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Control of Insect Pests of Okra (*Abemoschus exculentus* l.) with *Annona squamosa* and *Azadirachta indica* Leave Extracts

Fatai Olaitan Alao[1], Sa'dat Yetunde Yusuf[2], Oladele Abiodun Olaniran, Timothy Abiodun Adebayo and Tosin Banfe

[1]Ladoke Akintola University of Technology, Department of Crop and Environmental Protection, Ladoke Akintola University of Technology, Ogbomoso, Nigeria

[2] Ladoke Akintola University of Technology, Department of Crop Protection, University of Ilorin, Kwara State, Nigeria.

Corresponding author: yusuf.sy@unilorin.edu.ng Phone no: +23407034984182

Abstract

This research work was conducted to determine the bio-activities of Annona squamosa (Linn) and Azadirachta indica (A. Juss) leave extract on insect pest of okra (Abelmoschus esculentus L. Moench) at Ladoke Akintola University of Technology, Teaching and Research Farm Ogbomosho Oyo State during major and minor planting of 2019. Plant extracts formulation was done with cold water and filtrates were mixed with camphor, sulphur, black soap and salt. The mixture was stored separately in 5 litter keg for further use. Synthetic insecticide and untreated plots were included in the treatment for comparison. Data were collected on number of the insects, number of fruit yield and fruit yield. All the data collected were subjected to analysis of variance (ANOVA).The results show that the tested plant extracts effectively controlled Podagrica uniformis and P. sjostedti. However, the efficacy of the tested plant extracts against the observed insects depends on the concentration applied. Also, the result shows that Podagrica sjostedti are more susceptible to the applied plant extract than Podagrica uniformis. In respect to the number of fruit, it was observed that the highest number of fruit was observed on the plants treated with the synthetic insecticide (Dirchlovours). The yield obtained from plants treated with plant extracts at 15% and 25% v/v comparable Dirchlovours treated plants. Therefore, the tested plant extracts can be used in the management of insect pest of okra.

Keywords: Okra, Dirchlovours, *Podagrica spp*, *Annona squamosa*, *Azardiractha indica* Maize

Introduction

Okra is a vegetable crop which belongs to the genus Abelmoschus, family Malvaceae (Siemonsma, 1982; Simmone et al., 2004; Naveed et al., 2009). It is believed to have originated from East Africa and today, is widely distributed in the tropics, subtropics and warmer portions of the temperate region (Oyelade et al., 2003; Andras et al., 2005; Saifullah and Rabbani, 2009). Okra is grown on wide range of soils, but well drained fertile soils with adequate organic matter result in high yield (Akinyele and Temikotan, 2007). Literature has it that production of okra in the world is around six million tonnes per year. In West Africa, it is estimated at 500,000 to 600,000 tonnes per year (Burkil, 1997). In Nigeria, there are two distinct seasons for okra, the peak and the lean seasons. During the lean season okra fruit are produced in low quantities, scarce and expensive to get (Bamire and Oke, 2003).

Okra soup has a stretchy characteristic which plays an important role to improve the palatability of many dishes. (Cork et al., 2000; Glew et al., 1997; Gopalan et al., 2007; Varmudy. 2011;]. Farmers have been cultivating okra for its fruits and leave use as food or medicine for different disease (Mihretu et al., 2014)

Despite its multi-directional importance and utility, insect pest infestation is one major factor affecting okra cultivation in Nigeria (Igbal et al., 2008; Alao et al., 2011). It has been reported that the major insect pests of okra were Podagrica spp jac, Aphis gossypii Glov, sylepta derogata (F), Spodoptera litoralis, Dysdercus superstitiosus (F.), Semisia tabaci (Gean) and Zonocerus variegatus (F.) (Ahmed, 2000; Youdeowei, 2002; Obeng and Sackey, 2003; Fasunwon and Banjo, 2010; Odewole et al., 2014; Olaniran et al., 2016a).

