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Research Article

Characterization of Honeybees (*Apismellifera* L.) Behavior and Swarming Tendency in Bale, South- eastern Ethiopia

Abstract

The study was conducted to characterize honeybee's behavior and swarming tendency in Bale Zone of Oromia Regional state, South-eastern part of Ethiopia in 2014/15. Three districts (Dinsho, Adaba and DelloMenna) were considered based on variations in agro-ecology. From each districts two Rural Kebele (RKs), from each RK 30 beekeepers and a total of 180 beekeepers were selected using purposive sampling method. The selected beekeepers were interviewed using pre-tested structure questioners and single-visit – multiple formal survey method used to collect the data. The result showed that the sample respondents categorized honeybees as black (41%), red (15%), grey (10%) and (33.9) mixture of black and red. Depending on the stinging behavior beekeepers were rated their bee colonies very aggressive (27.2%), aggressive (51.1%) and docile (21.7%). They also characterized those bees with grey in color as very aggressive in stinging behavior and called "Fakiin local language or Afan Oromo". About 82.8% of the sample respondents were reported as absconding occur in their honeybee colonies. Out of the total sample responds about 99% had reported occurrence of swarming in their apiaries. The present study showed that honeybees in southern part of Ethiopia had aggressive behavior and high swarming tendency. However, it requires controlled studies in-colony and out-colony factors that determining the behaviors and swarming tendency of honeybee's colonies to fully understand it.

Introduction

The development of beekeeping had like effect the studying of bees behavior and the selection of the most productive and gentile families. The existence of sophisticated, social insect encapsulation behavior has only recently been described in honeybees, *Apismellifera* L. [1,2]. Africanized honey bees have become legendary for their aggressive, stinging, nest defense behavior and reactions in response to a disturbance of the colony. Enormously sensitive to the slightest disturbance, especially a jolt [3], an alarm was spread throughout the colony by a worker who immediately ran into the nest to recruit others by opening her sting chamber and extending her sting. This highly aggressive behavior may have evolved in response to greater levels of predation [4], or may be as a result of years of harvesting un-predictable resources [5].

The behavior is an interaction between the honeybee colonies and their environment. The bees' behavior is correlated with a number of factors, including climacteric conditions, hives microclimate, hives capacity and the queen laying potential [6]. The climacteric changes seriously disturb the activities

and behavior of the bees, by extreme temperatures, that it determines the early flowering of plants and the mild winters.

The honeybees, *Apismellifera* L., is a well-adapted insect with great economic importance and exists in different ecological conditions in the world. Colonies must grow early in the year to allow division into parent colony and swarm(s) that will attain adequate populations and surplus stores to reach the next yearly cycle of reproduction. Swarms are everywhere in all calendar seasons in tropical Africa. A swarm flies with high speed in the air as a cloud, hangs from the branch of a tree, or flies into a cavity in a tree or it may be baited in a bee hive and start nesting there [7,8]. Swarm cells are typically found in very strong colonies and this cause honeybee colony to swarm. More queens also emerge during honey flow period or the major flowering season and this causes honeybee colonies to swarm [9].

Adequate knowledge of the natural diversity of local subspecies and ecotypes is essential for their management and conservation. To protect the biological diversity of local populations of honeybees in their natural habitats, these

populations must, first of all, be characterized. Although the importance of beekeeping practices are generally recognized, honeybee behaviors and their activities in some honeybee subspecies is not yet well elucidated. Therefore, the aim of this work was to clarify some aspects of honeybee behaviors and their swarming tendency under the influence of environmental condition in southeastern part of Ethiopia.

Materials and Methods

Description of the study area (Figure 1)

Study Area, Sample Size and Sampling Techniques: The study was conducted in Bale Zone of Oromia Regional state, South-eastern Ethiopia throughout the year (September, 2014 to August, 2015). Three (3) districts (Dinsho, Dellomenna and Adaba) where beekeeping practices potentially dominated were purposively selected. From each districts two Rural Kebeles were selected purposively based on accessibility which represents the selected agro-ecology. A total of 180 experienced beekeepers (male and females) were selected purposively by the assistance of Development Agents and districts experts. Interviews using structure questioners and observation through inspection were used as research tool to collect the main data and to characterize honeybee's behavior and swarming tendency in the study area. Beekeepers households, DA's, and district experts were involved in interviews. Single-visit-multiple-subject formal survey method [10], was employed to collect data. The enumerators

who had knowhow on beekeeping were recruited to collect the data under the supervision of the researcher after training on the methods and the whole concepts of the data collections.

