Ukrainian Journal of Ecology

Ukrainian Journal of Ecology, 2023, 13(3), 20-27, doi: 10.15421/2023_435

ORIGINAL ARTICLE

Assessment of major fruit diseases and insect pests in silte, gurage and yem special woreda, southern Ethiopia

M. Kebede*, K. Bamud

Southern Agricultural Research Institute, Werabe Agricultural Research Center, P.O. Box 21 Werabe, Ethiopia

**Corresponding author E-mail: metaekebae2014@gmail.com*

Received: *15 March, 2023; Manuscript No: UJE-23-92933;* ***Editor assigned:*** *17 March, 2023, PreQC No: P-92933;* ***Reviewed:*** *28 March, 2023, QC No: Q-92933;* ***Revised:*** *03 April, 2023, Manuscript No: R-92933;* ***Published:*** *10 April, 2023*

Fruit crops are important both for health and economy; but the amount and mode of production is still weak in Ethiopia. This is because of various diseases and insect pests attack which reduce the quantity and quality of the product. The field survey was carried out in 2022 production season in major fruit crop of avocado, mango, orange and papaya at Silte, Gurage and Yem special woreda with the objectives of assessing the distribution of major diseases and insect pests. The survey result revealed that the highest mean infection of Anthracnose (16.7%, 31.6% and 14.7%,) were recorded from avocado, mango, and papaya, respectively. Whereas, the maximum mean severity of powdery mildew (19.2%, 27.7%, 16.5% and 11.3%) were recorded from avocado, mango, orange and papaya, respectively. The prevalence of orange scab and canker disease were 41.3% and 58.2%, respectively. Conversely, the mean intensity of mango white scale (*Aulacaspis tubercularis*) and woolly whitefly (*Aleurothrixus Floccusus*) of orange were 17.2% and 9.3%, respectively. The current results provide information on the magnitude of the damage due to different diseases and insect pest of fruit crop and will be useful to direct future disease management strategies. Thus, requests the need of management strategy that targets in reducing the occurrence of major diseases and insect pest infestation with various integrated pest management practices through considering the sustainability of farming system.

Keywords: Disease, Fruit crop, Insect pest, Prevalence, Severity.

Introduction

Ethiopia has suitable agro ecological conditions for the production of various tropical and sub-tropical fruit crops. Fruit crops make a significant direct contribution to small-scale subsistence farmers by providing an important source of nutritious food that is often available when other agricultural crops have not yet been harvested. It is also the most important potential crop for domestic, export markets and industrial processing. In Ethiopia fruit crop grown most importantly in different parts of the country. In Ethiopia about 161,470.8 hectares of land is covered with fruit crops out of the total cropland area under small peasant holders (CSA 2021). Of this cultivated land for the production fruit crops, Bananas, Mangoes, Avocados, Papayas, and Oranges occupied 63.30, 10.66%, 17.29%, 5.07% and 2.81% of the fruit production, respectively (CSA 2021).

In central zones of southern Ethiopia (Silte, Gurage and Yem special woreda) have divers' agro climatic conditions which range from lowland areas to moist highland areas, which make the zone suitable for fruits growing. Mango, avocados, orange and papaya are the fruit crops that are grown in the areas. Despite the nutritional and health benefits of these fruit crops, the production and productivity decrease over time due to different reasons. Small-scale cultivation systems and poor pre- and post-harvest management techniques contributed to lower yields of fruit crops in the areas. Other factors such as diseases and insect pests, attack are the major yield limiting constraint of fruit crops. Various fungal, bacterial, viral, nematode, insect pests and less likely

