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Review on the Management of Coffee Berry Disease (colletotrichum kahawae) in Ethiopia

Muluneh Bekele Etana (MSc.)
Samara University College of Dry land Agriculture Department of Horticulture P.O.box 132

Synopsis
Coffee (Coffae Arabica L.) is the major source of currency for Ethiopia and contributes more than 35% of the total export earnings. It is originated in Ethiopia. Coffee belongs to the family Rubiacea and the genus Coffea. The two main species of coffee cultivated on a world scale are Arabica coffee (Coffea arabica L.) and Robusta coffee (Coffea anaphora L.), which account for about 98-99% of the world coffee production. Even if the high production potential and economic importance of coffee production and productivity of crop is still limited due to its major disease; that is coffee berry disease which caused by Colletotrichum kahawae .It was first detected in 1922 in Kenya and covered all the main coffee growing areas of the country by 1951. The disease has been recorded to cause up to 80% yield loss, but on susceptible cultivar under favorable environment, 100% loose occur. Because of the seriousness of the problem two control measures under taken to coffee berry disease in Ethiopia, namely fungicide spraying and planting coffee varieties resistance to coffee berry disease. Therefore, the main objective of this seminar paper is to review on the management of coffee berry disease (colletotrichum kahawae) under Ethiopian condition.

INTRODUCTION

Coffee (*Coffea arabica L.*), is soft drink in the world which is originate is the most popular side in Ethiopia; it is currently grown in many countries. Over 2.25 billion cups are consumed every day (Ponte 2002). In Ethiopia agricultural sector plays a central role in the economic and social life of the nation. Around 80 to 85 % of people in Ethiopia are dependent on agriculture; among 80 to 85% about 40% of the sector contributes from cultivation of coffee. (Ghaiwat and Arora, 2014). Botanically, Coffee belongs to the family *Rubiacea* and the genus *Coffea*. The genus *coffea* consists approximately one hundreds species. The two main species of coffee cultivated on a world scale are Arabica coffee (*Coffea arabica L.)* and Robusta coffee (*Coffea anaphora L.*), which account for about 98-99% of the world coffee production. In fact, Ethiopia is the only center of origin and diversity of Arabica coffee. Arabica coffee is cultivated in most parts of the tropics, accounting for 80% of the world coffee market and about 70% of production.

Economically, coffee is the second most exported commodity after oil, and employs over 100 million people Worldwide (Petit 2007; Pedegrast 2010; Gray *et al*. 2013). The earlier use of coffee was as food, rather than as beverage. For instance, there are evidences which show that Oromo started using coffee as energy food long before its current popular use a beverage. There are also traditional beverages consumed locally, than the popular mode of consumption known worldwide. The traditional foods from coffee include coffee ball, bunaqalaa and qori, while traditional drinks are quti, hojja and chamo (Gole *et al.* 2013). It is the 2nd most valuable exported commodity on earth after oil. In socially, coffee is serving a respected guest; gathering neighbors to discuss economic, social and other matter. Coffee also used medicinal purposes; such as a good effect that is both temporary and transitory. Its stimulatory effect results in increased capacity for both mental activity and muscular work. (Alemayehu *et.al*, 2008).

More than 80 countries produce coffee in the world, and the total area of production in the country is estimated to be about 450,000-600,000ha.Average annual coffee production is estimated to about 350,000t and productivity of about 0.71t/ha. Ethiopia export only 40 to 45% of the total coffee it produced, 55-60% of coffee is consumed locally. Thus our country is 1st in Africa, 3rd in the world and Brazil is the leading country in exporting coffee to the world market. Many farmer particular in parts of kaffa and Ilulbabor were forced to cut or up root the coffee plants in order to grow food crops (Arega, 2006).

