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# The Prevalence of Honeybee Diseases and varroa mite in Selected Districts of East Wollega Zone, Oromia National Regional State, Ethiopia

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## Abstract

The study was conducted in selected district of East Wollega Zone, Oromia Regional State, Ethiopia, to determine the prevalence of honeybee disease and varroa mite. Questionnaire survey and laboratory diagnostic methods were used for the study. The questionnaire was administered to 146 beekeepers (97.1% males) and two honeybee colony samples from each beekeeper, totally (292 honeybee colonies) were collected from transitional and frame box hives for laboratory diagnosis. The honeybee samples collected were examined in laboratory for the prevalence of honeybee disease pathogens and varroa mite. From honeybee pests, Varroa and bee lice, from pathogens; Nosema, Amoeba and chalk brood disease were confirmed while tracheal mite, stone brood, American and European foul brood pathogen did not confirmed during the study period. The prevalence of varroa destructor was higher in active season, while the prevalence of Nosema and chalk brood disease was limited during dry season. Amoeba disease was distributed in both seasons.

**Keywords:** Disease, Honeybees, Infestation, Oromia, Pests, Prevalence

## 1. Background and Justification

Beekeeping is a long-standing practice in the rural communities of Ethiopia (GideyYirga and Mekonen Teferi, 2010) and the beekeeping sub-sector has been an integral part of agriculture in Ethiopia. It has been contributing to the household income and poverty alleviation and national economy through export. The country has huge apicultural resources that made it the leading honey and beeswax producer in Africa (Gemechis Legesse, 2014). 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 (Nuru Adgaba, 2007).

Like all other insects, honeybees (*Apis mellifera*) are susceptible to pests and diseases, the majority of which are specific to honey bees. It is important for beekeepers to be aware of these disorders, to identify them and effectively manage disorders to maintain healthy colonies. This is particularly important because the health of one beekeeper's colony can impact another beekeeper's colony in the surrounding area (FOA, 2006). The honeybee population and its products decline from time to time by some factors like, honey bee disease, pests, predators, pesticide, environmental stress and genetic disorder (IIS, 2013). The economic loss associated with the presence of honey bee diseases and pest was estimated in some works and significant loss was reported. In the present time the major honeybee diseases, pests and predators and their rate of distribution was reported in Ethiopia (Haylegebriel Tesfay, 2014). There should be regular and wide scale diagnostic survey that monitor the occurrences of new one and also that establishes the

distributions of the already reported for constraining measures. There are still insufficient evidences on the side effects of pests and diseases. Very importantly, comprehensive strategic response to the recently occurred varroa mite threat in determining its thresholds, economic damages and behavioral attributes with devising control options are very important (Desalegn Begna, 2015).

There are many honey bee diseases (bacterial, fungal, viral, microsporidial), parasites (mites), predators (bears, birds, humans), and pests (beetles, moths) that can adversely affect managed honey bee productivity and survival (Morse and Flottum, 1997). Colony strength and health status are regularly assessed, and samples are taken and checked for disease and parasite loads.

The adequate methods for defining and assessing the causes of death of honey bee colonies are not well implemented. This makes it difficult to assign annual die-offs to specific causes, and that makes it difficult for beekeepers to know what problems should be demanding their greatest attention. A well-defined list of symptoms for each honey bee pest, parasite, pathogen and predator allows for differential diagnosis of honey bee pathologies. Due to this difficulty in diagnosing a problem, it will be necessary to collect and archive samples of bees for regular basis. Accordingly, in East Wollega Zone there is no research information on honeybee disease and pests prevalence in the area. Therefore, this study was conducted to assess the prevalence of honeybee disease and pests in the area.

## 2. Objectives

### 2.1 General objective

To magnify honeybee pests and diseases by diagnostic survey in selected districts of East Wollega Zone.

### 2.1.2. Specific Objective

- To identify the common infectious disease and pest.
- To determine the prevalent of honeybee disease and pests.
- To determine the season of honeybee disease and pests prevalent.

