EFFECTS OF THREE AQUEOUS PLANT EXTRACTS IN THE CONTROL OF TOMATO FRUITWORM *(Helicoverpa armigera Hubner) (Lepidoptera: Noctuidae)* IN GOMBE, SUDAN SAVANNA OF NIGERIA

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ABSTRACT

This research was conducted at Federal College of Horticulture Research Farm, Dadin-Kowa, Gombe during 2003/2004 and 2004/2005 dry seasons. The objective was to evaluate the effects of three aqueous plant extracts (Balanites aegyptiaca Del., Momordica balsamina L., and Mitracarpus Villosus L.) on tomato fruit worm (Helicoverpa armigera Hubrer). The experiment was laid out in randomized complete block design replicated four times. The results showed that tomato treated with bitter melon at 10% w/v concentration at one week interval significantly reduced the number of holes/fruits in 2005/2006 and in 2006/2007 dry seasons. Bitter melon also reduced the number of damaged fruits/plant in 2005/2006 and in 2006/2007 dry seasons compared to the other treatments. The result also showed that M. balsamina had significantly highest number of undamaged fruits, highest fruit weight , highest fruit size and highest total fruit yield. It is therefore recommended that tomato production spaced at 60cm and sprayed at 10% w/v concentration with bitter melon extract at one week interval be encouraged among low resource farmers in Dadin Kowa, Gombe, Sudan Savanna of Nigeria.

Keywords: *Tomato, fruitworm, Mitracarpus villosus, Momordica balsamina, Balanites aegyptiaca aqueous extract, Sudan Savannah.*

INTRODUCTION

Tomato *(Lycopersicon esculentum Mill)* is widely used all over the world as soup, juice, paste, powder, puree, ketchup and salad. The seeds upon extraction contain 24% oil. The residual press cake is used in livestock feed and fertilizer (Gerald and Frank, 2005). In addition, tomatos also contain 0.9% fat, 4.3% carbohydrate, 0.6% fibre, 0.1 protein, Vitamins A, C and mineral salt (Gerald and Frank, 2005). Tomato production has greatly increased in Nigeria because of its high demand and revenue return (Kabura, Dada and Kamai, 1999). Tomato production in Nigeria is essentially restricted due to high temperature, humidity and pests attack (Erinle, 1989, Umeh, Kuku, Nwanguma, Adebayo and Manga, 2002). The major constraints of tomato production especially in the rainy season is that of a complex of pests notably fruitworm *(Helicoverpa armigera)*, whiteflies *(Bemisia tabaci)*, a vector of a number

of tomato viral diseases, root-knot nematode and leaf beetles (NRI, 1996, Umeh Kuku, Nwanguma, Adebayo and Manga, 2002). Helicoverpa armigera is one of the major tomato insect pests that are very serious in Northern Nigeria (NRI, 1996). The larvae bore and feed within the plant fruits eating the contents and causing damage that allows the entry of fungal pathogens (Erinle, 1989). Umeh et al. (2002) have reported that larval feeding can destroy several fruits if not controlled and that it can cause up to 25% crop loss in extreme conditions either by reducing the fruit weight, fruit size and total fruit damage in the field.

The use of synthetic insecticides like carbaryl, karate, cypermethrin, dimethoate and monocrotophos were found to be effective but they are toxic, scarce, and costly at the time of need and can cause environmental pollution and leave residues in food products (Cameron and Walter, 2002). Alternative natural pesticides which are readily available, environment friendly than synthetic pesticides are therefore required to replace the synthetic pesticides which are harmful and toxic to producers and consumers (Ivbijaro, 1990; Fuglie, 1998 and Stoll, 2000). This study therefore aimed at investigating the effects of bitter melon, asthma plant and balanites extracts on fruitworm control in Dadin-Kowa, Gombe, Sudan Savanna of Nigeria.

