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# Distribution and Status of Coffee Wilt Disease in West Oromia, Ethiopia

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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 diseases such as the Coffee wilt Disease (CWD) whose causal agent is the fungus *Fusarium xylarioides*. This work was done to assess the prevalence and incidence of coffee wilt disease in the East Wallaggaa Zone of Oromia. During survey work, 3 potential coffee-growing districts (Sasiga, Limmu, and Wayu Tuka) 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, and impact of some factors on the development CWD. Large numbers of coffee farms were attacked in Sasiga (80%) district followed by Wayu Tuka (73.33%) and Limmu (60%). A high rate of CWD incidence was recorded in Wayu Tuka (19 %) followed by Sasiga (16.67%) and Limmu (11.47%). CWD has influence positively and negatively by altitude, shade tree status, host resistant, coffee age and sanitation and field management. Local farmers should use CWD-resistant coffee cultivars and recommended field management to overcome CWD pressure observed in the coffee industry. Further investigation is also needed on the influence of some factors on the development of CWD in the study area.

## Keywords

*Coffea arabica* L., coffee wilt disease, prevalence and incidence

## 1. Introduction

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. Coffee is attacked by various disease-causing organisms such as fungi, bacteria, viruses, nematodes, insects and weeds. One of the limiting factors that influences coffee production in African countries is coffee diseases, which are the most important factor. Among coffee diseases wilt disease caused by *Fusarium xylarioides* is economically important and causes the complete death of the coffee mother tree. Nowadays, coffee production and development have been threatened by coffee wilt disease (CWD) in most coffee-growing regions of Ethiopia [1].

The major difference between tracheomycosis and many other coffee diseases is that it kills all affected trees at all stages of growth. Coffee wilt disease was first observed in 1927 in a plantation of *Coffea excelsa*, in the Central African Republic [1]. Since then, CWD has re-emerged on *C. canephora*/excelsa in portions of the Democratic Republic of Congo in the mid-1980s, it affected up to 90% of plantations in 1993 in Uganda. In Ethiopia, the outbreak of the pathogen has been

reported throughout the major coffee-growing districts in the south and southwestern coffee-growing areas.

The fungus lives in the soil, on infected debris, in alternative hosts, or as resistant propagules of species, and enters the coffee tree through wounds at the base of the tree or on the roots [1]. The disease infestation incidence varied between 14.9 and 34.0%. The estimated annual coffee yield losses caused by CWD are about 7.4%, 1.6%, and 2.6% in Uganda, Ethiopia and Tanzania, respectively [7]. CWD is distributed and caused coffee yield losses in major coffee-growing areas of western, southern, and eastern parts of Ethiopia [5]. The mean disease incidence ranged from 45% at Gera to 69% at Bebeka, with certain variations between coffee fields at each locality. It is difficult to control the pathogen by fungicides due to its niche is inside of the soil. However, the pathogen may be controlled by antagonistic biological control agents. *In vitro* evaluation of *Trichoderma* species has revealed up to 71% reduction of the mycelial growth of coffee wilt pathogen (*F. xylarioides*) [2].

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

## 2. Materials and Methods

### 2.1 Description of study area

The assessment of CWD was conducted in 45 sampled coffee farms in 3 districts (Wayu Tuka, Sasiga, and Limmu) of East Wallaggaa zone in 2021.

