PEST PROFILE AND DAMAGE ASSESSMENT ON THREE LAND RACES OF EGGPLANT (*Solanum* spp) IN EKITI STATE, NIGERIA

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ABSTRACT

The environments for growing crops within the next decade are expected to undergo significant abiotic and biotic transformations due to climate change. There is the probability that new economic pests would emerge or known pests become adapted to new crops. Knowledge of invasive pest species, their ability to adapt to a broad range of bio-geographical conditions and the pattern of their population development are essential in developing sustainable integrated management systems. This study evaluated the occurrence, distribution and infestation of insect pests on three varieties of eggplant: *Solanum melongena*, *S. macrocarpon* and *S. aethiopicum* grown in the nursery and field plots at the Teaching and Research Farm, Ekiti State University, Ado-Ekiti, Nigeria. The crops were planted in a completely randomized design (CRD) at a spacing of 0.5 m by 0.5 m. The pest profiles were monitored at nursery, pre-flowering, flowering and fruiting stages. The major pest in the nursery was the whitefly, *Bemisia tabaci* while grasshoppers, katydids, crickets, caterpillars of various moths, bugs and beetles (adults and larvae) caused damages to the crops in the field. Invasion of mealy bugs and development of *Verticillium* wilt disease occurred at the flowering and fruiting stages. *S. melongena* attracted the widest range of pests followed by *S.aethiopicum* and *S. macrocarpon*. However, *S. aethiopicum* was the most susceptible to damage from the invasive mealy bugs. Detailed knowledge of the optimal period of occurrence of these important pests will aid the farmers' choice of suitable control measures.

Keywords: Occurrence, insect pests, damage, land races, eggplants.

INTRODUCTION

Ekiti is an agrarian state in which 75% of its population derive their income and employment from active involvement in farming. The state is blessed with conducive climatic condition and it enjoys luxuriant vegetation. The main cash crops are cocoa, coffee, kolanut, cashew and oil palm. Among the food crops are yam, cocoyam, cassava, maize, plantain/banana, rice, beans, pepper. Other staple food include okra, walnut, varieties of vegetables, amaranthus, garden egg, sweet potato, tomatoe and groundnut (Oloidi, 2013).

Eggplant (*Solanum* spp.) also known as garden egg is an economic perennial plant grown mainly for its prolific fruit production, quick maturation and large fruit size. It is majorly cultivated under mixed cropping systems and is more prominent in compound or backyard farms where they are grown with household organic refuse of farm yard manure. Eggplant has great potential for income generation among rural farmers and households (Onekutu *et al.*, 2014).

The different species and varieties of eggplants vary particularly with respect to their morphology (plant growth habit, vigour, hairiness, fruit shape, fruit size, fruit colour and yield potential), physiology (flowering pattern and water use) and biochemical properties

