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Preliminary Identification of Poisonous Honeybee Plants in Western Amhara, Ethiopia

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ABSTRACT

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

1. INTRODUCTION

In Ethiopia, the diversified ecological situations create a conducive environment for the growth of 7000 species of flowering plants (Adi et al., 2014). High proportions of these flowering plants are endemic to the country (Edwards, 1976) and are also honeybee forage plants (Adi et al., 2014). Naturally, there are certain species of honey plants whose pollens, nectars, or honeydews are toxic to honeybees and humans (Adler, 2000; Van Egmond, 2004; Praz et al., 2008; Hassen & Muche, 2020). Some plants that are usually considered excellent sources of nectar have been shown to be poisonous to honeybees under certain specific stress conditions. These specific stress conditions of the plant also affect the dose of poison the bees receive. When environmental conditions, especially soil moisture stress, reduce the nectar of honeybee plants, and the bees are forced to forage from the toxic source plants, as it is the only food available (Descamps et al., 2021; Lema et al., 2025). On the other hand, when soil moisture is under normal conditions (availability of moisture in the soil), other sources are available that dilute the amount of toxic substances to a level below the threshold of a toxic response (Adler, 2000).

In different countries, honey plants that are toxic to honeybees and humans have been identified, and important cautions have been put in place (Adler, 2000; Praz et al., 2008; Stevenson et al., 2017). These exercises were also conducted in our country (Gela & Negara, 2017; Hassen & Muche, 2020; Lema et al., 2025). However, it is in its infant stage, which is not exhaustively described, and the knowledge we have in this respect is minimal in Ethiopia in general and the Amhara Regional State in particular (Lema et al., 2025). Moreover, beekeepers in Amhara Regional States in general and the Western Amhara region in particular are claiming that considerable honeybee colonies are dying from poisoning plants (Abay et al., 2023). Therefore, this study aimed to identify and determine the presence, distribution, and effects of major poisonous honeybee plants in the study area.

2. MATERIALS AND METHODS

2.1. Study sites and Methods of data collection

The survey data were collected from representative zones of the 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. A 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 interviews. Data were collected from the respondents on the presence of the problem, honeybee poisoning plant types, the time when the problem occurs, the flowering time of those blamed poisonous plants, and the possible effects they are causing.

2.2. 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 accuracy. Descriptive statistical analysis was applied to summarize the basic data sets. Summarized data were presented in the form of tables and figures.

3. RESULTS AND DISCUSSIONS

3.1. Household Characteristics of the Respondents

All the interviewed respondents were male-headed. This is in agreement with the findings of many authors (Tesfa et al., 2013; Fikru et al., 2015; Shibru et al., 2016) who have indicated that agricultural activities in general and beekeeping in particular are mainly duties of males, and females are mainly engaged in house activities. The majority of the respondents (about 83.3%) 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.

3.2. Poisonous bee plants and their flowering periods in the study area

Twenty plants were listed as poisonous plants to honeybees (

Table 1). 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 the listed poisonous plants to honeybees, *Croton macrostachyus (Bisana)*, *Justicia schenckiana (Simiza),*and *Euphorbia abyssinica (Kulkual)* were reported as poisonous honeybee plants in all 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 *Croton macrostachyus (Bisana)* as a potential poisonous plant, while 23.33%, 18.57% and 10.71% of the respondents from Awi, South Gondar, and East Gojjam have claimed that *Justicia schemperina (Simiza)* is a poisonous plant, respectively. Although the proportions of respondents at all levels were few, 13.33%, 5.71% and 1.79% of respondents also blamed *Euphorbia abyssinica (Kulkual)* for poisoning honeybees in the Awi, South Gondar, and East Gojjam zones, respectively. On the other hand, *Vernonia amygdalina (Gerawa)*, *Clematis hirusta (Azoareg)*, and *Juniperus procera (Tsid)* were reported as poisonous honeybee plants only in East Gojjam and Awi zones. While the rest are listed as poisonous plants only in one zone (

Table 1).