binding weeds seriously threaten the production and productivity of fruit crop in the areas. Fungal and bacterial disease namely, (Anthracnose, Powdery mildew and rust) on mango, (Anthracnose, dieback) on avocado, Scab (fruit and leaf), *Phytophthora* trunk canker, Leaf spots, Anthracnose, Powdery mildew and Sooty mold on citrus are some of the reported diseases by many literatures. There are several management approaches to reduce the yield losses due to diseases and insect pests in fruit crops including the use of improved varieties. However, an improved variety was not addressed enough in huge amount for many years. Although some fruits varieties were released, some were registered and others were recommended during the past many years (Herath et al., 1994; Seifu, 2003; Edossa et al., 2008; Asfaw and Derbew, 2013). Nowadays, the government of Ethiopia give special emphasis in crop intensified strategically important crop like avocado to produce in vast amount to increase the productivity per unit area of land. However, diseases and insect pest attack are the major yield limiting factor for fruit consumption, market and fruit processing industry. In addition the economic importance of each diseases and insect pest across location has not been documented previously. Knowledge based identification of diseases and an insect pest is important for appropriate surveillance and effective management strategies against the existing diseases and insect pests. For this purpose, the present study was designed with the objectives of assessing and documenting the distribution and intensity of major diseases and insect pest of fruit crop in central zone of southern Ethiopia.

Materials and Methods

Description of the Study Areas

Field survey was conducted in 2022 production seasons at Cheha, Meskan, Silti and Yem special woreda in southern Ethiopia. The surveyed areas have divers' climatic condition, ranging from the mid land to moist highland, making the zone suitable for very different kinds of fruits production. The study areas were characterized by bimodal rainfall, the short rainy season extending from March to May and the main rainy season from June to September. Surveyed areas differ in their geographical attributes (Fig. 1 and Table 1).

Table 1. Geographical description of the survey areas.

Location	Altitude (m.a.s.l.)	Latitude (N)	Longitude (E)
Cheha	1939-2159	08°10''146' to 08°06''223'	037°52''375' to 037°57''047'
Meskan	1915-2153	08°12''178' to 08°60''472'	038°27''370' to 038°19''701'
Silti	1809 -2132	07°59''484' to 08°00''491'	038°22''356' to 038°19''252'
Yem	1921-2346	07°03''723' to 07°56''363'	037°32''227' to 037°30''563'

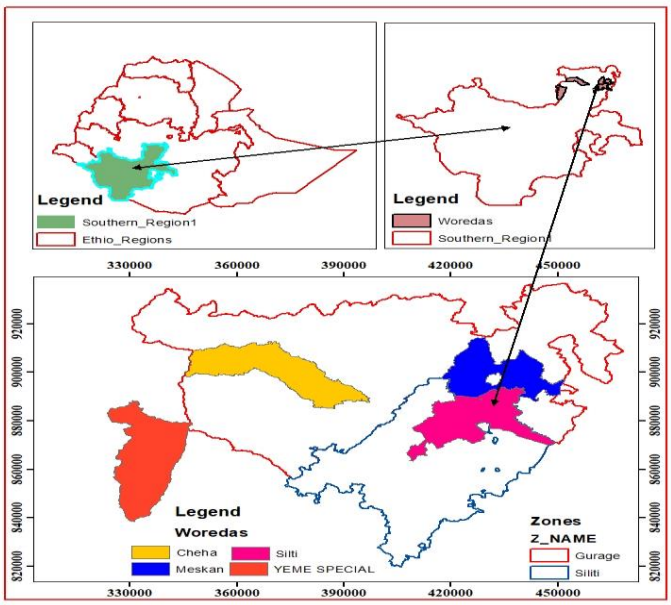

Fig. 1. Map showing the study areas.

Diseases and insect pest assessment techniques

During assessment a total of 64 farmers field and respondents were randomly selected from Silti, Meskan, Cheha and Yem special Woredas to determine the distribution of diseases and insect pests in each fruit crops. A questionnaire was used to collect information on diseases and insect pest in each fruit crop. Data on diseases incidence and severity were recorded from each fruit crops. A powdery mildew rating scale of 0 to 4 was used for each fruit crops and converted to a percentage and the remaining diseases types were expressed in percentage. Disease severity was assessed as average fruit areas covered by the disease symptoms form five randomly selected diseased plants per field. During assessment diseases identification was determined visually based on their symptom. Similar trend was used for identification of the insect pest. The formula for calculating the diseases prevalence, incidence and severity were:

