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Potentials of Some Plant Extract for the Control of Two Field Pests of Cowpea (*Vigna unguiculata Walp*)

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Abstract

Two field experiments were conducted at Badeggi in the "Southern Guinea Savanna Zone of Nigeria in 2013 and 2014 to screen the insecticidal potential of three local plant products as usable bio – pesticides. The three plant products were Tephrosia vogellic, Azadiracta indica and Annona senegalensis. A synthetic insecticide – pirimophos methyl (Actellic dust) and a control treatment where neither the plant product nor the synthetic insecticide was included for comparison. The results obtained from the study showed that all the local plant treatments reduced aphid population from four weeks after planting until seven weeks when there was no appreciable reduction anymore. Generally, the Ootheca species recorded across the treatments including the control is low for both years when plant products were used. In both years plots sprayed with extracts from Azadiracta produced significantly higher pod weight than plots sprayed with Tephrocia or Annona extracts. Similarly leaf extracts from Azadiracta and Tephrosia produced the highest weight of pods per plot in both years. All the treatments produced more pods per plot than that of the control treatment with neither plant products nor the synthetic insecticides.

Keywords: Aphid, Cowpea, Ootheca, plant extract.

Introduction

Cowpea (*Vigna unguiculata* (L)) Walp is a member of the family *leguminous* and is speculated to have originated in Africa. Njoku N. (2005) led by the evidence of the presence of wild progenitors of cowpea in West Africa suggested that the region was the nucleus of cowpea domestication. In the West African sub – region, Nigeria has been speculated to be the centre of origin of cowpea because of the existence and a widespread distribution of different varieties and wild prototypes. Ezenwa (2003) stated that judging by the nationwide practice and prejudices associated with the culture and utilization of the crop in Nigeria. Its African centre of origin may not be in doubt.

Cowpea is an important food source in Nigeria and the developing countries because of its high protein content (25 – 35%). IITA (2004) reported that the mean per capital consumption of dry beans in African (41.50Kg) is higher pthan the Latin America (25.30Kg). Krista *et al.*, (1990) showed that dry bean consumption could be classified as low (13kg/yr or 36g/day), medium (25kg/yr or 68g/day) or high 50Kg/yr or 137g/day). Adeoti (2009) reported that a minimum daily requirement of 58.9g available protein per head per day is needed in Nigeria out of this, over 60% is supplied by cowpea.

A number of factors militate against the mass production of cowpea in Nigeria. Prominent among these are the severe damage caused by disease and

susceptibility to a wide range of insect pests. These pests may attack virtually every part of the crops – roots, stems, leaves, flower and pods. (Kumar 1990). Raheja (2006) estimated that in Northern Nigeria about 71% of the yield losses of cowpea occur during flowering and pod formation stages of the plant. Aphis craccivora Koch is one major insect pest of cowpea that causes direct of seedlings. damage, stunting, leaf distortion, premative defoliation and death of cowpea that causes direct of seedings. An indirect damage and generally more harmful effect even of small populations is the transmission of cowpea aphid borne mosaic virus disease. Ootheca species is an important foliage feeder on cowpea seedlings. Adults feed interveinally on the leaves, later enlarging damage into feeding holes. High beetle populations can totally defoliate cowpea seedlings and kill them. Adult beetles are also effective vectors of cowpea yellow mosaic virus disease.

The objective of this study was to examine the effectiveness of extracts from three plant species namely *Azadirachta indica*, *Annona senegalensis* and *Tephrosia vogellii* in the control of these two major pests of cowpea. This is against the background of the fact that these extracts are less expensive, affordable, environmentally friendly, less hazardous and compatible with marginal farming circumstances throughout the tropics and requiring simple, adoptable skills for their use.

Materials and Method

Two field experiments were conducted at the National Cereal Research Institute Badeggi located on Latitude 9^0 37N, Longitude 6^0 23 E in Southern Guinea Savannah ecological zones of Nigeria during 2013 and 2014 cropping seasons. The land was cleared, ploughed and ridged. For each year, a gross area measuring 58.0m x 29.0m was marked out and 40 smaller plots each measuring 6m x 4.5m (i.e 6meters x 6ridges) were marked out. Each smaller plot was separated from the adjacent one by 1m gap path. Each experiment was then laid out in a randomised complete block design containing ten treatments replicated four times. An early maturing cowpea variety IT 82E – 32 was used in the study. Two seeds were sown at an inter – row spacing of 30cm and intra – row spacing of 75cm on 7^{th} June, 2013 and on 20^{th} May, 2014. The field was kept weed – free throughout the growing season.

