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Seasonal incidence of insects and diseases on okra (*Abelmoschus esculentus*) crop in zoba Anseba

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Abstract

Okra (Abelmoschus esculentus) is one of the important vegetable crops of Eritrea and many insect pests and diseases infest the crop from germination up to harvesting. The field trail was conducted at Hamelmalo Agricultural College in okra crop to study the seasonal incidence of pest and diseases. Insects such as aphid, leafhopper, spotted bollworm and dusky cotton bug were noticed on the crop whereas plant diseases like powdery mildew and okra blight infested the crop. The maximum average population of aphids/plant was 143 with (r = 0.452) and its population increased from December to March. The jassid population was non-significantly affected the okra but maximum population (13 leafhoppers/plant) was recorded during February. The maximum number of spotted bollworm was 7 larva?/plant. The dusky bug population was 0.6 and 11 per plant during February and March, respectively. The natural enemies, lady bird beetle and sirphid fly, were recorded but their population were non-significant with (r=0.800) and (r = 0.316) with maximum and minimum temperature. The incidence of powdery mildew and okra blight appeared during February and their severity increased till harvesting period. The overall disease complexes were found 85% per plant.

Keywords: Incidence, infestation, insect, disease, okra, temperature, Eritrea.

Introduction

Okra, *Abelmoschus esculentus* (L) Moench, is one of the major vegetable crops of the tropical and subtropical regions of the world and cultivated commercially in West Africa, South East Asia, Southern United States, Brazil, Turkey, and Northern Australia. Okra production is estimated to be 4 million tonnes throughout the tropical, subtropical and Mediterranean climates and contributes about 4% of the total vegetable consumption in most of the developing countries[1]. An average yield of okra varies from 6.5-7.5 t/ha of green fruits during the dry season and 11.5-12.5 t/ha during the rainy season. In Eritrea, okra is an important vegetable crop of summer and rainy seasons, grown in almost all agro climatic conditions. The production and productivity of okra varies from region to region and season to season. Eritrea has the production potential in area of 700 ha and the average yield was 5.5 t/ha was reported[2]. There are 30-40 insect pests known to attack okra crop and cause accountable damage[3]. The major insects include cotton jassids, *A. biguttula biguttula* (Ishida), spotted bollworm, *Earias insulana* (Fabr.), pink bollworm, *Pectinophora gossypiella* (Saunders) and cotton whitefly, *Bemisia tabaci* (Genn.). There are some major diseases which are affecting the production of okra, i.e. powdery mildew, okra mosaic virus, *Cercospora* leaf spot, fusarium wilt, verticillum wilt, ect. In Eritrea, the low productivity is because of unavailability of good quality of seeds, lack of fertilizers, poor management of diseases and pests. Most of the farmers, who are engaged in okra production lack technical knowledge and farm management practices. There are many biotic and abiotic factors that limit the production of okra. Present studies have been conducted to record the incidence of pests and diseases during cropping season and the results may be useful for sustainable management practices of okra crop.

Material and Methods

Soil and land preparation: The soil of the experimental field was sandy loam with poor organic matter content, which had been under potato cultivation for the last season. The field was properly ploughed once with disc-plough and then all other subsequent operation including leveling and sunken beds of 3m x 3m size were prepared with the provision of channels and subchannels for the irrigation. Between the plots, 1 m buffer was given and treatments were arranged in RCBD design with four treatments with three replications each.

Seed and sowing method: A local variety of okra seed [name the variety?] was used. The cultivar is characterized by the presence of purple patch at the base of the yellow petal on both the sides and a slight purple pigmentation on the stem, petiole and base of the leaf. The stem is moderately hairy and the fruits are dark green with five ridges. It takes about three months from sowing up to marketable maturity. The seeding rate was 4.3 g/plot, with 90% germination rate.

Data collection and analysis: Randomly five plants were selected from each plot and tagged with replicates. The observation was taken 15 days after germination (DAG). The data was subject to analysis along with average weekly minimum and maximum temperature correlation. The

temperature data was pooled from Ministry of Agriculture, Keren, Zoba Anseba. The disease incidence and severity was studied with the following formula[4].

Disease incidence = (Number of diseased plant*100)/total number of sampled plant, **Disease severity =** Area of tissue affected/Total area of tissue

Results and Discussion

Seasonal incidence of insect pests: Seasonal incidence of aphid population was non-significant on okra crop. The population of aphid per leaf and per plant is detailed in table-1. The population of aphid was non-significant (r = 0.749) with respect to maximum temperature and minimum temperature (r = 0.452) was 0.07 aphid/leaf and 0.83 aphid/plant during second week of December, whereas the average maximum and minimum temperature was 27.9 and 12.6°C, respectively and the population of aphid in the second week of March was 13 aphids/leaf and 143.5 aphids/plant which is non-significant correlated with maximum and minimum temperature was 29.9 and 14.6°C, respectively. Anitha[5] reported the incidence of aphid from first week of December with 19.1 aphids/3 leaves, which was an increasing trend in population and reached up to 24.9 aphids/3 leaves during the first week of January, afterword it gradually declined. This was supposed to be because of the fluctuation of temperature, the population of aphids increase or decrease. The similar results were obtained by Patel and Rote[6] that the aphid population decreased in December and then increased during January and later there was a gradual decline in aphid population. Jayaswal and Sundaramurthy[7] find out that in South zone, aphid was more during November-January in cotton.

