EFFECT OF **ACORUS CALAMUS** L. OIL VAPOURS EGG DEVELOPMENT FECUNDITY AND FERTILITY OF **DYSDERCUS CINGULATUS** FABR.

By

AHMED ALI BALOCH *

A B S T R A C T

Laboratory studies are carried out on the effect of **Acorus calamus** L. oil vapours an egg development; fecundity and fertility of **Dysderus cingulatus** Fabr. The results indicated that no significant effect of treatments i. e. different doses on the percent of hatching was observed, but a significant difference of adult emergences based on eggs could be observed at different exposure periods i. e. as the exposure period increases the percent of adults emergence decreased and vice versa. The vapours affected the hatching of eggs of all age groups. The nymphs that hatches out from some of these eygs did not moult but died particularly at high dose.

A slight carry over effect of the **A. calamus** oil vapours were also noted.

I N T R O D U C T I O N

Cotton is an important cashcrop of Pakistan and a main source of foreign exchange. The cotton crop is attacked by a variety of insect pests. **Dystercus cingulatus is** also a pest which attack cotton and many other Malvacae plants such as silk cotton; **Bombax ceiba;** lady's finger, **Abelmaschus esculentus; Abutelon indicu; Tillia** spp etc. Both adults and nymphs cause a considerable damage to the crop. In cotton it appears generally in early opening off crop and breed on bolls; puncturing the same; sucking up the juice and staining the lint. That is why it is also called cotton stainer. In United States and many oher countries it is a major pest of cotton.

C.Ü. ZİRAAT FAKÜLTESİ DERG. CİLT : 6 SAYI : 1 1990

* Cotton Research Institute; Sakrand; Pakistan.

In Pakistan though it appears on cotton crop but no any intensive work on its losses have been done so far. But its importance can not be ignored. The intial observation on population dynamics of cotton pests of Sindh carriedout by C.R.I. Sakrand reveals that it also cause a considerable damage to the crop particularly of late varieties or early varieties but sown in late season. Its attack also affect the quality of lint. So this pest also needs to be controlled effectively.

Chemostorilants and serilizing agents played a vital role in reducing the pest population particularly in stored grain pests and fruit flies. Many growers are very much convenced from these compounds due to their safety and other side effects.

Keeping the popularity of chemosterilants and sterilizing compounds among the growers; in view the scientists started testing the new compourds and their efficacy against different aspects of important pests particularly on sterility; fecondity fertility; embryonic and post embryonic development of an insect.

Many chemosterilants have been developed for use in sterile insect release programmes. The essential oil of **Accrus calamus** L.; has been reportedto show insecticidal activity and it was also observed that the oil also prevented the oviposition in stored grain pests like **Callasobruchus chinensis** L., and **Trogoderma granarium** Everts (Saxena and Srivastava, 1972). Rohdendort (1966) reported that of the vapours of A. calamus oil controlled the hatching and moulting of the first instar nymphs of **Dysdercs koenigii** F.

Acorus calamus oil is non toxic to human beings and its main and most effective compound is cis β. asaron.

Generally plants were amongst the earliest sources of insecticides to have been used by man. The **A. calamus** oil is extracted from the dry rhizomes of neem plants, easily available in Pakistan in a large quantity. Hence it was proposed to carryout some studies on its effeciveness as a sterilizing agent of a cotton pest **D. cingulutus** in the laboratory and makes the main object of this script.

METARIAL AND METHOD

Since last three years **D. cingulatus** adults and nymphs are reared in the Zoological laboratory of Hannover University of West Germany on the seeds of Tilia sp. at 30°C and 70% relative humidity; in separate plastic jars of 6" diameter having a thin layer of slightly moist builders sand.

In the present study newly laid eggs from F4 generation were taken. There were four sets of experiments where the doses were 1, 2; 3 and 4 µl. In each set different groups of 50 eggs of 24; 48, 72 and 96 hours old were exposed to A. calamus oil vapours for 96; 72, 48 and 24 hours. The eggs were placed in a small petridish of one inch diameter. The pedridishes were placed in jem jars of one pound capacity tightly lidded and containing filter paper impregnated with **A. calamus** oil. These jars were kept in an incubator set at 30°C after the required period of fumigation the jars were brought out for a few minutes and the eggs were placed in new jars and were again paced in an incubator for hatching. After that newly hatched nymphs were transferred to the rearing plastic jars containing half grinded seeds of **Tilia** sp. for further development.