MATERIALS AND METHODS

Field experiment was conducted at Federal College of Horticulture Research Farm Dadin-Kowa, Gombe during 2003/2004 and 2004/2005 dry seasons. Three different plant extracts, Bitter melon, Momordica balsamina L., Athma plant, Mitracarpus villosus L. and Balanites, aegyptiaca Del. were used as treatments laid out in a randomized complete block design replicated four times. Tomato Roma VFN variety was sourced from Gombe State ADP farm input store Bogo and used for the study. The three plant leaves were obtained from Dadin Kowa village and used for the study because of their availability in the locality and for their ease of preparation. The seedlings were raised in a nursery bed in October 2003 and October 2004 for four weeks and transplanted when they had six leaflets (5 WAS).

A week before transplanting, the experimental site was cleared of weeds, ploughed, harrowed and plots were made at 5.0m x 4.0m size with an inter plot space of 1.0m and border space of 2.0m round the experimental field. The tomato seedlings were transplanted into the field in the evening after all the plots were watered and allowed to drain to field capacity. One week after transplanting, gaps were filled, the plots were weeded and NPK 15.15.15 fertilizer was applied at 37g/stand. Fresh and clean leaves of the three plants were collected and pounded into pastes. The pastes were weighed 10g into 250ml conical flask and 100ml of clean water was added to each and manually stirred thoroughly for 15 minutes according to Fuglie (1998). The pastes and water were left for 24 hours and thereafter filtered through a 1.0mm sieve. The filtrates obtained were poured into three separate plastic bottles ready for application (Stoll, 2000 and Babarinde, Adebayo and Odeyemi, 2008).

The tomato plants were sprayed three times at one week interval with the three plant extracts at 10% w/v concentration to control the fruit worm. Data collection were carried out on five randomly selected and tagged tomato plants. These were on number of holes/fruit, number of damaged fruits/plant, number of undamaged fruits/plant, fruit weight/plot using weighing balance, fruit size/plant and total fruit yield were recorded at harvest. The data collected were subjected to analysis of variance (ANOVA) using statistix version 8.0 and their means were separated using Duncan multiple range test (DMRT) at 5% level of probability.

RESULTS AND DISCUSSION

The numbers of holes/fruit were significantly lower on tomato plants treated with biter melon *(Momordica balsamina)* followed by asthma plant while balanites had significantly higher number of holes/fruit (Table 1). The results presented on Table 2 show that *M. balsamina* significantly had the lowest number of damaged fruits/plant while balanites had significantly the highest number of damaged fruits/plant. The lowest number of holes/fruit and lowest number of damaged fruits recorded in bitter melon in the two years indicate that bitter melon was more effective than asthma plant and balanites in controlling tomato fruit worm at 10% w/v concentration at one week spray interval in the dry season. This agrees with the findings of Babarinde, Adebayo and Odeyemi (2008) who reported that some plants have insecticidal properties for deterring and protecting field crops against insect pests. This result also suggests that bitter melon was more effective in reducing fruit worm boring and feeding on the tomato fruits for up to one week after treatment than asthma plant and balanites.

Results presented on table 3 indicate the number of undamaged tomato fruits/plant that was significantly higher in 2003/2004 and in 2004/2005 in bitter melon treated plots than in Athma plant and balanites treatments during the study period. Similarly, the results obtained in plots treated with 10% w/v concentration of M. balsamina on table 4, 5 and 6 show that there were significantly higher fruit weight/plant, fruit size and total fruit yield than that of Athma plant and balanites extracts during the two dry seasons. There were moderate numbers of undamaged fruits, fruit weight, fruit size and yield in balanites treated plots while Athma plant had significantly the lowest number of undamaged fruits, fruit weight, fruit size and total yield in both years.

Table 6 indicates that bitter melon (M. balsamina) is more effective in protecting tomato fruits against the fruitworm infestation than B. aegyptiaca and M. villosus extracts during the study period at 10% w/v concentration. This agrees with the findings of NRI (1996), Umeh *et al* (2002), Gerald and Frank (2005) who reported that fruitworm infestation could cause serious damage to tomato by boring into the fruits thereby reducing the fruit weight, size yield and market value as a result of larval feeding within the fruit contents.