The herbs used were collected from local farmers around Badeggi and these were leaves, stems and roots from *Azadirachta indica*, *Annona senegalensis* and *Tephrosia vogellii*. These were collected manually and allowed to air dry at room temperature for seven days.

Upon drying all morphological plant parts of the herbs were crushed gently using a mortar and pistle until the powders resulted, individually, the dried powders were soaked in water and heated at 40^0C for about 30 minutes. This was left for another 24 hours before filtering with a Muslin cloth of fine mesh. For treatments involving root and stem parts, 120g of the dried powder per 4 litres of water was

used as recommended by Anon (1995). In the case of leaves of those herbs 200g per 5 litres of water was used. Application of these formulations was done on weekly internal starting from four weeks after planting.

At two weeks after planting, the number of aphids and Ootheca species on leaves, and stems were counted in situ on ten randomly selected plants per plot and weekly thereafter. Yield data collected included weight of pods per plot (Kg/ha) and grain yield of cowpea (kg/ha).

Results and Discussions

The results indicate some varying levels of insecticide activity on both aphids and Ootheca species. Within the period of one week after planting up to three weeks after planting when spraying had not started, there was high population build-up of aphid (Fig 1 and 2). This is attributing to the fact that aphids are highly prolific and within a short time, their numbers can increase rapidly (Balakov *et al.*, 2011). However between the period of three weeks after planting, application of the plant extracts had started and there seems to be a down population shift with each plant extract showing varying levels of aphid suppression (figs 1 and 2). It could be noticed that for the two years, the application of *Tephrosia vogelli* gave the least population of aphids (Figs. 1 and 2). In an earlier report, Elwell and Maas (1995) had shown that leaves of *tephrosia* are essentially effective against aphid when the water is warm at the time of spraying. The higher toxicity of *tephrosia* to aphids could also be linked to the fact that roterione which is among the active ingredients is mostly concentrated in the roots and leaves of the plant (Meitzner and Price 1996).

The performance of tephrosia was closely followed by the *Azadirachta indica* in ability to suppress the activity of the aphids (Figs. 1 and 2). These may be due to the fact that the active compounds in the neem which include *Azadirachta*, *salannin* and *Nimbare* concentrated in the seed. (Morgan, 2011). However, seed powder was not included in this study for the fact that the study was focused on the insecticidal potentials of other morphological parts apart from seeds of the three plant species used. *Annona senegalensis* was the least effective of the three plant species used in this study probably because its toxic effects sets in slowly (Graingne *et al.*, 1985). The control treatment which received no treatment with any of the plant extracts continued to maintain high populations of aphids throughout the two years (Figs 1 and 2).

