



# International Journal of Plant Pathology and Microbiology

E-ISSN: 2789-3073  
P-ISSN: 2789-3065  
IJPPM 2021; 1(1): 31-34  
Received: 25-01-2021  
Accepted: 24-03-2021

**Zenebe Wubshet Hordofa**  
Plant protection Research  
section, Ethiopian Institute of  
Agricultural Research, Jimma  
Agricultural Research Centre,  
P.O.B.192, Jimma, Ethiopia

## Coffee pathology research in Ethiopia: A review

**Zenebe Wubshet Hordofa**

### Abstract

Coffee is an engine for Ethiopian economy. Though, its production is affected by different biotic and abiotic factors. Among these, mainly the major and minor fungal diseases like berry, leaf rust, wilt, thread blight, bacterial blight etc. diseases of coffee are the current challenges across its production areas of the country. Besides, different efforts such as cultural, resistant variety development (example of >31 Coffee berry disease resistance varieties released), antagonistic bioagents identification (*Trichoderma* spp.), chemical screening etc. especially for major coffee diseases are carried out. Also, the current climate change favors these diseases to be aggravated hence, future research must focus on associated factors raised due to climate change. Hence, this review is written with the aim of giving insight on the status of coffee pathology research and future outlines in Ethiopia.

**Keywords:** Biocontrol agents, *coffea arabica*, coffee disease, resistance variety

### 1. Introduction

Ethiopia is the primary center of origin and genetic diversity of *C. arabica* and coffee is well known being the pillar of Ethiopian economy. Among the top three agricultural exports, coffee stands first followed by oil seeds and pulses. It accounts for 29 % of the total export and 37% of agricultural export earnings of the nation; 4.7 million small-holders directly involved in producing coffee and about 25 million people directly or indirectly depends on coffee sector for their livelihoods [5, 21]. Nowadays, coffee has produced in more than 80 countries with more than 10 million hectares of land [10]. Ethiopia is the primary center of origin and diversity of Arabica coffee and ranks 1<sup>st</sup> and 5<sup>th</sup> in Africa and the world respectively [9]. The existence of ideal and diverse agroecologies together with forest, semi forest, garden, and plantations production systems in Ethiopia made coffee to be the leading agricultural produce in the country [22]. Coffee is largely cultivated in the Southern, South Western, Western and Eastern parts of Ethiopia with 700,447 ha of total land coverage and 469, 091 tons of production per annum [23]. The average yield of coffee in the country is generally low (about 646kg /ha) which is half of that achieved in Latin America and almost one third of Asia's productivity [11, 9]. This is partly due to the widespread and prevalence of pests, weeds and diseases. coffee berry disease (CBD), coffee wilt disease (CWD) coffee leaf rust (CLR) caused by *Colletotrichum kahawae*, *Gibberella xylarioides* and *Hemileia vastatrix*, and Coffee thread blight and Bacterial blight of coffee caused by *Corticium koleroga* and *Pseudomonas syringae* are the major and potentially important disease respectively [12, 6, 1]. Local landraces development from the available genetic resources found in different coffee growing areas is the key and provides sustainable disease management [19]. Also, it is environmentally compatible and widely acceptable by the users. But, there is the variety adoption and the challenges of long breeding cycle associated with the long growth period of coffee have slowed down the progress of further varietal improvement works are raised as the as an issue [24]. As a national coordinating centre, Jimma Agricultural Research (JARC) takes a lion share in developing and releasing improved coffee varieties adapted to different agroecologies. For instance, more than 31 varieties developed to combat coffee berry disease problem of the producers [18, 23]; also many cultural, some biological and chemical disease management options are adopted for each diseases. In general, it is important to increase the genetic base of improved coffee varieties preferred by farmers. Assessing and developing varieties which bring tangible change on farmer's economy by increasing productivity through effective management of coffee diseases by minimizing production costs, reducing human health troubles and the environment is crucial. Therefore, this review is written to address the following objective(s).

**Correspondence**  
**Zenebe Wubshet Hordofa**  
Plant protection Research  
section, Ethiopian Institute of  
Agricultural Research, Jimma  
Agricultural Research Centre,  
P.O.B.192, Jimma, Ethiopia

**1.1. Objective(s)**

To give the general overview of coffee pathology research efforts achieved and the future research directions in Ethiopia.