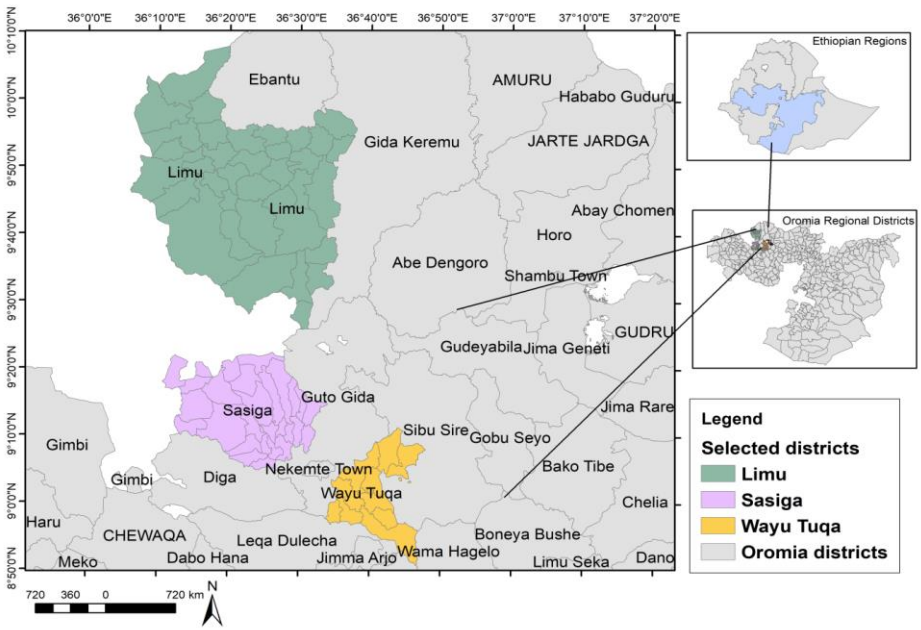


**Figure 1. Map of the study area.**

### 2.2 Sample size and methods

Five coffee fields/farms were selected in each kebeles (PAs) based on earlier surveys and preliminary information on gained from agriculture development agents in the respective districts. CWD assessment was taken between plots across coffee farms. In each 100 m x 100 m plot, 10-20 trees were diagnosed diagonally and consecutively following [1] procedure. All diseased (dying and dead) coffee trees in each sample field were diagnosed. The progressive external symptom development along with internal discoloration on the wood, after peeling off the bark, was observed and described. At the same time, the presence and/or absence of fungus fruiting body was examined visually or using a magnifying hand lens after

gently scratching the bark. Based on the external and internal symptoms, infected coffee trees by *G. xylarioides* were identified and recorded in the field. Then, the numbers of healthy and diseased trees were counted and the incidence of CWD was computed as a number of diseased trees/total number of observed coffee trees x 100. The number of stumps and uprooted coffee trees was ascribed to wilting. Besides secondary information on cultivars, planting years (estimated age), cultural practices (slashing, hoeing, pruning, etc.), and field history related to CWD and other related data were gathered during the surveys. Geographical positions were taken using a Garmin Ground Positioning System (GPS) for each surveyed farm. Data of Coffee wilt disease incidence and prevalence was summarized as means for all farms surveyed and analyzed using SPSS and descriptive statistics.

## 3. Results and Discussion

### 3.1 Distributions and status of coffee wilt disease in surveyed areas

#### 3.1.1 Coffee wilt disease prevalence across assessed areas

The coffee wild disease was observed across surveyed areas of the east Wallaggaa zone. The prevalence of CWD was recorded with none significant (p>5%) figure among and between surveyed areas. Disease was available at all agroecology in which coffee plantation was found. Large numbers of coffee farms were attacked in Sasiga (80%) district followed by Wayu Tuka (73.33%) and Limmu (60%). The overall mean of prevalence of coffee wilt disease was 71.11%. The variation in districts and between districts, within and between PA, and between farms was observed regards to prevalence. This none non-significant and/or different value of prevalence across surveyed areas shows the existence of factors that influence the development of CWD. These factors may be farmers' usual practices including uprooting of susceptible hosts, avirulent pathogens, using/existence of host resistance within the farm, and others.

According to Arfasa and Diriba [2] Coffee wilt disease was prevalent in all assessed coffee-producing districts of the western Guji zone. In the same study, the result indicated that CWD was prevalent in the study sites, with the highest mean incidence of 53.1% in kercha, 49.1% in Hambela Wamana, and 42.3% in Odo Shakiso districts indicating the present status of the disease is remarkably on an increasing trend and poses a big threat to the farmers. On the other hand, the lowest disease incidence (25.4%) was estimated Uraga district of the Guji zone.

#### 3.1.2 Incidences of coffee wilt disease in the surveyed area

Coffee wilt disease incidence was recorded in surveyed areas with different values. That means there was no significant variation (p>5%) among and within study areas. Accordingly, a high rate of incidence was recorded in Wayu Tuka (19 %) followed by Sasiga (16.67%) and Limmu (11.47%) (Table 1). The average mean incidence in the surveyed area was 15.71% (Table 1). The recorded value was varying from farm to farm, PA to PA, and within PA, within the district, and district to district. This dissimilarity indicates the existence of different factors which are influences the growth of the pathogen. These factors may be farmers' practices like uprooting of susceptible hosts, avirulent pathogens, and using host resistance. CWD incidence was reported at Gera and Bebeka at 45 and 69 %, respectively [3].