The controlls were kepf separately using acetone impregnated filter paper.

RESULTS AND DISCUSSION

Effect of **Acorus calamus** oil vapours on egg development.

The results are presented in Table - 1 which indicates that when the newly laid eggs were exposed to 1 µl to 4 µl of **A. calamus** oil vapours from 24 to 96 hours, no any significant difference on percentage of hatching was observed in treatments. As the percentage of adult emergence based on eggs and nymphs ise concerned a significant difference between 24 and 96 hours of exposure could be observed, in percentage of adult emergence based on the eggs i. e. at 24 hours exposure the emergence was 62.4% where as at 96 hours it was 42.8% where the dose was 1 µl. In case of adult emergence based on nymphs though the differences were there but the results were non - significant. Similar type of results were obtained on the other doses also.

When the different doses were compared at constant exposure period of 96, 72; 48 and 24 hours, it was observed that percentage of hatching decreased as the dose and exposure period increases eg at 1 µl dose at 96 hours exposure the percentage of hatching was 82.4% Where as at 24 hours exposure it was 93.2%. Similarly at 4 µl the percentage of hatching at 96 and 24 hours exposure was 67.6 and 79.2% which is significantly less at 1 µl of dose (Table 2).

Table 2 also indicates that the percentage of adult emergence based on eggs and nymph is also significantly decreased at same dose and different exposure peridos and vice versa.

Similarly the effect of the oil vapours of **A. calamus** was investigated by Saxena and Srivastava (1971) on the eggs **D. koenigii** and reported that the vapours affected the hatching of eggs of all age groups. Saxena and Srivastava (1972) reported that at a 100 ppm concentration (13 ml solution) of oil of **A. calamus** the eggs of **D. koenigii** did not hatch. But Schmidt and Borchers (1981) could not found any sterilizing effect on the eggs of ants (Formica sp.).

As the effect of A. calamus oil vapours on percentage of hatching and moulting of the nymphs is concerned the results are presented in Table - 3 which indicates that as the dose and exposure period increases the hatching and moulting of nymphs decreases and vice versa. eg. at 1 µl with 24 hour exosore the percentage of hatching of 24 hours old eggs was 92% and the moulting of nymphs was 89% but the same of 96 hours old eggs at same exposure period was 89 and 76.5 % respectively. Similarly at same dose the percentage of hatching and nymphal moult of 96 hour old eggs at 24 and 96 hour of exposure was 85 and 62.5 and 65 and 15 % respectively. When the dose is increased to 4 µl the percentage of hatching and moulting of 24 hour old eggs at 24 and

96 hours exposure were 80 and 58.5 and 20 and 0% respectivly whereas the same in 96 hour old eggs was 25 and 0% at 24 hour exposure and at 96 hour exposure even the eggs did not hatch.

These results are with aggrement of Sexena and Srivastave (1972) vho reported that the younger eggs of **D. koenigii** are comparatively less affected by **A. calamus** vapours than older ones. With 1 μl treatment eggs of 0 - 72, 72 - 96 and 96 - 120 hours age groups showed 100, 89; 70 % hatching respectively. In this treatment moulting of nymphs was, however, observed in eggs upto 48 hour of age. The nymphs from 48 - 72 hour old eggs did not show moulting at 3 μl dose. The percentage of hatching was reduced in eggs older than 72 hours. Nymphs did not show any moulting in this treatment.

Effect of **Acorus calamus** on F1

generation of **D. cingulatus.**

Some times it happens that partial effectiveness of chemicals are carried over to the off springs. So to see whether the effect of **A. calamus** oil vapours is carried over to the F1 generation or not. Therefore the nymphs emerged from the treated eggs were allowed to develop and complete the life cycle. The results thus recorded are presented in Table 4.

