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Factors Affecting bee Colony Absconding and Prevention Mechanism in Ethiopia: Review

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Abstract **– This review on bee colony absconding and their prevention mechanisms has been conducted with the objective of reviewing factor affecting honey bee colony absconding and their prevention mechanism in Ethiopia. The country is the largest honey producer in Africa and 10th largest honey producer in the world. Despite the long tradition of beekeeping in Ethiopia, having the highest bee density and being the leading honey producer as well as one of the largest bees wax exporting countries in Africa, the products obtained from the subsector were still low as compared to the potential of the country. The low yield of honey and other beekeeping products resulted from insufficient management practices and lack of adequate beekeeping training. In Ethiopia the major factors for bee colony absconding are lack of enough food and water, agrochemical, parasite and disease attack, uncomfortable hive, frequent disturbance, too high or low temperatures and poor beehive ventilation. The prevention mechanisms of bee colony absconding in Ethiopia includes: Make the hive homey, Control Interior Temperatures, Keep agrochemicals away, Provide Proper Ventilation, Keep away large animals/Predators, Minimize Disturbance, Provide enough food and water, Control parasites and diseases, Create more hive space, and Secure bee flight paths. The prevention mechanism of honey bee absconding are also reduced chemical application, provide supplementary feed, exercise good honey bee management practice. Absconding is top ten honey bee production factor.**

Keywords **– Absconding, Bee Colony, Chemicals, Ethiopia and Prevention Mechanism.**

I. INTRODUCTION

Ethiopia is one of the countries, which has the largest honeybee population and owns big potential of honey production. Owing to its varied ecological and climatic condition, (1). Ethiopia is the home to the most diverse flora that provides surplus nectar and pollen for honeybees. Moreover, beekeeping is an appropriate and well-adapted farming practice to extensive range of ecosystems of the country. To date over 10 million of bee colonies are found in the country, which include both domesticated and wild bees (2). Ethiopia is known for its tremendous variation of agro-climatic conditions and biodiversity which favored the existence of diversified honeybee flora and huge number of honeybee colonies (3). The diversified agro climatic conditions of the country create environmental conditions conducive for the growth of over 7000 species of flowering plants of which most are bee plant (4). Beekeeping is an important, sustainable, integral agricultural and forestry activity under the rural development program (5). It provides nutritional, economical, and ecological security (6). The most important and available insect in the world today is the honeybee. There are several species of honeybees existing, but Apis mellifera is country famous. It is a wonderful and popular bee type for its honey and bee wax production besides the major value obtained because of plant pollination (7).

The country is the largest honey producer in Africa and 10th largest honey producer in the world (8). The presence of good climatic conditions and diversified bee flora contributed for the existence of about five million honeys bee colonies in Ethiopia (9). The yearly honey production in Ethiopia is estimated to be around 54,000 tones which make the country leading of honey producing in Africa and ninth in the world (10). Despite the long tradition of beekeeping in Ethiopia, having the highest bee density and being the leading honey producer as well as one of the largest beeswax exporting countries in Africa, the products obtained from the subsector were s

-till low as compared to the potential of the country (11).

Beekeeping is exceptionally sustainable as the activity has no impact on the environment and rather it stabilize fragile area and help in reclaiming degraded lands and increase biodiversity (12). The low yield of honey and other beekeeping products resulted from insufficient management practices and lack of adequate beekeeping training (13). Pollen and nectar are a resource need for honeybees available only during certain periods. When surplus food source are available it is known as honey flow season. In contrast during dearth period there will be scarcity of food. Local bee flora skill and specific seasonal colony management plans play a key role intrans forming beekeeping sector (14). Productive beekeeping involves understanding of the yearly colony cycles and carrying out seasonal bee management operations to build colonies to its maximum population during the main nectar flow and to survive the dearth period to assure the greatest possible return (15). Pollen and nectar are a resource need for honeybees available only during certain periods. Therefore, Proper seasonal colony management practices would greatly improve colony performance and honey yields. The use and contribution of honey bee is diverse including honey, bee wax, queen, bee colonies, and other products such as pollen, royal jelly, bee venom and propolis in cosmetics and medicine. Additional role of beekeeping is pollination of food crops & many plants species used for conservation of the natural environment, and can be integrated with agricultural practices like crop production, animal husbandry & horticultural crops (16).