**2. The current status of coffee diseases and achievements**

**2.1. Current status of coffee diseases**

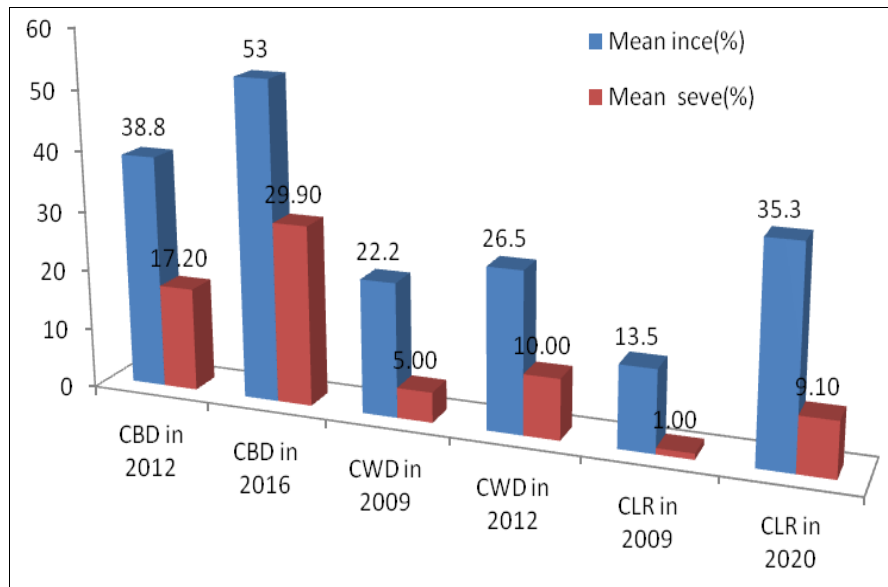
However coffee is among the top export commodity for Ethiopian economy, its average yield is very low (about 748 kg/ha) in contrast to the achievement in Latin America and Asia. This is due the occurrence of pests (diseases, insect pests, and weeds), limited use of improved technologies and best cultural practices by producers [12, 17]. Different diseases that challenge coffee production across the country are reported (Table 1).

**Table 1:** Various identified *Coffea arabica* coffee diseases, their causative agent and status in Ethiopia.

Name the disease	Scientific name	Status	References
Coffee berry disease	<i>Colletotrichum kahawae</i> Waller & Bridge	Major	20, 23
Coffee leaf rust	<i>Hemileia vastatrix</i> Berk. & Br.	Major	5,8
Tracheomycosis	<i>Gibberella xylarioides</i>	Tracheomycosis	14,21
Thread blight	<i>Corticium koleroga</i> (Cke) Hohnel	Potentially important & becomes the current treat	15
Bacterial blight of coffee	<i>Pseudomonas syringae</i> pv. <i>garcae</i> van Hall	Potentially important	12
Root rot	<i>Armillaria mellea</i>	Potentially important & becomes the current treat	12
Others			
Diseases	Scientific name	Status	
Brown blight	<i>Colletotrichum gloeosporioids</i>	Minor	
Leaf blight	<i>Ascochyta tarda</i>	Minor	
Fruit rot	<i>Fusarium</i> sp.	Minor	
Damping off	<i>Pythium</i> spp. <i>Rhizoctonia</i>	Minor	
Coffee bean mould	<i>Aspergillus</i> and <i>Penicillium</i> spcs.	Minor	

Coffee producers mainly challenged by coffee berry disease (*Colletotrichum kahawae*), Coffee wilt disease (*Gibberella xylarioides*) and coffee leaf rust (*Hemileia vastatrix*) that attack the green berries, vascular tissues (Xylem and phloem) and photosynthetic part (the leaf) respectively and

cause to higher losses in coffee yield. These are the major challenges of coffee production in the coffee ecology in Africa especially in Ethiopia starting from the earlier time [6, 2]. The current climate changes also favor to be aggravated throughout the country (Fig. 1).



**Fig 1.** The status of coffee diseases

**2.2 Major achievements in managements**

Development of 15 highly resistant cultivars is one of the ever success stories in coffee pathology research which saved the Ethiopian coffee industry from catastrophe and now more than 31 CBD resistance varieties are identified (7, 18, 23, Table 2). Six fungicides recommended for the control of CBD, absence of host specialization (physiologic races) in the CBD pathogen population in Ethiopia [4]. The two forms of pathogenic isolates attacking *Coffea arabica*, and those pathogenic to *C. canephora* and *C. Excelsa* reported. But, no genetic variation within each subpopulation except certain differences in aggressiveness,

more than 12 diseases (Table 1) along with causal pathogens have been identified and documented on Arabica coffee in Ethiopia (16, 15). Genetic diversity and population structure of *H. vastatrix* was determined. About 110 different mycoparasites isolated from *H. vastatrix* were identified. Antagonistic potential of 40 mycoparasites were evaluated. Current status of CLR intensity was updated nationally with 35 and 22.5% incidence and severity respectively [5]. Status of released varieties against CLR documented. Basic information on the biology and ecology of the major and some of the potential insect pests have been documented [8].