Table 4 indicates that at the individual dose with different exposure peridos, do not have any significant effect on the percentage of hatching of the eggs laid by the adults emerged ffrom the treated eggs. Similarly the percentage of adult emergence based on eggs and nymphs was also nonsignificant at the same dose with different exposure peridos. But the differences between treatment and control were quite significant.

Similarly the results of Table 5 indicates that the percentage of hatching, and adult emrgence based on eggs and nymphs in F1 generation were significantly different at the same dose particualrly of 96 and 24 hours exposure and at different doses with the same exposure periods, which indicates that in general as the exposure period and dose increases the percentage of hatching and adult emergence based on eggs and nymphs decreases and vice versa. But the level of decrease in F_1 generation as compared to control is not too much. So one can say that the carryover effect of **A. calamus** oil vapours is not encouraging one.

Anyhow the results have open the door for further investigations particularly on oviole development and mode of action of the chemical.

The present results show that the nymphal development was more or less normal but Saxena and Srivastava (1971) reported that the nymphs that hatched out from some of he treated eggs with A. calamus oil vapours did not moult but died, only a few of them moulted where the dose was low but all them died within 24 hours.

Further studies have also been made of the oil vapours of A. calamus. They have proved to be a very effective antigonadial agent on female reproductive systems (Thermobia domestica, Sexena and Rohdendorff, 1974; Rohdendorf and Saxena, 1974; **Dysdercus koenigii;** Sexena and Mathur, 1976; Stored grain beetles, Sexena; Koul and Tikku, 1977). The vapours have also been reported as sterilizing the males (**Musca domestica,** (Mathur and Saxena 1975). He also reported that the vapours of **A. calamus** oil have profound influence on D. koenigii. Higher concentration of vapours impades copulation whereas slightly lower doses hamper the maturation of ova resulting in partial eggs sterility and fecundity, even the chorionized egg get stuck in common oviduct.

From the present studies it could be concluded that the oil vapours of **A. calamus** have got chemo steriliant action upto some extent and very little of it can be carried over to F_1 generation, which is not sufficient to accept it as an insect controlling agent. So further studies are required to found out the actual dose and the actual stage of the insect which is more affected by this chemical.

ACKNOWLEDGEMENT

The author is highly thankful to the Alexander Von Humbold Foundation of West Germany for te Financial support. Sincere thanks are also due to Prof. Dr. G.H. Schmidt for providing the laboratory facilities and critical review of the article.

Table-1 Effect of **Acorus calamus** oil Vapours on Percentage of hatching and adult emergence

Dose/Factor	Duration of exposure of eggs in hours							
	24 hours		48 hours		72 hours		96 hours	
	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
Dose 1 μl								
% age of hatching	93.2 a	93.6 a	91.6 a	93.6 a	82.4 a	89.4 a	82.4 a	96.2 a
% age of adult emergence based on eggs	62.4 c	86.8 b	55.2 c	83.6 c	46.4 c	82.4 b	42.8 b	79.2 c
% age of adult emergence based on nymphs	66.9 b	92.6 a	60.1 b	89.3 b	56. b	92.0 a	46.6 b	86.6 b
Dose 2 μl								
% age of hatching	80.8 a	93.2 a	81.2 a	90.8 a	80.0 a	91.6 a	72.0 a	92.0 a
% age of adult emergence based on eggs	45.2 c	88.4 b	43.6 c	82.8 b	41.2 c	82.0 b	35.5 a	83.2 b
% age of adult emergence based on nymphs	55.7 b	94.8 a	53.0 b	91.2 a	51.1 b	89.5 a	48.4 a	90.5 a
Dose 3 μl								
% age of hatching	78.4 a	91.6 a	76.0 a	92.4 a	73.6 a	90.4 b	70.8 a	92.0 a
% age of adult emergence based on eggs	39.6 c	84.8 b	36.8 c	85.2 b	37.6 c	84.4 c	32.4 c	84.8 b
% age of adult emergence based on nymphs	50.2 b	92.5 a	48.2 b	92.2 a	50.5 b	93.3 a	45.0 b	92.2 a
Dose 4 μl								
% ago off hatching	79.2 a	94.0 a	76.8 a	93.6 a	73.6 a	91.2 b	67.6 a	90.4 a
% age off adult emergence based on eggs	37.6 c	86.0 b	35.6 c	87.2 b	32.4 c	86.8 c	27.6 c	82.8 b
% age off adult emergence based on nymphs	47.1 b	91.5 a	45.6 b	93.2 a	43.4 b	95.1 a	39.9 b	91.6 a

Means followed by similar letters are notsignificantly different from each other according to DMR test

Table-2 Comparative effect of dose and exposure period on percentage of hatching and adult emergence.