## 3. Materials and Methods

### 3.1 Description of the Study Area

The study was conducted in selected districts of East Wollega Zone, Oromia Regional state at about 332km away from Addis Ababa, and the capital city of Ethiopia. The zone is located in the area stretching from 36 0 30’00” to 36 0 45’00’’longitude and 9 0 05’00’’ to 9 0 15’00’’ latitude with elevation ranging from 1000m to 3207m. The range of annual rainfall of the zone is from 1500mm to 2200mm with mean annual temperature 15-20 degree centigrade. The study was conducted in Diga and Wayu Tuka districts. Diga district is located at about 346 km away from Addis Ababa and 15km from Nekemte town to the West. Based on agro-climatically conditions namely: Highland altitude ranges 2100-2342m and Midland ranges 1200-2100m with annual rainfall of 2400mm (CSA 2007). Wayu Tuka district is located 324 km from the capital Addis Ababa at an altitude of 1700–2200 m above sea level and has an average annual rainfall of 2400 mm (CSA 2007).

### 3.2. Types of data collected

In this study, both primary and secondary sources of data were used. The primary data was collected from sample household beekeepers through a semi-structured questionnaire, field examination and laboratory diagnosis of adult worker honeybees and brood. The data collected comprises both qualitative and quantitative data that generated by questioner survey and laboratory diagnostic.

### 3.3. Sampling technique and sample size determination

A multistage sampling procedure was employed to select beekeepers and honeybee colonies. In first stage two districts were selected from the zone using purposive sampling method based on their possible for beekeeping potential and accessibility. In second stage, six rural villages (six beekeeping site) selected from each districts based on their potential beekeeping. In the third stage, twelve beekeepers were selected in each rural village and two honeybee colony samples from each beekeeper sites were selected using random sampling method. In total 146 beekeeper respondents’ 68 beekeepers from WayuTuka district and 78 beekeepers from Diga district were taken. The beekeeper samples were based on owning honeybee colonies with frame box and transitional beehives from both districts.

### 3.4.1. Adult honeybee and Brood sampling

In order to examine the prevalence and infestation rates of the onset of diseases and pests, two honeybee colonies considering each 146 beekeeper as one apiary site, totally 292 honeybee colonies samples were taken from both districts. The beekeeper should be 2km-5km far distant from each other. The internal and external inspection was done and adult honeybees and broods were taken for laboratory diagnoses. Finally, prevalence for apiary level and infestation/infection for colony level was calculated using (Vanenglesdorp*et al*., 2013)protocols:

Prevalence =

$$\frac{\text{Number of positive apiary Sites or colonies}}{\text{Total number of sampled apiary sites or colonies}} \text{ X } 100$$

## 3.5 Laboratory Examination Procedures

### 3.5.1. Laboratory Examination of *Varroa destructor*

The study followed the standard methods for Varroa detection (Dietemann*et al*. 2013). From each sample of honeybee colonies, 250 adult honeybees were brushed off from the brood comb directly into a wide mouth plastic container. The collected adult bees were killed using 70 % ethyl alcohol and placed in 10 ml of 1% detergent-water solution (10 ml detergent in 1000 ml water) and vigorously shake for 1 minute to dislodge mites. The mites were collected filtering the solution through a ladle (8- to 12-mesh) that hold the bees back and let out the mites with the solutions. Then, wire gauze was used to hold the mites back and discharge the solutions. The wire gauze was turned down to white paper on which the presence/absence of the mite was examined and counted.

For brood examinations samples 5 X 5 cm brood comb areas from drone and/or worker pupae broods were taken. About 100 pupae were randomly removed from their cells using forceps and checked for the presence of varroa mites on the worker and/ or drone pupae. Number of varroa mites observed in both diagnosis (adult and brood) were recorded.

### 3.5.2. Laboratory examination of tracheal mite

Samples of 20-30 adult honeybees collected from colonies at random. The sample of honeybee were preserved by adding 70% alcohol.The head and first pair of legs of honeybees were removed usingscissor. Transverse-section thoracic disks were sliced and placed directly in a small bottle containing 10-percent potassium hydroxide (KOH). The sliced thoracic disks in KOH were heated and stirred gently near toboiling point for approximately 10 minutes until the soft internal tissues dissolved to expose trachea rings. The disk-trachea suspension were examined for infested under microscope at 10 magnification power (Sammataro *et. al*., 2013).