Seasonal incidence of jassid was studied and it was found that population of jassid significantly affected the okra crop. The population of jassid per leaf and per plant was recorded in table-1. The population of jassid correlated with maximum temperature (r = 0.883) and minimum temperature (r = 0.359) was 0.45 jassid/plant in second week of December, whereas average maximum and minimum temperature was 27.9°C and 12.6 °C, respectively and the population of jassid significantly increased in the second week of March (9.55 jassids/plant) which is non-significant correlated with maximum and minimum temperature of 29.9°C and 14.6 °C, respectively (table 1 and 3). However, the highest population was recorded in February (1.16 jassid/leaf) and 12.9 jassid/plant with maximum temperature 29.9°C and minimum temperature 13.6°C, respectively. Senapati and Mohanty[8] studied that there was a progressive increase in leafhopper population from the second week of December reaching a peak in the third week of January. The similar results was obtained by Anitha[5] during November and December 2006 with 10.2 leafhoppers/3 leaves and peak incidence was noticed during first week of January 2006 (18.4 leafhoppers /3 leaves), thereafter there was a gradual decline in population of leafhopper. It may be due to prevailing increasing temperature during that period.

The population of spotted boll worm significantly affecting the okra production table-1. The population of spotted boll worm was non-significant (r = 0.600) with maximum temperature and minimum temperature (r = 0.315). It was 0.02 spotted bollworm / pod and 0.08 spotted bollworm/plant in the last day of January whereas average maximum and minimum temperature was 29.1 and 15.1°C, respectively (table 3). The population of spotted bollworm in March was 0.6 spotted bollworm/leaf, 2.2 spotted boll worm / pod and 6.7 spotted boll worm /plant which is non-significant correlated with maximum and minimum temperature 29.9 and 14.6°C, respectively. Kumar and Urs[9] reported spotted bollworm, *E. vittella* as a major insect pest, which causes 8.4-73.2 percent infestation of okra fruits depending on the season. Ahmad *et al.*[10] observed that larval population peak (185.7) of *E. vittella* in fruits of okra was minimum (109.3) during 2nd fortnight of May when the temperature (31.6 ± 7.7 °C) was comparatively higher, and the analysis revealed the existence of significant positive relationship with the minimum temperature (r_m = 0.578) and negative correlation with the maximum temperature (r_m = -0.747) as well as positive correlation.

Table-1
Population of insect pest and natural enemies in okra crop

Days	Total number of samples	Average of aphid /plant	Average of jassid/plant	Average of spotted bollworm / plant	Average of dusky bug / plant	Average of ladybird beetle / plant	Average of syrphid / plant
30-12-2012	60	00	0.45	00	00	00	00
15-01-2013	60	00	1.86	00	00	0.25	00
31-01-2013	60	00	2.91	0.08	0.58	0.75	1.25
15-02-2013	60	49.6	6.5	0.9	2.11	1.7	2.13
28-02-2013	60	64.4	12.9	2.81	5.25	53.4	7.02
15-03-2013	60	143.53	9.55	6.68	11.4	6.05	6.18

Table-2
Incidences and diseases severity in okra crop

Date of observation	Disease incidence (% age per plot)	disease severity (powdery mildew per plant)	Disease severity (blight per plant)
30-12-2012	00	00	00
15-01-2013	00	00	00
31-01-2013	00	00	00
15-02-2013	64.11	52.15	51.92
28-02-2013	70.87	58.25	62.71
15-03-2013	85.24	88.74	85.7

Table-3
The value of correlation regression (r) of incidence of pest and disease with temperature

Pest and disease incidence	Value of r at Tmin	Value of r at Tmax
Aphid	0.749	0.452
Leafhopper	0.883	0.359
Spotted bollworm	0.600	0.315
Dusky cotton bug	0.704	0.369
Lady bird beetle	0.800	0.316
Sryphid	0.470	0.663
Disease incidence	0.313	0.749
Powdery mildew	0.461	0.636
Blight	0.355	0.731