Dose	Exposure period (hours)	% age of hatching		% age of adult emergen. based on EGGS		NYMPHS	
		Treated	Cont.	Treated	Cont	Treated	Cont.
1 µl	96	82.4 b	91.2 a	42.8 c	79.2 b	46.6 c	86.6 b
	72	82.4 b	89.6 a	46.4 c	82.4 b	56.1 b	92.0 a
	48	91.6 a	93.6 a	55.2 b	83.6 b	60.1 b	89.3ab
	24	93.2 a	93.6 a	62.4 a	89.0 a	66.9 a	92.6 a
2 µl	96	72.0 b	92.0 a	35.2 b	83.2 b	48.4 a	90.5 b
	72	80.0 a	91.6 a	41.2 a	82.0 b	51.1 a	89.5 b
	48	81.2 a	90.8 a	43.6 a	82.8 b	53.0 a	91.2 b
	24	80.8 a	93.2 a	45.2 a	88.4 a	53.9 a	94.8 a
3 µl	96	70.8 c	92.0 a	32.8 b	84.8 a	45.0 a	92.2 a
	72	73.6bc	90.4 a	37.6ab	84.4 a	50.5 a	93.3 a
	48	76.0ab	92.4 a	36.8ab	85.2 a	48.2 a	92.2 a
	24	78.4 a	91.6 a	39.6 a	84.8 a	50.2 a	92.5 a
4 µl	96	67.6 c	90.4 a	27.[illegible] c	82.8 a	39.9 b	96.6 b
	72	73.6 b	91.2 a	32.4 b	86.8 a	43.4ab	95.1 a
	48	76.8ab	93.6 a	35.6ab	87.2 a	45.6ab	93.2ab
	24	79.2 a	94.0 a	37.6 a	86.0 a	47.1 a	91.5 b

Means followed by similar letters are not significantly different from each other according to DMR test.

Table-3 Effect of **Acorus calamus** oil vaporus on eggs development and molting of nymphs of *D. cingulatus*

Dose	Exposure period (hours)	No. of eggs	24 hors Hatc.	24 hors Moul.	24 hors Died during moulting	48 hors Hatc.	48 hors Moul.	48 hors Died during moulting	72 hours Hatc.	72 hours Moul.	72 hours Died during moulting	96 hours Hatc.	96 hours Moul.	96 hours Died during moulting
Control	...	200	185	180	5	184	181	3	180	178	2	187	182	5
	24	200	184	178	6	180	190	10	178	163	15	178	153	25
1 µl	48	200	180	160	20	176	150	23	180	130	50	182	120	62
	72	200	173	140	33	160	120	40	152	82	70	140	60	80
	96	200	170	125	45	150	98	52	146	51	95	130	30	100
Control	...	200	184	181	3	190	188	2	186	180	6	184	183	1
	24	200	180	172	8	180	165	15	176	153	20	170	140	30
2 µl	48	200	176	156	20	178	151	27	170	111	59	165	95	70
	72	200	170	130	40	158	110	48	158	73	85	135	40	95
	96	200	160	105	55	140	72	63	142	27	115	115	0	115
Control	...	200	190	188	2	180	178	2	183	185	1	182	181	1
	24	200	180	162	18	170	140	30	168	113	55	160	85	75
3 µl	48	200	178	150	28	160	123	37	160	85	75	150	60	90
	72	200	162	112	50	128	58	70	120	20	100	105	0	105
	96	200	148	78	70	100	5	95	58	0	58	20	0	20
Control	...	200	188	182	6	190	184	6	184	180	4	190	188	2
	24	200	160	117	43	190	78	52	100	2	2	98	0	50
4 µl	48	200	138	58	80	80	2	78	50	0	50	30	0	30
	72	200	75	3	72	30	1	29	30	0	30	20	0	20
	96	200	40	0	40	5	0	0	0	0	0	0	0	0