Prevalence (%)=[(No of fields affected)/(Total fields assessed)] × 100

Disease incidenc=[(Number of inffected plant)/(Total number of plant assessed)] × 100

Disease severity=[(Area of plant tissue affected)/(Total area of plant tissue examined)] × 100

Results and Discussion

Framers in surveyed areas produce fruit crops for different reasons. Farmers produce fruit crops for consumption, market, fire wood, as a construction material and for soil and water conservation. However, various fruit crop production constraint was assessed during surveying time. Unavailability of improved planting material, absence of improved agronomic practises, diseases insect pest and market problem are some of the major production constraint of fruit crops in surveyed areas. Farmers are very much disappointed by the longer time of some fruit crop to bear fruit. Inadequate water supply during dry period affected the physiological process of fruit crop that indirectly reduce fruit production. Lack of market to absorb the production; large number of middlemen in the marketing system; absence (weakness) of marketing institutions safeguarding farmers' interest and rights over their marketable produces (e.g., cooperatives); lack of coordination among producers to increase their bargaining power; imperfect pricing system of traders was a major problem to producers. The lack of awareness on post harvest management and traditional production system has been the other production constrain of fruit crop in surveyed areas. Similarly, (Emana, 2007) reported that the traditional methods of fruit crop production in small scale in their small sort of lands. Disease and insect pests attack are the main biotic constraints of fruit crop production of surveyed areas. These diseases and insect pest contributed for post-harvest losses which reduced the quality and quantity of the fruit. Similarly, (Akem, 2006) reported that the economic and quality loss of fruit crop due to post harvest diseases. The major production constraint of fruit crop is presented in Fig. 2.

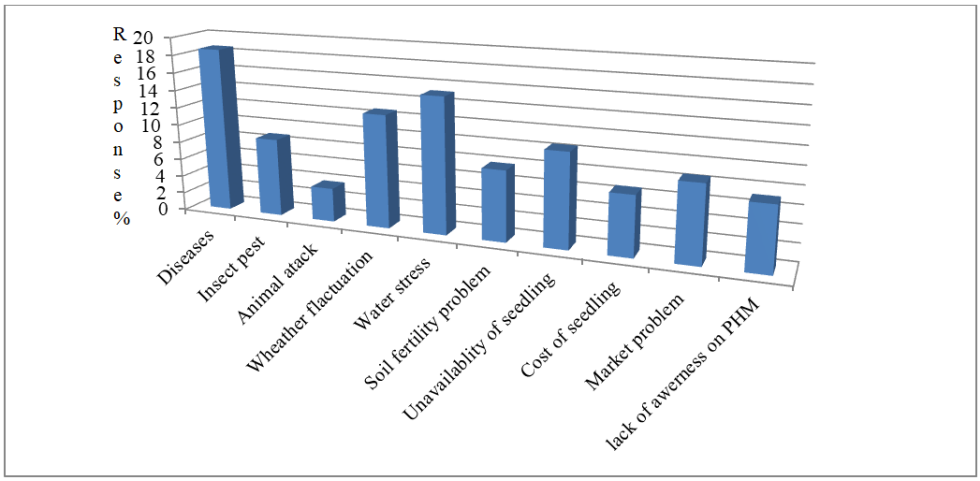

Fig. 2. Major Fruit crop production constrain in surveyed areas (%).

Various fruit crops diseases were prevalent in all the surveyed areas with different magnitude of infection. During assessment about seven diseases were recorded in surveyed areas on selected fruit crops. Anthracnose of avocado was one of the disease assessed in mid and highland agro ecology of surveyed areas. Nevertheless, the prevalence, incidence and severity varied across the locations.

The maximum diseases prevalence and mean incidence of avocado anthracnose were 23.4% and 11.3%, respectively. While disease severity ranged from 0-25% with a mean severity of 16.7%. Powdery mildew was the other disease observed in most avocado farms. The incidence of powdery mildew of avocado ranged from 0-30% with the mean incidence of 14.5%. While, disease severity ranged from 2.5-35% with a mean value of 19.5%.