(fruit bitterness and glycoalkaloid content) (Osei *et al.*,2010; Chinedu *et al.*,2011). The most obvious characters that vary amongst the different varieties of garden egg include the fruit size, fruit shape, fruit colour and taste (Frary *et al.*,2007). *Solanum melongena* (aubergine or brinjal) is a species of night shade grown for its edible fruits. The fruits which are like large pendent, long to oblong berries shape vary in colour from purple to purple-black. *Solanum aethiopicum L.*, the bitter tomato (also known as Ethiopian eggplant or Akati) has yellow or white flower with yellow stamen, and fruits with white, red or yellow rind sometimes stripes. The shape can be round, round lobed, inside the fruit is white or light green. The highly variable fruit of the plant is eaten both raw and cooked, some with a sweet flavor and others very bitter. It is sometimes used to make a tomato based sauce which can be used to eat yam (USDA, 2015). *S. macrocarpon L.*(also known as African eggplant or gboma) has oval shaped fruits which are green when young or a purple and white color with dark stripes and ripens to yellow or a yellow-brown. The fruits and young leaves of *S. macrocarpon* taste very bitter and are consumed for their high nutrient yield (Oboh *et al.,* 2005). The complex of pests and diseases problems constitutes a major biotic factor militating against increased production of the crop especially during the dry season when it commands high prices. Imam *et al.,* (2010) reported that a great diversity of species of insects from different orders and families with their characteristic damages based on mode of feeding have been recorded on the eggplant. The insect species which inflict damages on the crop through biting and chewing of the plant parts include *Orthoptera* (grasshoppers, locusts, crickets), larvae of Lepidoptera (fruit and shoot borer, leaf roller, caterpillar), adults and larvae of many beetles (Coleoptera) and other *dipteran* larvae. The other insect species which also inflict damage on the crop by the plant sap from the phloem (or xylem) system or from general tissues of foliage, roots and fruits include *hemiptera* (bugs), *homoptera* (leafhoppers, whiteflies, aphids) and the *Thysanoptera* (thrips) (Shivalingaswamy and Satpathy, 2007). Onekutu *et al.,* (2014) reported that insect pests account for reduced yield and losses of as much as 80% of the crop. Farmers' heavy reliance on chemical pesticides to protect their crop from these array of insect pests has resulted into series of problems related to both loss of effectiveness on the long-run and certain extremities such as pollution and health hazards (AVRDC, 2003).

Periodical survey of insect pests on crops is of great importance because routine use of control measures (cultural, pesticides or both) without taking into consideration the pest density is economically wasteful. Also, adequate knowledge of invasive pests species and their ability to adapt to a broad range of bio-geographical conditions as well as the pattern of their population development are essential in developing sustainable control strategies. The objective of this study was to evaluate the occurrence, distribution and infestation of insect pests on three landraces of eggplant.

MATERIALS AND METHODS

Description of the study site

The study was carried out at the Teaching and Research Farm of Ekiti State University, Ado - Ekiti. The study site lies between the latitude 5^0 45' and the longitude 8^0 15' tropical rain forest of Agricultural zone of Nigeria. The rainy season in Ado-Ekiti is usually between late March to October, while the dry season falls between November and February. The trial was laid as a Completely randomized Design (CRD) with the three varieties of eggplant namely, *Solanum melongena, S. aethiopicum, S. marcrocapon* (Plate 1) as treatments and replicated five times.

Development in Nursery

The eggplant seeds were sown inside a perforated bowl containing 20g sandy loam soil. Two bowls were used for each variety, watering and other cultural practices were carried regularly in the nursery for six weeks before transplanting to the field. The seedlings were transplanted into the field after six weeks of being raised in the nursery.

Observations, collections and identification of insect pests in the Nursery

Pest survey was conducted at 10 days after the development of vegetative leaves in the nursery and this continued daily for the entire nursery period of 42 days.

Development in Field

Land clearing was done with the aid of cutlass and beds of 12 cm high from ground level was raised using hoe. Compost manure was added to the beds to enrich its nutrient composition. The young seedlings were transplanted after six weeks in the nursery. The total area of land used was 121.5m^2.

Observations, collections and identification of insect pests in the field

Scouted insects were removed with pouter and brought into laboratory for identification with the aid of a stereo-microscope. After transplant, pest survey was conducted daily in the morning (6 am–9 am), afternoon (12 noon–1 pm) and evening (5 pm–7 pm) periods during the vegetative, flowering and fruiting stages.

Analysis of data

Descriptive statistic was used to describe the occurrence and relative abundance of insect pests. The data collected were also subjected to ANOVA and separation of treatment means was computed with Duncan Multiple Range Test (DMRT) using SPSS package version 16.