### 3.5.3. Laboratory examination of Nosema and Amoeba diseases

As these two diseases affect the abdominal contents of adult honeybees, their sampling and diagnostic techniques are almost the same. Therefore, bee samples collected for either of the two can help to tell the condition or status of the other (OIE, 2008). The samples of 30-60 worker adult honeybees were collected from the hive entrance (Fries *et al*., 2013) and preserved in 70% alcohol until laboratory analysis. The abdomen of honeybees from each sample were cut and grounded in mortar containing 5-10ml distilled water. The mortar and pestle were thoroughly cleaned before being used again.A loop of suspension were placedon microscopic slide using the sterilized loop and covered with cover slid. Then suspension was examined under light microscope using 40 magnification power.

### 3.5.4. Laboratory examination of chalk brood disease

The chalk brood mummies were checked at the bottom board of hive entrance, in thecomb cells and on the ground beneath the hive entrance. Mummies were moistened withdistilled water and the supernatant was placed on microscope slid, covered with cover slid andexamined under light microscope for spores and/or spore balls and cysts of *Ascosphera apis*.

### 3.5.5. Examination of American Foulbrood and European Foulbrood

Field diagnostic procedures for AFB and EFB were used based on the (OIE 2008) procedure. During the early stages of decay until about three weeks after death, the dead larvae have a glue-like consistency. To test for the AFB disease, larvae that would be discolored, exhibits a melted appearance, ropness, hard and dark scales that adhere strongly to the lower sides of the cell and protruding tongue were checked for its presence.

### 3.6. Data management and statistical analysis

The collected data were stored in Microsoft Excel and SPSS software programs (SPSS @, version 20) for analysis. The statistical analysis used in the study varied depending on the type of variable and information obtained. Summarized data was presented in the form of tables and figures. The data collected through semi structured questionnaires were analyzed using descriptive statistics and the ranking of the different types of beekeeping constraints, Common Cause of honeybee colony and yield decrease, control method of bees from agrochemicals and the effect of pest and predators on honeybee colonies obtained in the study were done by using the rank index formula as described by (Musa *et al.,* 2006):

**Rank index**=sum of (5 X number of household ranked first + 4 X number of household ranked second + 3 X number of household ranked third + 2 X number of household ranked fourth + 1 X number of household ranked fifth) for an individual reason divided by the sum of (5 X number of household ranked first + 4 X number of household ranked second + 3 X number of household ranked third + 2 X number of household ranked fourth + 1 X number of household ranked fifth) for overall reasons.

## 4. Results and Discussion

### 4.1 Socio-demographic characteristics of the respondent

Of 146 sample households, about 2.9% and 97.1% were female and male headed in Wayu Tuka district respectively and 3.8% and 96.2% were female and male headed in Diga district respectively. About 80.6% of respondent's age in WayuTuka district ranges from 18 to 42 years and (76.9%) of respondent's in Diga district aged between 18 to 42 years (table 1). This result shows that beekeeper in the study areas were more in productive age. The survey result indicated that marital status of most beekeepers in WayuTuka (89.7%) and Diga (88.5%) were married.

The result concurs the finding of (GueshGodifey, 2015) who indicate that people in the most economically productive age are actively engaged in beekeeping activities. These is also in agreement with (ChallaKinati, 2010), in that people in most productive age are actively involved, accommodating experiences from elders and finally become independent beekeepers in his study area.

Based on education status of respondents, about 32.4%, 22.1% and 7.4% of respondent beekeepers in WayuTuka district have attended elementary, secondary school and diploma respectively while 38.2% of respondent beekeepers cannot read and write. Similarly about 44.9%, 19.2% and 1.3% of the beekeepers in Diga district have attended primary, secondary school and diploma respectively and remaining 34.6% of respondent beekeepers cannot read and write (table 1). Beekeeping activity in the study area was practiced by both educated and non-educated beekeepers, but beekeepers with better educational background are more productive since they are quicker adopters of beekeeping technologies than that of non-educated ones.

Concerning to occupational status of respondents, 95.6% in WayuTuka and 96.2% in Diga districts were farmers. The family size were small (39.7%, 32.1%) and medium (50.0%, 42.3%) in WayuTuka and Diga districts respectively (table 1). Most of beekeepers practice beekeeping as side of crop production in the study area.

