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EFFECT OF NEEM LEAF EXTRACTS AND POWDERS AGAINST THE COWPEA WEEVIL, *CALLOSOBRUCHUS MACULATUS* (F.) (COLEOPTERA, BRUCHIDAE)

SANAA. M. MAHGOUB

Plant Protection Research Institute , Agricultural Research Centre, Dokki, Egypt.

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Abstract

The effect of neem leaf extracts and powder was tested on *Callosobruchus maculatus* (F.) adults. Results revealed that chloroform extract gave 88.3% mortality at 1.0% concenration and after three days of exposure, while the aqueous extract marked the lowest percentage of mortality (51.9%). In case of neem leaf poweder, the highest concentration (3%) gave 100% mortality at the same period.

The effect of the organic solvent extracts and powder on the biological aspects and fecundity of *C.maculatus* was also studied. Extracts and powder highly decreased the number of deposited eggs per female. Tested extracts prevented the emergence of adults.

The effect of tested materials on the germination of seeds was also studied. Germination of the treated seeds remained almost equal to that of the control even after 120 days of storage.

The protection dusts failed to give the same protection after 4 months.

INTRODUCTION

Parts of the neem tree, *Azadirachta indica* A. Juss have been used in Africa and Asia for many years to control insect pests in stores. However, with the development of the chemical industry and petroleum-based synthetic insecticides, this plant was neglected to some extent. For the last 15 years, problems of pest resistance, the excessive persistence of certain products in the environment, and especially the high costs of pesticides have forced scientists to look for new sources of

insecticides and thus to explore the insecticidal capacity of certain plants. For example, in rural India people mix dried neem leaves with stored grain, and place leaves in the folds of clothes and woolen blankets to keep insects away.

Investigations have been undertaken with extracts from leaves and seeds of neem by several authors (Butterwoth and Morgan 1968, 1971; Sharman *et al.,* 1980; Siddig 1980; Akou-Edi 1988; Mahgoub 1989).

The present study deals with the efficiency and persistence of neem leaf extracts and powder as protectants to cowpea seeds against infestation with the cowpea weevil, *Callosobruchus maculatus* (F.).

MATERIALS AND METHODS

Preparation of neem extract

The neem leaves used were obtained from Azadirachta indica A. Juss trees raised in Central Sudan (Khartoum), dried in shade, and sent 6-8 weeks later by air mail then stored under laboratory conditions.

The dried leaves were ground by an electrical mortar, sieved using a 300 mesh sieve and kept in tightly clean dried bottles.

Extraction was carried out in a 250 ml Soxhelt apparatus with chloroform, ethanol, acetone and distilled water. The solvents were removed from the extracts by means of a water bath at 50^{o}C . The crude extracts were then preserved in tightly corked 10 ml vials and stored in the refrigerator until used for tests (Islam, 1983).

Surface treatment of cowpea

The calculated amount of leaf extracts to give the required concentration was added to 60g seeds and mixed manually in one liter jar then divided into three replicates. Additional seeds were treated and held for 120 days for studying the persistence under the same experimental conditions.

Insect exposure in surface treated seeds

Each replicate was infested with 12 pairs of 24h old *C.maculatus* adults immediately after neem treatment and the tubes were covered with muslin. Mortality

was recorded daily for one week after which the adults were removed. Number of hatched and unhatched eggs were recorded for each replicate. Adults emerging were recorded after six weeks from infestation.

The persistence of neem treatment was assessed in a similar experiment in which adult beetles were placed on treated cowpea seeds for 120 days after treatment.

The effect of neem treatments on seed germination was also studied. Seeds were kept for 120 days free from infestation. At the end of the storage period, germination tests were carried out. Samples of twenty seeds each were placed in a Petri-dish lined with cotton and filter paper soaked with water. Germination was recorded 4 days later. Each treatment was replicated 3 times.