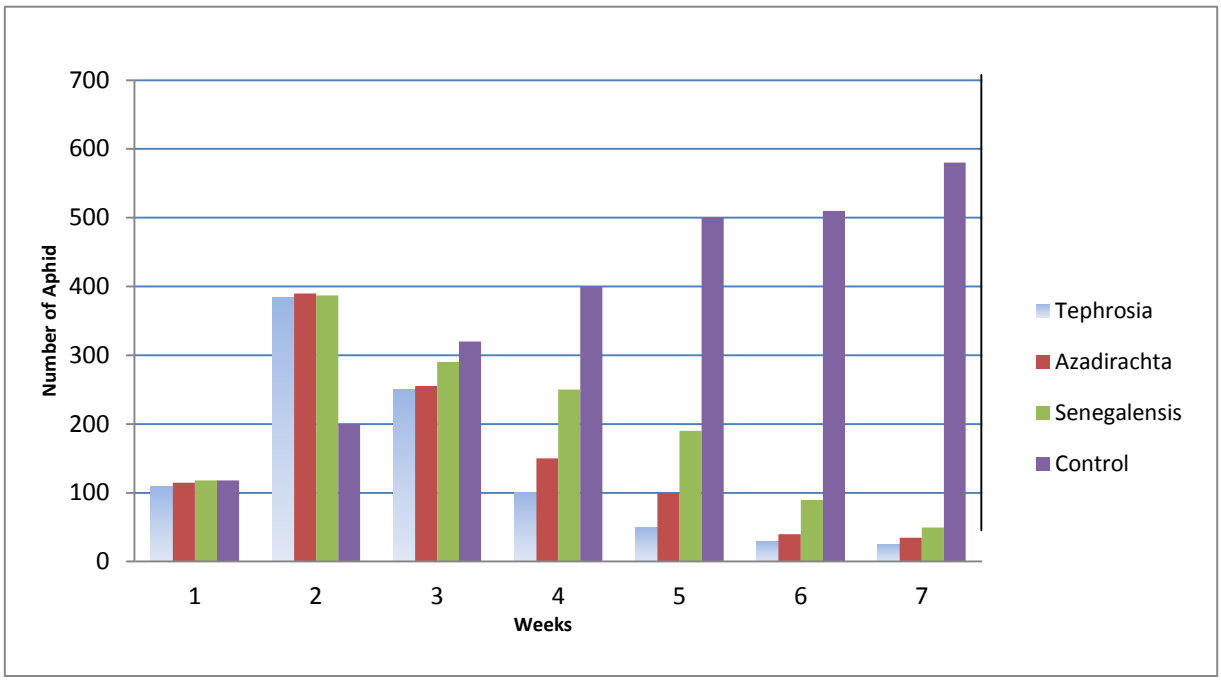

FIG 1: APHID POPULATION FOR 2013

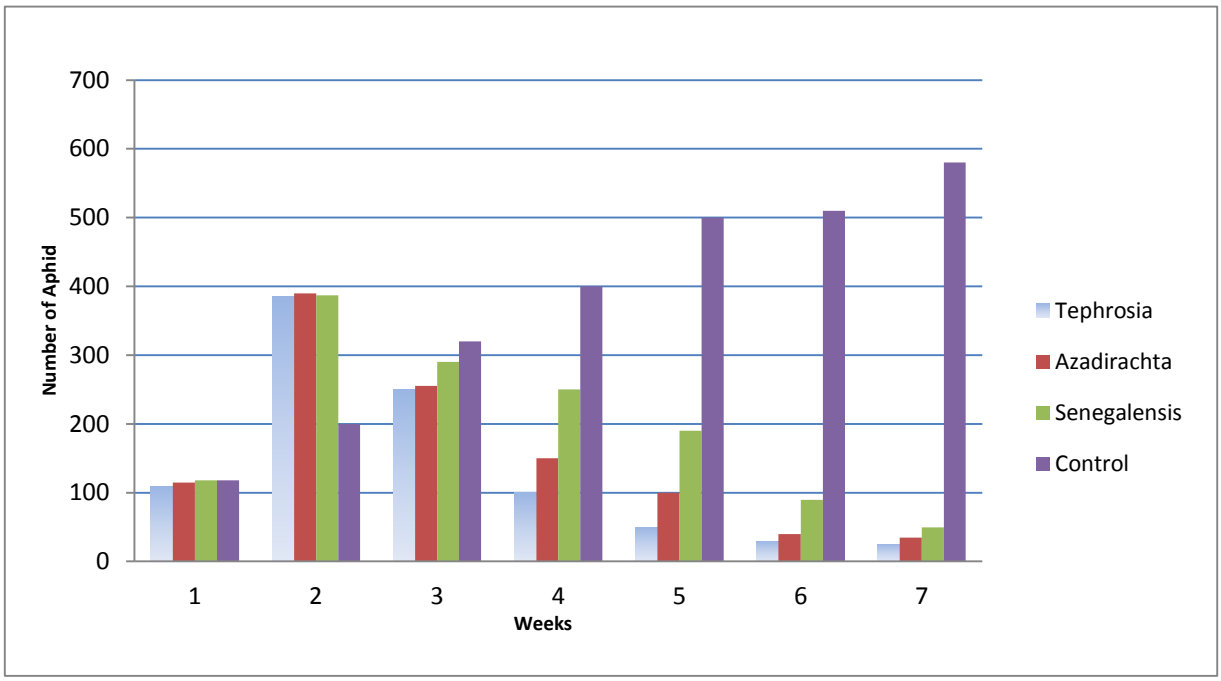

FIG 2: APHID POPULATION FOR 2014

Similar trends as explained above in the case of aphids were also observed for Ootheca species populations in 2013 and 2014 (Figs 3 and 4). However the population of aphid was particularly low for the two years. In an earlier report, Akingbohungbe (2013) had indicated that very high number of Ootheca species is required before a serious damage can be caused on the field and that this high number is normally not always attained under field practical conditions. The mechanisms of action of these potential plant products could be partly contact toxic action because some dead aphids and Ootheca were noticed around the treated plants. It could also be due to mechanisms such as repellence and antifeedant actions.