Mango anthracnose was the most widely distributed disease during assessment. The disease affected the inflorescence, young leaves, branch and fruit from new to old plant in most surveyed fields. The maximum prevalence and mean incidence of mango anthracnose were 76.3% and 58.5%, respectively. On the other hand the diseases severity ranged from 15-70% with mean severity of 31.6%. Based on the result of survey prevalence of mango anthracnose was relatively higher as compared to the prevalence of other fruit crop disease. This might be due to the fact that wider virulence spectrum of the pathogen across different location. In addition framers in surveyed areas does not use any control strategies to reduce the development of the disease this also helped for wider virulence spectrum of the pathogen. There were also variations on disease level of anthracnose across different environment. These variations might be due to the prevailing environmental conditions.

Similarly, (Kranz and Rotem, 1987; Estrada, et al., 2000; Tarekegn, et al., 2006; Harikrishnan and Delo Rio, 2008) reported that the effect of weather parameters, such as rainfall and temperature on the development of plant diseases in different pathosystems. Mango powdery mildew was the other recorded disease at both Cheha and Mskan woreda. The maximum disease prevalence, mean incidence and severity of mango powdery mildew were 71.3, 41.6% and 27.7%, respectively. The disease was observed on flower part of the plant, young shoots and fruit. During assessment unfertilized flowers of mango were dropped on the ground due to the disease.

Few farmers in surveyed areas spray available chemical like Tilt 250 EC to disease as a control option but, their effectiveness is not quantified properly. Adoption of effective chemical utilization is mandatory to control powdery mildew and other fungal disease of fruit crop through considering other cultural practice like selective pruning and phytosanitary to reduce inoculum and the spread of the disease.

Orange plant production was practised in few pocket areas like Meskan and Cheha woredas. Citrus Canker, scab and powdery mildew are the major citrus diseases obtained in the study areas. Orange canker was one of a ravaging bacterial disease recorded in most surveyed areas which threatening orange tree production. The mean average incidence and severity of the disease were 19.8% and 21.6%, respectively (Table 2).

The disease resulted in premature leaf and fruit drop, twig dieback, eventual decline, and blemished citrus almost in all surveyed areas. The disease was appeared on both the upper and lower canopies of the leaf in all surveyed areas. Moist weather condition and the distribution of windblown rains in the areas might be contributed for the development of orange canker disease. In addition rapid and easy spread of the pathogen and the complexity of pathogenic profile could also provide for observation of the disease in many areas. Farmer in the areas does not use any control measure against this disease which help for multiplication of the pathogen. Orange scab was the other major disease assessed in the study areas. The incidence and severity of the disease ranged from 0-30% and 0-45%, respectively (Table 2).

The disease affects the fruit, leaves and twigs of susceptible varieties of orange. Long periods of humidity might be favoured the development of disease in the study areas. Premature fruit was dropped on the ground in most orange field due to scab disease. Very few farmers in the study areas apply fungicide like Tilt 250 EC as a control measure but, response from farmers feedback showed that the applied chemical does not give substantial measure against orange scab disease. Powdery mildew of orange caused by Acrosporium tingitanium was the other fungal disease recorded in the study areas. The maximum mean diseases incidence and severity of diseases were 11.3% and 16.5% respectively (Table 2).

Papaya Anthracnose, caused by Colletotrichum gloeosporiodes as an important fungal disease assessed almost in all surveyed areas. The prevalence, mean incidence and severity of disease were 69.4, 22.3 and 14.7% respectively (Table 2). Based on assessment result percentage of infection on the leaves were higher than that of the fruits. However the disease was aggravated on the fruit at maturity and ripening stage, in few surveyed fields. During assessment period there was weed infestation in some papaya field which can be contributed as indirect effect on diseases development by reducing air circulation cause for the increment of relative humidity and the temperature which are conducive for the outbreak of disease. However, few farmers practiced field sanitation for management of papaya anthracnose through removing infected plant part and weed management. The result of research finding is

similar with the finding of (Yesuf, et al., 2001) who reported that the importance of field sanitation measure as integrated disease management strategy against papaya anthracnose. Papaya powdery mildew was also observed in most papaya frames. We are easily recognized the occurrence of diseases through the presence of a white, superficial symptom on leaf surfaces. The disease severity ranged from 0-30% with mean value of 11.7%. Based on assessment result the occurrence of most of fungal diseases was started on the field and more developed during storage time which contributed for post harvest loss. Similarly, different reports suggested that the postharvest loss of most fruit crops started at the farmers' field immediately after they harvested and continued at the wholesaler, retailers, and consumers level (Irtwange, 2006).

