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Insecticidal Efficacy of SABRUKA Formulations as Protectants of Cowpea Against Field Pests

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Abstract: The efficacy of SABRUKA (a mixture of soap, water and kerosene) and its mixture with naphthalene (camphor) was evaluated for the control of insect pests of cowpea during the 1998 and 1999 cropping seasons in the Research Farm of the Institute for Agricultural Research, Samaru, Nigeria. The SABRUKA products were tested against the three major post flowering insect pests of cowpea in the northern Guinea Savanna ecological zone. These pests were *Megalurothrips sjostedti* Trybom (Thysanoptera: Thripidae) legume flower bud thrips, larvae of *Maruca vitrata* Fab. (Lepidoptera: Pyralidae), the legume pod borer and *Clavigralla tomentosicollis* Stal (Hemiptera: Coreidae), the coreid bug. SAMPEA 7, an improved local cowpea variety was used in the study. Four SABRUKA products- camphorated SABRUKA, concentrated SABRUKA, diluted camphorated SABRUKA and diluted SABRUKA. Camphorated SABRUKA and concentrated SABRUKA were effective in reducing the numbers of all the tested pests during the four weekly applications of the products. Pod damage was least on camphorated SABRUKA, consequently leading to higher grain yield compared to other SABRUKA products and the untreated control. From the results, camphorated SABRUKA was recommended for use on farms managed by limited resource farmers in Africa and other third world countries.

Key words: SABRUKA, protectant, cowpea, insect pests

Introduction

SABRUKA, a soap, water and kerosene emulsion is derived from Hausa words Sabulu (soap), Ruwan (water) and Karogin (kerosene). Kerosene is a product of petroleum refinery and is used in homes for cooking and heating. SABRUKA, a natural product is popular among the peasant farmers in the Savanna region of Nigeria particularly in Katsina, Kano, Jigawa, Sokoto, Gombe, Bauchi and Kaduna states who use the preparation to control insect pests of crops especially cowpea and cotton plants. Kerosene-soap-water emulsion has been reported as a contact insecticide for piercing and sucking insects (Jex-Blake, 1950). Similarly, the usefulness of this emulsion against scale insects, bugs, mites, aphids and leaf miners has been documented by Van der Werf (1985). Other natural products such as ashes from the leaves of *Lantana* sp. and *Ochroma* sp. have been found effective against aphids attacking stored potato (Anonymous, 1982). Ashes from burnt palm frond and bunches have been traditionally used in the eastern parts of Nigeria to dust the leaves of okra as a

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protectant against leaf eating beetles (*Podagrica* spp.). Cow dung and urine have been found effective against mealy bugs, thrips, and mites (Peries, 1989), aphids, caterpillars and mites (Rankin, 1986) and major post flowering insect pests of cowpea (Oparaeke, 2003). Local plant materials such as neem, garlic, clove, West African pepper, pepper fruits and African nutmeg extracts are also employed in the control of field insect pests of crops (Tanzubil, 1991; Jackai *et al*., 1992; Oparaeke *et al*., 2000, 2002; Dike, 1997; Iwuala *et al*., 1981; Sombatsiri and Pathumchartpat, 1979).

Currently, synthetic insecticides are widely used in Nigeria and other third world countries for insect pests control on field crops. However, these insecticides are expensive, unavailable at critical periods of need and also cause environmental pollution. Their potential hazards to human health and livestock have generated a lot of interest in the search for alternative pests control strategies worldwide. SABRUKA formulations are one of such strategies. This study reports the efficacy of SABRUKA preparations against the three major post flowering insect pests of cowpea.

Materials and Methods

This experiment was conducted in 1998 and 1999 cropping seasons at the research farm of the Institute for Agricultural Research, Zaria, Nigeria. Treatment consisted of the untreated control, diluted SABRUKA, diluted camphorated SABRUKA, concentrated SABRUKA, camphorated SABRUKA and Sherpa-plus (a standard synthetic check). Concentrated SABRUKA (stock solution) formulation consists of one bar soap, flaked and dissolved in 20 L of boiling water. After cooling (40°C), 5 L of kerosene is added and stirred to obtain a thorough mixture. Five litres of this solution is added to 10 L of water to produce diluted SABRUKA. Camphorated SABRUKA is derived by mixing a solution of 40 g (10 tablets) of naphthalene with concentrated SABRUKA. Sherpa-plus was applied at 1 L ha^{-1}.

The field layout was a Randomized Block Design (RBD) with three replicate plots. Each plot had five ridges 0.75 m apart (three main and two discards, one on either side of the main ridges), measuring 6.0x5.0 m and separated by a 2.0 m wide border along the ridge and two unplanted ridges. SAMPEA-7, cowpea variety used in the study was dressed with Apron-plus before sowing. Sowing took place in the first week of August in both years. Three seeds were sown per hole and about three weeks later were thinned to two seedlings per hole. Two weeks after sowing the seedlings were side-dressed with NPK (15.15.15) fertilizer at the rate of 35 kg a.i per hectare. The plots were weeded once since pre-emergent herbicide (Galex) was applied immediately after sowing. All the plots received a tank mixture of benomy1 and mancozeb at 0.30 g a.i per hectare each to control fungal diseases. The solution was applied four times at weekly intervals from the fourth week after sowing.