The major constraints in the beekeeping sub sector in Ethiopia are the behaviors of bees (aggressiveness, swarming tendency, and absconding characteristics), lack of skilled manpower and training institutions, low level of technology used, high price of improved beekeeping technologies, drought and deforestation of natural vegetation, poor post-harvest management of beehive products and marketing constraints, indiscriminate application of agrochemicals, honeybee disease, pest and predators, poor extension services, absence of coordination between research, extension and farmers, shortage of records and up-to- date information, and inadequate research institutions to address the problems. Nevertheless, all these problems may not be constraints to all parts of the country and may not be equally pressing to every place (11).

Objectives

- To review factors affecting honeybee colony absconding and prevention mechanism in Ethiopia.

Literature Review

Absconding one of the most disappointing things that can happen to a beekeeper in Ethiopia is colony absconding. Absconding may be defined as the complete abandonment of the nest by the whole colony. It differs from swarming in that the nest does not divide into two or more parts but the whole colony moves and presumably seeks and finds a new nest site elsewhere. Beekeepers in many places benefit from this planned absconding (or migration) to fill their empty bee hives. The tendency to abscond is mainly determined by climate and the effects of climatic change on flowering and nectar flow. Absconding is top ten honey bee production factor (17).

Table 1. Estimated number of beehives by type, Ethiopia.

Types of Beehives	No	%
All Bee hives	5916100	100

Types of Beehives	No	%
Traditional Bee hives	5,706,959	96.46
Intermediate Bee hives	70,753	1.2
Modern Bee hives	138,388	2.34

Source (18).

Table 2. Average productivity of each hives.

Honey Production		Productivity per hive/yr
All Types of Beehives (Number)	6,189,329	
Production (Kilograms)	47,706,101	
Average Frequency (Harvests/Year)	1.64	
Traditional Beehives (Number)	5,902,624	7 kg
Production (Kilograms)	42,927,921	
Average Frequency (Harvests/Year)	1.64	
Intermediate Beehives (Number)	80,832	25kg
Production (Kilograms)	2,036,969	
Average Frequency (Harvests/Year)	1.94	
Modern Beehives (Number)	205,873	13.4 kg
Production (Kilograms)	2,741,211	
Average Frequency (Harvests/Year)	1.5	1.5

Source (18).

There are two types of absconding; planned and unplanned absconding. Disturbance-induced (or unplanned) absconding can be induced by predation, or invasion of the colony by undesirable pests, such as hive beetles, ants or wax moths. Poor physical conditions such as entry of water into the hive, excessively high temperatures due to lack of shade or shortage of water, the proximity of bush fires or excessive disturbance can also encourage colonies to abscond. Resource-induced (or planned) absconding appears to occur due to scarcity of nectar, pollen or water and occurs primarily during the dearth periods found in tropical conditions (18).

Seasonal Absconding

Seasonal absconding is the result of fluctuation in colony size and composition, due to decreasing flowering of the vegetation. But with honey in stores, brood-laying continues long and even drones may still be present. The rains come, flowering restarts, and new colonies grow when the old ones are absconding. Many colonies abscond also because rain drips into their nest (19). It is a misunderstanding that the rainy season causes the absconding. It rains only <10% of the time and bees are very efficient at escaping the rains, coming in with large numbers even before the rain falls. Also the pests are not causing it, because colonies leave behind the combs totally clean (20). As a rule, the pests come only after and destroy the combs, but there are exceptions, particularly in managed hives.

Cause of Honey Bee Colony Absconding

Predators of bee

Number of enemies, which cause damage to the colonies, attacked the honeybees and they have some of the predator of bees are :-

Ant

Ants are among the most common predator of honeybees. In many part of Ethiopia, ants are serious problem to beekeeping activity. The ants feed on honey, bee larvae, adult bees etc, as bees the ant are also social insects; they attack a colony in large number swarm and abscond. Beekeepers have found that the most effective method of controlling ants are to search systematically for the ant nest in the vicinity of the apiaries to destroy them by burning, painting the motor oil waste to the leg of the live stand, providing soil treatment to apiary site with suitable pesticide (21).

Bird

In Ethiopia, there are few bird species, which prey on the adult bee. If the population of the bird species is more, the colony will be severely affected in relation to forager population. Bee eater birds are king crow and sparrow with brown feathers, yellow triangular band underneath the beak, and green bee eater severally affected bee colony. Those birds prey on adult bee when bees are weak and the fight speed decrease some birds can sit near the hive entrance and eat bees. Generally, farmers use to control those birds by destroying their nest, kill one hunter and hang it near the hive (22).