Table 2. Diseases prevalence, incidence and severity on each fruit crop in surveyed areas.

Fruit Type	Diseases	Pathogen	Pre (%)	INC (%)		SEV (%)	
				Range	Mean	Range	Mean
Avocado	Powdery mildew	*Oidium spp*	39.1	0-30	14.5	2.5-35	19.2
	Anthracnose	C.gloeosporoides	23.4	0-15	11.3	0-25	16.7
Mango	Anthracnose	*C.gloeosporioides Glomerella cingulata*	76.3	5-95	58.5	15-70	31.6
	Powdery mildew	*Oidium mangiferae*	71.3	25-80	41.6	35-55	27.7
Orange	Scab	*Elsinoë fawcettii*	41.3	0-30	14.5	0-45	11.5
	Canker	*Xanthomonas citri*	58.2	0-55	19.8	0-40	21.6
	powdery mildew	*Acrosporium tingitanium*	26.9	0-20	11.3	0-25	16.5
Papaya	Anthracnose	*C.gloeosporioide*	69.4	0-40	22.3	0-20	14.7
	powdery mildew	*Oidium caricae*	47.7	0-30	16.9	0-30	11.3

Pre=prevalence (%), INC=Incidence (%), SEV=Severity (%).

Mango white scale insect was the major insect pest attack mango plant almost in all surveyed fields. The insect has been easily identified through elongate hard scales with pinkish active crawlers on leaves, twigs and panicle. The prevalence and mean intensity of white scale inset were 64.3% and 17.2%, respectively (Table 3).

The distribution and intensity of white scale insect was relatively varies among the locations. This might be due to the fact that the prevailing weathers conditions and the temperature requirement of the insect for the reproduction which significantly influenced the population density of the insect. There was high population of white scale insect in lower altitudinal area of surveyed field which significantly reduce the marketable yield and quality of the produce. Similarly (Bakry and Tolba, 2018) reported that the significant yield loss from high population density and incidence of the insect in Egypt. Special attention should be taken in to account for mango whit scale inset because it is an extremely destructive disease that can cause drastic reduction in yield and even a total decline of the tree in some farmers field in lower altitudinal areas. Woolly white fly was one of the insect observed on orange plant in the study areas that are plaguing citrus plantation leading to economic loss. The prevalence and intensity of woolly white fly were 15.2% and 9.3% respectively (Table 3).

The distribution and intensity of woolly white fly was different across locations. This could be due to the difference among agro climatology of the areas for distribution and abundance of insect. Climate change is expected to trigger the changes in diversity and abundance of arthropods, geographical and temporal distribution of insect pests, insect biotypes, herbivore plant interactions, activity and abundance of natural enemies, species extinction, and efficacy of crop protection technologies which in turn will have a major bearing on food and nutritional security.

Table 3. Insect pest infestation on mango and orange fruit crops.

Crop type	Insect	Scientific name	Prevalence	Mean intensity
Mango	White scale	*Aulacaspis tubercularis*	64.3	17.2
Orange	Woolly white fly	*Aleurothrixus Floccusus*	15.2	9.3

