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Sustainable production of improved pigeonpea pods through management of *Riptortus dentipes* Fab. (Hemiptera: coreidae) with formulated neem seed oil at varying rates and spraying schedules in Owerri, Nigeria.

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ABSTRACT

Control of population of *Riptortus dentipes* Fab. on improved pigeonpea pods using formulated neem seed oil (F-NSO) at varying rates and spraying intervals. The study was carried out at the Postgraduate Teaching and Research Farm, Department of Crop Science and Technology, Federal University of Technology, Owerri Imo State beginning from May 2009, 2010 and July 2010. The July planting season which was the approved planting date in the area from research trials, was also subjected to control strategy with F-NSO to determine the population of *R. dentipes* under pest control measures. The experiment was laid out in 3 x 5 factorial comprising three rates of neem seed oil, 2 mL (4.2 L ha^{-1}), 4 mL (8.3 L ha^{-1}), 6 mL (12.5 L ha^{-1}) with 0mL (0 L ha^{-1}), and synthetic pyrethroid (cypermethrin) 0.72 mL (1.5 L ha^{-1}) as checks plots and three intervals of application: once a week, once in two weeks, and once in three weeks. Results from field trials showed that application of F-NSO at higher dosage rate of 12.5 L ha^{-1} and at four regime spraying intervals of once a week significantly ($p<0.05$) reduced the population of *R. dentipes* on the pods compared with the untreated plots but was not superior to the plots treated with syntethic pyrethroid (SPY).

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Key words: Improved pigeonpea, podding phase, *Riptortus dentipes*, neem seed oil, synthetic pyrethroid, rates, frequencies.

INTRODUCTION

Pigeonpea (*Cajanus cajan* (L.) Millsp is an important source of protein and often regarded as poor man's food in Nigeria especially at south eastern part of the country (Dialoke *et al*., 2010). The main factor that limits the production is the presence of insect pests particularly the pod sucking bugs dominated by R. dentipes which contributed to about 57.92 -95.69 % in Kogi State, 59.71-80.85 % in Benue State, and 68.50-93.10 % in Imo State (Dialoke, *et al.,* 2010). The nymphs and adults of *R. dentipes* feed on the succulent pigeonpea pods. There may be complete crop failure if insecticidal protection is not given attention. Unfortunately insecticidal application causes a lot of problems ranging from destruction of natural enemies of pests, environmental degradation, pest resistance, resurgence to health risks to farmers and livestocks, among others. This situation therefore stimulated an interest for research on alternative insecticides that will be environmental friendly, and safe to humans and livestocks. Insecticides from plant origin can definitely offer such management option. Aqueous oil extracts from plants have been used by farmers worldwide, as bio-agents (Yang and Tang, 1987). Information from research materials on the use of formulated neem seed oil (F-NSO) to manage the population of *R. dentipes* in Rainforest Zone of owerri is vague. Therefore the objective of this research is to determine the quantity of formulated neem seed oil (F-NSO) and the frequency of spraying that can reduce the population of *R. dentipes* on improved pigeonpea pods to a threshold level in Owerri farmers' farms.

MATERIALS AND METHODS

Experimental site

Field research was carried out in the Postgraduate Teaching and Research Farms, Department of Crop Science and Technology, Federal University of Technology, Owerri, Imo State, Nigeria. Experiment was carried out in the months of May

2009, 2010 and July 2010. The research field is located in the rain forest belt (7° 12′ E and 5° 27′ N). An improved pigeonpea cultivar, ICRISAT pigeonpea lines (ICPL) 84023 procured from the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), India under phytosanitary certification was used for the research. The cultivar has maturity duration of 3 to 4 months as against our local cultivar that needs 8 to 9 months.

An area measuring 40.0 m by 15.0 m (600.0 m^2) was cleared and mapped out at the Postgraduate and Research Farms, Department of Crop Science and Technology, Federal University of Technology, Owerri at the beginning of May 2009, 2010 and July 2010 cropping seasons.

There were 5 treatments comprising three rates of formulated neem seed oil (F-NSO), 2 mL (4.2 L in 840 litres of water ha^{-1}), 4 mL (8.3 L in 840 litres of water ha^{-1}), 6 mL (12.5 L in 840 litres of water ha^{-1}), untreated plot (0 L ha^{-1}) and synthetic pyrethroid [Cyperforce (cypermethrin 30g/L +dimethoate 250 g/L EC] at 0.72 mL (1.5 L in 840 litres of water ha^{-1}) as checks with 3 intervals of application (once in a week, once in two weeks, and once in three weeks). There were 15 treatments allocated at random to each plot.