Despite the high production potential and economic importance of coffee production and productivity of crop is still limited due to several factors; such as shortage of adaptive cultivar and soil fertility status, diseases, insect, pest and weeds. Among this factors coffee berry disease caused by *Colletotrichum kahawae* , coffee wilt disease Caused by *Gebberella xylarioides* and coffee Leaf disease caused by *Hemileia vastatrix* are the three most important and destructive diseases threatening coffee production in Ethiopia. However, coffee berry disease is the most serious problem of coffee production. The disease is an anthracnose of green and ripe berries induced by *Colletotricumkahawae.* McDonald first detected coffee berry disease in 1922 in Kenya. The disease has been recorded to cause up to 80% yield loss, but on susceptible cultivar under favorable environment, 100% loose occur. Because of the seriousness of the problem two control measures under taken to coffee berry disease in Ethiopia, namely fungicide spraying and planting coffee varieties resistance to coffee berry disease (Prihastuti *et.al,* 2009). Therefore, the main objective of this seminar paper is to review on management of coffee berry

disease (*colletotrichum kahawae*) under Ethiopian condition.

2. LITERATURE REVIEW

2.1. Coffee Berry Disease

Coffee berry disease is a major cause of crop loss of Arabica coffee in Africa and a dangerous threat to production elsewhere. The disease is an anthracnose of green and ripe berries induced by Colletotricum kahawae. The pathogen is an ascomycete that reproduces sexually and asexually. The asexual spores (conidia) are stored within acervuli. The asexual spores (conidia) are stored within acervuli. .Mc Donald first detected coffee berry disease in 1922 in Kenya causing about 75% crop loss.

According Jirata and Assafa, (2000) a high rain fall , high air humidity or wetness and relatively low temperature that persist for long periods favour coffee berry disease development and the disease is invariable severe at high altitudes where these condition generally prevail. High humidity and temperatures between 20 and 22 degrees Celsius are conducive for germination and appresorium formation.

2.1.1 .Disease Cycle

The fungi can infect the plant during any stage from the flower to the berry (Silva *et.al*, 2006).Mummified berries, twig bark, and dead branches are considered to be primary inoculum sources for the disease. Colletotrichum conidium germination can occur 24 hours after conidia enter into contact with the tissues of the host plant. There then follows elongation of the germ tubes, whose apical section later differentiates into an appressorium. The infection hyphae arising from those appressoria then colonize the fruit, causing necrosis of the tissues on which new acervuli form (Silva and Diogo, 2010). Many berries drop prematurely, but berries that remain attached serve as a source of secondary inoculum. Most conidia are dispersed by rainfall. It is unknown what part of the pathogen survives between seasons. There is a sexual stage, but it does not play a role in the spread of coffee berry disease (Mouen *et al*, 2010).

2.1.2. Host and symptom of coffee berry disease

The only current host for Colletotrichum kahawae is Coffeaarabica. Common symptoms are dark, necrotic, sunken spots and brown, superficial lesions. Coffee Berry Disease affects green berries and causes premature fruit drop and mummified or damaged fruits Coffee Berry Disease affects green berries and causes premature fruit drop and mummified or damaged fruits (Manuel *et .al,* 2010).

Signs of orange-colored acervuli on the fruit, bark, and dead branches have been recorded. Signs of orange-colored acervuli on the fruit, bark, and dead branches have been recorded. (Mouen *et .al,* 2010).

2.1.3. Loss of yield by coffee berry disease

Bayetta, (2001) reported that the national average yield loss due to the disease in Ethiopia is estimated to 20-25 %,and also he reported that the loss may reach 100% during favorable seasons in some areas were altitude and rain fall are high.

Nicto (1999) reported that crop season provenance of coffee berry disease was conducted Oromia region and south nation nationalities and people and the result indicated that 38.8% and 17.2% of mean percent prevalence of disease, respectively.

2.1.4. Coffee berry disease management in Ethiopia.

Current methods for control of Coffee Berry Disease are resistance and fungicide. Resistant genes have been found in three cultivars; Rume Sudan, Hibrido de Timor, and K7. The Catimorvariety has also shown resistance similar to that of Hibrido de Timor. (Omondi *et. al*, 2001).The only one of these resistant varieties that is used commercially is Catimor. An issue with fungicide is that in order to be effective it requires 7-8 applications per year, which can be laborious and expensive (Manuel *et. al*, 2010). Coffee berry disease's chemical control may account for up to 45% of the annual cost of production. Despite such elaborate control measures, losses as high as 50% of the potential crop may still occur under unfavorable weather conditions. *Colletotrichum kahawae* has been shown to produce less disease when shaded by fruit trees, as the fruit trees prevent rainfall from falling on berries, thus preventing dispersal of conidia (Bedimo *et.al*, 2008).