**Table 1**. Socio- demographic characteristics of households

| Character of respondents | Category | Diga District | | WayuTuka District | |
|---|---|---|---|---|---|
| | | N=78 | Frequency in (%) | N=68 | Frequency in (%) |
| Sex | Female | 3 | 3.8 | 2 | 2.9 |
| | male | 75 | 96.2 | 66 | 97.1 |
| Age | 18-42 | 60 | 76.9 | 48 | 80.6 |
| | 43-55 | 13 | 16.7 | 11 | 16.2 |
| | 56-68 | 3 | 3.8 | 5 | 7.4 |
| | >69 | 2 | 2.6 | 4 | 5.9 |
| Education level | Cannot read | 27 | 34.6 | 26 | 38.2 |
| | elementary | 35 | 44.9 | 22 | 32.4 |
| | secondary | 15 | 19.2 | 15 | 22.1 |
| | diploma | 1 | 1.3 | 5 | 7.4 |
| Occupation | farmer | 75 | 96.2 | 65 | 95.6 |
| | merchant | 2 | 2.6 | 2 | 2.9 |
| | student | 1 | 1.3 | 1 | 1.5 |
| Family size | Small(2) | 20 | 25.6 | 7 | 10.3 |
| | Medium(3-5) | 25 | 32.1 | 27 | 39.7 |
| | Large(>6) | 33 | 42.3 | 34 | 50 |

### 4.2. Trend of honeybee colony and products

Based on majority of respondents the trend of honey bee colony and its Products was decreasing in traditional, transitional and frame box beekeeping (31.80%) without any harvest (4.18%). Some of beekeepers also respond to honeybee colony and yield increasing (19.25) and others responded to stable (table 2). Based on visual observation during survey most of the respondents (5.86) were shifting their traditional beekeeping to transitional and frame box beekeeping system. Sometime the colony population and products was decreasing with various factors. As the result of data, most beekeepers faced with shortage of food for their honey bee colony and faced with no products.

**Table 2**. Trends of honeybee colony and products in Diga and WayuTuka Districts.

| Trend of honey production | Frequency | Percent |
|---|---|---|
| No Harvest | 10 | 4.18 |
| Increasing | 46 | 19.25 |
| Stable | 14 | 5.86 |
| Decreasing | 76 | 31.80 |

### 4.3. Cause of honeybee colony and yield decrease

Majority of the respondents states the cause of honey bee colony and yield decrease by ranks were lack of bee forage (as 1$^{st}$), pest and predators (as 2$^{nd}$) and Honeybee diseases (as 3$^{rd}$) and others (Table 3) and all these cause the decrease in productivity and honeybee colony population. The result is agreement with (Kerealem Ejigu*et al.*, 2009 and Mulisa Faji and Fekadu Begna, 2017) shortage of bee forage is ranked first due to population pressure, lack of land use policy and the high demand for farmlands put pressures on mountainous areas to be used for crop production and livestock grazing. These create deforestation, soil erosion and irreversible ecological degradation. Shortage of bee forage directly associated with off flowering period of major honeybee forages (Kidane Mollaw, 2014).

**Table 3**.Cause of honeybee colony and yield decrease in Diga and WayuTuka Districts.

| Common problems | Relative degree of importance | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1st | 2nd | 3rd | 4th | 5th | index | Rank |
| Lack of bee forage | 9 | 11 | 14 | 13 | 30 | 0.093 | 6 |
| Lack of water | 0 | 0 | 0 | 3 | 24 | 0.015 | 8 |
| Drought | 0 | 0 | 0 | 0 | 3 | 0.002 | 9 |
| Absconding | 11 | 11 | 14 | 8 | 28 | 0.092 | 7 |
| Agrochemicals | 13 | 18 | 38 | 12 | 2 | 0.138 | 3 |
| Pests and predators | 61 | 14 | 22 | 3 | 0 | 0.216 | 1 |
| Decrease in price of honey | 15 | 8 | 23 | 34 | 1 | 0.122 | 5 |
| Honeybee disease | 19 | 21 | 24 | 5 | 0 | 0.13 | 4 |
| High price of bee equipment | 32 | 45 | 11 | 4 | 0 | 0.19 | 2 |

**Index** = Sum of (5*ranked 1st+ 4* ranked 2nd+3* ranked 3rd+2* ranked 4th+1* ranked 5th) for individual reasons divided by the sum of (5*ranked 1st+ 4* ranked 2nd+3* ranked 3rd+2* ranked 4th+1* ranked 5th) for over all reasons.