The experimental design was a 3 x 5 factorial laid out in Randomized Complete Block Design (RCBD) with three replications. Spraying was carried out weekly starting from flower bud initiation till pods maturity using hand operated knapsack sprayer. Formulated neem seed oil (F-NSO) from neem tree *Azadirachta indica* A. Juss marketed by National Research Institute for Chemical Technology (NARICT), BASAWA Zaria Road, Kaduna was used in all the spraying trials at recommended rate of one litre in 200 litres of water per hectare. At spraying time the different concentrations were diluted with a constant water volume of one litre of clean water/plot and latter converted to hectare basis as mentioned above.

There were three replications with 3.0 m pathways between replications and each replication comprised of 15 plots of size 2.4 m by 2.0 m and separated by 1.0 m pathways between plots. There were five ridges per plot and each ridge contained 12 plants. Within row, planting spacing was 0.2 m and 0.4 m between ridges. Three seeds were planted per hole on 4th May 2009 and 2010 and later thinned down to one plant per stand two weeks after planting (WAP) to give a plant population of 60 plants per plot and 125,000 plants per hectare.

All the plots were kept weed free manually with the use of hoe at two weeks and six weeks after planting. There was no application of organic or inorganic fertilizers to the plots.

Data collection

Data collection started from pigeonpea pod formation using four plants selected at random from each three middle ridges giving a total of 12 sampled plants per plot till pod maturity. *Riptortus dentipes* observed visually were done at weekly intervals from 6.30 a.m. to 7.30 a.m. and numbers recorded following the method of Amatobi, 1994.

Statistical analysis

The analysis of variance for data on *R. dentipes* at podding phase was carried out using Genstat Discovery Edition 3, (2009). Data were first subjected to square root transformation before analysis of variance was carried out, while treatment means was separated by the use of Least Significant Difference (LSD) at 5 % level of significance

RESULTS AND DISCUSSION

The response of *R. dentipes* on pigeonpea pods to application of formulated neem seed oil (F-NSO) and synthetic pyrethroid (SPY) at spraying different frequencies during 2009 is presented in Figure 1 (A, B).

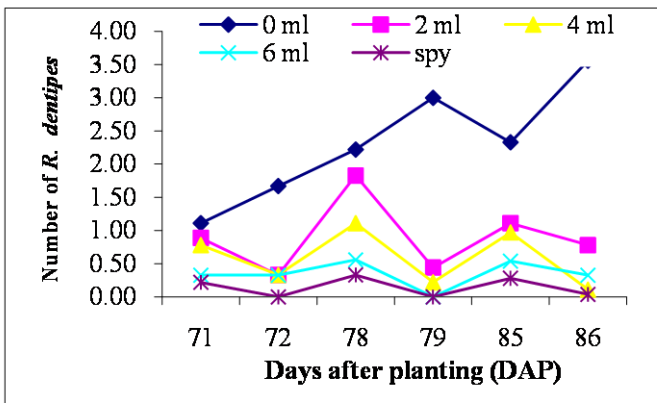

Fig. 1 (A). Effect of rates of formulated neem seed oil (F-NSO) on number of *R. dentipes* per plant at podding phase during May 2009 planting season.

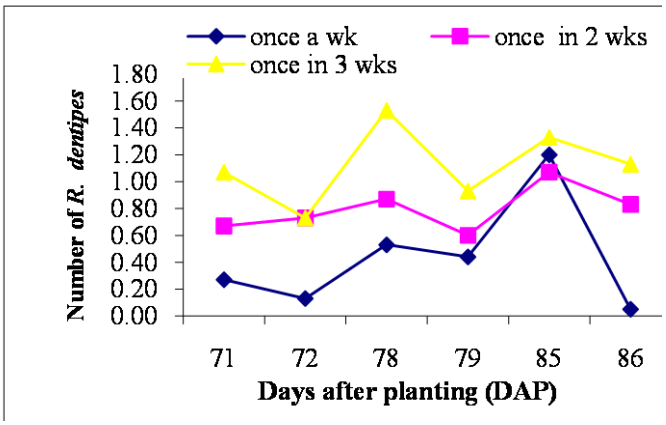

Fig. 1(B). Effect of frequency of spraying formulated neem seed oil (F-NSO) on number of *R. dentipes* per plant at podding phase during MAY 2009 planting season.

