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Incidence and Severity of Coffee Berry Disease in West Hararge Zone, Eastern Ethiopia

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Abstract
Coffee is principal cash crop in Ethiopia. Harar coffee is one of the coffee types of Ethiopia known for their fine quality unique aroma and flavor. Large proportion of Harar coffee is produced in West Hararge Zone in Eastern Ethiopia. Coffee berry disease is the major disease of coffee in the country. It causes huge yield loss of 25-30% at national level. In addition to yield reduction, the disease deteriorates cup quality of coffee. There was a need to study status of coffee berry disease is Harar coffee grower areas. Accordingly, this study was conducted with the objective to determine incidence and severity of coffee berry disease (CBD) in West Hararge Zone. Total of 135 coffee farms at 27 study sites in three districts (Daro Labu, Habro and Boke) were used for this study. The study sites were selected using multi stage sampling techniques. Incidence and severity of coffee berry disease were determined as percentage of diseased plants and percentage of diseased berries, respectively. Incidence of CBD was studied by visual assessment on 10- 15 trees/ farm. Sample plants were randomly selected and diagnosed for presence and absence of the disease. Then, disease incidence was calculated as number of diseased trees divided by total observed trees and multiplies by 100. CBD severity was determined using berry counting method. For each plot, 8 to10 coffee trees were randomly selected, following diagonal and zigzag method. Each coffee tree was divided into three strata of branches (top, middle and bottom). From each stratum one branch was selected and the number of CBD infected and that of healthy berries was recorded. From that, percentage of diseased coffee berries was worked out. Data was analyzed for descriptive statistics (mean, range, percentage). The result of this study revealed that incidence of CBD varied among study sites. CBD incidence in West Hararge varied from 8.0% 84.0 % with mean of 49.7%. On the other hand severity of coffee berry disease ranged from 0.0 to 26.7% with mean of 10.0%. Both incidence and severity of the disease varied across study districts and sites. Hot spot areas were identified. Hence, it is advisable to introduce CBD resistant coffee varieties for hot spot areas. Training farmers to use cultural control methods such as pruning, sucker management is also the way forward.
Keywords: Coffee berry disease; Eastern Ethiopia; Incidence; Severity
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1. Introduction

Coffee is the principal cash crop in Ethiopia. The country is the 5th and 1st coffee producer in the world and Africa, respectively (FAO, 2020). Coffee is a means of livelihood for one-fourth of the country's population. Ethiopia earned 839 million dollar from coffee export, accounting for about 30% of income from all commodities (NBE, 2019). Ethiopia is the center of origin and diversity for Arabica coffee (Bayeta et al., 2007). The coffee types of Ethiopia that are distinguished for their very fine quality, unique aroma and flavor characteristics include Harar, Sidamo, Yirgacheffe, Ghimbi and Limu types (Workafes and Kassu, 2000). Harar coffee accounted for 10% of the total country's coffee acreage and 8% of the country's coffee export. Harar coffee is grown in altitude ranging from 1510 to 2120 masl. West Hararge Zone is the major producer of Harar coffee. In 2017, area devoted to coffee production in west Hararge Zone was 7,746 ha with yield of 0.6 ton/ha (CSA, 2017). The low yield of coffee in the Zones stems from several factors including diseases. Harar coffee is susceptible to coffee berry disease. . Coffee berry disease is the major disease of coffee in the country. CBD causes yield loss of 25-30% at national level. The disease affects flower, fruits and branches of the coffee plant. It causes premature fruit drop and mummified fruits and thereby reduce both yield and cup quality of coffee (Tefesetewold, 1995; Eshetu *et al.*, 2000). Hence, there was a need to study status of coffee berry disease is Harar coffee grower areas. Accordingly, this study was conducted with the objectives.

Objectives:

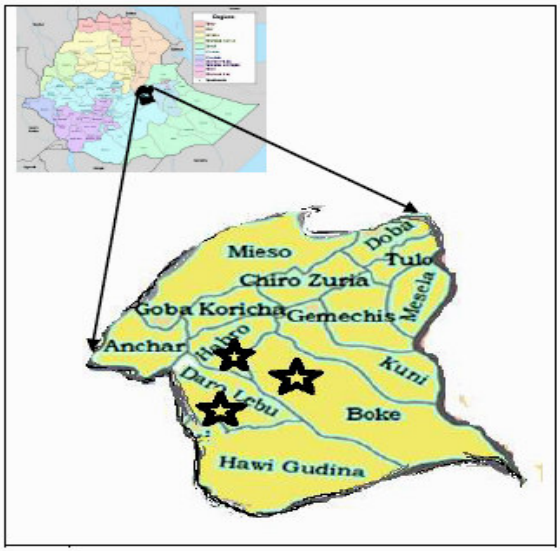
- To determine incidence and severity of coffee berry disease (CBD) in West Hararge Zone.