**Table 1. Distribution and current status of coffee wilt disease in surveyed areas during 2020/21**

| Districts | Prevalence% | Incidence% |
|---|---|---|
| W/Tuka | 73.33 | 19.00 |
| Sasiga | 80.00 | 16.67 |
| Limmu | 60.00 | 11.47 |
| Overall mean | 71.11 | 15.71 |
| P-value(0.05) | 0.119 | 0.009 |

### 3.2 Influence of biological and abiotic factors on the infection rate of coffee berry disease (*Colletotrichum kahawae*) in surveyed areas

Some preliminary observations indicate that temperature, rainfall, topography, coffee tree age, shade, soil type, and weeding methods have significant effects on CWD. The incidence of CWD is higher on coffee trees that are older, shaded,

planted on loamy soil, and weeded by slashing [2]. Above all, the susceptibility of coffee cultivars and agronomic/cultural practices has consistent effect on the occurrence and severity of the disease.

### 3.2.1 Agronomic practices on CWD incidence

Besides the inherent genetic factors of coffee cultivars, certain agronomic and routine cultural practices have long been postulated to aggravate CWD. There is a strong association between wounding and dissemination of the fungal fruiting bodies (perithecia and ascospores) from a single infected tree to other disease-free trees/plots [4]. Accordingly high CWD incidence was recorded from farms poorly managed and in which infected coffee mother tree was used as wood and fence (Figure 2). While the lowest CWD incidence was recorded from well-managed coffee farms.

The predominant disease-spread mechanisms mainly involve human activities including pruning, stumping (to rejuvenate old and unproductive trees), slashing and hoeing to control weeds, and transporting infected trees from one field to the other (long-distance spread) [8, 9]. The use of contaminated farm implements across various plots/fields also plays a significant role in spreading the fungus inoculum. A common practice in Ethiopia is to cut wilted trees, store them somewhere in the field or near the houses, and use them for various purposes such as for firewood, for fencing around dwelling houses or coffee farms, and as a support for climbing beans [5, 8, 9]. These trees and remaining stumps harbor the fungal fruiting bodies (perithecia with ascospores) that serve as inoculum source for further infection and initiate disease epidemics [3]. It has been estimated that 60% of the farmers in Ethiopia used wood for fencing, 26% for constructing houses and animal sheds, 10% gave surplus wilted trees to their neighbors for firewood and 2% sold the trees [3].