Similarly with (DestaAbi, 2017) indicated that the Presence of honeybee pests and pathogen, prevailing bad weather (prolonged precipitation and freezing and heavy wind speed), Lack of knowledge and skill of honeybee Pest and diseases control, application of agrochemical (direct spray of pesticide on bee visited agricultural crops), Shortage of bee forage, poor or absence of practice of hive shading, Lack of practice of Hive inspection and Shortage of improved hive types were ranked in the decreasing order of their importance.

### 4.5 The prevalence of honeybee disease and parasitic mites

In this study of 146 beekeeping sites and 292 honeybee colonies were examined for major honeybee parasites (varroa mites, bee lice and tracheal mites), adult honeybee diseases (Nosema and Amoeba) and brood diseases (Chalk brood, American Foul brood and European Foul brood) with their prevalence in the study area. However AFB, EFB, SBD and tracheal mite did not confirmed during the study period. Based on the data collection and laboratory diagnosis method the following result was recorded during the study period (figure 3).

Figure 1 Field examination and laboratory diagnosis procedure and results.


### 4.5.1 .Prevalence of chalk brood disease

In this study of 146 beekeeping sites and 292 honeybee colonies were examined and *Ascosphaera apis* was confirmed (figure 3). From the examined beekeeping site to determine the prevalence of chalk brood disease 26(17.4%) and 34(30.4%) were confirmed during dry and wet season, respectively. From the total of 292 honeybee colonies examined for chalk brood disease 49(13%) in dry and 53(17.9%) in wet season were infected during the study (table 4). The reason of prevalent and incidence rate of chalk brood disease was significantly ($p<0.05$) higher in wet season may be due to the growth of fungal related with wet condition.

**Table 4**. Prevalence of Chalk brood disease

| Districts | Apiary level Prevalent of *Ascosphaera apis* | | | | | Colony level *Ascosphaera apis* | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Dry season | | wet season | | | Dry season | | wet season | | $X^2$ For both seasons | P value |
| | N | +ve | % | +ve | (%) | N | +ve | % | +ve | (%) | | |
| Diga | 78 | 15 | 28.3 | 18 | 33.3 | 156 | 31 | 26.2 | 29 | 31.9 | 10.818 | 0.001* |
| WayuTuka | 68 | 11 | 25.1 | 16 | 27.6 | 136 | 18 | 21.8 | 24 | 26.2 | 11.132 | 0.001* |
| Total | 146 | 26 | 17.4 | 34 | 30.4 | 292 | 49 | 13 | 53 | 17.9 | | |

The prevalence of Chalk brood disease was limited during the dry season. Similarly the growth of chalk brood in the honey bee nest appears to be enhanced by high moisture (colonies not well ventilated in high humidity situations), cool temperatures, and colony stress and the humidity favors the multiplication of fungus (Lopes *et al.*, 2015, Flores *et al.*, 1996, Desalegn Begna, 2000 and GueshGodifey, 2015).

### 4.5.2 .Prevalence of Amoeba disease

In both Diga and Wayu Tuka districts, 146 beekeeping sites and 292 honeybee colonies were assessed for the prevalence of Amoeba (*Malpighamoeba mellificae*) disease. The prevalence was recognized in beekeeping site 113 (77.4%) in dry and 119(79.7%) wet season. From 292 honeybee colonies, 200 (78.4%) and 243 (81.8%) honeybee colonies were infected during dry and wet season respectively (table 3).

Colony level prevalence of amoeba disease in dry and wet season in Diga and Wayu Tuka districts were not significantly different (P > 0.05). This indicates that the incidence of amoeba disease may be depending on colony population and agro ecology.

**Table 5.** The Prevalent and incidence rate of *Malpighamoeba mellificae*

| Study districts | The prevalent of *Malpighamoeba mellificae* | | | | | Colony level prevalence of *Malpighamoeba mellificae* | | | | | $X^2$ For both season | P value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | Dry season | | wet season | | N | Dry season | | wet season | | | |
| | | +ve | % | +ve | (%) | | +ve | % | +ve | (%) | | |
| Diga | 78 | 52 | 66.7 | 83 | 93.6 | 156 | 104 | 66.7 | 123 | 93.6 | 2.405 | 0.121* |
| WayuTuka | 68 | 47 | 69.1 | 70 | 88.2 | 136 | 96 | 69.1 | 120 | 88.2 | 3.068 | 0.080* |
| Total | 146 | 113 | 77.4 | 119 | 79.7 | 292 | 200 | 78.4 | 243 | 81.8 | | |