The effect of treatment on pod weight and grain yield is shown on table 1; revealing that all the treatments recorded some reasonable yield with the exception of control which recorded the lowest yield (Table 1). However the yield obtained may be as a result of so many other factors within control and out of control. This study has shown that the various morphological parts of the plant products used can be effective in the control of cowpea pests, these crude extracts of plant species have the dual advantage of minimal adverse impact on non – target beneficial organisms and unlikely event of emergence of resistant pest biotype (Mclaughin *et al.*, 2011). In conclusion, this study as reaffirmed the efficiency of these morphological parts of the plant extract used as substitute for synthetic insecticides

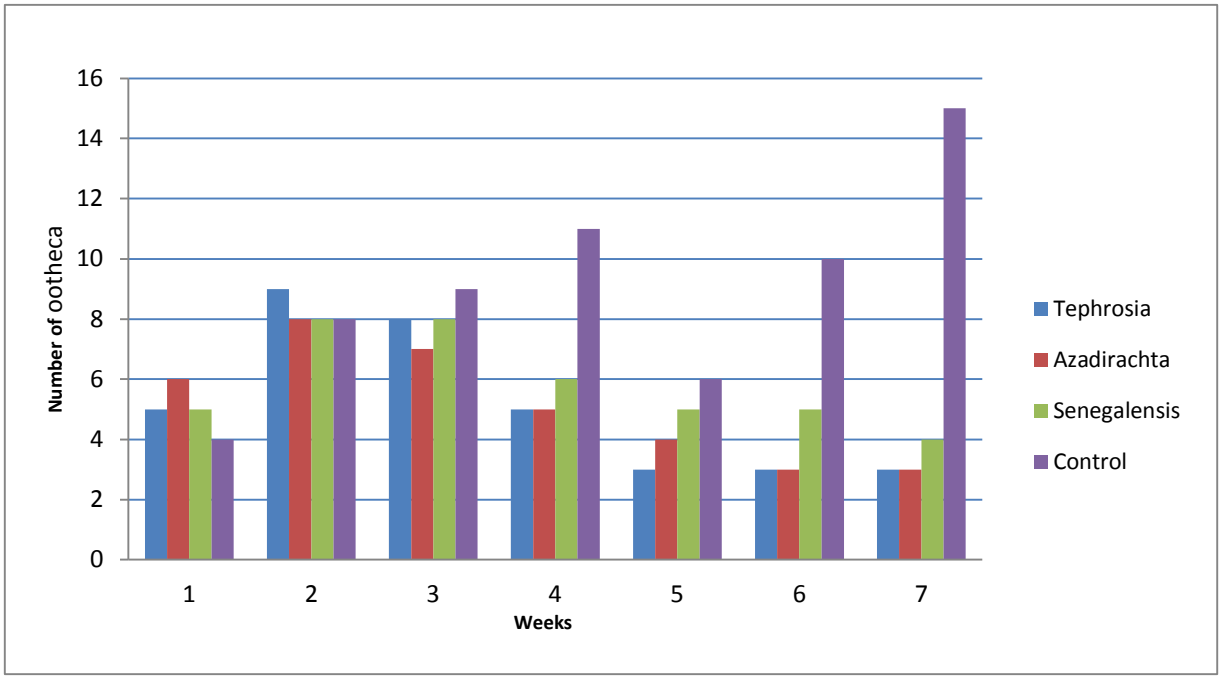

FIG 3: OOTHECA POPULATION FOR 2013

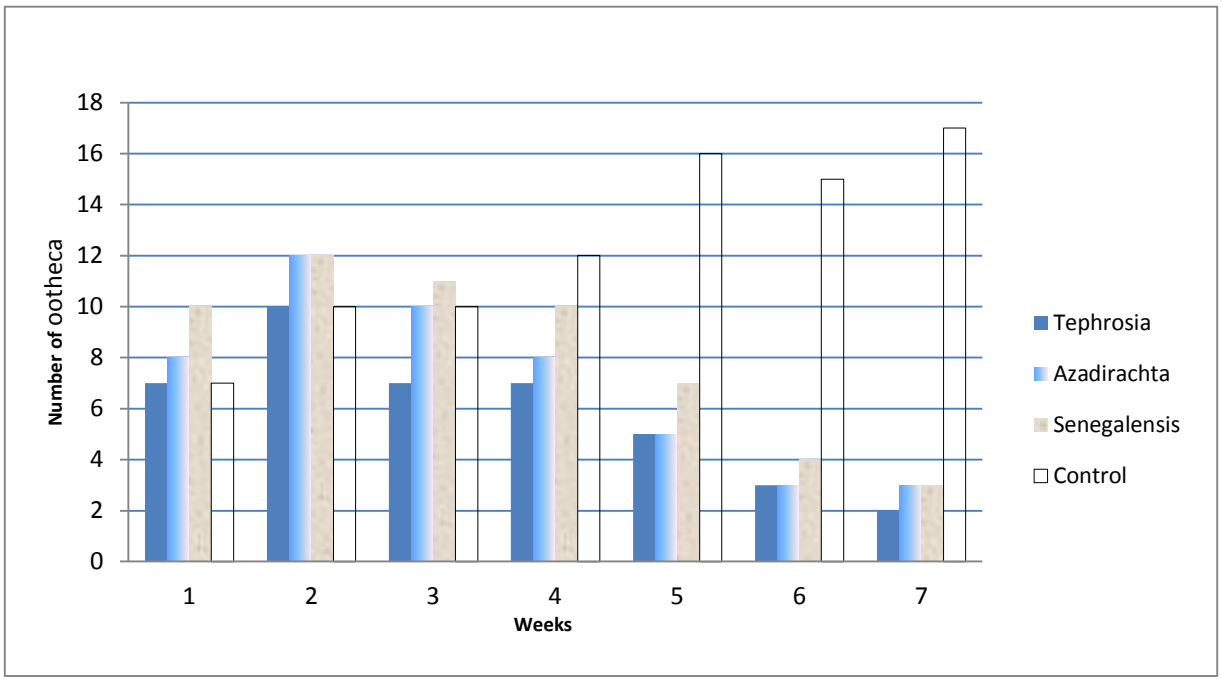

FIG 4: OOTHECA POPULATION FOR 2014

Table 1: Effect of Different Plant Parts of Three Plants on Yield of Cowpea.

Treatments	Total weight of pods (kg/ha)		Grain yield kg/ha	
	2013	2014	2013	2014