Spider

Spiders are predator and feed an insect of which the honeybee is only one pray among other spiders catch their prey in different way, some seek their prey actively in while other lay in wait to catch vesting insects. Most spiders built their web near the hive or near the forage source or elsewhere. So this spin web are sticky traps for flying or crawling insects so that, these have to be identified and destroyed: otherwise the forager will be trapped and killed (23).

Termites

Termites are found everywhere in Ethiopia they complete their reproduction in outer surface of hives if plastered with straw. They eat bees and honey so that farmers use ash to control them (24).

Pests of Bee

Wax Moth

Wax moth will not attach the bees directly, but feed on the wax used by the bees to build their honeycomb. The development of the wax moth larvae depends on food availability and temperature. So the adult worker and drone bees are unable to leave their cells. There are not easy on inexpensive chemotherapeutic measures for controlling the wax moth in living honeybee but there preventive measures like ensuring adequate food store, adapting the hive space to strength of the colony, reducing the hive entrance, sealing cracks and crevice.

Lack of Enough Food and Water

Shortage of bee forage due to population pressure, lack of land use policy and the high demand for farm lands

put pressures on mountainous areas to be used for crop production and livestock grazing. These create deforestation, soil erosion and irreversible ecological degradation. Moreover, burning of undergrowth and destroying of forestland for expansion of farmland could trigger a reduction of honey producing floras and foraging areas (27 Agrochemical).

The elimination of good nectar and pollen producing tree species in many areas make it difficult to maintain bee colonies without feeding (28). Due to deforestation and poising of agro-chemicals, the honey bee population is in state of continues declining. As a result, it has become a serious challenge to get honey bee colonies to start and beekeeping (29). Beekeeping sector is dependent on healthy flora and a healthy environment. Recent years have seen environmental changes in Ethiopia in terms of erratic rain fall patterns and deforestation. The use of pesticides that kill bees and herbicides are not toxic to bee colonies but destroy many plants that are valuable to bees as sources of pollen and nectar such as Malathion, sevin, DDT, 2-4 and Acetone (28). Pesticide residues in pollen and nectar are taken by the forager bees to their colonies and remain in the beebread and honey for quite some time. These residues are then fed to the larvae and the queen, which are affected in similar ways as the forager bees (30).

In Ethiopia farmers are producing mainly wheat, barley, Teff, chick pea and different horticultural crops and they use chemical spray such as pesticide and herbicide for pest and weed controlling it cause bee colonies either die or absconded from their hive (27). The chemical spray used by farmers is also destroying bee forage like herbs and shrubs which is used as sources of bee forage.

Fig. 1. Effects of herbicide application in wheat crops and on honeybee populations in Ethiopia (31).

Parasite and Disease

Attack Pests and predators result in a great damage on honey bee colonies with in short period of time. Like all living animals, honey bees were infected with disease and attacked by parasites and pests endangering their health and life (32). These diseases of honey bees impose serious problem on honey bee production and productivity in Ethiopia. This is because if it once occurs in the colony, they cause partial or total loss of colonies and most of them spread very quickly and difficult to treat (33). Honey bees diseases, pests and predators are causing a significance economic loss in honey bees and their products (34). Bee parasites feed on the honey and can also harm the insects directly. Some pests that can lead to the loss of your colony include: mites (tracheal & varroa), ants, birds, butterflies and wasps. The honey bee colony is not immune from

predation and it can take a variety of forms, from destruction of a comb by wax moth to physical dismembering of a colony by a hungry black bear (35).

Uncomfortable Hive

Too High or Low Temperatures

In the lowland area of Ethiopia and too high temperatures cause overheating in the interior hive. If you see bees staying outside, you should know the structure is overheating. Lack of ventilation can make the house too hot even in winter. Too low temperatures can also cause the absconding problem (36).

Prevention Mechanism of Bee Colony Absconding

Make the Hive Homey

Nothing drives away these pollinators like an uncomfortable beehive. New hives usually do not provide the right living conditions for bees, which mean that the pollinators can move out immediately after being put in them. Odors and smells of new paint or glue are some of the things that cause them to leave (37). The workers will be forced to stay and build combs since they can't leave without the queen. Once there are some combs, release the queen and the colony will stay put. Alternatively, you can place one or two honeycombs in the new hive to make it less strange to the insects (38).