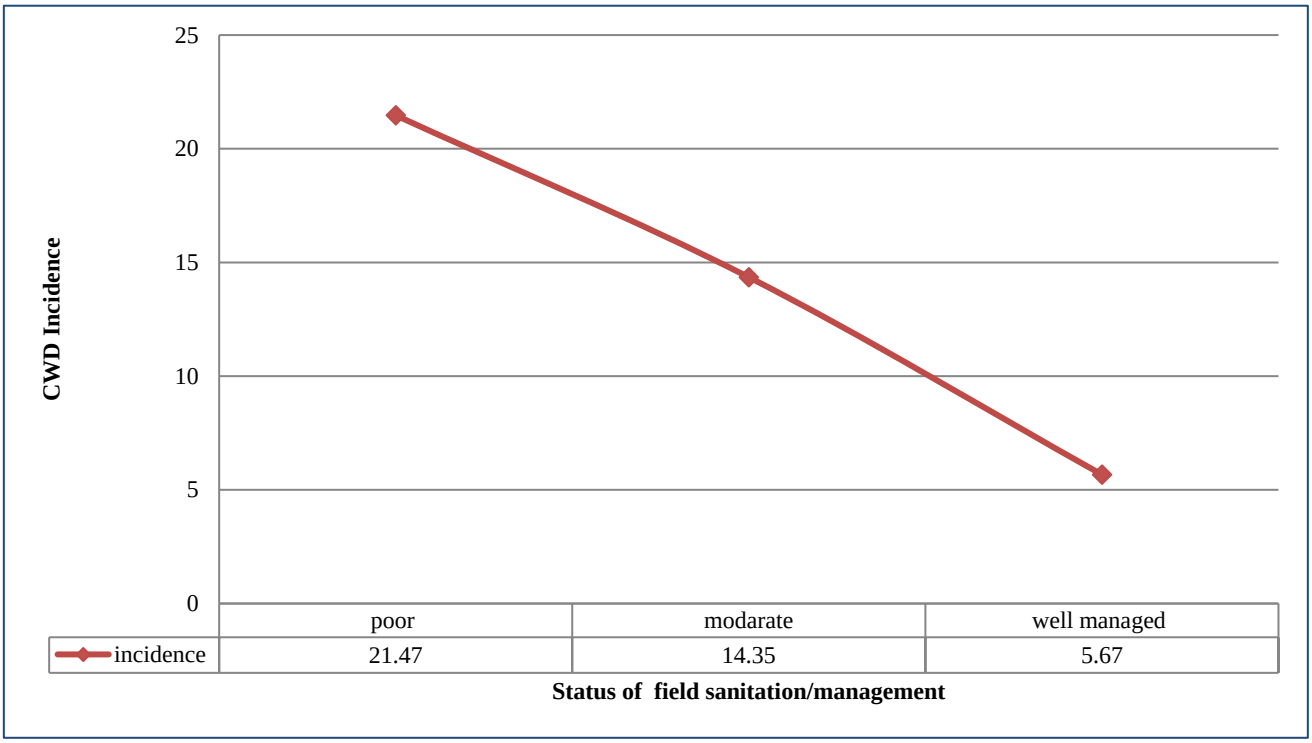


**Figure 2. Effect field management practices on intensity coffee wilt disease.**

### 3.2.2 Host resistance in the field

The disease reaction level of plants has its own impact on the development and growth of disease/ pathogen. High CWD incidence was recorded from farms cultivated with local cultivars, while the lowest was from farms covered with improved coffee cultivars (Figure 3). A number of researchers have reported existence of marked differences in resistance levels in arabica coffee populations to CWD under field conditions at various locations [4, 5]. The studies assessed the incidence of the disease in single-tree progenies of different coffee accessions for 6 years (1979-1984) at Gera and obtained tree loss ranging from 0.3% to 87%. Replanting susceptible coffee cultivars into already contaminated fields increases fungal inoculum, and further infection occurs in the second planting [6, 7].

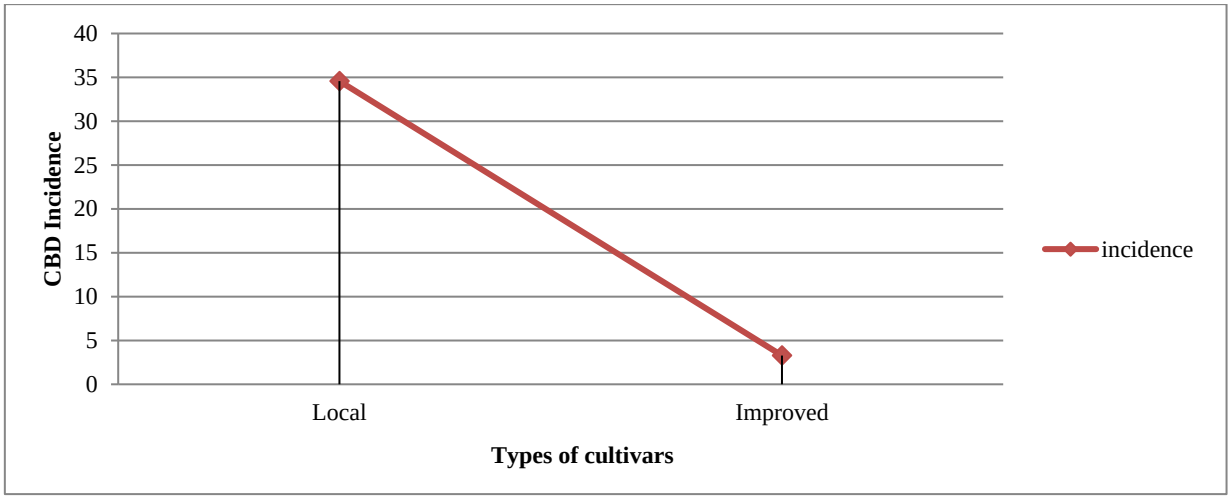


**Figure 3. The effect of host resistances in line with coffee wilt disease intensity.**

## 4. Conclusion and Recommendation

Coffee wilt disease was observed across surveyed areas. In another case, the occurrence of CWD is not limited by agroecology. Coffee wilt disease was highly severe in poorly managed coffee fields and coffee fields rich with susceptible landraces. Growth and development of coffee wilt disease has influenced by field management and sanitation and host resistance. Therefore, coffee growers should use CWD resistance varieties, integrated disease management, proper/ideal field management, and sanitation to overcome CWD problems in the coffee industry. Further management studies should be conducted shortly. Detailed investigations regarding the influence of factors on CWD growth and development should be conducted in the near future.

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