Data management and statistical analysis

All the collected data were coded, tabulated, and organized for analysis in to MS- Excel spread sheets. Then the data was analyzed using *SPSS version 20* Software and the data was summarized using descriptive statistics (mean, mean comparison, frequency, percentages and ranges).

Results and Discussions

Socio-economic characteristics of the sampled beekeepers

Table 1 summarizes the distribution of sampled beekeepers by socioeconomic characteristics. About 99.44% male headed and 0.56% female headed households were participated on the interview. Regarding ages of sample respondents, the mean age was 43.46 with ages age ranges from 20 – 81 years old. The average family size per household during study time were 8.01 and ranges from 1 to 20 persons per household.

The result revealed that there were significant different ($P < 0.05$) in Beekeeper's experience between Dellomenna and Adaba districts with no significant difference ($P > 0.05$) between Adaba and Dinsho, Dellomenna and Dinsho districts

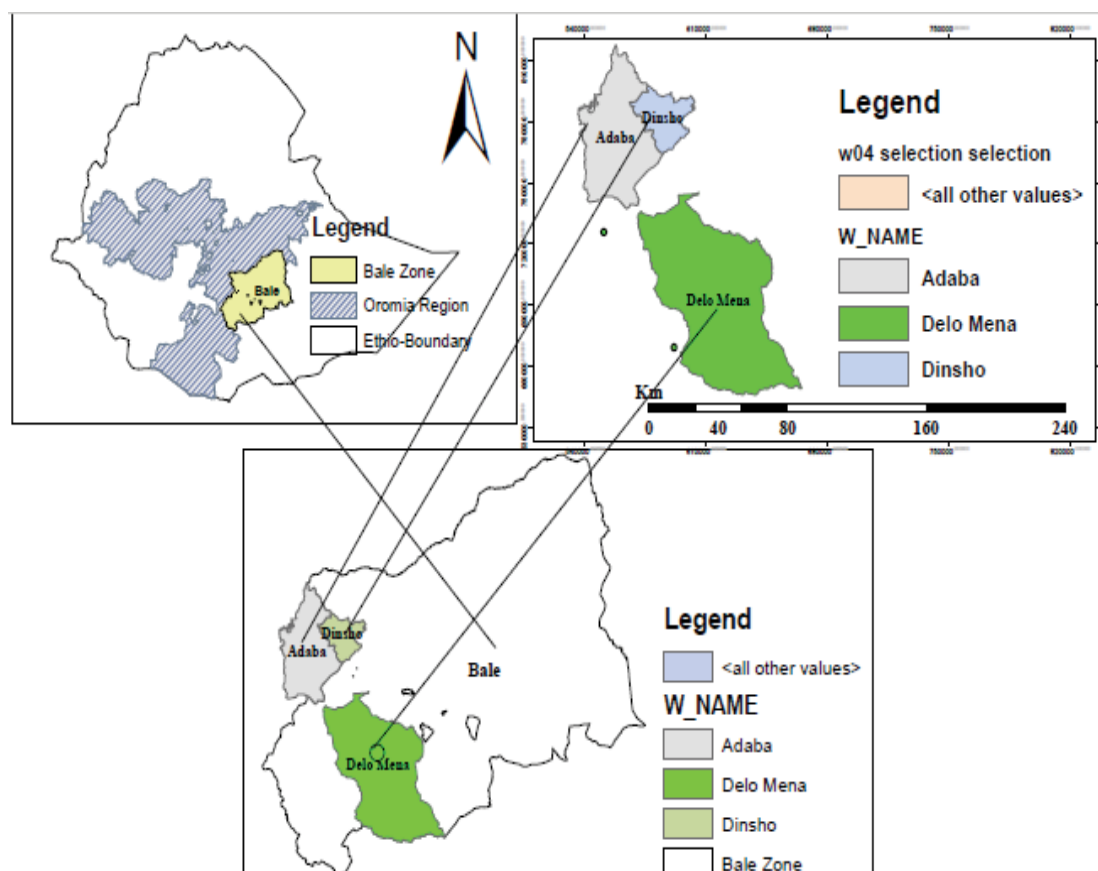


Figure 1: Map of study areas.