RESULTS AND DISCUSSION

A. Direct effect

Effectiveness of neem leaf against the cowpea weevil *C.maculatus*

Results in Table 1 indicate that at the highest concentration of extracts (1.0%) and after three days of exposure, chloroform extract was the most effective (88.3% kill) followed by ethanol extract (76.6% kill) and acetone extract (60.7% kill). The aqueous extract marked the lowest percentage of mortality (51.9% kill). In case of neem leaf powder, the highest concentration (3%) gave 100 % kill at the same period. In the lowest concentration (0.05%), the tested extracts could be arranged as follows : chloroform (64.67 % kill) > 0.5% powder (61.0 % kill) > ethanol (53.0% kill) > acetone (40.5% kill)> aqueous extract (37.6 % kill).

All extracts gave complete protection within five days of exposure except the lowest concentration of acetone extract (97.0%) and powder (91.0%) and the two lowest concentrations of aqueous exract which gave 87.0% and 93.3% kill, respectively. These results agree with Mahgoub (1987) who showed clear significant differences between seeds treated with neem and the untreated control.

Persistence of neem leaf during storage

Table 1 indicates that acetone and aqueous extracts showed a sharp decline in

their efficiency after 120 days of exposure. The other two extracts and powder showed a gradual decrease in their persistence.

After five days of exposure, powder at the highest concentrations (2.0 and 3.0%) exhibited a higher persistence (100 % kill) than at the lowest concentrations (0.5 and 1%). This agreed with Jacobson *et al.* 1983 who showed that poweder of neem leaves mixed at 1 or 2% with wheat in the laboratory gave significant protection from infestation with the adult stored products insects, *Rhizopertha dominica and Sitophilus granarius.*

Table 1. Response fo *Callosbruchus maculatus* F. adults to neem leaf extracts mixed with cowpea seeds.

Material	Conc.	Initial			4 months		
	%	1	3	5	1	3	5
Powder	0.5	48.67	61.00	91.00	27.33	64.00	71.33
	1.0	89.00	70.67	100	55.00	69.00	80.00
	2.0	90.33	100	100	100	100	100
	3.0	100	100	100	100	100	100
Chloroform	0.05	51.50	64.67	100	42.33	50.00	71.00
	0.1	59.33	72.00	100	50.7	41.7	100
	0.5	68.90	81.00	100	50.00	73.90	100
	1.0	76.70	88.30	100	62.70	79.70	100
Ethanol	0.05	27.90	53.00	100	22.30	50.30	72.60
	0.1	40.90	61.70	100	27.60	52.70	67.00
	0.5	47.3	68.00	100	32.90	53.00	100
	1.0	58.00	76.60	100	42.30	66.90	100
Acetone	0.05	18.00	40.50	97.00	10.30	27.00	56.90
	0.1	27.30	46.00	100	25.00	30.30	69.90
	0.5	36.6	53.3	100	27.00	44.00	62.70
	1.0	43.00	60.70	100	27.90	41.70	74.00
Aqueous	0.05	13.30	37.60	87.00	10.00	27.90	49.00
	0.1	20.00	40.9	98.30	14.60	22.00	55.30
	0.5	27.50	42.30	100	22.60	30.00	60.90
	1.0	32.00	51.90	100	28.00	37.00	60.70
Control	-	-	4.00	9.40	-	4.00	12.40

B. Latent effect

All treatments caused significant reduction in the number of eggs laid, hatchability and number of offspring (Table 2).

Chloroform extract prevented egg laying completely at the higher concentrations 0.5% and 1.0 %. The highest concentration of ethanol 1.0 % performed similarly. Powder at all rates failed to prevent egg laying.

After 4 months of storage, the number of eggs laid increased at all tesed concentrations but there was a clear significant difference between the average number of eggs laid per female on untreated and treated seeds.

These results agree with those of Mahgoub (1989) who showed that neem seed treatment significantly reduced the fertility of *C.maculatus*, and Ivbijaro (1983) who demonstrated that neem seed significantly reduced the fecundity of females. On the other hand, chloroform and ethanol gave 100% inhibition of egg hatchability up to 4 months of storage except for the lowest concentration of ethanol. The same result was shown with the higher concentrations of acetone. All rates of aqueous extract and neem powder failed to give 100% inhibition of egg hatchability excep for the highest concentration of powder which gave 100% inhibition of egg hatchability.