Tmin = Minimum temperature, Tmax = Maximum temperature

The dusky cottony bug non-significantly affected the okra crop (table-1). The population of dusky cottony bug non-significantly (r = 0.704) with maximum temperature and minimum temperature (r = 0.369) was 0.053 dusky cottony bug/leaf, 0.19 dusky cottony bug/pod and 0.59 dusky cottony bug/plant in mid of January whereas average maximum and minimum temperature was 29.1 and 15.1°C, respectively. The population of dusky cottony bug in March was 11.4 /plant which is non-significant correlated with maximum and minimum temperature 29.9 and 14.6°C, respectively. According to Ahmad *et al*.[10] that the dusky cotton bug, *Oxycarenus laetus* Kirby of peak population was recorded during hotter months March–July; but the population build up was at its low during colder winter months (November–January) and high temperature (35–40°C) with moderately high humidity (45–60%) seem to be the favourable climate for rapid growth of the population.

Incidence of natural enemies: The population of natural enemies of insect pest of okra crop habituating in plant with availability of food sources. In the present study two natural enemies i.e. lady bird beetle and syrphid fly was recorded. The population of lady bird beetle non-significantly (r = 0.800) with maximum temperature and minimum temperature (r = 0.316) was 0.02 lady bird beetle/leaf and 0.25 lady bird beetle/plant in the first week of January whereas, average maximum and minimum temperature was 28.5 and 12.7°C, respectively (table-1 and 3). The population of lady bird beetle in March was 0.55/leaf and 6.05/plant which is non-significant correlated with maximum and minimum temperature 29.9 and 14.6°C, respectively. Syrphid population was non-significantly affected the population of aphids. The population of syrphid non-significantly (r = 0.470) with maximum temperature and minimum temperature (r = 0.663) was 0.1 syrphid/leaf and 1.25 syrphid/plant in the mid of January whereas, the average maximum and minimum temperature was 29.1 and 15.1°C, respectively (Table 1 and 3). The population of syrphid in March was 0.56 syrphid /leaf and 6.18 syrphid/plant which is non-significantly correlated with maximum and minimum temperature 29.9 and 14.6°C, respectively. However, the highest population of natural enemies of aphid was recorded in February, i.e. 53.4 lady bird beetle/plant and 7.02 syrphid/plant.

Incidence and disease severity: Disease severity of powdery mildew in okra crop was studied and it was found non-significantly affecting the okra crop. Anjorin *et al*.[11] reported that farmers in the FCT-Abuja region in Nigeria experienced wide spread of early blight disease in okra and eggplant fields. The severity of powdery mildew was correlated with maximum and minimum temperature. The severity of powdery mildew was non-significant (r = 0.626) with maximum temperature and minimum temperature (r = 0.461) was 52.15%/plant in the first week of February whereas, the average maximum and minimum temperature was 29.8 and 14.5°C, respectively (Table 2 and 3). Wide variation (13-15°C) in the maximum and minimum temperature and day and night relative humidity (39.9-51.7%) increases powdery mildew intensity in black gram[12].

The severity of powdery mildew in March was 88.7 percent per plant which is non-significantly correlated with maximum and minimum temperature 29.9 and 14.6°C, respectively. Similarly the disease severity of blight in okra crop was studied and it was found non-significantly affecting the okra crop. The severity of blight was non-significant (r = 0.731) with maximum temperature and minimum temperature(r = 0.345) was 51.9 per cent per plant in the first week of February whereas, the average maximum and minimum temperature was 29.8 and 14.5°C, respectively. The severity of blight in March was 85.7 per cent per plant which is non-significantly correlated with maximum and minimum temperature 29.9 and 14.6°C, respectively. Singh[13] found that early blight caused by *Alternaria solani* is free from inhibitions caused by weather conditions and occurs in cool as well as warm areas. The age of the crop, the cool nights and dry weather situation were more favourable for the powdery mildew to become severe[14]. The variation of disease severity in various localities is mainly attributed to the climatic factors like temperature, relative humidity and distribution and amount of rainfall followed by cultural practices like sanitation and other suitable management practices[15].

Conclusion

The aphids, jassids and spotted bollworm are known pests of okra in Eritrea attacking on the okra crop from early stage when

the plants are in 4-6 leaf stage. The aphids and jassids pierce and suck the cell sap from the tender leaves, flowers, twigs and tiny fruits. It results in the dwarfing of the plants height, reduction in the amount of flowering and fruit setting. On the other hand, there are natural enemies like lady bird beetle and syrphid fly maggot may also control up to certain level. The powdery mildew and blight were found as common diseases in okra crop and damaging in different stages when the plants are in 6-8 leaf stage. However, it was recorded that powdery mildew attacks on maturing stage and interfer with photosynthesis and thus affect the fruit setting. The infected plants results in reducing in the quality of fruits and yield reduction. Blight cause yellowing and drying of leaves which starts from the margin and goes to the center of the leaves. Finally, it results in drop of leaves and hindering of photosynthesis as well as reducing yield.

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