(Table 1). The total mean of the three locations were 16.18 years' experience with range of 1 to 70 years. Besides, the correlation between age of beekeepers and beekeeper's experience indicated that strong positive and highly significant relationship ($r=0.582$, $N=180$, $P=0.00$), showing engagement in beekeeping from early age [11].

Characterization of honeybees behaviors

Beekeepers have their own traditional and indigenous knowledge of characterizing honeybee's behaviors. This is mostly based on the coat color and stinging behavior of the bees. Accordingly, about 41% of the sample respondents categorized honeybees as black and the rest respondents categorized as red (15%), grey (10%) and mixture of black and red (33.9). Beekeepers in the study area characterized those bees with grey in color as very aggressive in stinging behavior and called "Faki" and they believe that this type of honeybee is productive ("Hameessa" in Local language or Afan Oromo) as well. Whereas, those bees black in color are docile in behavior and also low in productivity ("Baakuu" in Local language or Afan Oromo) as compared with Faki. Furthermore, beekeepers behaviorally rated their bee colonies very aggressive (27.2%), aggressive (51.1%) and docile (21.7%) and this characterization was depending on the stinging behavior of honeybees. This behavioral rating result is similar with the finding of [12], that reported similarly for *A.m bandassii* the bee races that commonly found in sub moist central highland of Ethiopia and *Apis mellifera scutellata* in the west, south and southwest humid midlands.

Occurrence of absconding and migration

Honeybee colonies abscond from their hives at any season of the year when the hives affected by their enemies [13]. According to this study about 82.8% of the respondent reported absconding of their honeybee colonies with the absconding incidence occurred 37.1%, 25.6%, 12.8%, 8.3% and 16.1% in March to May, September to November, December to February, June to August and no response or I don't know about absconding, respectively. Bee enemies are rated number one initiator of bee colony absconding with the other reported reasons for absconding of bee colonies are indicated in table 2. Also different mechanisms are used to control bee colony absconding which includes: queen wing clip, providing additional feeds, queen caging (that made from *shimal*, *kerka*), leaving honey combs during harvesting and cleaning and smoking the beehives (Table 2).

Most of the time migration is occurred because of changes between seasons [13]. According to the respondents reply, migration of bee colonies occurred from March to May ranked first (43.3%) followed by September to November (25%), December to February (21.7%), June to August (5%) and no response (5%). From the results of this study, one can concluded that the cause of migration from March to May (43.3%) might follow the dearth period mainly drought due to high temperature of the area. Similar result was reported by [14], there was absconding and migration immediately following the main honey flow season and continued throughout the dry season up to the next active period in Adami Tulu, Jido, Kombolcha district in mid rift valley of Ethiopia.

Honeybee colony swarming and means of control

Swarming is a form of colony reproduction whereby the parental colony splits into one or more subunits each containing at least one sexual female (queen) and a fraction of the colony's workers. From the total 180 respondents in this study, about 99% reacted occurrences of reproductive swarming in their apiary with the remaining about 1% had no knowhow about swarming. The respondents mentioned that frequency of swarming depends on the availability of honeybees flower and season of the swarming occurrences (Table 3). In addition, the experienced beekeepers have reported that only at a single active flowering season strong colony can produce about 3 - 7 swarms. They have also requested that "Have you an experience on catching swarm? About, 84.4% of the sample respondents replied as they had experience of catching the issued swarm and this result agrees with report of [15], who recorded 85.80% experience in catching swarm for beekeepers in Burie District of Amhara Region. Also in this study about 72.8% of the sample respondents agree that issuing swarm had advantage to increase their number of colony and replace non-productive colony with only 27.2% responded swarm has no advantage. Further, most of the beekeepers reported to use many ways of controlling reproductive swarming among which removal of queen cell, returning back the issued swarm to mother colony, use large volume of hive and harvesting or cut combs some of the ways they were mentioned in the study area.