Insects sampling and application of SABRUKA formulations began at flower bud initiation phase. Insects sampling was conducted before each spraying within the main ridges. Thrips and *Maruca* larvae were sampled by randomly picking twenty flowers per plot and placed them in vials containing 30% alcohol (Amatobi, 1994). The flowers were dissected next day in the laboratory and the number of thrips and *Maruca* pod borers observed were counted and recorded. Thirty pods were also randomly picked per plot, dissected and observed for *Maruca* larvae in the pods. Pod sucking bugs (mainly *Clavigralla tomentosicollis* Stal) were randomly sampled on plants located in three 1.0x1.0 m quadrant within the main ridges. The total number of pods produced per stand was taken from ten plants randomly selected within the three quadrants. Pod damage was assessed as an inverse of pod load (density). Grain yields were assessed after threshing and winnowing by weighing the grains produced per plot while grain quality was sampled by bulking grains from similar treatment and

weighing out 500 g of each of these in three replicates. Each of these was selected to remove sub standard, malformed seeds and other contaminants and re-weighed. Grain quality was calculated as an inverse of the original weight of the seeds (500 g). Plants were assessed for phytotoxicity throughout the periods. Data were analysed after square root transformation or arcsine conversion for percentage data while means were separated using Student Newmann Keuls of SAS programme (Anonymous, 1987).

Results

There was a significant reduction of thrips, *Maruca* pod borers and pod sucking bugs among the treated plots with Sherpa-plus, camphorated SABRUKA and concentrated SABRUKA treatments (in that order) being superior to other treatments and the untreated control in both years (Table 1-3). Pod density (pod load) per plant was higher in Sherpa-plus treatment but was not statistically superior to camphorated SABRUKA treatment, which in turn had significantly higher pod density than other SABRUKA formulations (Table 4). However, Sherpa-plus treatment caused considerable reduction of damage to cowpea pods by hemipterous insects compared to camphorated SABRUKA treatment. Similarly, the grain yield and quality were highest in Sherpa-plus treated plots followed by plots treated with camphorated SABRUKA (Table 4). However, the latter was significantly ($p<0.05$) superior to other SABRUKA formulations and the untreated control on these parameters.

Table 1: Effect of weekly application of SABRUKA formulations on *Megalurothrips sjostedti* population in 1998 and 1999 cropping seasons.

	Mean number of *M. sjostedti*/flower							
	1998				1999			
Treatments	Week 1	Week 2	Week 3	Week 4	Week 1	Week 2	Week 3	Week 4
Diluted SABRUKA	3.0ab	3.0b	2.33b	1.33b	3.33b	3.0b	2.67b	0.67b
Diluted camphorated SABRUKA	2.33abc	1.67bc	1.33c	1.0b	2.67bc	2.0bc	1.67c	0.33b
Concentrated SABRUKA	1.67bcd	1.33c	1.0c	0.67bc	2.0bcd	1.67bc	1.33c	0.0c
Camphorated SABRUKA	1.0cd	0.67c	0.0d	0.0c	1.33cd	1.0c	0.0d	0.0c
Sherpa Plus	0.67d	0.33c	0.0d	0.0c	1.0d	0.67c	0.0d	0.0c
Control (0.0)	3.33a	5.33a	3.67a	2.0a	4.0a	6.0a	4.0a	2.33a
CV (%)	54.04	60.26	55.43	77.56	47.42	50.03	40.48	70.0
SE±	0.52	0.54	0.34	0.28	0.51	0.53	0.28	0.16

Means followed by the same letter(s) are not significantly different by Student Newman Keuls Test ($p<0.05$)

Table 2: Effect of weekly application of SABRUKA formulations on *Maruca vitrata* larvae population in 1998 and 1999 cropping seasons

	Mean number of *M. vitrata*/flower and/or pod							
	1998				1999			
Treatments	Week 1	Week 2	Week 3	Week 4	Week 1	Week 2	Week3	Week 4
Diluted SABRUKA	3.67b	3.67a	3.0b	1.67b	3.67b	3.33a	2.67b	1.0b
Diluted camphorated SABRUKA	3.0bc	3.0a	2.33b	0.67bc	3.33bc	2.67a	2.67b	0.67bc
Concentrated SABRUKA	2.3bcd	1.33bc	0.67c	0.33cd	2.67bcd	2.0bc	0.67c	0.33cd
Camphorated SABRUKA	1.67de	0.67cd	0.33c	0.0d	2.0de	1.0cd	0.33c	0.0d
Sherpa Plus	1.0e	0.33d	0.0c	0.0d	1.33e	0.67d	0.0c	0.0d
Control (0.0)	4.0a	4.0a	4.67a	2.0a	5.0a	5.33a	5.33a	3.0a
CV (%)	31.18	49.01	47.06	84.59	35.39	32.54	58.16	69.17
SE±	0.39	0.49	0.38	0.28	.50	0.39	0.51	0.25