**Table 2:** Coffee berry disease resistant and moderately resistant varieties released based on Ethiopian agroecologies

Varieties name	Yield /ha	Reaction for CBD	Recommended altitude	Year of release
741	12.2	Res.	1550-2100	1977/78
744	16.6	Res.	1550-2100	1979/80
7440	16.2	Res.	1000-2100	1979/80
7454	18.3	Res.	1000-2100	1980/81
7487	23.8	Res.	1550-2100	1980/81
74110	19.1	Res.	1550-2100	1978/79
74112	18.1	Res.	1550-2100	1978/79
74165	17.3	Res.	1550-2100	1978/79
754	14.8	Res.	1550-2100	1980/81
75227	17.9	Res.	1550-2100	1980/81
Dessu	18.2	Mod.res.	1000-1750	1998
Ababuna	23.8	Mod.res.	1000-1750	1998
Melko CH2	24	Mod.res.	1000-1750	1998
Me'oftu	21.2	Mod.res.	1550-1750	2002
Gawe	26	Mod.res.	1550-1750	2002
Merdacheriko	15.4	Res.	1750-2100	2006
Buno Washi	23.5	Res.	1750-2100	2006
Yachi	19	Res.	1750-2100	2006
Wushush	16.4	Res.	1750-2100	2006
Angefa	20.4	Mod.res.	1550-1750	2006
Haru-1	15.66	Res.	1750-2100	2010
Challa	15.6	Res.	1750-2100	2010
Sende	16.1	Mod.res.	1200-1750	2010
Manasibu	16.4	Mod.res.	1200-1750	2010
Harusa	16	Mod.res.	1200-1750	2010
Mocha	13.5	Mod.res.	1200-1750	2010
Mechara-1	12	Mod.res.	1200-1750	2010
Bultum	17	Mod.res.	1200-1750	2010
Fayate	20	Mod.res.	1740-1850	2010
Odicha	19.5	Mod.res.	1550-1750	2010
Koti	11.6-21.2	Res.	1740-1850	2010

NB: the abbreviations CBD, Res and Mod res, refers, coffee berry disease, Resistant and moderately resistant respectively.

### 2.3 Future Research Directions

- Standardize pre-selection tests for CBD, CWD and CLR considering methods available elsewhere to maximize selection efficiency and correlation with field resistance
- Develop recommendations on integrated disease management options that minimizes cost and maximize disease control efficiency
- Understanding the current status of all known coffee diseases in Ethiopia viz. conducting national survey
- Study and generate information on the biology and epidemiology of major coffee diseases
- Develop new recommendations on different management options such as chemical, cultural, biochemical and natural enemies/biocontrol agents/ for the current alarming coffee diseases.

### 2. Conclusion

Coffee is the Ethiopian green gold which leads the country's economy with major contributions. However, many factors challenge/limit/ its production across the country. Of which, fungal diseases such as coffee wilt, Berry, leaf, twig, branch diseases that affect its production throughout the country are reported as the major constraints are identified. To combat effect of these diseases, different management options such as cultural, biological, chemical etc. are recommend. Currently around 42 varieties are developed and released for the users across the country. Among these varieties more than the 31 are released as a good fighter of coffee berry

disease. The current climatic conditions are also favor to aggravate these fungal diseases especially the disease which considered as the minor and potentially important are becoming a serious treats of coffee production in the country and need critical research focus in the future.

### Acknowledgment

The author acknowledged all the plant pathology team at Jimma agricultural Research center for their contribution by providing important information

### References

1. Adugna G, Jefuka C, Hindorf H. Interactions of coffee leaf rust (*Hemileia vastatrix*) with its host across production systems of Ethiopia. The proceeding of 26<sup>th</sup> International Conference on Coffee Science, November 13-19, Kunming, China. 2016, 38.
2. Alemu K, Adugna G, Lemessa F, Muleta M. Current status of coffee berry disease (*Colletotrichum kahawae* Waller & Bridge) in Ethiopia, Archives of Phytopathology and Plant Protection. 2016;49:17-18:421-433. Doi: 10.1080 /03235408.2016. 1228736
3. Alemu K, Adugna G, Lemessa F, Muleta D. Variation among *Colletotrichum* isolates associated with coffee berry disease in Ethiopia. Cogent Biology. 2020;6(1): 1740537. <https://doi.org/10.1080/23312025.2020.1740537>.
4. Belachew B. Arabica coffee breeding for yield and resistance to coffee berry disease (*Colletotrichum*