Management practices of insect pests control centres mostly on the use of synthetic insecticides due to their quick effects on the target crops. In the recent years, the negative side effects of synthetic insect become obvious to the entomologists and environmentalists. Increase in the cost of

procurements by the farmers becomes a source of concern and some insects were reported to have developed resistant to most of these synthetic insecticides (Isman, 2008; Laetemia and Isman, 2004). Therefore, call for the environmental friendly alternative control of these insects becomes necessary. Botanical insecticides have been a suitable alternative in view of their availability within the reach of farmers, this does not necessary involve any additional cost implication by the farmers (Mkenda et al., 2015; Amoabeng et al., 2014). Preparation of botanical insecticides does not involve high technicality and there is little or no information of insects developing resistant to botanical insecticides. Research has shown that use of botanical insecticides increases the nutritional contents of field treated crops (Olaniran et al.,2016b; Alao et al., 2020). These above facts ginger the use of plant extracts in the management of field insect pests of okra. Plants extracts of many plants spp (e.g. Neem, Garlic, Tobacco and Ginger) have shown promise as bio-pesticides for management of insect pest and diseases in agriculture (Khater, 2012; Showler, 2017). Therefore, A. squamosa and A. indica leaves extracts were tested against Podagica spp of okra and their effects on the okra fruit yield.

Materials and Method

Study Site: The field experiment was conducted in the cropping season of 2018 and 2019 at Ladoke Akintola University of Technology (LAUTECH) Teaching and Research Farm, Ogbomoso, Oyo state. This region is on longitude 403'E and latitude 1005'N. The region can be described as humid tropical falls in Southern Guinea Savannah of Nigeria.

Experimental Design and Management

Experimental beds were made with hoe after clearing with cutlass. Twenty four beds were arranged and demarcated in a Randomized Completed Block Design with three replicates. The plot size was 2 m x 2 m with a planting space of 0.5 m x 0.5 m between and within the plant rows respectively. Two to four seeds of okra variety (NH47-4) were planted per hole which was later thinned to one plant per stand after two weeks of planting. Manual weeding was done fortnightly.

Formulation of Botanical Insecticides

The leaves of the tested plants (Annona squamosa and Azadirachta indica) were air dried for two weeks and grinded into powdered form with the use of grinding machine, 700g of the grounded leaves were mixed separately with 100 g of sulphur, 100 g of camphor, 20 g of black soap, 80 g of salt and 2000 litres of water were used to soak the said materials overnight. This formulation is in line with the method developed by Olaniran et al., 2016a. Filtration of the soaked materials was done with muslin cloth and filtrates collected were stored separately in 5-litre plastic keg for further use.

Treatment Application

Application of the treatment commenced three weeks after planting. The plant extracts were applied at 5, 15 and 25% v/v and each of the aqueous solution was diluted with the equivalent volume of water to achieve the same spraying volume of 1000 ml of water. Application was done with the use of hand-held sprayer of 2-litre capacity and spraying was done early in the morning to avoid photodecomposition of the plant extracts. The synthetic insecticide was applied at 1 ml per 2 litres of water. Spraying was done at 7 days interval for three weeks.

Data Collection and Analysis

Data were collected on insect population densities and this was done early in the morning by visual observation. The morphological data collected were based on number of fruits, and yield was calculated in kg/ha which was later converted to ton per hectare (t/ha). Data collected were subjected to analysis of variance (ANOVA) and significant means were separated using Ducan multiple range text at 5% probability level. Meanwhile, data on insect populations were transformed using acsin transformation (square root x + 0.5) before subjecting to the statistical analysis

Results

As presented in in Table 1, plants sprayed with A. squamosa and A. indica extracts at 25% v/v compete effectively with Dichlovours in the control of P. uniformis infestation at 2 and 3 week after treatment (WAT). Population density of P. uniformis on the plants treated with A. squamosa at 25% v/v was significantly low than other treated plants as well as untreated plants. A. indica applied at 15% and 25% exhibited the same insecticidal effects with synthetic insecticide (Dichlovours) treated plants at 2 and 3 WAT. However, A. indica performed better in the control of this insect infestation than A. squamosa 1 and 2 WAT but the tested plant extracts had the same insecticidal potential at 3WAT.