The results are partially in agreement with findings of Nuru and Hepbern (2001), who indicated that *Croton macrostachyus (Bisana)*, *Euphorbia abyssinica (Kulkual)*, *Justicia schemperina (Simiza)*, and *Clematis hirusta (Azoareg)* are poisonous to honeybees. Furthermore, except for two plants, *Jatropha Curcas (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; Ejigu, 2009; Shenkute et al., 2012). Thus, as these two plants, *Jatropha Curcas (Mogno)* and *Ethulagracilis Del (Ashmuch)*, were reported as poisonous plants for the first time at Awi and East Gojjam, respectively, they need further work to confirm that these plants and their resources cause any abnormalities in honeybees.

Most of these plants considered as poisonous plants to honeybees are the major honeybee plants providing nectar and pollen to honeybees (Tesfa et al., 2013; Addi & Bareke, 2019). Though this seems a contradictory idea, it is a normal phenomenon and can happen in nature. Some plants that are usually considered an excellent source of nectar have been shown to be poisonous to honeybees under certain specific stress conditions (Stevenson et al., 2017; Hassen & Muche, 2020). 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 (Patel, 2013; Dong et al., 2013; Stevenson et al., 2017).

These poisonous honeybee plants flower in different months of the year. About 40% and 30% of these plants flower from December to February and from March to May, respectively, while about 15%, 10% and 5% of the plants flower year-round, from June to August and from September to November. These results indicate that about 65% of the poisonous plants are flowering during the times when there is a scarcity of nectar and pollen (December to February and June to August, including those that flower year-round). In the absence of other potential honeybee floras, bees are forced to visit the poisonous plants, and this may increase the chance of getting poisoned. Therefore, plants that blossom during these periods, like *Croton macrostachyus (Bisana)*, *Euphorbia abyssinica (Kulkual*), *Vernonia amygdalina (Grawa)*, *Justicia schemperina (Simiza),* and others, may have high potential to poison honeybees, inducing 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 (Van Egmond, 2004; Patel, 2013; Fletcher & Netzel, 2020).

3.3. Distribution of identified poisonous bee plants based on beekeepers' questionnaire data

Most of the poisonous honey plants identified (about 82%) were grown in midland areas ranging between 1500 and 2400 m.a.s.l. (Figure 1), indicating that these poisonous plants are frequently found in the midlands of the study areas and honeybee poisoning problems may mostly occur in the midlands than in other agroecologies of the Amhara Regional State. Similarly, Tulu et al. (2023) stated that the existence of more poisonous plants is found in the midlands of South West Ethiopia.

Table 1. Preliminary survey results 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	*Crotonmacrostachyus*	46.43	41.43	45.00	44.09	June-August
Grawa	*Vernoniaamygdalina*	39.29	0.00	25.00	19.89	December-February
Simiza	*Justiciaschemperina*	10.71	18.57	23.33	17.74	December-February
Azoareg	*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	*Solaniumindicum*	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	*Buddeiapolystachya*	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	*Vernoniabiafrae*	1.79	0.00	0.00	0.54	March-May
Tsid	*Junipurusprocera*	1.79	0.00	1.67	1.08	Year round
Mirze	*Acokantheraschimperi*	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	*JatrophaPurrcas*	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**	