*N=Number of beekeeping sites and honeybee colonies examined, +Ve= Number of honey bee colonies found positive, $X^2$=chi-square*

The result showed that *Malpighamoebamellificae* pathogen was occurred throughout the year. The same result reported by (AmssaluBezabih*et al.*, 2010) indicated that Amoeba disease was reported to be widely distributed and identified in most places of the country throughout the year. The difference in prevalence and infestation level of amoeba disease was affected by agro ecology and temperature. The result contradicted with the finding by (AmssaluBezabeh and Desalegn Begna, 2012 and Aster Yohannes*et al.*, 2010).), who reported that highest cyst number (infestation) in the months of April and August (high humidity) and lowest intensity in the month of January (high temperature) was recorded.

### 4.5.3 .Prevalence of Nosema disease

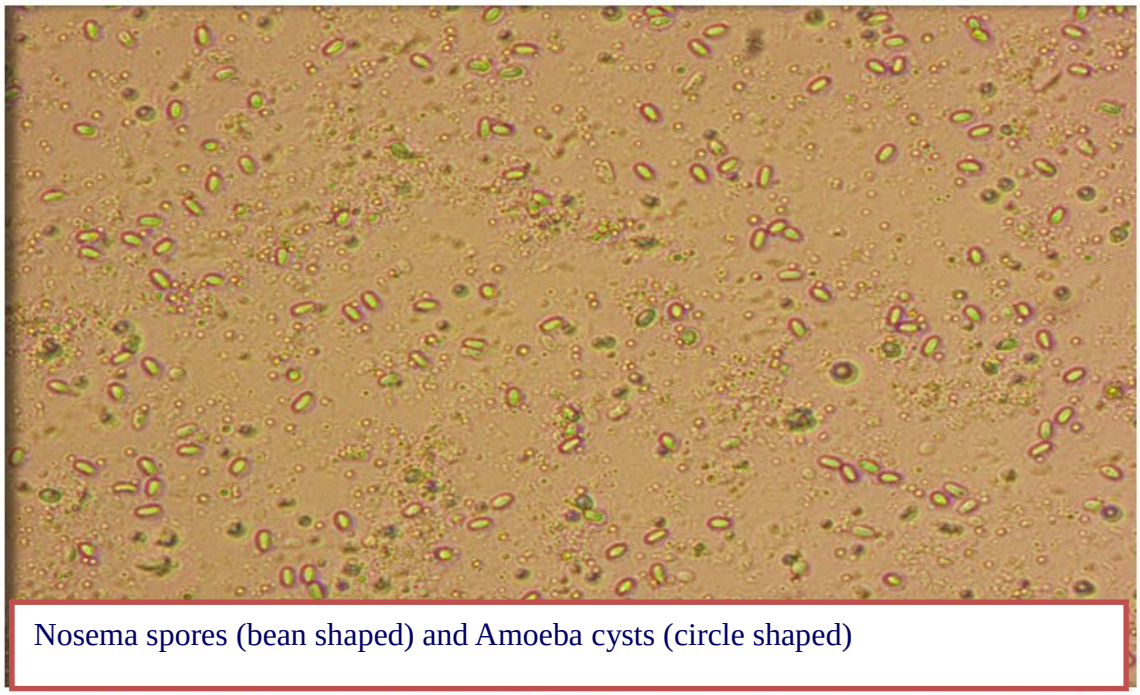
In the study area 146 beekeeping sites and 292 honeybee colonies were examined for the prevalence of *Nosema apis* and it was confirmed (figure 3) in Diga and WayuTuka districts. From 146 apiary sites examined for the apiary level prevalence of nosema during the study were 64(43.8%) sites in dry and 122(63.6%) sites in wet season. The colony level prevalence also tested that out of 292 colonies 137(34.8%) tested positive in dry and 173 (52.6%) tested positive in wet season (Table 5). The prevalence of nosema disease in Diga and WayuTuka districts was significantly ($p<0.05$) higher in wet season than dry season. The difference of nosema disease may be due to the humidity condition. The prevalence of of nosema disease was high in wet season due to availability of moisture for the growth of nosema spore in the hive.

