Evaluation of plant extracts for controlling insect pests of pepper (*caspicum* spp.) in Nigeria humid rainforest

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Abstract: The field experiment was conducted at the Teaching and Research Farm, School of Agriculture, Lagos State Polytechnic, to evaluate the efficacy of plant extracts: *Ageratum conyzoides, Ocimum basilum* and *Senna hirsuta* in controlling insect pest of pepper (*Caspicum* spp.) in Ikorodu area of Lagos state. The experiment was laid out in 4 × 3 factorial in a Complete Randomised Block Design (CRBD) replicated three times. Extract made from the plants at 1 kg leaf/4 litres of water were used as botanical insecticides. These were compared along with synthetic insecticides (Lambda-cyhalothrin). The effect of the plant extract and synthetic insecticide were not significant different ($P < 0.05$) on the number of days to 50% flowering, number of fruit drops and number of holes on three upper leaves. *A. conyzoides* extract plants was found to produced least number of holes (1.56) followed by Lambda-cyhalothrin. In term of yield, highest yield was observed from pepper treated with *A. conyzoides* extract (169.34) followed by control (133.45). In view of lack of significant difference among the treatments, the result revealed that *A. conyzoides, Ocimum basilum* and *Senna hirsuta* extracts can be used as alternative to synthetic insecticides in controlling insect pests of pepper.
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Introduction

Capsicum species popularly known as pepper is the world's second most important fruit vegetable crop after tomato. According to Adamu, *et al* (1994) Nigeria is the largest producer of pepper in Africa, accounting for about 50% of African production and FAO reported that Nigeria produced 695,000 metric tons from total area of 77,000ha. The crop has a wide distribution as a garden crop, while as a commercial vegetable production; its cultivation is confined to the drier savannah region of Nigeria (Annons, 2006). Five different species were domesticated; *Capsicum annum, C. frutescens, C. baccatum, C. Chinese* and *C. pubescens*. Among the species, *C. annum* is the most widely spread and most important. Consumption of pepper accounts for about 20% of the average vegetable consumption per person per day in Nigeria (Erinle 1989; Alegbejo 2002). It is used extensively in food flavouring in the daily diet of over 1.2 million Nigerian irrespective of their socio-economic status. It is used in the preparation of soup and stew, which are among the major essential compliments of staple based cereals and root crops and also forms remedies for toothache and sore throat (Alabi 2006; Asawalam 2007).

However there is need to increase production as indicated by the demand for pepper throughout the year, but this has been hampered as result of insect pest infestation. Insect pest constitute a limiting factor in pepper production. The major insect pest include aphids, crickets, cutworms, thrips and whiteflies which have devastating impact on pepper production (Cobley 1976; George1999). Insect pests account for about 20% of yield loss, in recent time, the protection of agricultural crop and produce has been accomplished with the use of synthetic insecticides. These insecticides, though valued for their effectiveness, has been characterized by several shortcomings such as health hazard to farm households and consumers in developing countries (Ngamo 2004), erratic supplies and unavailability at critical period (Adedire and Ajayi,1996), high cost and inadequate knowledge by farmers about proper use Arannilewa 2007). Since it is well established that chemical pesticides have potential harmful effect on environment, and in accordance with the current global focus towards discouraging the use of synthetic insecticides on consumable items, there is an urgent need for effective botanical pesticides with biodegraeable and non-toxic effect on target organisms. Hence, this study was carried out to investigate the efficacy of that *A. conyzoides, O. basilum* and *S. hirsuta* extracts in controlling insect pest in pepper production.

Materials and Methods

The experiment was carried out during the wet period of 2010 season at the Teaching and Research Farms of Lagos State Polytechnic, Ikorodu, Lagos State (Latitude 5^0 10' N and longitude 3^0 16' E). The site has been previously cropped with maize and the total land area is 19m × 61m ($1159m^2$). The nursery site was located beside the main plot. The experimental plot was ploughed twice to obtained a clean fine tilt soil and thereafter pegged and divided into 12 blocks of 4m × 19m from which each was sub-divided into 3 plots of 4m × 5m, each and giving a discard space of 1m between each plot.

Seeds of local varieties of "Sombo", "Tatase", and "Ata wewe" (Ijosi) were obtained from Ifo open market in Ifo Local Government Area, Ogun State, Nigeria. Wood ash was used to treat the seed before planting Roy et al 1972) in order to prevent attack from soil borne pathogen. The seeds were sown using broadcasting method and all necessary routine nursery management was carried out accordingly. The seedlings was transplanted at 4 leaf stage at spacing of 1m × 1m Norman (1992) at one seedling per stand to give 20 stand per plot, while 720 stands were recorded for the whole site amounting to 10,000 stands/ha and all necessary post cultural operations were carried out as at when due.

Aqueous leaf extract of *A. conyzoides* (Goat weed), *Ocimum basilum* (sweet basil) *and Senna hirsuta* (Stinking cassia) were used as botanical insecticides and synthetic insecticide (Lambda-cyhalothrin) was used as control treatment. Cold water method of extraction was employed for the 3 botanicals. The preparation of the extract was done by maceration of 1kg of each plant leaves in 4 litres of cold water for 24h separately and thereafter the extract was filtered with muslin cloth. The insecticides were applied using knapsack sprayer FT 15 model.

The experiment was laid out in 4 × 3 factorial in a Completely Randomised block Design (CRBD) and replicated 3 times. Six plants were randomly selected and tagged as sampling unit per plot for data collection and the following data were collected: number of days to 50% of flowering, number of holes bore on 3 upper leaves of the plant, number of fruit drop/plot and number of fruits harvested per plot. Data collected were analysed using analysis of variance and treatment means were separated using Least Significance Difference (LSD) at 5%.