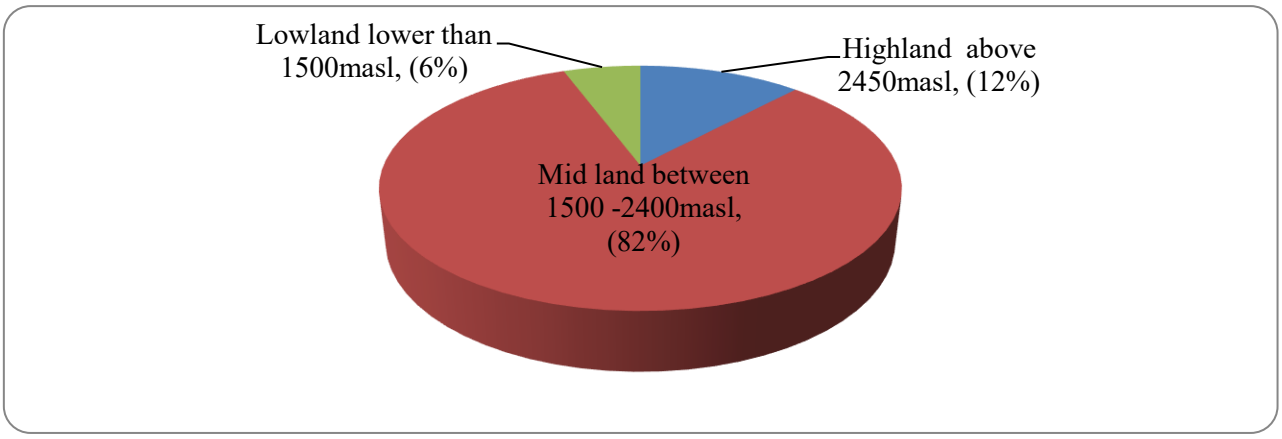

Figure 1: Distribution of identified poisonous bee plants

3.4. Effect of poisonous plants on honeybees

According to the survey from beekeepers, *Croton macrostachys (Bisana)*, *Eucalyptus camadulensis (QeyBahirzaf)*, *Sennadidymobotrya (Serkabeba)*, *Jatropha Purrcas (Mogno)* plants have been reported to cause diarrhea in honeybees, while *Clematis hirusta* (Azoareg) and *Vernonia amygdalina (Grawa)* are causing intoxication in honeybees (

Table **2**). *Croton macrostachyus* contains bioactive compounds such as alkaloids, diterpenoids, and flavonoids, which have medicinal properties but can also be toxic to some animals/insects (Maroyi, 2017).

Croton macrostachyus (Bisana) has also been reported to cause the death of honeybees in the Kaffa and Sheka Zone (Shenkute et al., 2012). Even though beekeepers stated *Eucalyptus camaldulensis* as a poisonous plant, melissopalynological analysis indicated that it is the

predominant pollen source plant and beneficial to honeybees (Tulu et al., 2023).

Plants vary in their toxicity to honeybees. Some produce toxic honey from their pollen and nectar, while others have toxins that directly harm bees through contact. The level of poisoning depends on the type and amount of toxin, as well as each bee's sensitivity Hassen & Muche, 2020; Lema et al., 2025). The signs of abnormality caused by poisonous plants are the reflection of the composition of food offered (Thomson et al., 2015; Fletcher & Netzel, 2020; Lema et al., 2025). 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%) (Table 3). These all entail the action of poisonous plants on honeybees. Similar studies by Tulu et al. (2023) identify poisonous plants as a threat to both honeybee populations and human health in Southwest Ethiopia. Exposure to these plants, either through direct contact or consumption of contaminated nectar or pollen, can result in mortality or paralysis in honeybees. Furthermore, the resultant honey produced from these plants may be rendered toxic and unsafe for human consumption.

Table 2. Major Poison Plants with Their Effects

Common name of a poisonous plant	Scientific Name	Plant type	Total symptom frequency	Highest symptom Frequency	Percent (%)	Major identified symptom
Bisana	*Crotonmacrostachyus*	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	*JatrophaPurrcas*	Shrub	10	4	40	Diarrhea

Table 3. Symptoms of a 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 the wax moth	2	1.18
Shivering	2	1.18
Mechanical damaged	2	1.18

4. CONCLUSION AND RECOMMENDATION

Poisonous plants are those that kill or paralyze honeybees when they come into contact with or ingest nectar or pollen from them. Twenty plants have been reported as poisonous plants against honeybees, among which *Croton 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 bloom at times when there is a scarcity of nectar and pollen (December to February and June to August), and thus, there might

be a high chance of being visited by honeybees; thereby, honeybees get poisoned. Poisonous plants are those that kill or paralyze honeybees when they come into contact with or ingest nectar or pollen from them. Therefore, in a place where abundant poisonous plants are found, planting the non-poisonous major honey plants that bloom at the same time as poisonous plants is necessary to neutralize the effect of poisonous plants and practice feeding of honeybee colonies during the 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 determine toxicity levels caused by pollens and/or nectars of these plants. Identification of the toxic components from these poisonous plants and the 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 was 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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