Control Humidity and Improve Beehive Drainage

High humidity can cause moist conditions inside the structure, and if the structure is poorly drained, water can stagnate inside it. Water or extreme wet conditions can kill the insects and destroy their combs. Reduce the number of openings in winter to minimize the amount of moist air entering inside. Install your structure in a slightly inclined position to improve drainage and prevent water stagnation (39).

Secure Bee Flight Paths

Like other flying insects, these pollinators like to fly freely without any disturbance in their flight paths. The workers spend most of their time collecting nectar, pollen & water, and thus need secure paths to and from the hive. Install the structure with the entrance and exits facing clear paths. Cut any trees obstructing the flight paths, and place food & water containers in a place that is easily accessible by the insects (40).

Provide Enough Food and Water

Some important local honeybee plants (trees, shrubs, herbs and cultivated crops are known as a source of nectar and pollen in Ethiopia, namely Tebeb (Becium grandiflorum), Girbiya (Hypoestes forskaolii), siwakerni (Leucasabyssinica), kiliow (Euclea schimperi), Awhi (Cordia Africana), Bahirzaf (Eucalptus spp) Girawa (Vernonia amygdalina), Wanza (Cordia africaca), Wyira (Olea Africana), Meche (Guizotia scabra), dogma (Syzygiumguineese), Bisana (Crotonmachrostachyus) and, beles (Opuntia ficus-indica) identified as the major bee foragein different parts of the country (41). To solve this problem beekeepers migrating their bee colonies from their area to other area during the dry season for searching bee forage. These insects make their own food, especially when the colony is large. But if the colony is new or has swarmed, the workers may not be able to collect enough food and water. The colony can decide to abscond if it is not getting enough of these necessities. Many bee foods have been formulated and manufactured variety of nutrients. If you are using less reputable foo-

-ds, that don't develop your bees (27).

Bee keepers supplement sugar syrup, hot pepper, roasted pea flour, water, honey syrup , roasted bean flour, and roasted barley flour during dearth period (42) Supplementary feeding and migratory beekeeping practices to overcome the feed shortage at the dry season is common practice. Majority of the beekeepers provide besso (roasted and grounded barley flour), shiro (roasted spiced pulses flour), sugar syrup and honey with water mainly from February to May (35).

Control Parasites and Diseases

Parasites and diseases are a major cause of the absconding problem. The most common parasites are mites, wax moths and ants. Some diseases that you should be aware of are foulbrood and dysentery. The pollinators can decide to leave if the parasite attack is unbearable or if a big part of them has been killed by a disease. Use sugar and grease patties or menthol crystals to control parasites. In the case of diseases, remove affected combs and use suitable medications to treat the sick insects (43).

Fig 2. Traditional ant protection and wax moth affected combs (44).

Create More Hive Space

Management practice includes combining weak colonies to make strong colonies, maintain adequate feed supply, cleaning of the hives for night safety of colonies against pesticide. Hazard, remove empty and unused comb from the hive during dearth period keep the bottom area of the hive clean of residue that drops, do not leave comb laying around the apiary, scrapping of burr comb and porpoise from the hive and frame wood work, remove black old comb by newer combs (45).

II. CONCLUSION

This review showed that the causes of honey bee absconding in Ethiopia were agro chemicals fertilizer, improper management, predators, feed shortage, climatic change, strong wind and disease. Among those agrochemicals and lack of proper managements are the major factors for honey bee colony absconding in Ethiopia. The rate of absconding is high in the traditional hive compared with other hive types.

The main absconding season in Ethiopia is occurred in the winter and spring season (from January- June). However, there were many possible solutions bee colony absconding in Ethiopia to control from agro chemicals by using; shade or cover the hives, move the hives from chemical exposed area to safe environment, screen placed over the hive entrance, chemical spraying at evening, communication between farmer and bee keeper, and educating both bee keepers and insecticide user.

From those chemical controlling mechanisms chemical spraying at evening and Screen placed over the hive entrance are commonly practiced in Ethiopia. To prevent from predators and pests; destroying the ants nest, Inspection of the hive, remove old comb from the hive, narrowing the hive entrance, fencing and chasing with dogs, and hand picking and killing practiced by bee keepers in Ethiopia. Generally Chemical application is a danger in honey bee production in Ethiopia.

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