2. Material and Methods

2.1. Study Sites and Sampling

This study was conducted in August 2014 in West Hararge Zone. It is bordered on the south by Bale Zonea, on the east by East Harerge, the northeast by Somale region. Three districts namely Daro labu, Habro and Boke (Map 1) were purposively selected for their coffee production potential. Altitude of study sites varied from 1658

to 1833 masl in Daro labu district, 1721 to 1772 masl in Habro and 1762 to 1855 masl in Boke district. From each district, nine representative study sites were selected through discussion with districts' coffee experts and mainly based on coffee production potential and representativeness. Then, five coffee farms (at distance of 3-5 Km) were selected for study. Hence total of 135 coffee farms were used for the study.



Map1. Map of West Hararge Zone and study districts (star)

2.2. Data Collection and Analysis

Incidence of coffee berry disease (CBD): Incidence of CBD was recorded on 10-15 coffee trees/farm by visual assessment. Sample coffee trees were randomly selected. Then the selected coffee trees were diagnosed for presence and absence of the disease. The disease incidence was calculated as percentage of diseased trees.

*Severity of coffee berry disease***:** CBD severity was determined using berry counting method. About 10-15 coffee trees/farm were randomly selected, following diagonal and zigzag method. Each tree was divided into three strata of branches (top, middle and bottom). From each stratum one branch was selected. Then, CBD infected as well as healthy berries were counted. Finally, CBD incidence (%) was determines as percentage of diseased coffee berries.