Conclusion

The production of fruit crop is in its infant stage particularly in central zone of southern Ethiopia. Different diseases, insect pest and other production constraints are contribute to the low production of fruit crops in the areas. Among these diseases of Mango and Papaya Anthracnose, Orange canker, powdery mildew of mango avocado and papaya are the most common diseases of fruit crops in the areas. Mango white scale and wooly white fly of citrus is the other economically important insect pest that can cause tremendous yield loss in the areas. The presence of more than one disease at different growth stages in each fruit crop has been complex to quantify yield losses due to disease. In addition growth stage, cultivar diversity and prevailing weather are expected to be the major factor influenced the distribution of major diseases and insect pest in the study areas. Due to the knowledge gap in identifying important diseases and insect pests, fruit growers do not adequately handle the post harvest management options. Thus, the current available technology should be addressed to small scale fruit growers which have to be extended by the extension agents. In addition integrated approach for management of diseases and insect pest is required through considering different intervention (use of resistance varieties, improved agronomic practices, awareness creation for farmers and experts from site selection to post-harvest handling) approach to reduce the complex diseases in the studied areas. However, further diagnosis of the major diseases of fruit crops is critical to the development of more effective disease management recommendations and strategies.

Acknowledgement

The authors thank the southern agricultural research institute for the facilities and financial support that made this work possible.

References

Akem, C.N. (2006). Mango anthracnose disease: Present status and future research priorities. Plant Pathology Journal, 5:266-273.

Asfaw, Z., Derbew, B. (2013). Grapevine review: The fruit of great antiquity, unique nature and remuneration potential. Proceedings of the Fourth Biennial Conference of Ethiopian Horticultural Science Society, Ambo, Ethiopia, pp:262-281.

Bakry, M., Tolba, E.F. (2018). Relationship between the population density of the white mango scale insect, Aulacaspis tubercularis (Newstead)(Hemiptera: Diaspididae) and the yield loss of mango trees in Luxor Governorate, Egypt. Journal of Phytopathology and Pest Management.

CSA. (2021). Agricultural sample survey: Report on area and production of major crops (Private peasant holdings, Meher Season). Addis Ababa, Ethiopia, 1:14.

Derso, E., Sijam, K. (2007). Citrus canker: a new disease of Mexican lime (Citrus aurantifolia) and sour orange (C. aurantium) in Ethiopia. Fruits, 62:89-98.

Edossa, E., Lemma, A., Dereje, T. (2008). Review on the status of some tropical fruits. Proceedings of the Inaugural and First Ethiopian Horticultural Science Society Conference, Addis Ababa, Ethiopia, pp:39-44.

Emana, B., Gebremedhin, H. (2007). Constraints and opportunities of horticulture production and marketing in eastern Ethiopia. DCG Report.

Estrada, A.B., Dodd, J.C., Jeffries, P. (2000). Effect of humidity and temperature on conidial germination and appressorium development of two Philippine isolates of the mango anthracnose pathogen Colletotrichum gloeosporioides. Plant Pathology, 49:608-618.

Harikrishnan, R., Rio, L.D. (2008). A logistic regression model for predicting risk of white mold incidence on dry bean in North Dakota. Plant Disease, 92:42-46.

Irtwange, S.V. (2006). Application of modified atmosphere packaging and related technology in postharvest handling of fresh fruits and vegetables. Agricultural Engineering International: CIGR Journal.

Kranz, J., Rotem, J. (2012). Experimental techniques in plant disease epidemiology. Springer Science and Business Media.

Gebre Mariam, S. (2003). Status of commercial fruit production in Ethiopia. Ethiopian Agricultural Research Organization.

Tarekegn, G., McLaren, N.W., Swart, W.J. (2006). Effects of weather variables on grain mould of sorghum in South Africa. Plant Pathology, 55:238-245.

Yesuf, M. (2013). Pseudocercospora leaf and fruit spot disease of citrus: Achievements and challenges in the citrus industry: A review.

Kebede, G., Kabeto, E.G., Dagnew, A. (2021). Distribution and identification of anthracnose of papaya caused by Colletotrichum gloeosporioides in the central rift valley of Ethiopia. Plant Protection, 5:139-147.

Citation:

Kebede, M., Bamud, K. (2023). Assessment of major fruit diseases and insect pests in silte, gurage and yem special woreda, southern Ethiopia. *Ukrainian Journal of Ecology.* 13:20-27.