To exploit differences in resistance within the indigenous coffee production, establishment of an appropriate selection program was necessary. Based on the assumption that resistance is horizontal, since all levels of disease intensities had been observed during the 1971 and 1972 survey, and based on Robinson designed 'crash selection' to identify resistant genotypes in the shortest time possible. It was called the crash program because the normal procedure was ruled out and multiple step wise activities were simultaneously under taken to shorten the peroid of selection as sited by (Derso *et.al,* 2000).

The implementation of the selection program was begun in 1973 as a matter of urgency. Selection program was carried out from 1973 to 1975 for different areas heavily infected with coffee berry disease, but farmers and agents of the ministry of coffee and tea development actively participate in the identification of mother tree in the field (Arega, 2006).

During the three years period, thousands of trees were inspected from which altogether about 649 mother trees were choose and retained as selection. The selection mother trees in each year were immediately to field

observation plus detached berry tests and seedling inculcation tests in the laboratory. Observation for yield, quality and other diseases and pests incidence were made. Seeds were collected and sown for possible multiplication in the same year (Derso*, et.al,* 2000).

Fungicide screening program was started as early as the year of coffee berry disease out break1972.The success of chemical control of coffee berry disease depends on the protection of the immature and developing coffee berries throughout the rain season Time and frequency of fungicide applications depends on epidemiology of pathogen and ontogeny of coffee berry development .Thus, timely applications and appropriate volume of spray provides effective control (Bayetta, 2001).Fungicide spray in Ethiopia starts six weeks after main flowering, usually at flowering for mid Januaryto march developing on the rain fall pattern that affect blossoming and the consequent berry envelopment. In areas were shortage of water does not occur high volume of 750-1000ml/tree. (Alemu, 2001)

SUMMARY AND CONCLUSIONS

Coffee plant is a plant which grows in all over the world particularly in Ethiopia. Coffee belongs to the family *Rubiacea* and the genus *Coffea.* It consists approximately one hundreds species. But the two main species of coffee cultivated on a world scale are Arabica coffee *(Coffea arabica* L.) and Robusta coffee (*Coffea anaphora L.),* which account for about 98-99% of the world coffee production. From these arabica coffee (*Coffea arabica L.*) the most species, which is originated in Ethiopia. It has many importances in economically, socially and medicinally. It gives high product, but it reduces its product due to coffee berry disease. Coffee berry disease is the most important disease that affects the Ethiopian coffee production if not controlled by fungicide and resistance varieties. Control of coffee berry disease by resistance cultivars is by far advantages over the use of fungicide, because the cost of fungicide is beyond the purchasing of all farmers, difficulty of organic coffee on the world market. On the other hand, it is difficult to supply the few limited coffee berry resistance cultivators to all regions due to adaptation.

Future Prospects

In Ethiopia, coffee farmers are not mostly able to apply fungicide for control of coffee berry disease due to the high relative costs of fungicides, and they have not enough knowledge about how to control coffee berry disease by cultivating resistant cultivar. Therefore, it should be search for another control method for the future which includes integrated management system in order to produce premium quality product and get high profit.

References

Alemayehu T., Esayas K, and Kassu K., (2008).Coffee Development and Marketing Improvement plan in Ethiopia. In: GirmaAdugna, BayettaBelachew, TesfayeShimber, EndaleTaye, TayeKufa(eds). Coffee diversity and knowledge Proceedings of National Workshop Four Decades of Coffee Research and Development in Ethiopia. Addis AEthiopia, pp. 375-381

Alemu,(2001)The status of coffee berry disease in minor coffee growing regin.Inproceedingof workshop on control of coffee berry disease in Ethiopia.13-15 August1999, pp 29-35 Addis Ababa, Ethiopia

Arega Zeru, (2006). Diversity of Arabica coffee population in Afromontane rain forest of Etiopia in relation to Colletotrichumkahawae and Gibberellaxylaroidus.Msc Thesis.Addis Ababa University, Etiopia.

Arega, Alemu.T and Sokar.I.(2000).The status of coffee berry disease in minor coffee growing region. In proceeding of the work shop on control of coffee berry disease in Ehiopia.13-15 August 1999,AddissAbeba Ethiopia.

