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Efficacy of Different Rates of Formulated Neem Seed Oil and Frequency of Application on the Control of Flower Thrips Infesting Early Maturing Pigeonpea Cultivar in Owerri, Imo State, Nigeria

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Abstract
Thrips (*Megalurothrips usitatus* Bagnall) population dynamics on early maturing pigeonpea flowers was carried out in 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. In this study, thrips (*M. usitatus*) population management using formulated neem seed oil (F-NSO) at different doses and spraying frequencies was examined. The experiment was laid out in 3 x 5 factorial comprising three rates of neem seed oil, 2 ml (4.2l ha^{-1}), 4 ml (8.3l ha^{-1}), 6 ml (12.5l ha^{-1}) with 0ml (0l ha^{-1}), and synthetic pyrethroid (cypermethrin) 0.72 ml (1.5l ha^{-1}) as check plots and three intervals of application: once a week, once in two weeks, and once in three weeks. Results from formulated neem seed (F-NSO) control measures showed non-significant ($p<0.05$) effect on the population of *M. usitatus* even at higher dosage of once a week 2 or 3 weeks of spraying in a four spraying regime. The application of synthetic pyrethroid (SPY) at once a week in a four spraying regime affected significantly ($p<0.05$) the population of *M. usitatus* on the flowers of early maturing pigeonpea.
Keywords: Improved pigeonpea, Thrips, flowers, population, formulated neem seed oil, rates, and frequencies.

Introduction
Pigeonpea flower thrips (*Megalurothrips usitatus* Bagnall) is one of the destructive pests causing considerable losses to flowers of pigeonpea (Kimani 1987). More than 200 insect species have been reported feeding on pigeonpea at various stages of its growth (Lateef & Reed 1990). Raheja (1973) observed that damage by thrips in early stages of crop growth would seem to be more important and is likely to result in substantial reduction in yield. Damage on cowpea by the pest is characterized by distortion, malformation, discoloration of the floral parts and drying of flowers (Taylor 1969). Thrips can also act as vectors of virus diseases on pigeonpea. Several control measures have been advocated such as cultural, use of resistant varieties and insecticides but these interventions have not been able to solve the problems of thrips on farmers' fields. Presently insecticides are the only method for effective control of thrips for reasonable pod yields (Jackai & Adalla, 1997). Chemical intervention however is not a sustainable practice as it is inundated with a number of problems such as pest resistance and resurgence, escalating cost of spraying, non availability of appropriate products at critical periods of need, environmental degradation and high mammalian toxicity among others. Insecticides are sold in open markets by business men who have no knowledge of toxicological consequences of pesticides to man and the environment. These problems have encouraged recent researches nationwide into alternative pest management system (APS) using plant based insecticides (PBI), mineral products and waste water. A number of plants have been found effective in various trials worldwide for pest control on crops (Saxena 1999, Schmutterer 1990) but unfortunately most of the protection centred on stored products (Oparaeke, *et al.* 1998, Dike & Mbah 1992). Neem tree being one of the trees is widely distributed throughout tropical Africa in both dry and humid areas (FAO 1988). It is grown in many parts of west Africa such as Nigeria, sierra leone, Ghana, Sudan, Ethiopia and East and Southern, Africa and used for pest control in crude aqueous formulation. There is lack of information on field application of formulated neem seed oil for pests control in pigeonpea Therefore this study investigated the population dynamics of pigeonpea flower thrips under control measures with formulated neem seed oil (F-NSO) at different spraying intervals and frequencies in Rain forest Zone of Imo State, Nigeria.

Materials and Methods.
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, longitude 7° 12′ E and latitude 5° 27′ N of equator. An improved pigeonpea cultivar, ICRISAT pigeonpea lines (ICPL) 84023 was used for the research and was procured from the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) India. The cultivar matures within 3 to 4 months as against our local cultivar that takes up to 8 to 9 months before maturity.

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Data on *M. usitatus*, were sampled removing 20 flowers from plots located within the two outer rows per plot. The flowers were placed in vials 30-70 % alcohol and taken to the laboratory where they were dissected and number of thrips counted using hand lens and recorded. All data collected were subjected to analysis of variance using Genstat Discovery Edition 3, (2009). Data on thrips count were 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.

Cultural practices:
Weeding was done manually with the use of hoe at three weeks and seven weeks after planting.

Results And Discussion
The response of flower thrips (*Megalurothrips usitatus*) to application of F-NSO and SPY at different frequencies during 2009 is presented in figure 1 (a and b). The results show that application of F-NSO on the pigeonpea flowers had no significant effect on the population of flower thrips, *M. usitatus* when compared with unprotected plots. Most probably the repellent effect of the F-NSO on the *M. usitatus* could have been reduced by rain. Application of SPY, however significantly reduced the population of flower thrips. The frequency of spraying at once a week and once in 2 weeks were not significant with respect to the reduction in the population of flower thrips.

