

Distribution and Status of Major Coffee Insect Pests in West Oromia

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How to cite this paper: Hika Bersisa, Natol Bakala, Abebe Tilahun. (2024). Distribution and Status of Major Coffee Insect Pests in West Oromia. *International Journal of Food Science and Agriculture*, 8(2), 80-84.

DOI: 10.26855/ijfsa.2024.06.005

Received: May 28, 2024

Accepted: June 25, 2024

Published: July 23, 2024

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Abstract

Coffea arabica L. has commercially grown in more than 10.5 million ha in 80 different countries worldwide. Ethiopia is the largest Arabica coffee producer in Africa and 5th one from the world. Coffee is vital to the economy of East and Central Africa, providing a major source of foreign exchange earnings and as a cash crop, supporting the livelihood of millions of people who are involved in cultivation, processing, marketing, and export. However, coffee production in Ethiopia is highly restricted by many biotic factors. Among coffee insect pests are the ones that limit coffee production and productivity. This work was done to assess the prevalence, incidence, and severity of coffee major coffee insect pests in coffee-growing areas of East Wallaggaa Zone of Oromia. During survey work, 3 potential coffee-growing districts (Diggaa, Sibule, and Gudeya Bila) were used. Accordingly, 3 PAs per district and 5 coffee farms per PA were used. Totally, 45 coffee farms were used for this survey work. Data was collected on the prevalence, incidence, severity, and impact of some factors on the infestation of insect pests. Coffee insect pests were observed across the surveyed area with the different values across surveyed areas. Coffee leaf skeletonizer was observed with 100, 90.67, and 32.01% overall mean prevalence, incidence, and severity across surveyed areas, respectively. Coffee blotch leaf miner was observed with 97.78, 28.22, and 4.27% overall mean prevalence, incidence, and severity across surveyed areas, respectively. while, coffee leaf serpentine was recorded with 100, 44, and 6.08% overall mean prevalence, incidence, and severity across surveyed areas, respectively. Among the three most important insect pests, coffee leaf skeletonizer severely damaged coffee production across surveyed areas followed by serpentine and blotch leaf miners. The infestation rate of these identified coffee pests was influenced by host resistant, field sanitation/management and shade tree status. Therefore, further study is needed regards to insect pest management and on the influence of some biotic and abiotic factors to some coffee insect pests. Any coffee growers can use tolerant coffee variety and proper field management practices.

Keywords

Coffea arabica L., coffee insect pests, prevalence, incidence and severity, infestation rate

1. Introduction

Coffea arabica L. and *C. canephora* var. *robusta* Pierre ex A. Froehner are the two main cultivated and commercially traded species of the genus *Coffea* (Rubiaceae). Both coffee species originated in Africa—*Coffea arabica* L. in the highlands of rainforest of southwestern Ethiopia and surrounding regions, whereas *C. canephora* in the lowland of tropical Africa, west of the Rift Valley [1]. Coffee is one of the most traded commodities worldwide, and it is grown in about 80 coffee producing countries and contributes as a source of foreign exchange earnings for many developing countries [2].

Coffee plays a key role in the Ethiopian economy and the livelihoods of about 15 million people [3].

Coffee is an evergreen perennial crop that grows in an ecosystem that favours insect pests to survive from year to year [4]. Succulent green shoots, leaves, flowers, and young fruits of coffee plant parts are attacked by different chewing and sucking insects [5]. Despite the existence of suitable natural conditions for coffee production, the average national yield is very low in Ethiopia. Insect pests are among a number of factors that contribute to low yield [6]. Over 49 species of insect pests were recorded on coffee in Ethiopia, which were categorized as major, potential, and minor pests [7].

The west part of Oromia is a potential area for coffee production. In these areas like other Ethiopian coffee growing belts coffee production has been threatened by different biotic factors including coffee insect pests. Yet there has been a lack of information related to the geographical occurrence, distribution, and status of coffee insect pests in this area. Assessment of the distribution and status of insect pests is important to map providing baseline and prioritize research problems in order to design proper insect pest management strategies. Therefore, the present work was done with the objective of assessing the prevalence, incidence, and severity of coffee insect pests in the study area.