3. Result and Discussion

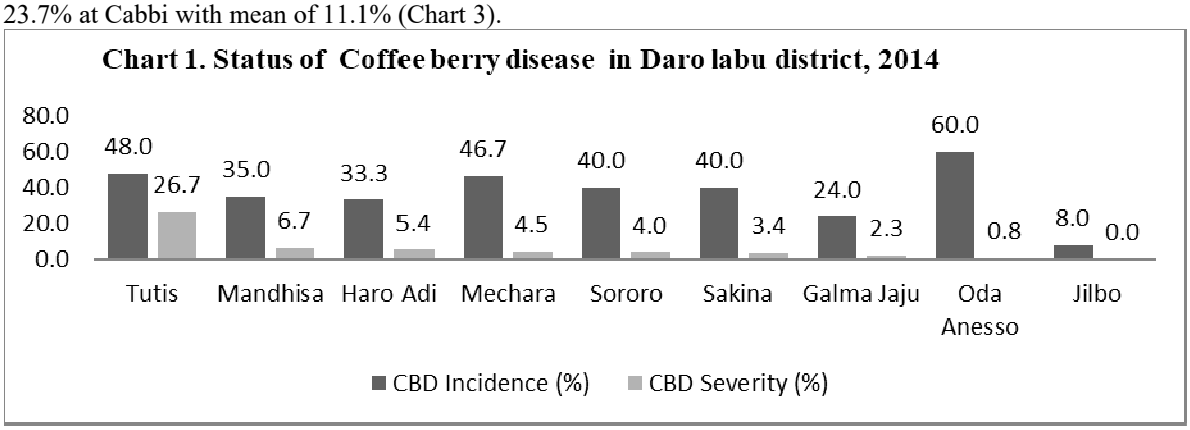
3.1. Incidence of coffee berry disease

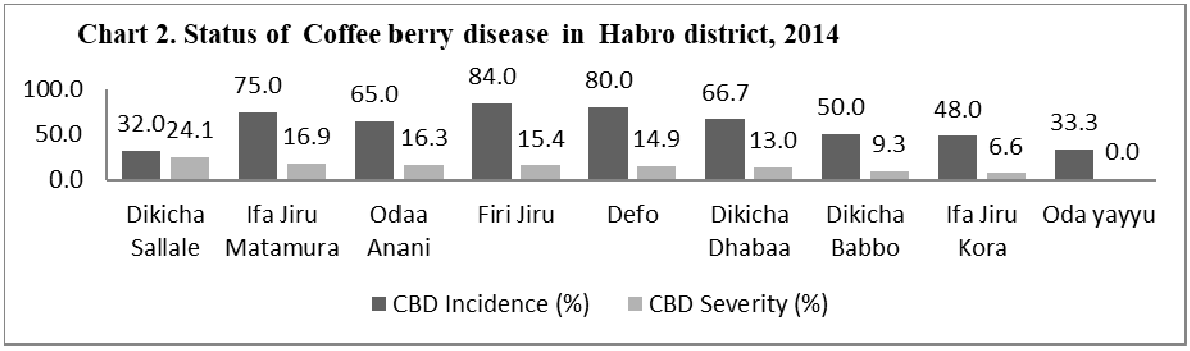
The result of this study revealed that incidence of CBD varied across study sites. CBD incidence varied from 8.0% at Buke guddo of Boke district to 84.0 % at Firi Jiru kebele of Habro district with mean of 49.7%. In this study, CBD incidence ranged from 8.0 to 60.0% with mean of 37.2% at Daro labu district, 32.0 to 84.0% with mean of 59.3% at Habro district and 8.0 to 75.0% with mean values of 52.5% at Boke district. In Daro labu district, CBD incidence varied from 8.0 to 64.0% with mean of 37.2% (Chart 1). The highest CBD incidence (60.0%) was recorded at Odda Anesso followed by Tutis (48.0%), Mechara (46.7%), Sororo and Sakina (40%). In Habro district, the minimum and maximum incidence of CBD were 32.0% and 84.0% while the mean value was 59.3% (Chart 2). The highest CBD incidence (84.0%) was recorded at Firi Jiru followed by Defo (80.0%), Ifa jiru matamura (75%), Dikicha Dhabaa (66.7%), Odaa Annanii (65.0%) and Dikicha Babbo (50%). On the other hand, CBD incidence was 8.0 to 75% with mean of 52.5% in Boke district (Chart 3). Areas with high CBD incidence, in the district, were Iddo aroji-2 (75%), Haro muda (66.7%), Soraa (65.0%), Cabbi (63.3%), Iddo Arojjii-3 and Iddo Arojjii-1 (60%). The result of this study is comparable with study conducted in different parts of the country. For instance, Arega (2006) reported that CBD incidence varied from 0-50% in Bale area, 20-60% in Bonga, 0-20% in Sheko and 0-50% in Yayu areas. The result of study conducted in 1994 depicted that mean incidence of CBD was 38.8% and 17% in Oromia and Southern Regional States, respectively (JARC, 1997). The minor discrepancies with our study may be due differences in study areas and time of study. The incidence and severity of CBD was very high in especially at higher altitudes and in valley bottoms. Similar findings were reported by Merdassa (1986) who studied status of CBD in southern region of the country.