Figure 2 (a and b) presents the response of flower thrips *M. usitatus* to application of synthetic pyrethroid (SPY), and F-NSO at spraying frequencies in May 2010. The results similarly show no significant effect on the population of flower thrips compared to the control and in response to the application of F-NSO, but the thrips population was significantly reduced under application of synthetic pyrethroid (SPY). The low population of *M. usitatus* in synthetic pyrethroid (SPY) plots compared with formulated neem seed oil (F-NSO) and untreated plots indicated that SPY could be an alternative *M. usitatus* control measure.

In Figure 3 (a and b) the results with respect to thrips population during July 2010 planting is presented. There was also non significance ($P>0.05$) difference of the thrips the population on the flowers even though there was reduced population during July period compared with high population encountered during May 2009 and 2010 planting seasons. The non-significant observed in all the planting seasons indicated that F-NSO as a contact insecticide could not have penetrated inside flower where thrips were located. The results are contrary to the findings of (Oparaeke *et al*. 2006) from Zaria who worked on cowpea and reported that neem extracts do control *M. sjostedti*.

Summary And Recommendation
The population of flower thrips (*M. usitatus*) in the control plots was not- significant with the plots sprayed with F-NSO, in 2009, 2010, and July 2010 planting seasons. The application intervals were also not-significant even though slight reduction of *M. usitatus* population was noticed on plots sprayed at weekly intervals. Significant reduction of the population of M. usitatus was observed in the synthetic pyrethroid (SPY) sprayed plots.

Therefore for proper management of *M. usitatus* on early maturing pigeonpea, use of synthetic pyrethroid should be adopted. However because of health concerns of SPY, more research should be carried out to strengthen the potency of formulated neem seed oil with botanical pesticides having stronger systemic action that can penetrate inside flowers to kill thrips species.

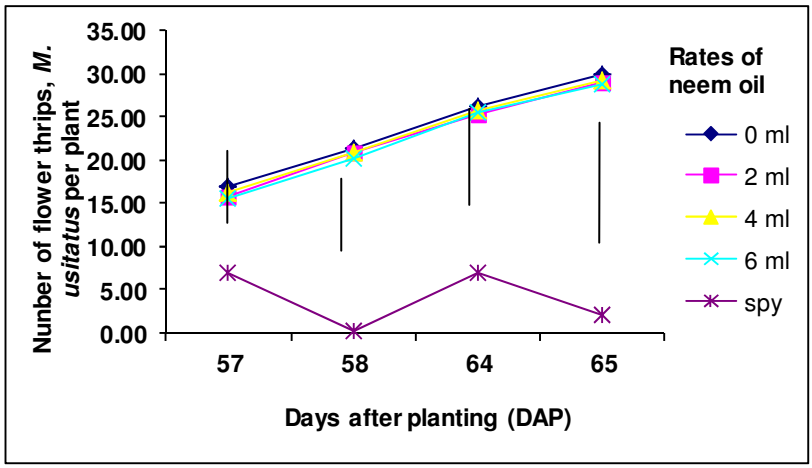

Figure 1 (a): Effect of rates of formulated neem seed oil (F-NSO) on number of flower thrips, M. usitatus per plant at flowering phase during MAY 2009 planting season.

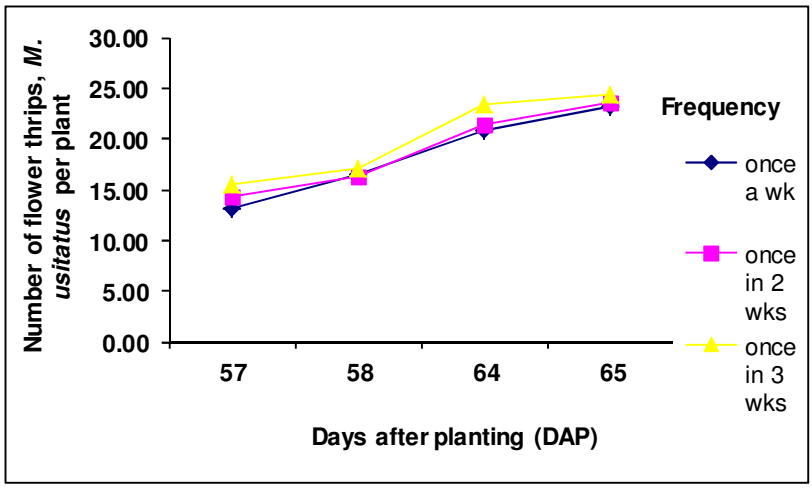

Figure 1 (b): Effect of frequency of spraying formulated neem seed oil (F-NSO) on number of flower thrips, M. usitatus per plant at flowering phase during MAY 2009 planting season.