Table 1: Effects of Insecticides on Podagrica Uniformis Infestation

		Weeks after treatments.		
Treatments	**Rates**	**1**	**2**	**3**
DDVP		6.33[b]	3.33[b]	2.33[bc]
Control		18.0[a]		10.0[a]
Annona squamosa	5	11.3[ab]	5.0[b]	5.67[abc]
	15	10.0[ab]	5.33[b]	2.67[bc]
	25	6.00[b]	4.00[b]	0.67[c]
Azadirachta indica	5	17.3[a]	11.8[a]	4.33[bc]
	15	10.0[ab]	5.00[b]	1.33[bc]
	25	7.67[b]	4.33[b]	1.33[bc]
Insecticides				
DDVP		6.33[c]	3.33[c]	2.33[b]
Control		18.0[a]	12.3[a]	7.78[a]
Annona squamosa		9.11[bc]	4.78[bc]	3.00[b]
Azadirachta indica		11.6[b]	7.00[b]	2.33[b]

Means with the same alphabet(s) are not significantly different at 5% probability

The result shows that, the tested plant extracts at 15% and 25% v/v controlled P. sjostedti population as Dichlovours treated plants throughout the experimental trials (Table 2). No significant different in the level of P. sjostedti infestation was detected between plants sprayed with the two tested plant extracts at 5% V/V and unprotected plants (Table 2).

Table 2: Effects of Insecticides on Podagrica sjosdesti Infestations

		Weeks after treatments.		
Treatments	**Rates**	**1**	**2**	**3**
DDVP		1.00[b]	0.33[b]	0.00[b]
Control		13.3[a]	11.3[a]	8.67[a]
Annona squamosa	5	11.3[ab]	5.0[b]	5.67[abc]
	15	10.0[ab]	5.33[b]	2.67[bc]
	25	6.00[b]	4.00[b]	0.67[c]
Azadirachta indica	5	11.0[a]	11.3[a]	8.67[a]
	15	2.33[b]	0.33[b]	0.00[b]
	25	1.33[b]	0.33[b]	0.00[b]
Insecticides				
DDVP		1.00[c]	0.33[c]	0.00[c]
Control		13.3[a]	11.3[a]	8.67[a]
Annona squamosa		4.78[b]	3.89[b]	3.11[b]
Azadirachta indica		4.89[b]	4.00[b]	2.78[b]

Means with the same alphabet(s) are not significantly different at 5% probability

Table 3: Effects of insecticides on okra fruit yield

The result presented in table 3 shows the effect of insecticides on the number of harvested fruits. Plants treated with Azadirachta indica and Annona squamosa at 25% concentration had the same significant number of fruits with plants treated with DDVP at 1st harvesting (2.00). At 2nd harvesting, none of the applied plant extracts competes effectively with plants treated with DDVP which had highest fruit yield (3.00). The quantity of okra fruits obtained from plants sprayed Annona squamosa at 15%v/v and 25% v/v was significantly the same(2.00 and 2.33 respectively). At 3rd harvesting, plants treated with Azadirachta indica at 25% v/v performed better than Annona squamosa treated plants at 25% v/v. On the average, no significant difference was observed between the plants treated with Azadirachta indica at 15% v/v and Annona squamosa at the rate. None of the applied plant extracts had the same significant number of fruit as it was observed on the plants treated with DDVP.

Table 3: Effects of Insecticides on Number of Fruits

		Harvested okra fruits/ plant			
Treatments	**Rates**	**1**	**2**	**3**	**Average no. of Fruits**
DDVP		2.00[a]	3.00[a]	2.67[a]	7.67[a]
Control		0.00[d]	2.00[ab]	2.00[ab]	4.00[c]
Annona squamosa	5	0.67[cd]	0.33[c]	1.00[bc]	1.00[bc]
	15	2.00[a]	2.00[ab]	2.33[a]	6.33[ab]
	25	2.33[a]	2.33[ab]	2.00[ab]	6.67[ab]
Azadirachta indica	5	1.00[bc]	1.67[b]	0.00[c]	2.67[cd]
	15	2.00[a]	2.00[ab]	2.33[a]	6.00[b]
	25	2.00[a]	1.67[b]	2.33[a]	6.00[b]
Insecticides					
DDVP		2.00[a]	3.00[a]	2.67[a]	7.67[a]
Control		0.00[b]	2.00[b]	2.00[b]	4.00[c]
Annona squamosa		1.67[a]	1.56[b]	1.78[b]	5.00[b]
Azadirachta indica		1.56[a]	1.78[b]	1.56[b]	4.89[b]