Significant ($p<0.05$) reduction of *R. dentipes* population was noticed in F-NSO and SPY plots compared with untreated plots. However, application of F-NSO at 4 ml, 6 ml/litre of water and SPY at 0.72 ml/litre of water did not significantly ($p>0.05$) differ in their efficacy at 72 DAP, and 79 DAP. In figure 2 (A, B), the population of *R. dentipes* on pods during 2010 was much reduced in all F-NSO treated plots at 6 ml/litre of water while the untreated plots experienced increased population.

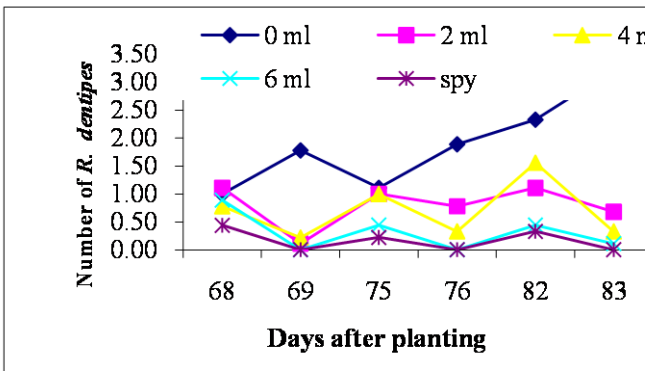

Fig. 2 (A). Effect of rates of formulated neem seed oil (F-NSO) on number of *R. dentipes* per plant at podding phase during MAY 2010 planting season.

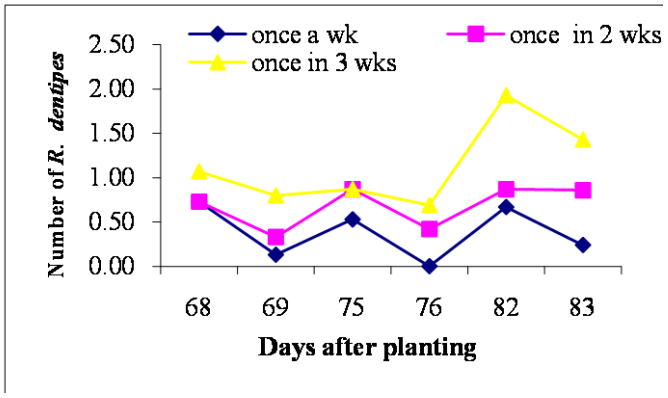

Fig. 2 (B). Effect of frequency of spraying formulated neem seed oil (F-NSO) on number of *R. dentipes* per plant at podding phase during MAY 2010 planting season.

The *R. dentipes* population in SPY was the lowest but not significantly different when compared with application of 6 ml of F-NSO at 76 DAP and 83 DAP. In fig. 3 (A, B), the population of *R. dentipes* on pods during July 2010 follows the trend as in figure 2 of May 2010 planting season. The population of *R. dentipes* at this period was much lower compared with the population during May 2009 and 2010 planting seasons. In fig. 1 (B), 2 (B) and 3 (B), scheduling the application of F-NSO and SPY at once a week had significant effect ($p<0.05$) with great reduction in the population of *R. dentipes* followed by application at once in 2 weeks. Delaying application to once in 3 weeks did not give sufficient protection to the pigeonpea pods.

There was an increased population of *R. dentipes* at podding stage of pigeonpea. The presence of many pods often longer on the plants than the flowers probably must have attracted greater population of *R. dentipes* at the podding phase**.** At podding phase, the population of *R. dentipes* before spraying F-NSO was high on pigeonpea pods but after spraying their population decreased, while the population fluctuates in untreated pigeonpea pods in relation to days after spraying.