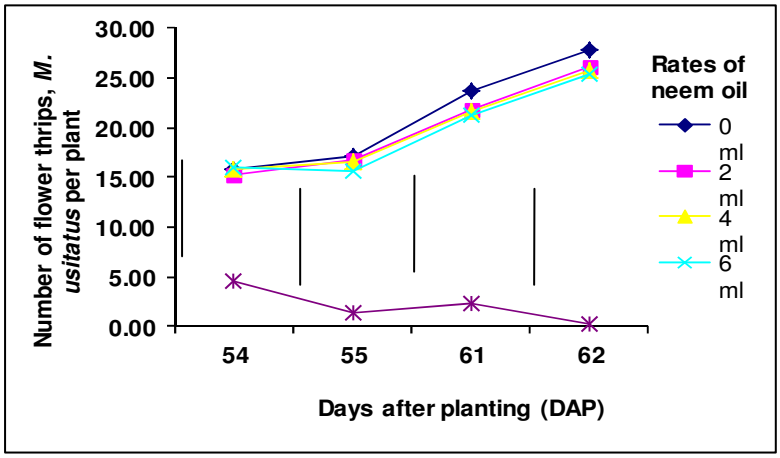

Figure 2 (a): Effect of rates of formulated neem seed oil (F-NSO) on number of flower thrips, M. usitatus per plant at flowering phase during MAY 2010 planting season.

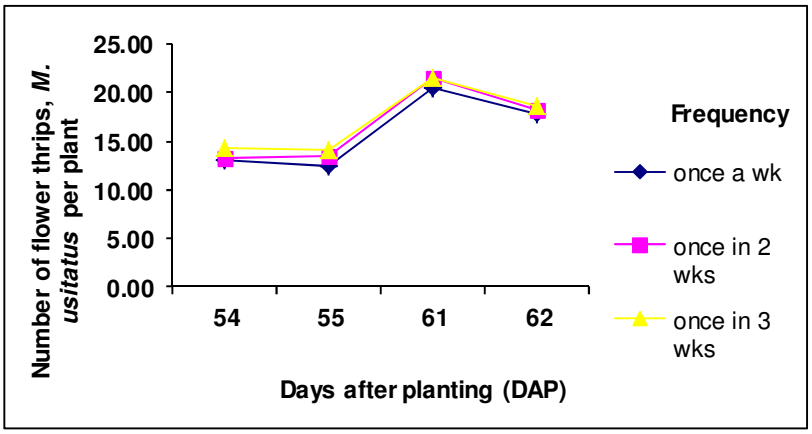

Figure 2 (b): Effect of frequency of spraying formulated neem seed oil (F-NSO) on number of flower thrips, M. usitatus per plant at flowering phase during MAY 2010 planting season.

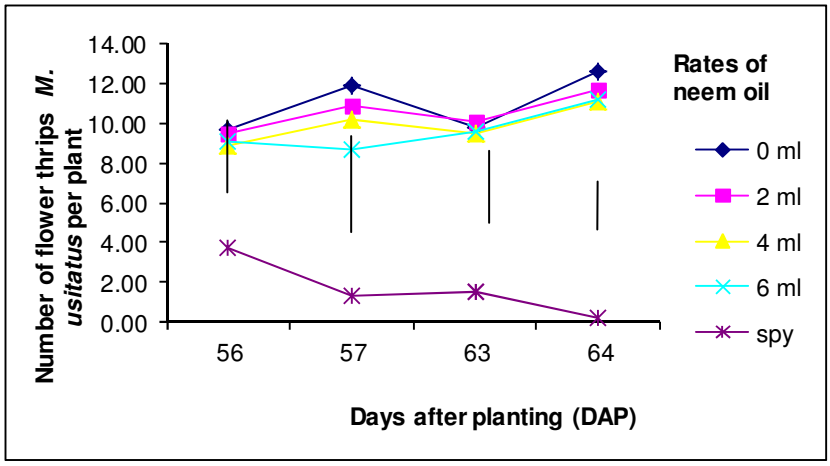

Figure 3 (a): Effect of rates of formulated neem seed oil (F-NSO) on number of flower thrips, M. usitatus per plant at flowering phase during JULY 2010 planting season.

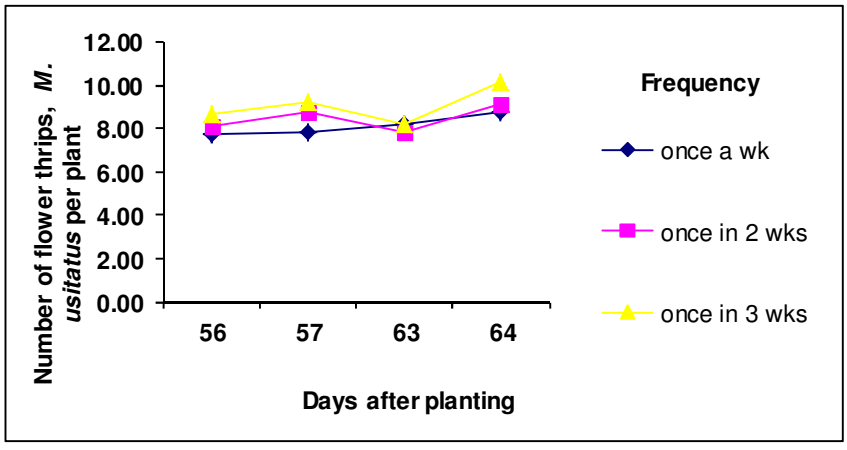

Figure 3 (b): Effect of frequency of spraying formulated neem seed oil (F-NSO) on number of flower thrips, M. usitatus per plant at flowering phase during JULY 2010 planting season.

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