Result and Discussion

Number of days to 50% flowering

The effect of insecticides and species on the number of days to 50% flowering is shown in table 1. The result shows that "Tatase" cultivar having an average day to flowering of 34 days, "Sombo" cultivar with 36 days and "Ijosi" with 40 days and was statistically different. Statistical analysis also revealed that there were no significant (P> 0.05) interaction between insecticides and the species of pepper used on the number of days to 50% flowering. It also revealed that synthetic insecticide used was not significant (P > 0.05) different from plant extract used.

Number of fruit drops

The effect of plant extracts and species on the number of fruit drops is shown in table 2. The result shows that the highest number of fruit dropped was recorded in Tatase (49), followed by Sombo with 29 fruit drops, while the least was recorded from Ijosi pepper. Statistically, there were no significant (P > 0.05) difference between the effect of conventional insecticide used and the plant extract on the number of fruit drops recorded during the experiment.

Number of fruits harvested per plant

Table 3 shows the effect of plant extract and species on the number of fruits harvested per plant (yield). From the result, the highest numbers of fruits harvested were observed on all the species of pepper treated with *A. conyzoides* extract followed by synthetic insecticide, *S. hirsuta* and *O. basilum* extract respectively. Statistically, the result shows significant effect on the yield of pepper. Also the result revealed significant effect of the species on the number of fruit harvested and interaction effect of insecticides and species.

Number of hole on 3 upper leaves

The effect of plant extracts and species on the number of holes on the upper leaves of pepper is presented in Table 4. The result revealed that least number of holes was recorded on the pepper treated with *A. conyzoides* extract followed by *O. basilum* extract, synthetic insecticide and *S. hirsuta.* Statistically there were no significant differences in the number of hole on three upper leaves among the three cultivars of pepper used, so also the synthetic insecticide and plant extract used; while interaction effect of species and insecticides were highly significant.

Discussion

Plant extracts (aqueous or oil) have been used for pest management worldwide by limited resource farmers and have been found effective in various trials by scientists (Ahmed 1998; Jacobson 1989; [Schmutterer 1990). In Nigeria, some of the plant materials used in this study has been found individually effective in storage pest control (Oparaeke et al., 2003; Okoye 1996; Ivbijaro 1990; Olaifa 1998). Information on the use of plant extracts for field pest control is limited. This result

demonstrated the potential of extracts to control insect pests on pepper plants. The mode of action of these extracts in controlling the target pest is not clear. However, it could be contact activity, and possibly antifeedant action.

The yield obtained from plant extracts treated plots were significantly higher, this is in line with Panhwar (2002) and Fuglie (1998) who reported that plant extract applied on field cowpea plant increased flower production per plant. Insect pests infestation on the field has been identified as the major obstacle to crop production. These results correspond positively with the earlier work conducted by previous researchers which showed that plant extract increased yield of vegetables and pea plants by protecting them from insect pests Panhwar 2002;Amgridge 1996;Stoll 1998). Similarly, Gaby (2000) showed that, application of plant extract in powder or solution form significantly increased yield of cowpea plants. Field observations indicated that none of the extracts used in this study produced any phototoxic effect on pepper leaves. The result obtained from this study was in contrast with the findings of Olaifa and Adenuga (1998) who reported that neem products caused yellowing and subsequent shedding of leaves. The effectiveness of plant based insecticidal application may be enhanced if it is sprayed either in early morning or late evening (Oparaeke et al., 2003).

Result of the experiment showed that all the tested plant extracts have potential value to substitute synthetic insecticides in boosting pepper production within the framework of sustainable pest management in organic farming. Further research is needed to test the extracts on other crop, which have similar pest complex to verify the result obtained in this study and also to determine the efficacy levels of the extracts.

Table 1. Effect of plant extracts and species on number of days to 50% flowering

Species Insecticides	Tatase	Sombo	Ijosi	Insecticide effect
Lamba-cyhalothrin	205.6	231.0	240.3	225.63
S. hirsuta	206.0	232.3	236.3	224.87
O. basilum	208.3	234.6	237.6	226.87
A. conyzoides	206.3	234.3	238.6	226.40
Species main effect	206.55	233.05	238.2	

LSD = 2.01

Table 2. Effect of plant extract and species on the number of fruit drops

Species Insecticides	Tatase	Sombo	Ijosi	Insecticide effect
Lamba-cyhalothrin	2.33	0.67	1.00	1.33
S. hirsuta	3.67	2.33	0.67	2.23
O. basilum	3.00	4.00	0.00	2.33
A. conyzoides	7.33	2.67	2.33	4.11
Species main effect	4.08	2.42	1.00	

LSD = 2.01

Table 3. Effect of plant extract and species on the number of fruits harvested per plant

Species Insecticides	Tatase	Sombo	Ijosi	Insecticide effect
Lamba-cyhalothrin	16.67	143.67	24.00	133.45
S. hirsuta	16.00	107.33	267.00	130.11
O. basilum	17.00	124.00	219.00	120.00
A. conyzoides	20.67	195.67	291.67	169.34
Species main effect	17.59	142.67	254.42	

LSD = 29.49

Table 4. Effect of plant extract and species on the number of holes on 3 upper leaves

Species Insecticides	Tatase	Sombo	Ijosi	Insecticide effect
Lamba-cyhalothrin	3.33	1.67	1.67	2.22
S. hirsuta	3.00	3.00	2.33	2.78
O. basilum	3.66	1.33	2.67	2.55
A. conyzoides	3.00	0.00	1.67	1.56
Species main effect	3.25	1.50	2.09	

LSD = 2.01

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