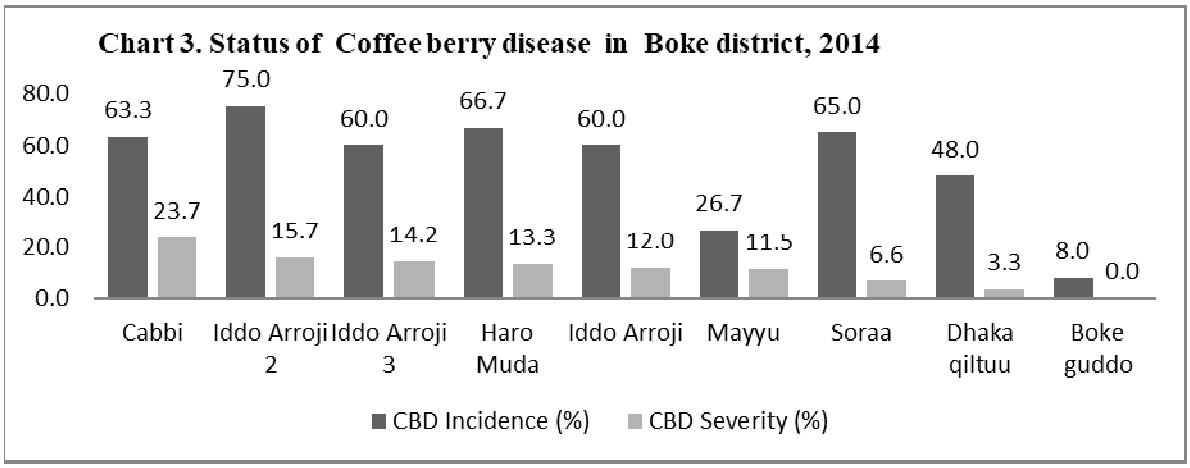
3.2. Severity of coffee berry disease

Severity of coffee berry disease, throughout 27 study sites, ranged from 0.0 at Jilbo (in Daro labu district) and Boke guddo (in Boke district) to 26.7% at Tutis Kebele of Daro labu district with mean of 10.0%. CBD severity varied across studied districts and sites. In Daro labu district, CBD severity varied from 0.0% at Jilbo to 26.7% at

Tutis with mean value of 6.0% (Chart 1). Highest CBD incidence was recorded at Tutis (26.7%) followed by Mandhisa (6.7%), Haro Adi (5.4%), Mechara (4.5%) and Sororo (4.0%). In Habro district the lowest CBD severity (0.0%) and the highest severity (24.1% were recorded at Oda yaayyu and Dikicha salale, respectively (Chart 2). Mean severity of the disease was 12.9%. Disease severity varied across study sites in the district. The CBD severity of 24.1%, 16.9%, 16.3%, 15.4% and 14.9% were recorded at Dikicha Sallale, Ifajiru matatuma, Oda Anani, Firi Jiru and Defo in that order. In Boke districts, CBD severity varied from 0.0 at Boke guddo to 23.7% at Cabbi with mean of 11.1% (Chart 3).







The result of this study further revealed that CBD severity was less than incidence at all study sites. Incidence occurred across all the 27 study sites. This shows that CBD is important disease in West Hararge. Hot spot areas can be identified from the present study. In Daro Labu district, Tutis, Mandhisa and Haro Adi are hot spot areas for CBD. Dikicha Salale, Ifa Jiru Matamura, Oda Anani, Firi Jiru, Defo and Dikicha Dhaba are hot spot areas in Habro district. It is important to note that CBD severity was high in Habro district than in Daro labu district. Daro labu is drier than Habro district. On the other hand, Cabbi, Iddo Arrojji-2, Iddo Arrojjii-3, Haro Muda, Iddo Arrojji-1 and Mayyu are hot spot areas in Boke district. In previous studies conducted in other parts of the country CBD severity varied from 0.9 to 15% in Bale, 12.5 to 22.5% in Bonga, 0.0 to 6.5% in Sheko and 0.0 to 7.8% in Yayu (Arega, 2006). The result of survey conducted in in six major coffee growing zones of Oromia regional state in 1997 and 1998 revealed average CBD severity was of 31.5 %. That study further showed that CBD severity was 42.0% in West Hararge Zone (Melaku and Samuel, 2000). The mean CBD

severity recorded in the present study (10.0%) is lower than severity (42.0%) reported in late 1990s. This could be due to difference in study sites and rise in temperature over the last 14 years due to climate change. CBD is favored by low temperature and high relative humidity. CBD can cause yield loss of up 100% (Van der Graaff, 1981) when hot is susceptible, environment is suitable for the disease to occur and the pathogen is virulent.

4. Conclusion and Recommendation

The result of this study revealed CBD occurred across all study districts and sites. CBD incidence in West Hararge varied from 8.0% 84.0 % with mean of 49.7%. On the other hand severity of the disease ranged from 0.0 to 26.7% with mean of 10.0%. Both incidence and severity of the disease varied across study districts and sites. CBD incidence ranged from 8.0 to 60.0% with mean of 37.2% at Daro labu district, 32.0 to 84.0% with mean of 59.3% at Habro district and 8.0 to 75.0% with mean values of 52.5% at Boke district. On the other hand, CBD severity varied from 0.0% to 26.7%, 0.0 to 24.1% and 0.0 to 23.7% in Daro labu, Habro and Boke districts, respectively. The mean severity of CBD was 6.0% in Daro labu, 12.9% in Habro and 11.1% in Boke districts Disease severity was moderate to high in most of study sites in Habro and Boke districts. Hence, it is advisable to introduce CBD resistant coffee varieties for production in hot spot areas. Training farmers to implement cultural control methods such as pruning, sucker management is also the way forward.

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