No offspring emerged in all treatments of neem extracts and powder up to 120 days of storage except for the aqueous extract and the two lowest concentrations of powder. This agrees with Jilani and Su (1983) and Fry(1938) who proved that powder of neem leaves mixed at 1 or 2% with wheat gave significant protection from infestation by adult stored product insects. This also, agrees with Ambika (1981) who proved that there was a significant reduction in fecundity and progeny of *C.chinensis* treated with neem leaf exract.

Germination test

Germination of treated cowpea seeds remained almost equal to the control even after 120 days of storage. This finding agrees with Ivijaro (1983) who found that neem seed did not affect the viability of maize grains.

Table 2 . Effect of neem leaf extracts on the number of laid eggs, hatchability and progeny of *Callosbruchus maculatus* F. adults (27°C and 65 ± 5% R.H.).

Material	Conc. %	Initial			After 4 months		
		Av.no. of eggs	% hatch-ability	Av.no. of progeny	Av.no. of eggs	% hatch-ability	Av.no. of progeny
Powder	0.5	18.33	19.67	0.0	27.00	30.30	5.00
	1.0	10.00	12.33	0.0	17.00	12.50	2.00
	2.0	9.00	1.33	0.0	15.50	7.30	0.0
	3.0	2.67	0.0	0.0	9.01	0.0	0.0
Chloroform	0.05	21.33	0.0	0.0	32.67	0.0	0.0
	0.1	14.33	0.0	0.0	20.00	0.0	0.0
	0.5	0.0	0.0	0.0	12.17	0.0	0.0
	1.0	0.0	0.0	0.0	8.0	0.0	0.0
Ethanol	0.05	33.00	4.00	0.0	44.60	6.67	0.0
	0.1	20.33	0.0	0.0	16.00	0.0	0.0
	0.5	10.00	0.0	0.0	14.00	0.0	0.0
	1.0	0.0	0.0	0.0	10.33	0.0	0.0
Acetone	0.05	41.00	10.80	0.0	54.67	24.00	0.0
	0.1	30.30	10.00	0.0	42.33	18.67	0.0
	0.5	19.00	0.0	0.0	28.0	0.0	0.0
	1.0	10.30	0.0	0.0	17.01	0.0	0.0
Aqueous	0.05	51.33	33.00	46.00	65.00	42.33	60.20
	0.1	49.00	21.30	33.50	52.00	37.00	46.60
	0.5	17.60	8.30	10.00	30.30	22.00	22.01
	1.0	12.00		0.0	27.00	15.33	13.00
Control		87.17	89.00	141.8	91.33	90.06	273.90
F value			27.13			51.07	
L.S.D.			4.23			4.06	

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تأثير مسحوق ومستخلص أوراق النيم (*Azadirachta indica A. Juss*) ضد حشرة خنفساء اللوبيا (*Callosobruchus maculatus F.*)

سناء محمود محجوب

معهد بحوث وقاية النباتات – مركز البحوث الزراعية – الدقى .

اجريت دراسات معملية على نبات النيم وهو على صورة مسحوق و مستخلصات الكلوروفورم والايثانول والأسيتون والمستخلص المائى كمواد واقية لبذور اللوبيا ضد الإصابة بحشرة خنفساء اللوبيا (*Callosobruchus maculatus F.*) وقد دلت النتائج على مايلى :

١- مستخلص الكلوروفورم كان أكثر المستخلصات كفاءة يليه مستخلص الايثانول ثم الاسيتون وأخيرا جاء المستخلص المائى الذى اعطى أقل نسبة موت وكان ذلك حتى ١٢٠ يوما من المعاملة.

٢- بالنسبة لمسحوق أوراق النيم كان التركيز المستخدم (٣٪) وقد اعطى حماية كاملة للوبيا بعد يوم واحد من المعاملة واستمر ذلك حتى ١٢٠ يوم .

٣- المستخلصات المختبرة والمسحوق قد سببت نقصا معنويا فى عدد البيض الموضوع ونسبة الفقس و الخلفة الجديدة.

٤- كل المستخلصات المختبرة وكذلك المسحوق لم توثر على نسبة إنبات البذور حتى ١٢٠ يوما.