2. Materials and methods

2.1 Description of study area

The assessment was done in coffee-growing areas of East Wallaggaa zone. Gudeya Bila, Digga and Sibul Sire districts were selected as coffee potential area of the zone.

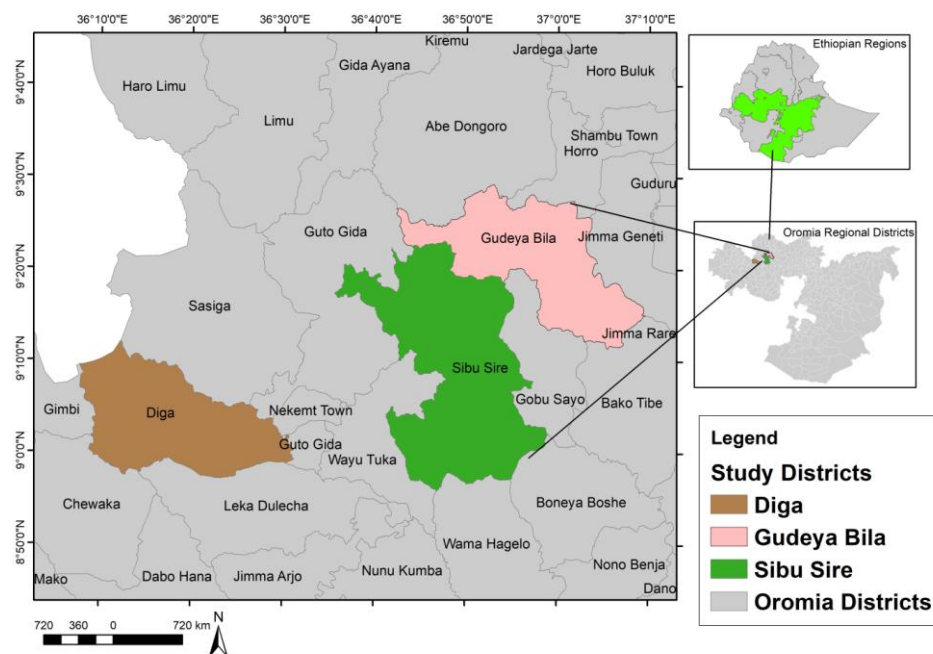


Figure 1. Map of study areas.

2.2 Sample size and methods

From each districts three PA and five coffee farms per PA were selected in order to apply pest assessment. Depending on farm size, five to ten coffee mother trees with similar ages were used. Each coffee mother tree was stratified into top, middle, and bottom. One pair of representative branches was used from the strata. The following disease assessment methods were applied properly.

Insect pests Incidence: thirty trees per farm were randomly taken and diagnosed visually for the presence and absence of Insect pests on each tree. Then after, Insect pests incidence was calculated as $(\text{Number of infected trees}/\text{total observed trees}) \times 100\%$.

Insect pests Severity assessment: ten trees per farm were randomly taken and each tree was divided into three strata of branches (top, middle, and bottom). From each stratum, one pair of branches was selected to compute Insect pests' severity. Damaged and healthy tissues were counted and then the percentage of damaged tissues over the total counted tissue was calculated.

Insect pests Prevalence: the selected farms were visually assessed for the presence and absence of insect pests. Finally, insect pest distribution was calculated as the number of infected farms from the total assessed farms) x 100%.

3. Results and discussion

3.1 Distributions and status of major coffee insect pests in surveyed areas

Currently, the 3 most important coffee leaf-damaging insects have been identified. Kindly, coffee leaf skeletonizer, blotch leaf miner, and coffee leaf serpentine. Three of them were observed in all surveyed areas. These are the most economically important coffee leaf insect pests in Southwester Ethiopia [5, 8]. However, there was no significant variation ($p>5\%$) among and within study areas. Numerical variation was observed from district to district, PA to PA, farm to farm, and tree to tree. This variation may be due to some biotic and abiotic factors.

3.2 Prevalence, incidence, and severity of coffee leaf Skeletonizer (*Leucoplemma dohertyi*)

100% of the prevalence of Skeletonizer was recorded in all surveyed areas. High incidence and severity of coffee leaf Skeletonizer were recorded at Digga and Gudeya Bila districts followed by Sibiu Sire. While lowest incidence and severity was recorded at Gudeya Bila and Digga followed by Sibiu Sire (Table 1).