Cameron and Walker (2002) suggest that M. balsamina reduces the boring and feeding damage of the fruitworm than the other treatments. The efficacy of M. balsamina extract in reducing the boring and feeding activity of the fruit worm is probably attributable to the strong pungent odour and taste of the plant (Ivbijaro, 1990). The moderate efficacy of Balanites aegyptiaca extract could be due to its active ingredient, saponin, which is toxic to cold blooded animals but not to mammals (Edwin, 1991). The effectiveness of bitter melon over that of balanites and asthma plant extract on tomato fruitworm implies that bitter melon extract which is available in the locality can be used as alternative to synthetic insecticide for the control of the pest.

Table 1: Effect of three aqueous plant extracts on number of holes/fruit in 2005/2006 and 2006/2007 dry season.

Treatment	Number of holes/fruit	
	2005/2006	2006/2007
Miracarpus villosus	2.7b	2.6b
Momordica balsamina	2.4b	2.5b
Balanites aegyptiaca	3.3a	3.2a
SE(±)	0.19	0.35
LSD (0.05)	0.47	0.85

Means within the same column followed by the same letter are not significantly different at 5% level of probability according to DMRT.

Table 2: Effect of three aqueous plant extracts on number of damaged tomato fruit/plant.

Treatment	No. of damaged fruit/plant	
year	2005/2006	2006/2007
M. Villosus	4.4b	4.3b
M. balsamina	3.6c	3.5c
B, aegyptiaca	6.8a	6.7a
SE(±)	0.36	0.39
LSD (0.05)	0.88	0.96

Means within the same column followed by the same letter are not significantly different at 5% level of probability according to DMRT.

Table 3: Effect of three aqueous plant extracts on number of undamaged fruit/plant.

Treatment	No. of undamaged fruit/plant	
year	2005/2006	2006/2007
M. Villosus	42.8c	42.7c
M. balsamina	53.9a	54.5a
B, aegyptiaca	47.1b	47.2b
SE(±)	3.85	4.04
LSD (0.05)	9.43	9.87

Means within the same column followed by the same letter are not significantly different at 5% level of probability according to DMRT.

Table 4: Effect of three aqueous plant extracts on fruit weight in 2005/2006 and 2006/2007 dry seasons.

Treatment	Fruit weight/plant (g)	
	2005/2006	2006/2007
M. Villosus	26.2c	25.1c
M. balsamina	31.9a	32.1a
B, aegyptiaca	29.7b	29.76b
SE(±)	0.87	1.21
LSD (0.05)	2.12	2.96

Means within the same column followed by the same letter are not significantly different at 5% level of probability according to DMRT.

Table 5: Effect of three aqueous plant extracts on number of fruit size in 2005/ 21006 and 2006/2007 dry seasons.

Treatment	Fruit (size/mm)	
	2005/2006	2006/2007
M. Villosus	31.0c	31.5c
M. balsamina	42.2a	41.6a
B, aegyptiaca	36.8b	36.4b
SE(±)	1.42	1.56
LSD (0.05)	3.47	3.82

Means within the same column followed by the same letter are not significantly different at 5% level of probability according to DMRT.

Table 6: Effect of three aqueous plant extracts on total fruit yield in 2005/2006 and 2006/2007 dry seasons.

Treatment	Total fruit yield (t/ha)
M. Villosus	22.33c
M. balsamina	27.29a
B, aegyptiaca	24.84b
SE(±)	0.82
LSD (0.05)	1.94

Means within the same column followed by the same letter are not significantly different at 5% level of probability according to DMRT.

CONCLUSION

This study investigated the effects of bitter melon, asthma plant and balanites extracts on fruitworm control in Dadin-Kowa, Gombe, Sudan Savanna of Nigeria.The findings of this study have shown that bitter melon *(Momordica balsamina)* is effective against tomato fruitworm damage at 10% w/v concentration sprayed at one week interval. It has significantly reduced the number of boring holes/fruit, number of damaged fruits, and had significantly increased the number of undamaged fruits, fruit weight, size and yield. The use of bitter melon *(Momordica balsamina L.)* extract at 10% w/v concentration sprayed three times at one week interval by low resource farmers in Gombe, Sudan Savanna of Nigeria should be encouraged for optimum tomato production in the dry season.

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