Inspection of honeybee colonies

With regards to collecting information on the inspection of bee colonies by the beekeepers, about 92% of the respondents do undertake inspection of their bee colonies with only about 8% not. This indicates that most of beekeepers visit and inspect their beehives both externally and internally at varied

Table 1: Mean comparison of Age, Beekeeping experience and family size of the Respondents.

Variable	Total Sample sizes (N= 180)							
	Adaba(N= 60)		Dinsho(N= 60)		Dellomenna(N= 60)		Overall	
	Range	Mean ± SE	Range	Mean ±SE	Range	Mean ±SE	Range	Mean ±SE
Age of respondent (Years)	22 - 67	40.78±1.52	20 - 81	45.33±1.78	22 - 80	44.27±1.92	20 - 81	43.46±1.01 ^{NS}
Total Family Size (Number)	1 - 18	7.55±0.43 ^b	1 - 13	7.37±0.42 ^b	1 - 20	9.10±0.53 ^a	1 - 20	8.01±0.27
Beekeepers' Experience (Year)	1 - 32	13.17±1.12 ^b	1 - 60	15.78±1.70 ^{ab}	2 - 70	19.60±1.96 ^a	1 - 70	16.18 ±0.96

ab= The mean difference is significant at the 0.05 level, NS= Non significant, SE= Standard Error, N = number of respondents.

frequency to check either the hive was save or filled with honey (Table 4). However, internal hive inspection was limited to those honeybee colonies placed at backyard and under the eaves of the house. Different researcher [14,16,17] reported that farmers in Ethiopia do not commonly practice internal hive inspection due to the difficulty of the traditional hives for internal inspection i.e., fixed combs attached to the body of traditional beehive.

However, it was observed that during the survey period the beekeepers farmers who have frame and transitional beehives did not manage it properly. This might be due to lack of training and now how on improved beekeeping practices that in turn can be due to lack of appropriate beekeeping extension services.

Conclusion

The honeybees, *Apismellifera L.*, is a well-adapted insect with great economic importance and exists in different ecological conditions in the world. However their behavior and swarming tendency is influenced by environmental factors depending on their species. Experienced beekeepers have their own characterizing mechanisms of honeybees. Based

Table 2: Factors responsible for absconding of honeybee.

Reason of Absconding	Total Sample sizes (N= 180)	
	%ages	Rank
Honeybee enemies	50.7	1 st
Indiscriminate application of agro-chemicals	26.0	2 nd
Lack of bee forages	36.4	3 rd
Lack of Protection against bad weather	62.3	4 th
Poor management system of beekeeping	1.3	5 th

Notice: For each rank, the factors responsible for absconding can be evaluated out of 100% by multiple response analysis method and the winner take its %age.

Table 3: Frequency of reproductive swarming occur.

Season of occurrence	Frequency	(%)
Every season	115	63.9
Every year	59	32.8
Once in two year	4	2.2
No know how	2	1.1
Total	180	100.0

Table 4: External and internal hive inspection frequency.

	External		Internal	
	Frequency	%	Frequency	%
Every day	16	8.9	2	1.1
Every three day	22	12.2	5	2.8
Every week	13	7.2	3	1.7
Every two week	16	8.9	4	2.2
Every month	65	36.1	38	21.1
Not at all	19	10.6	108	60.0
If necessary	29	16.1	20	11.1
Total	180	100.0	180	100.0

on this finding honeybees found in southern part of Ethiopia had aggressive behavior and high swarming tendency. The survey result showed that honeybees categorized as black (41%), red (15%), grey (10%) and (33.9) mixture of black and red. depending on their coat color in the study area. Moreover, depending on stinging behavior honeybees rated as very aggressive (27.2%), aggressive (51.1%) and docile (21.7%).

However, further controlled studies have required on both the in-colony and out-colony factors that determining the behaviors and swarming tendency of honeybees to fully understand. In addition, possible methods for reducing the honeybees' swarming activity on plants and their colonies need to be investigated.

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