**Table 6** prevalent and Incidence rate of *Nosema apis* in inspected apiaries and honeybee colonies.

| Study districts | Prevalent of Nosema | | | | | Incidence of Nosema in dry and wet season | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | Dry season | | wet season | | N | Dry season | | wet season | | x2 | P value |
| | | +ve | % | +ve | (%) | | +ve | % | +ve | (%) | | |
| Diga | 78 | 25 | 37 | 53 | 77.9 | 156 | 76 | 27.3 | 36 | 45.6 | 12.630 | 0.001* |
| WayuTuka | 68 | 39 | 50 | 69 | 88.5 | 136 | 61 | 41.7 | 37 | 58.3 | 10.499 | 0.002* |
| Total | 146 | 64 | 44 | 122 | 63.6 | 292 | 137 | 34.8 | 173 | 52.6 | | |

*N=Number of beekeeping sites and honeybee colonies examined, +Ve= Number of honey bee colonies found positive*

According to study by (OIE 2013) justify the infestation level increase when bees are confined, such as in the autumn and winter in colder climates because the disease is transmitted among bees via the ingestion of contaminated comb material and water, and by trophallaxis; honey stores and crushed infected bees and *Nosema* can cause problems during winter Months when bees are confined within the hive for long periods (Marla and Gary, 2016).



Nosema spores (bean shaped) and Amoeba cysts (circle shaped)

**Figure 2. Laboratory examination of *Nosema apis* and *Malpighamoeba mellificae*.**

### 4.5.4 Prevalence and infestation of Varroa mites

Varroa originally evolved in Asia, on a different species of honeybee, the Asian honey bee (*Apiscerana*), and has since spread to the western honey bee (*Apismellifera*) throughout most of the world. According to (Paul, 2012) Varroa is now present in almost all honey bee colonies at different levels of infestation that are always increasing unless treated.

### A) The Prevalent of *varroa destructor*

From the total of 146 sample of apiary sites examined for the prevalence of varroa, 110 sites (69.6%) and 84 sites (60.9%) were positive to varroa mites in adult bees during dry and wet seasons, respectively. Similarly, from the total of 146 beekeeping sites examined in sealed brood, Varroa mites positive 86(56.5%)indry and72 (52.2%) in wet season (Table 7). The result indicates that prevalence of Varroa mites was higher in dry season (59.7%) than in dearth period (43.8%).

**Table 7** The Prevalent of *Varroa destructor*

| Study districts | N | Varroa mite in apiaries | | | | Varroa mite in sealed Brood | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Dry season | | wet season | | Dry season | | wet season | |
| | | +ve | % | +ve | (%) | +ve | (%) | +ve | (%) |
| Diga | 78 | 59 | 75 | 48 | 66.7 | 47 | 58.3 | 37 | 58.3 |
| WayuTuka | 68 | 51 | 63.3 | 36 | 54.6 | 39 | 54.5 | 35 | 45.5 |
| Over all | 146 | 110 | 69.6 | 84 | 60.9 | 86 | 56.5 | 72 | 52.2 |

*N=Number of apiary sites examined, +Ve= Number of sites found positive*

**B) Infestation of *varroa destructor***

From the total of 292 honeybee colonies examined for infestation of Varroa mites in adult bees, the infestation recorded during dry and wet seasons was 200 (78.5%) and 170 (69.6%), respectively(table 8). The *varroa destructor* infestation was limited during wet season. The infestation was higher in dry season than wet season. The difference in infestation in dry season may be due to more availability pollen source for brood rearing since brood rearing depend on bee forage availability in the area and the result indicate that, the infestation rate was higher in dry season than in wet season.

Table 8.Incidence rate of *Varroa destructor*

| Study districts | N | Incidence of *varroa destructor* | | | | $X^2$ for both seasons | p-value |
|---|---|---|---|---|---|---|---|
| | | Dry season | | wet season | | | |
| | | +ve | % | +ve | (%) | | |
| Diga | 156 | 107 | 83.1 | 89 | 62.8 | 4.081 | 0.043* |
| WayuTuka | 136 | 93 | 74.2 | 81 | 55.9 | 5.382 | 0.032* |
| Total | 292 | 200 | 78.5 | 170 | 69.6 | | |

*N=Number of beekeeping sites and honeybee colonies examined, +Ve= Number of honey bee colonies found positive*

The varroamite population recovery was also reported in the drier months of January and March attributed to lower brood rearing during dry season (DesalegnBegna et al., 2016 and GueshGodifey, 2015). The high prevalence of varroa mite infestation on both brood and adult bees is terrible problem to beekeeping (Adeday Giday *et al.*, 2017).