Means with the same alphabet(s) are not significantly different at 5% probability

Table 4: Effects of Insecticides on Yield (t/ha)

		Okra Fruit Yield (t/ha)
Treatments	**Rates**	**Yield**
DDVP		1.36a
Control		0.58b
Annona squamosa	5	0.38b
	15	1.11a
	25	1.21a
Azadirachta indica	5	0.47b
	15	1.10a
	25	1.09a
Insecticides		
DDVP		1.36a
Control		0.58c
Annona squamosa		0.89b
Azadirachta indica		0.89b

Means with the same alphabet(s) are not significantly different at 5% probability.

Azadirachta indica.

Table 4: Effects of insecticides on fruit yield (t/ha)

Table 4 shows the effects of insecticides on the okra fruit yield. Plants treated with Annona squamosa and Azadirachta indica at 15% and 25% v/v had the same significant fruit yield as it was obtained in Dirchlovours treated plants. Whereas, plants treated with Annona squamosa and Azadirachta indica at 5% v/v had the same yield which was comparable to that of untreated plants.

Generally, the yield obtained from plants treated with DDVP was considerable higher (1.36 t/ha) than other treatments and the untreated plants which had the least okra fruit yield (0.58 t/ha). However, the same significant fruit yield was observed in plants treated with Annona squamosa and Azadirachta indica extracts.

Discussion

This experiment demonstrated the effectiveness of A. squamosa and A. indica in the control of Podagrica spp of okra. Two Podagrica spp namely; P. uniformis and P. sjostedti were observed on the field as major insect pests of okra. The tested plant extracts exhibited insecticidal control of the observed insect pests. This observation is in line with Olaniran et al, 2016; who reported that A. squamosa and Moringa oleifera extracts exhibited insecticidal action against Podagrica spp and Zonocerus variegatus infestation. Musa et al., 2013 also observed that A. squamosa and T. vogelii extracts significantly suppressed Podagrica spp.

The data observed show that the efficacy of the tested plant extracts depends on the concentration applied though there was no statistical difference in the efficacy of the tested plant extracts applied

at 15% and 25% v/v. This concurs with the earlier observation by Alao 2015; who reported that the effectiveness of some tested plant extract against field insect pests of watermelon were concentration dependent. Similar observation was reported by Seljasin and Meadow, 2006; who reported that the efficacy of plant extracts are dose related. Ahamed et al., 2007 also reported correlation between the tested plant extracts at different concentrations and
Podarica spp infestation

The result also shows that the tested plant extracts applied at 15 and 25% v/v compete effectively with synthetic insecticide (Dirchlovours) in the control of Podagrica spp. Previous study by Uzair et al., (2018) reported that among the tested plant extracts, the efficacy of A. indaca extracts was comparable with the synthetic insecticide in the control of insect pests of okra. Neem and Tobacco extracts have been reported to have had similar insecticidal effects with synthetic insecticide against insect pests of okra (Shabozoi et al., 2011). Further study also revealed that the bioactivity of Neem extracts against pests of tomato, onion and okra supersedes the synthetic insecticide (Carbamates butocaboxin) (Hossain et al., 2013). This observation suggests that A. squamosa and A. indica extracts can be used as an alternative to Dichlovours in the management of insect pests of okra.

However, the highest yield was obtained from synthetic insecticide and plant extract treated plants at 15% and 25% concentration rate while the least yield was obtained from the untreated plants and the plant extracts treated at 5% v/v meaning that the observed insect pest resulted into low yield of okra fruit. This observation was in line with Pedigo and Rice, (2014) who reported that there is a correlation between the insect infestation and crop yield.

Conclusion

This experiment revealed that the tested plant extract exhibited the insecticidal action against insect pest of okra, and the effectiveness of the two tested plant extract depended on the concentration of the plant extracts. Also the two tested plants extracts applied at 15% and 25% concentration rate can serve as an alternative to the use of Dirchlovours in the control of insect pest of Okra. Therefore, the two tested plant extracts can be used in the organic farming system in order to reduce the over dependence on synthetic chemicals by our local poor resource farmers.

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