Coffee leaf skeletonizers are among the most commonly occurring insect pests causing coffee leaf damage and showing a high proportion of damage incidence (78%) [2]. In the same study, at yayo, Birhane-kontir, and Bonga coffee population Coffee leaf skeletonizer share 71, 72, and 74%, respectively. According to [5] report the prevalence of Coffee leaf skeletonizer was high ($>71\%$). Variations in the incidence and severity of a pest or disease across space can depend on various biotic and abiotic factors [5]. Most of these factors vary spatially across the landscape and environmental variables such as light, temperature, and humidity often play direct regulating roles [5-7].

Table 1. Infestation level of coffee leaf skeletonizer at surveying area

Districts	Prevalence	Incidence	Severity
Diggaa	100.00	98.00	30.33
Sibu Sire	100.00	92.00	31.99
Gudeya Bila	100.00	82.00	33.72
Overall mean	100.00	90.67	32.01
P-value (0.05)	2.13	3.54	2.78

3.3 Prevalence, incidence, and severity of Blotch leaf miner (*Leucoptera coffeina*)

100% of the prevalence of Skeletonizer was recorded in all surveyed areas. High incidence and severity of coffee leaf Skeletonizer were recorded at Digga and Gudeya Bila districts followed by Sibiu Sire. While lowest incidence and severity were recorded at Gudeya Bila and Digga followed by Sibiu Sire (Table 2).

Table 2. Infestation levels of coffee leaf miners in study areas

Districts	Prevalence	Incidence	Severity
Diggaa	100.00	29.33	2.01
Sibu Sire	93.33	26.67	5.06
Gudeya Bila	100.00	28.67	5.75
Overall mean	97.78	28.22	4.27
P-value (0.05)	3.24	5.78	4.12

3.4 Prevalence, incidence, and severity of coffee leaf Serpentine (*Cryphiomystis alatreuta*)

100% of the prevalence of Skeletonizer was recorded at all surveyed areas. High incidence and severity of coffee leaf Skeletonizer were recorded at Digga and Gudeya Bila. Districts followed by Sibiu Sire. While lowest incidence and severity were recorded at Gudeya Bila and Digga followed by Sibiu Sire (Table 3).

Table 3. Infestation levels of coffee leaf serpentine in study areas

Districts	Prevalence	Incidence	Severity
Diggaa	100.00	42.67	7.88
Sibu Sire	100.00	46.67	4.80
Gudeya Bila	100.00	42.67	5.57
Overall mean	100.00	44.00	6.08
P-value (0.05)	2.64	3.74	3.58

3.5 Influence of essential factors on the infestation rate and occurrence of coffee insect pests in surveyed areas

3.5.1 Affects of Field sanitation and management

Sanitation and field management affect the intensity of insect pests modifying microclimate from conducive to none conducive one. It reduces debris and inoculum sources. Accordingly, high incidence and severity of coffee insect pest were recorded from coffee farms managed poorly (Figure 2). While the lowest incidence and severity was recorded from well-managed followed by moderately managed (Figure). Crop management directly or indirectly affects the incidence of pests by increasing the tolerance of the host [3, 5, 6].