**Figure 3**.Laboratory examination of brood for Varroa.

### 4.5.5 The prevalent and infestation of bee lice

From the total 146 apiary sites examined for the prevalence of *Braula coeca*, 21(26.1%) and 7(13.0%) had lice during dry and wet seasons respectively (Table 9).

Table 9. Prevalent of bee lice in inspected apiary sites

| Study districts | N | *Braula coeca* in apiaries | | | |
|---|---|---|---|---|---|
| | | Dry season | | wet season | |
| | | +ve | % | +ve | (%) |
| Diga | 78 | 12 | 33.3 | 7 | 16.7 |
| WayuTuka | 68 | 9 | 18.2 | 0 | 0 |
| Total | 146 | 21 | 26.1 | 7 | 13.0 |

*N=Number of apiary sites examined, +Ve= Number of sites found positive*

### Infestation of Bee lice

From the total 292 honeybee colonies examined for incidence of *Braula coeca*, 32(21.9%) and 26(17.8) of them were infested during dry and wet seasons, respectively (Table 20). The prevalence of bee lice was higher during dry season due to more Population of honeybee colonies than in wet season.

Table 10 Incidence rate of bee lice

| Study districts | N | Incidence rate of *Braula coeca* in honeybee colonies | | | | $X^2$ For both season | P value |
|---|---|---|---|---|---|---|---|
| | | Dry season | | Wet season | | | |
| | | +ve | % | +ve | (%) | | |
| Diga | 156 | 19 | 24.4 | 15 | 19.2 | 4.005 | 0.045372 |
| WayuTuka | 136 | 13 | 19.1 | 11 | 16.2 | 5.276 | 0.045372 |
| Total | 292 | 32 | 21.9 | 26 | 17.8 | | |

The overall prevalent of bee lice (21.9%) observed in the current study was much greater than other previous reports in Ethiopia. The present result was higher than report of (GideyAdeday *et al.*, 2012) who indicated the prevalence rate of 4% in adult honey bees. However, the current finding was less than the report by (GemechuGizachew *et al*., 2013), who found 42% lice prevalence in and around Holata. However according to (GizachewGemechu *et al.*, 2013) highest prevalence of bee lice observed in the strong colony than of weak colony.

## 5. Conclusion and Recommendations

Based on laboratory and survey result the most common honeybee diseases and pests, Amoeba, Nosema, chalk brood diseases and *varroa destructor* were identified with their different prevalence and infestation within dry and wet season during the study period. Beekeeping is an important to rural communities by providing a variety of goods honey, wax, and pollen in particular and enriching ecosystem by pollination. However honeybee colony and its products decrease due to honeybee health, poor management, lack of improved bee equipment, lack of bee forage, absconding and improper application of agrochemical. The most common pests and predators revealed in the study area were ants, beetles, wax moths, dead head hawks moth, honeybee eater birds and honey badgers and these were major problems on honeybee colony health and production the study areas.

Honeybee disease like American Foulbrood, Europian Foul brood, Stone brood diseases and tracheal mites do not confirmed in the study area however the common parasites and pathogens such as *Braulacoeca*, *Varroa destructor*, *Nosema apis*, *Malpighamoeba mellificae*, and *Ascosphaera apis* were confirmed in areas. *Nosema apis* and Ascosphaera *apis* were more prevent in wet season than dry season, *and varroa destructor* was more prevalent with higher incidence rate in dry season than wet season and the amoeba disease was common in dry and wet season.

According to the result of this study, some of the suggested issues that require consideration by beekeepers and any development organizations are high lightened below:

- To save honeybee colony form agrochemicals, beekeeper and others in mind chemicals which are not harm full to honey bees and the application should not match with flowering season to minimize the poisoning effect on honey bee.

- Scientific information of honeybee pests and parasites in addition, standards evaluation of honeybee disease and pest with their prevalent/incidence rate is needed to evaluate the health of honeybee colonies.

- Awareness creation for beekeepers in terms of internal and external inspection for honeybee disease symptoms and report the status to laboratory for diagnosis.

- Beekeepers should maintain strong and healthy honeybee colonies enable the natural prevention of honeybee from disease and pest.

- For the reason of time restraint in this study, farther study on economic threshold of honeybee disease and pests is suggested by monitoring throughout the year.

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