Azadiracta indica leaf	1887.3[a]	1968.5[a]	917.5[a]	1003.4[a]
Indica stem	1772.5[b]	1933.5[a]	756.2[a]	998.3[b]
A. indica root	1660.0[c]	1780.3[b]	622.0[c]	681.0[c]
Tephrosia Vogellii leaf	1720.0[b]	1931.8[a]	867.0[ab]	980.2[b]
T .vogellii stem	1690.0[c]	1874.6[ab]	.0[c]	869.0[d]
T.vogellii root	1420.0[d]	1773.3[b]	552.5[d]	708.2[e]
Annona senegalensis leaf	1420.0[d]	1665.0[c]	64.7[c]	890.2[d]
A .senegalensis stem	1332.5[e]	1633.0[c]	558.7[e]	715.0[e]
A .senegalensis root	1158.7[f]	1489.6[d]	446.0[g]	585.6[f]
Control	635.0[gg]	757.4[e]	294.3[h]	365.7[g]
SE	47.1	52.2	48.4	49.[3]

Means followed by the same letters within a column and treatment group are statistical reboot significantly different (P>0.05).

Conclusion

The study examined the effectiveness of extract from three plant species namely *Azaradichta indica, Annona senegalensis* and *Tephrosia vogellii* in the control of two major pests of Cowpea. The study as reaffirmed the efficiency of these morphological part of the plant extracts used as substitutes of synthetic insecticides**.**

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