RESULTS AND DISCUSSION

Table 1. shows the array of insect pests identified on the three landraces of eggplants. The pests associated with the three eggplant varieties were from five insect Orders, Coleoptera, Hemiptera, Homoptera Lepidoptera and Orthoptera. This corroborates Shivalingaswamy and Satpathy (2007) who reported shoot borer, flea beetle, leaf hopper, whitefly, thrips, aphids, spotted beetles, leaf rollers, cotton stainer, blister beetle and spider mites as major pests of eggplant in the tropics. The predominant insect pest in the nursery was white fly. These insects are active during the day but settle under the leaf surfaces at night. Both the adult and nymph sucked plant sap and reduced photosynthetic efficiency of eggplant through secretion of honeydew when present in high population (Srinivasan, 2009). The mealybug (*Coccidohystrix insolita*) was observed to be invasive during the dry spell experienced between April and June and it showed preference for *Solanum aethiopicum*. The mealybugs infested the lower leaf surfaces and stem of eggplant. This suggests that the pest has potential of becoming an important economic concern for eggplant production particularly during the period of drought. Moore *et al.*,(2014) had earlier noted that *Coccidohystrix insolita* has the hallmarks of being a major pest in Guam, (small tropical island) because of a warm climate with no winter, coupled with a lack of natural enemies for new arrivals. Grasshoppers,

crickets (Orthopterans) and beetles (Coleopteran) were among the notorious insects feeding on the foliage. The adults and nymphs of grasshoppers as well as adults of the beetles caused appreciable damage by feeding on cotyledon, stems and foliage of young plants. The bugs were the most prominent insect observed at the plant's flowering stage especially on *S. macrocarpon*. Egg masses of about twenty-one each were observed on the underside of the leaves of infested plants. The eggs eventually hatched after seven days and the emerging nymphs developed through different instars stages until the emergence of new adults after about ten days. The adults feed in groups and severe infestation may kill the whole plants or weaken them to the point that fruit fails to develop (www.ipm.ncsu.edu). However, the presence of these bugs on *S. macrocarpon* seemed not to pose any threat because despite their aggregation this landrace had the longest fruiting period

Occurrence of insect pests among the three landraces of eggplant

The occurrence of insect pests among the three landraces of eggplant is shown in Table 2. Varying degrees of significant preferences were observed among the three varieties. Cotton stainer, stink bug, leaf roller, caterpillar and beetle and were the predominant pests on *S. melongena*. There were more brown bugs on *S. macrocarpon* than other insect pests while the population of mealy bugs was highest on *S. aethiopicum*. The major pests that could be potential targets of control in the long run due to their rates of build-up and nature of damage were grasshoppers, and mealy bugs. Damage by mealy bugs was severe on *Solanum aethiopicum* and massive towards fruiting period and could be a potential threat to yield in the long-run.

Leaf Damage Assessment

Damage assessment on the leaves is shown in Table 3. The assessment was estimated by using the visual rating scale of 1 – 5 per individual plant; where 1 = 0 – 20% of foliage consumed, 2 = 21 – 40% of foliage consumed, 3 = 41 – 60% of foliage consumed, 4 = 61 – 80% of foliage consumed and 5 = 81 – 100% of foliage consumed (Anjorin *et al.*, 2013). *S. aethiopicum* leaf was badly damaged by insect pest having the highest number of rating scale while *S. melongena* had the lowest rating scale.

CONCLUSION

This study has shown the array of insect pests attacking the three landraces of eggplant (*S. melongena, S. aethiopicum, S. macrocarpon*) cultivated in Ekiti State. The three landraces were all attacked by insects from five insect orders namely Orthoptera, Coleoptera, Hemiptera, Homoptera and Thysanoptera. However, only *S. aethiopicum* was found to be susceptible to attack by the mealybugs, *Coccidohystrix insolita* during a short period of dry spell. This is an indication of the insect's potentiality in becoming a potential or invasive pest on *S. aethiopicum* especially under drought conditions. The preference on *S.* macrocarpon by the coreid bugs also raised a concern for further studies on the possibilities of some interactions between them. It should be noted that of the three landraces, *S. melongena* was least susceptible to attack in its post- flowering stage. The findings of this study could be used as a baseline for further studies on seasonal variations in pest occurrence and development of an adaptable pest management strategy for eggplant farmers in Ekiti State.