- kahawae* sp. Nov). Dissertation, Imperial College at Wye, University of London. 232.
5. Belachew K, Senbeta GA, Garedew T. Altitude is the main driver of coffee leaf rust epidemics: a large-scale survey in Ethiopia. *Trop. plant pathol.* 2020;45:511–521. <https://doi.org/10.1007/s40858-020-00383-4>
  6. Belachew K, Teferi D, Gidisa G. Screening of Some *Coffea arabica* genotypes against coffee wilt diseases (*Gibberella xylarioides* Heim and Saccus) at Jimma, Southwest Ethiopia. *International Journal of Sustainable Agricultural Research.* 2015;2:66-76.
  7. Benti T. Progress in Arabica coffee breeding in Ethiopia: Achievements, challenges and Prospects. Ethiopian Institute of Agricultural Research (EIAR), Jima Agricultural Research Center (JARC), Jimma, Ethiopia. 2017;33:15-25.
  8. Chala J, Chemedi F, Girma A and Holger H. Coffee Leaf Rust Epidemics (*Hemileia vastatrix*) in Montane Coffee (*Coffea arabica* L.) Forests in Southwestern Ethiopia. *East African Journal of Sciences.* 2010;4(2):86-95.
  9. CSA (Central Statistical Agency). Agricultural Sample Survey for the 2018/2019 Crop Season. Volume I Report on Area and Production of Major Crops Private Peasant Holdings, Meher Season. Statistical Bulletin, FDRE/CSA, Addis Ababa, Ethiopia. 2019.
  10. Etana MB. Review on the Management of Coffee Berry Disease (*Colletotrichum kahawae*) in Ethiopia. *Journal of Food Science and Quality Management.* 2018;76:73-76.
  11. FAS (Foreign Agricultural Service/USDA), 2018. Coffee: World Markets and Trade. Available on: <http://www.fas.usda.gov/data/coffee-world-markets-and-trade> accessed on June, 2018.
  12. Girma A, Chemedi J, Arega Z, Tesfaye. Advances in coffee diseases research in Ethiopia. Increasing crop production through improved plant protection. Volume ii proceeding of the 14th annual conference of the plant protection society of Ethiopia. 2009;540:275-303.
  13. Hinkosa GG, Lencho A, Selvaraj T, Sadessa K. Pathogenicity and molecular characterization of coffee bacterial blight (*Pseudomonas syringae* pv. garcae van Hall) isolates from sidama and gedee zones, SNNP Regional State, Ethiopia. *International Journal of Life Sciences.* 2017;5(1):35-45.
  14. Kranz J, Mogk M. *Gibberella xylarioides* Heim et Saccas on Arabica coffee in Ethiopia. *Journal of Phytopathology.* 1973;78(4):365-366.
  15. Nagassa D, Alemayehu C, Kifle B, Elfinesh S. Morphological Characterization of *Corticium koleroga*, Cause of Thread Blight on Arabica Coffee. *Pharmaceutical Science and Technology.* 2020;4(2): 31-39. doi: 10.11648/j.pst.20200402.12
  16. Tadesse G, Zavaleta E, Shennan C, Fitzsimons M. Local ecosystem service use and assessment vary with socio-ecological conditions: A case of native coffee-forests in southwestern Ethiopia. *Human Ecology.* 2015;42:873-883.
  17. Teferi D, Ayano A. Assessment of commercially grown coffee types for their tolerance to bacterial blight of coffee (BBC) at Sidama and Gedee Zones, Southern Ethiopia. 2017;6:0.001-0.005.
  18. Teferi D and Belachew K. A review of coffee diseases research in Ethiopia. *International Journal of Agriculture and Biosciences.* 2018;7:65-70.
  19. Van der Vossen H, Bertrand B, Charrier A. Next generation variety development for sustainable production of Arabica coffee (*Coffea arabica* L.): a review. *Euphytica.* 2015;204:243-256.
  20. Waller JM Bridge, PD Black R, Hazika G. "Characterization of the Coffee Berry Disease pathogen, *Colletotrichum kahawae* sp. nov". *Mycological Research.* 1993;97(8):989-994. Doi: 10.1016/s0953-7562(09)80867-8
  21. Wassie A. "Integrated Disease Management on Coffee Wilt Disease Caused by *Fusarium Xylarioides* and its distribution in Ethiopia Review." *Agricultural Research & Technology: Open Access Journal.* 2019;23(3):302-308.
  22. Workafes W, Kassu K. Coffee production systems in Ethiopia. In: Proceedings of the workshop on control of coffee berry disease in Ethiopia; 1999 Aug 13–15, Addis Ababa. 2000, 99-107.
  23. Zenebe W, Daniel T Weyessa G. Characterization and virulence determination of *Colletotrichum kahawae* isolates from Gidami, Western Ethiopia. *Journal of Plant Science Phytopathology.* 2021;5:004-013. doi: 10.29328/journal.jpst.1001054
  24. Zeru A. Diversity of Arabica coffee populations in Afromontane rainforests of Ethiopia in relation to *Colletotrichum kahawae* and *Gibberella xylarioides*. 2006, 1-68.