Bayetta Bellachew.2001 .Arabica coffee breeding for yield and resistance to coffee berry disease PH.D. Thesis is submitted to imperial college at wye university of london.London,pp 54-77.

Bedimo, J. A. Mouen; Njiayouom, I.; Bieysse, D.; Nkeng, M. Ndoumbè; Cilas, C.;Nottéghem, J. L. (2008). "Effect of Shade on Arabica Coffee Berry Disease Development: Toward an Agroforestry System to Reduce Disease Impact".Phytopathology. 98 (12): 1320–1325. doi:10.1094/PHYTO-98-12-1320. ISSN 0031-949X.

Derso, Adugna and Gebrezgi (2000) .Control of coffee berry disease by fungicide in Ethiopia. In processing of the workshop on control coffee berry disease in Ethiopia,13-15 August 1999 pp 35-47 Addis Ababa ,Ethiopia.

Gole, T.W., Teketay, D. and Kelbessa, E. 2013. Coffee is Ethiopia's gift to the world. In Coffee-a global success (H.W. Lack, K. Grotz and Tadesse W. Gole, eds.). PP 12-19, Botanischer Garten and Botaniches Museum Berlin-Dahlem, Berlin.

Gray, Q., Tefera, A., and Tefera, T. 2013. Ethiopia: Coffee Annual Report. GAIN Report No.ET 1302.

Jirata and Assafa,(2000). The status of coffee berry disease in Ormiya .In processing of the workshop on control coffee berry disease in Ethiopia 13-15 August 1999.Addis Ababa ,Ethiopia .pp118.

Manuel, Luzolo; Talhinhas, Pedro; Várzea, Vítor; Neves-Martins, João (2010). "Characterization of

Colletotrichumkahawae isolates causing coffee berry disease in Angola". Journal of Phytopathology. 158 (4): 310–313. doi:10.1111/j.1439-0434.2009.01613.x

Mouen Bedimo, *et.al* (2010). "Role of rainfall in the development of coffee berry disease in Coffeaarabica caused by Colletotrichumkahawae, in Cameroon".Plant Pathology. 59 (2): 324–329. doi:10.1111/j.1365-3059.2009.02214.x. ISilva, Diogo N (2010). Analysis of the neutral and adaptive genetic variation of Colletotrichumkahawae and its relationship with the C. gloeosporioides complex. Lisbon: University of Lisbon. p. 102.SSN 0032-086

Omondi, C.O.; Ayiecho, P.O.; Mwang'ombe, A.W.; Hindorf, H. (2001). "Resistance of Coffeaarabica cv. Ruiru 11 tested with different isolates of Colletotrichumkahawae, the causal agent of coffee berry disease". Euphytica. 121 (1): 19–24. doi:10.1023/A:1012056622969. ISSN 0014-2336.

Pendergrast, M. 2010. Uncommon grounds: The history of coffee and how it transformed our world, Basic Books, New York, 424p.

Petit, N. 2007. Ethiopia's Coffee Sector: A Bitter or Better Future? Journal of Agrarian Change. Vol. 7: 225–263.

Ponte, S. 2002. The 'Latte Revolution'?Regulation, Markets and Consumption in the Global Coffee Chain. World Development 30: 1099–1122

Prihastuti, H; Cai, L; Chen, H; McKenzie, EHC; Hyde, KD (2009). "Characterization of Colletotrichum species associated with coffee berries in northern Thailand" (PDF). Fungal Diversity. 39: 89–109

Silva, Diogo N (2010).Analysis of the neutral and adaptive genetic variation of Colletotrichumkahawae and its relationship with the C. gloeosporioides complex. Lisbon: University of Lisbon. p. 102.SSN 0032-0862

Silva, Maria do Céu; Várzea, Victor; Guerra-Guimarães, Leonor; Azinheira, Helena Gil; Fernandez, Diana; Petitot, Anne-Sophie; Bertrand, Benoit; Lashermes, Philippe; Nicole, Michel (2006). "Coffee resistance to the main diseases: leaf rust and coffee berry disease". Brazilian Journal of Plant Physiology. 18 (1): 119–147. doi:10.1590/S1677-04202006000100010. ISSN 1677-0420

S. N. Ghaiwat and P. Arora, "Detection and Classification of Coffee diseases Using Image processing Techniques", A Review, vol. 2, no. 3, (2014).