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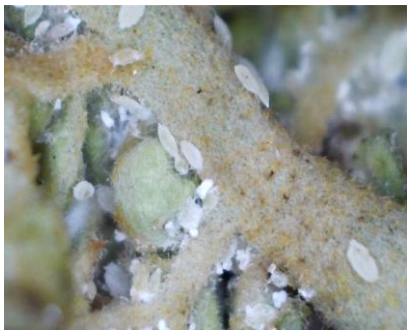
S. aethiopicum

S. macrocarpon

S. melongena

Plate 1. The Three Landraces of Eggplant



Mealybug on *S. aethiopicum*

***S. aethiopicum* infested with mealybug**

Selepa docilis* on *S. macrocarpon

Coreid bugs on *S. macrocarpon*

Leaf roller on *S. melongena*

Plate 2. Array of insect pests on the three landraces of *Solanum* spp

Table 1: Identified insect pests, pestiferous life stages and nature of damage

Insects (English name)	**Scientific name**	**Order**	**Plant stage**	**Pestiferous life stages**	**Nature of damage**
Grasshopper	*Zonocerus variegatus*	Orthoptera	Vegetative	Nymph and adults	Leaf damage(Feed on the foliage)
Mealy bug	*Coccidohysrtix insolita*	Hemiptera	Flowering	Nymph and adults	Sucking of sap causing loss of vigour and disease
Cotton stainer	*Dysdercus suturellus*	Hemiptera	Vegetative	Nymph and adults	Damage of fruits, (punctures) and sucks flower buds
Stink bugs	*Nezara virudila*	Hemiptera	Flowering and fruiting	Nymphs and adults	Damage of fruits, results to distortion
Brown bugs	*Halyomore halys*	Hemiptera	Flowering and fruiting	Nymphs and adults	Damage fruits, results to distortion
Leaf roller	*Olivacea eublemma*	Lepidoptera	Vegetative	Larvae and adults	Defoliation occur on leaf, damages the fruit causing scarring and deformation
Caterpillars and larvae of other unidentified Lepidopterans)	*Selepa docilis larvae*	Lepidoptera	Flowering	Larvae	Feed on leaves, flowers, shoots and fruits
Beetles	*Epilachna beetle*	Coleoptera	Vegetative	Adults	Chewing numerous small hole on the leaves
Crickets	*Gryllus spp*	Orthoptera	Vegetative	Nymphs and adults	Damage fruits by chewing the fruits and also staining the fruits

Table 2. Mean occurrence of insect pests on three varieties of eggplant

Variety	Grasshopper	Mealybugs	Cotton Stainer	Stink Bug	Brown Bug	Leaf Roller	Caterpillar	Beetle	Cricket
S. melongena	62.70ab	0.00b	52.80a	30.93a	30.80b	35.33a	45.73a	35.87a	26.20ab
S.aethiopicum	70.30a	64.67a	34.53b	15.43c	24.47c	25.67b	31.13b	33.67a	34.13a
S.macrocarpon	59.20b	0.00b	24.47c	27.07a	52.60a	28.60b	11.80c	22.00b	20.13b

Values in the same row and sub-table not sharing the same subscript are significantly different at p< .05
in the two-sided test of equality for column means.

Table 3: Leaf damage rating of insect pests on the three landraces of eggplant

Insect pest	Damage rating/ Severity		
	S. melongena	*S.aethiopicum*	*S. macrocarpon*
Zonocerus variegatus	1	3	1
Olivacea eublemma	2	1	1
Selepa docilis larvae	1	4	1
Epilachna beetle	1	2	1
Gryllus spp	1	1	1

Scale: 1 = 0 – 20 % 2 = 21 – 40 %,

3 = 41 – 60 % 4 = 61 – 80 %,

5 = 81 – 100 %