Means followed by the same letter(s) are not significantly different by Student Newman Keuls Test ($p<0.05$)

Table 3: Effect of weekly application of SABRUKA formulations on *Clavigralla tomentosicollis* population in 1998 and 1999 cropping seasons

	Mean number of *C. tomentosicollis* plant^{-1}							
	1998				1999			
Treatments	Week 1	Week 2	Week 3	Week 4	Week 1	Week 2	Week 3	Week 4
Diluted SABRUKA	2.67b	1.67b	1.67b	1.0b	3.0b	2.0b	2.0b	1.33b
Diluted camphorated SABRUKA	1.67bc	1.33b	1.33b	0.33bc	2.0bc	1.67b	1.67b	0.67bc
Concentrated SABRUKA	1.0c	1.0bc	0.67bc	0.33bc	1.33c	1.33bc	1.0bc	0.67bc
Camphorated SABRUKA	0.67c	0.33c	0.0c	0.0c	1.0c	0.67c	0.0c	0.0c
Sherpa Plus	0.67c	0.33c	0.33b	0.0c	1.0c	0.67c	0.67bc	0.0c
Control (0.0)	5.0a	9.33a	8.33a	4.0a	5.33a	9.67a	8.67a	4.33a
CV (%)	48.83	35.76	56.76	100.23	81.96	93.40	61.17	92.74
SE±	0.44	0.36	0.50	0.40	0.86	1.09	0.60	0.48

Means followed by the same letter(s) are not significantly different by Student Newman Keuls Test ($p<0.05$)

Table 4: Effect of weekly application of SABRUKA formulations on pod density, pod damage, grain yields and quality of cowpea in 1998 and 1999 cropping seasons.

	Mean pod density plant^{-1}		Mean pod damage plant^{-1}		Mean grain yield (kg ha^{-1})		Mean grain quality/500 g seeds	
Treatments	1998	1999	1998	1999	1998	1999	1998	1999
Diluted SABRUKA	14.78d	15.0d	74.53b	75.66b	167.67e	170.22e	55.91e	58.99e
Diluted camphorated SABRUKA	26.60c	27.0c	55.67c	56.52c	316.95d	321.78d	64.94d	68.52d
Concentrated SABRUKA	33.49b	34.0b	24.36d	24.73d	707.01c	717.78c	68.08c	71.82c
Camphorated SABRUKA	45.97a	46.67a	14.66e	14.88e	888.69b	902.22b	88.92b	90.26b
Sherpa Plus	46.08a	46.78a	12.66f	12.85f	1078.24a	1094.66a	94.51a	95.93a
Control (0.0)	7.99e	8.11e	91.50a	92.89a	77.63f	78.81f	4.81f	5.08f
CV (%)	11.8211.96	6.86	6.86	7.66	7.66	1.94	1.58	
SE±	1.68	1.72	1.42	1.44	19.80	20.21	0.60	0.58

Means followed by the same letter(s) are not significantly different by Student Newman Keuls Test ($p<0.05$)

Discussion

The results indicate that camphorated SABRUKA treatment being more effective than other SABRUKA formulations may be a good replacement for synthetic insecticides, which are expensive and may be unavailable at critical periods of need in addition to posing a health hazard to the user. This is the first time that camphorated SABRUKA is being reported as a potential insecticide and is deleterious to thrips, pod borers and pod sucking bugs. Fortunately, there was no phytotoxicity observed on treated plants throughout the spraying periods.

The mode of action of camphorated SABRUKA in reducing insects' population as observed in this study is not very clear. However, it may be that naphthalene addition to the concentrated SABRUKA gave the solution very strong repellent and /or contact effects on these insects. Jex-Blake (1950) and Van der Werf (1985) reported that kerosene-soap-emulsion acted as contact insecticide for piercing and sucking insects. The strong pungent characteristics of naphthalene may have additional potency to the insecticidal properties of camphorated SABRUKA when compared to other SABRUKA formulations.

In the Northern Guinea savanna of Nigerian (Samaru), where this trial was conducted, all the materials are readily available in the local markets and are affordable compared to the synthetic insecticides. SABRUKA formulations are not likely to pose any health-risk to the user and the environment as they are already being used for other domestic purposes. In contrast, the indiscriminate use of synthetic insecticides by untrained farmers in Nigeria and other third world countries poses a

potential danger to man and the environment. In addition, the high cost of procurement, its non-availability at critical periods, quick degradation under high tropical temperatures and high technology required for application, have made these insecticides unwholesome candidate for crop protection in low input agriculture characteristic of limited resource farmers.

The potential of camphorated SABRUKA in reducing insect pests population and damage to cowpea pods on the field has been highlighted in this study. Kerosene, a hydrocarbon compound obtained by fractional distillation in refineries in Nigeria and abroad and naphthalene used in homes as protectants/repellents against cockroaches (*Periplanata americana*) and ants could provide a suitable alternative for pest control in field crops grown by limited resource farmers. Further research is necessary to ascertain the levels, spraying rates and shelf life of the formulations under different environmental conditions.

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