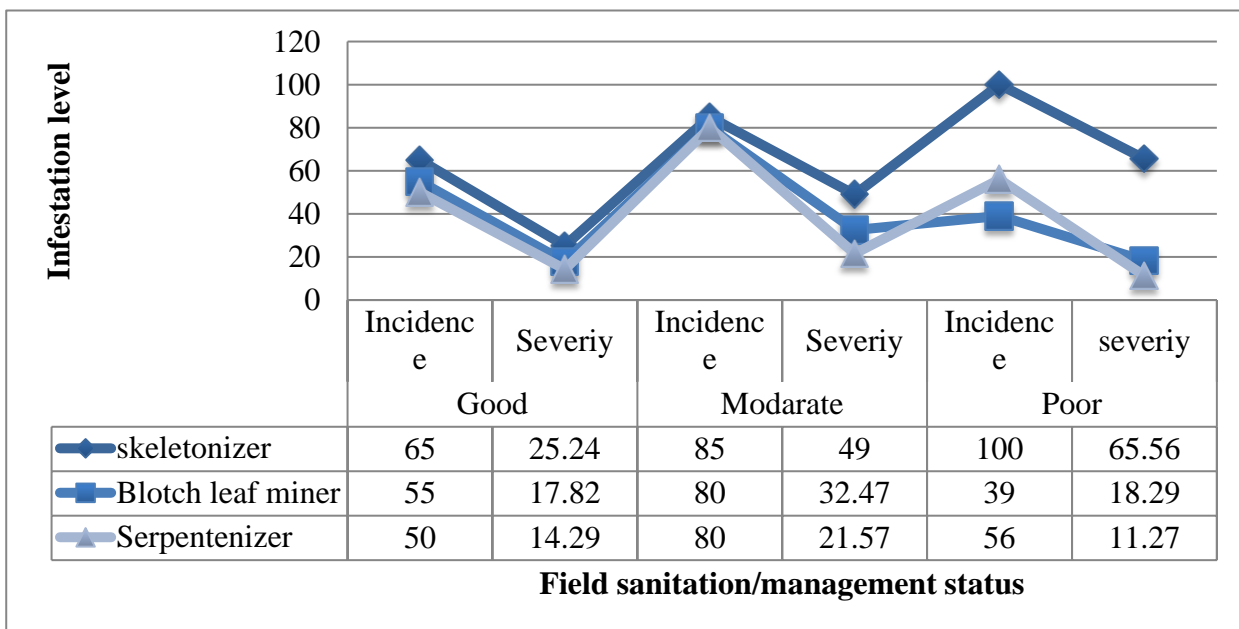


Figure 2. Field sanitation and coffee insect pests’ infestation/damage level.

3.5.2 Resistant/tolerant host

Resistant/tolerant cultivars have their own impact on the infestation of insect pests. The highest incidence and severity were recorded from local cultivars, lowest was from improved [8, 9].

Table 4. Host resistance/ tolerance and coffee insect pests’ infestation/damage level

Insect pests	Local		Improved	
	Incidence	Severity	Incidence	Severity
Skeletonizer	100.00	65.00	65.00	25.24
Blotch leaf miner	95.00	47.47	32.00	17.82
Serpenterizer	90.00	28.57	23.00	14.29
Mean	95.00	47.01	40.00	19.12

3.5.3 Influence of shade tree status on infestation rate of coffee insect pests

Shade has a great effect on the infestation rate of each coffee insect pest. Infestation level of each insect pest was varying in terms of shade tree status. High incidence and severity of skeletonizer was recorded under shaded, while the lowest was under open sun. High incidence and severity of blotch leaf miners were recorded under the open sun, while the lowest was under shade. High incidence and severity of serpantenizer were recorded under shaded, while the lowest was under the open sun (Table 5).

Table 5. Shade tree status and coffee insect pests' infestation/damage level

Insect pests	Open		Moderate		Shaded	
	Incidence %	Severity %	Incidence %	Severity %	Incidence %	Severity %
Skeletonizer	55.00	25.24	70	33.37	100.00	65.00
Blotch leaf miner	95.00	47.47	50.00	19.25	32	12.25
Serpantenizer	23.00	14.29	65	28.57	90	36.38
Mean	57.67	29.00	61.67	27.06	74.00	37.88

4. Conclusion and recommendation

Coffee insect pests (mostly blotch leaf miners and skeletonizer) are observed in all surveyed areas. In other case, they were dominated across coffee ecology. Coffee leaf skeletonizer was highly severe coffee mother trees grown under shade and poorly managed coffee farms. While coffee blotch leaf miner was found more with coffee mother trees handled under poor management. Growth and development of these insect pests are influenced by many factors including field management/sanitation, shade tree management, and host resistance. Therefore, coffee growers should use insect pest tolerant varieties, integrated pest management, proper/ideal field management practices, and sanitation. Further management study should be made in the near future. Detail investigation regards to influence of some factors on coffee insect pests' growth and development is needed also.

Acknowledgment

The authors extended their thanks to IQQO and Bako Agricultural Research Center who support financially and facilitated this study. All technical staff of the coffee research case team is also appreciated for their support in data collection.

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