa* | *Vernoniaamygdalina* | Tree | 24 | 13 | 54.2 | Intoxication |
| *Simiza* | *Justiciaschemperina* | Shrub | 14 | 8 | 57.14 | Crawling |
| *AzoAreg* | *Clematis hirusta* | Climber | 10 | 3 | 30 | Intoxication, death, crawling |
| *Astenager* | *Daturastramonium L* | Herb | 4 | 1 | 25 | Death, crawling |
| *QyeBahirzaf* | *Eucalyptus camadulensis* | Tree | 4 | 2 | 50 | Diarrhea |
| *Kulkual* | *Euphorbia abyssinica* | Shrub | 6 | 4 | 66.7 | Death |
| *Serkabeba* | *Sennadidymobotrya* | Shrub | 6 | 4 | 66.7 | Diarrhea |
| *Mogno* | *Jatropha Purrcaf* | Shrub | 10 | 4 | 40 | Diarrhea |

Table 3 Symptom of poisonous plant reported in honeybees

|  |  |  |
| --- | --- | --- |
| **Symptom** | **Frequency** | **Percent** |
| Diarrhea | 54 | 31.76 |
| Dwindling | 12 | 7.05 |
| Intoxicated | 26 | 15.29 |
| Absconding | 6 | 3.53 |
| Death | 36 | 21.18 |
| Crawling | 24 | 14.12 |
| Aggressiveness | 6 | 3.53 |
| High infestation level of wax moth | 2 | 1.18 |
| Shivering | 2 | 1.18 |
| Mechanical damaged | 2 | 1.18 |

**CONCLUSION AND RECOMMENDATION**

Twenty plants have been reported as poisonous plants against honeybees among which *Coroton macrostachyus, Vernonia amygdalina, Justicia schemperina* and *Euphorbia abyssinica* are the major and widely distributed plants in all study zones. About 65% of these poisonous plants are blooming at times where there is scarcity of nectar and pollen (December to February, and June to August) and thus there might be high chance to be visited by honeybees thereby honeybees get poisoned. Therefore, in a place where abundant poisonous plants are found, planting the non-poisonous major honey plants is necessary to neutralize the effect of poisonous plants and practice feeding of honeybee colonies during flowering period of these poisonous plants to limit honeybees from visiting poisonous plants. Moreover, when selecting apiary sites, it is much better to consider sites where poisonous plants are in sufficient. From this study, it is found important to study the levels of honeybee poisoning from these plants and determining toxicity levels caused by pollens and/or nectars of these plants. Identification of the toxic components from these poisonous plants and specificity of the plant resources involved in poisoning of the honeybees and/or humans shall be recommended as a medium term research strategy. The scope of this study is limited to the three zones of Amhara region and thus further study is important to exhaustively identify poisonous honeybee plants existing in the region.

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**REFERENCE**

Adler, L S., and Irwin, R E. (2005). Ecological costs and benefits of defences in nectar. Ecology 86, 2968-2978.

Adler, L S. (2000). The ecological significance of toxic nectar. Oikos 91, 409-420.

Alemayehu Gela, & Taye Negara. (2017). Evaluating the Toxicity Effect of Euphorbia Contifolia on Honey Bees (Apis mellifera) at Field Condition. *International Journal of Ecotoxicology and Ecobiology*, *2*, 145–149. https://doi.org/10.11648/j.ijee.20170204.12

Assemu Tesfa, Kerealem Ejigu and Adebabay Kebede. (2013). Assessment of current beekeeping management practice and honeybee floras of Western Amhara, Ethiopia. Inter J Agri Biosci, 2: 196-201.

Awraris Getachew, Yemisrach Getachew, Dejen Assefa, Nuru Adgaba,Gebeyehu Ganga and Workneh Abebe. (2012).Honey production systems (*Apis mellifera* L.) in Kaffa, Sheka and Bench-Maji zones of Ethiopia, J. Agri. Ext. Rural Dev. 19, 528-541

Dereje Shibru, [Getahun Asebe](https://www.researchgate.net/profile/Getahun_Asebe) andEmana Megersa. (2016). Identifying opportunities and constraints of beekeeping: the case of Gambella Zuria and Godere Weredas, Gambella Regional State, Ethiopia. Entomol Ornithol Herpetol 5, 2-6.

Edwards S. (1976). Some Wild Flowering Plants of Ethiopia. Addis Ababa University Press, Addis Ababa. Ethiopia. Ent.18,265-267.

Kerealem Ejigu, Tilahun Gebey, Preston TR. (2009). Constraints and prospects for apiculture research and development in Amhara region, Ethiopia. Liv. Res. Rural Dev. 21: no. 10.

Kerealem Ejigu. (2005). Honeybee Production System, Opportunities and Challenges in Enebsesar Midir woreda (Amahara region) and Amaro special woreda (SNNPR), Ethiopia. M.Sc. Thesis, Alemaya University, Ethiopia.

Praz, C J; Müller, A; Dorn, S. (2008). Specialized bees fail to develop on non-host pollen: do plants chemically protect their pollen? Ecology. 89, 795-804.

Sisay Fikru, Gebremedhin Gebresilassie, Awoke Kassa. (2015). Assessment of Beekeeping Practices (Absconding, Bee Forage and Bee Diseases and Pests) in Jigjiga Zone, Somali Regional State of Ethiopia. Poult Fish Wildl Sci 3: 135

Solomon Bogale. (2009).*Indigenous Knowledge and Its Relevance for Sustainable Beekeeping Development: a Case study in the Highlands of Southeast Ethiopia*. *Mada Walabu University, Ethiopia.*

Tessega Belie. (2009). Honeybee Production and Marketing Systems, Constraints and Opportunities in Burie District of Amhara region, Ethiopia. Pp, 24-45.

Vansell, G. H. and Wntliins, W.G. (1933). A plant poisonous to bees -J. econ. Entomol., 26 (p. 168).

Hassen, A., & Muche, M. (2020). Preliminary Survey of Poisonous, Useful and Medicinal Bee Plants in Ethiopia: Review. *Bulletin of Pure & Applied Sciences- Botany*, *39*, 106–121. https://doi.org/10.5958/2320-3196.2020.00016.6

WHO. (2018). *Natural toxins in food*. *2018*, 1–5. https://www.who.int/news-room/fact-sheets/detail/natural-toxins-in-food