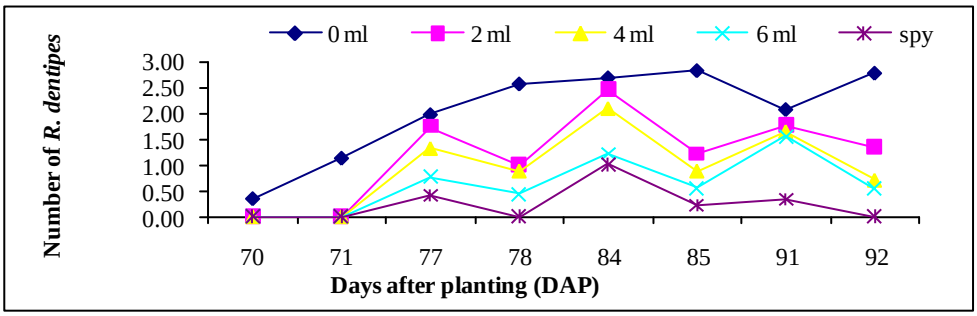

Fig. 3 (A). Effect of rates of formulated neem seed oil (F-NSO) on number of *R. dentipes* per plant at podding phase during July 2010 planting season.

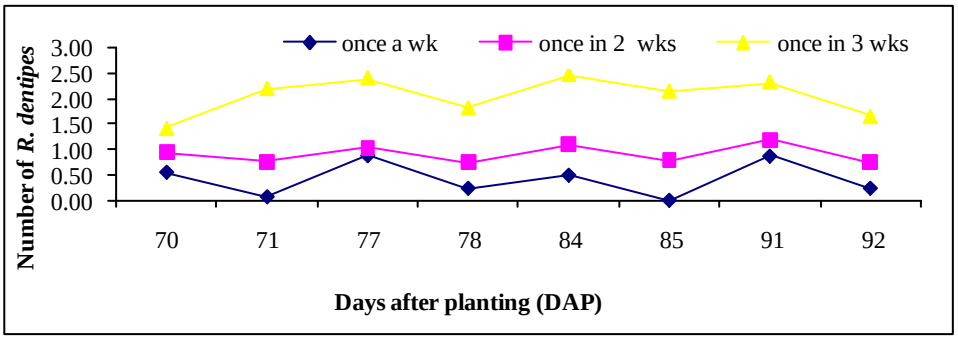

Fig. 3 (B). Effect of frequency of spraying formulated neem seed oil (F-NSO) on number of *R. dentipes per* plant at podding phase during July 2010 planting season.

This finding also agreed with earlier reports from Jackai (1993) who observed that neem products are reliable biopesticides which can be extended to control a wide range of insect pests on cowpea in the field. Marco *et al.* (1990) on pigeonpea also recorded ecdysteroid depletion when neem extracts was applied. The synthetic pyrethroid controlled *R. dentipes* on the pods better than the F-NSO.

The insecticidal activity of azadirachtin has been demonstrated against numerous insect pests (Emosairue and Ubana, 1996; Emosairue and Ukeh, 1996; Schmutterer and Singh, 1995; Basedow *et al.*, 2002) and its various mode of action can include disruption of feeding, reproduction or development (Mordue (Luntz) *et al.*, 1998; Walter, 1999). Also as a repellent neem prevents insects from initiating feeding and as a feeding deterrent, it causes insect to stop feeding either immediately after the first taste (due to the presence of deterrent taste factors) or at some point soon after ingesting the food (due to secondary hormonal or physiological effects of the deterrent substance (Olaifa *et al.*, 1991). As a growth regulator neem is thought to disrupt normal development interfering with chitin synthesis (Schmutterer, 1990, Olaifa *et al.*, 1991). Olaifa *et al.* (1991) also maintained that the susceptibility to the various effects of neem differs from species to species.

The F-NSO and SPY when sprayed on the pods at once a week proved better control strategy but for economic reasons spraying at once in 2 weeks also gave reasonable control of the pest better than once in 3 weeks (Degri and Hadi, 2002).

Application of all rates of formulated neem seed oil (F-NSO) controlled the population of *Riptortus dentipes*. but better control was noticed at high application rate of 6 ml/litr of water once a week compared with high population of *R. dentipes* in untreated pigeonpea plots. However, spraying synthetic pyrethroid at once a week showed better control of *R. dentipes* compared with formulated neem seed oil (F-NSO). The use of F-NSO has been found to be free from residual problems while SPY possesses residual toxicity to humans and environment. In this regard therefore, the efficacy of SPY notwithstanding it will be most appropriate for farmers to adopt the use of F-NSO at 4-6 ml/litre

of water in a four weekly application intervals in order to bring down the population of R. dentipes infesting pigeonpea pods in farmers field.

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