Table-4 Effect of **Acorus calamus** oil Vapours on percentage of hatching and adult emergence of F_1 generation

Dost/Factor	Duration of exposure of eggs in hours							
	24 hours		48 hours		72 hours		96 hours	
	Treatment	Conrol	Treatment	Conrol	Treatment	Control	Treatment	Control
Dose 1 µl								
% age of hatching	88.0 a	83.8 b	83.8 a	87.0 c	84.0 a	87.8 b	83.2 a	89.2 a
% age of adult emergence based on eggs	78.2 b	83.8 c	55.2 c	82.0 c	48.2 c	80.8 c	45.8 c	78.2 b
% age of adult emergence based on nymphs	72.4 c	95.5 a	65.8 c	94.3 a	57.3 b	92.0 a	55.0 b	87.6 a
Dose 2 µl								
% age of hatching	79.2 a	85.6 b	76.2 a	88.6 b	73.4 a	89.6 b	69.6 a	87.4 b
% age of adult emergence based on eggs	57.8 c	82.8 b	51.2 c	83.2 c	45.0 c	83.2 c	41.4 c	79.8 c
% age of adult emergence based on nympyhs	72.9 b	93.7 a	66.9 b	93.9 a	61.1 b	92.8 a	59.4 b	91.2 a
Dose 3 µl								
% age of hatching	72.6 a	85.6 b	71.6 a	89.2 b	70.6 a	88.6 b	68.8 a	87.0 a
% age of adult emergence based on eggs	47.4 c	82.8 c	45.6 c	81.4 c	44.6 c	83.0 c	38.0 c	78.4 b
% age of adult emergence based on nymphs	65.1 b	96.7 a	63.5 b	91.3 a	62.7 b	93.7 a	54.8 b	90.0 a
Dost 4 µl								
% age of hatching	71.4 a	87.2 a	71.4 a	88.4 b	68.6 a	85.8 b	67.2 a	90.4 a
% age of adult emergence based on eggs	43.4 c	80.2 b	41.0 c	84.0 c	39.0 c	81.2 c	34.2 c	77.8 c
% age of adult emergence based on nymphs	60.1 b	92.1 a	57.3 b	95.0 a	56.2 b	94.2 a	50.4 b	86.1 b

Means followed by similar letter are not significantly diffe rent from each other according to DMR test

Table-5 Comparative effect of dose and exposure period on percentage of hatching and adult emergence

Dose	Exposure period (hours)	% age of hatching Treated	Cont.	% age of adult emergen. based on EGGS Treated	Cont.	NYMPHS Treated	Cont.
	96	83.2 b	89.2	45.8 c	78.2 b	55.0 c	87.6 b
	72	84.0 b	87.8	48.2 c	80.8ab	55.1 c	92.0 a
1 µl	48	83.8 b	87.0	55.2 b	82.0ab	65.8 b	94.3 a
	24	88.0 a	86.8N.S	63.8a	83.8 a	72.4 a	96.5 a
	96	69.6 d	87.4	41.4 c	79.8 a	59.4 c	91.2 b
	72	73.4 c	89.6	45.0 c	83.2 a	61.1 c	92.8ab
2 µl	48	76.2 b	88.6	51.2 b	83.2 a	66.9 b	93.2ab
	24	79.2 a	85.6N.S	57.8 a	82.8 a	72.9 a	96.7 a
	96	68.8 b	87.0	38.0 b	78.4 b	54.8 b	90.0 b
	72	70.6 ab	88.6	44.6 a	83.0 a	62.7 a	93.7ab
3 µl	48	71.6 a	89.2	45.6 a	81.4ab	63.5 a	91.3 b
	24	72.6 a	87.6N.S	47.4 a	82.8 a	65.1 a	96.7 a
	96	67.2 b	90.4	34.2 b	78.8 b	50.4 b	86.1 b
	72	68.6 b	85.8	39.0 a	81.2ab	56.2 a	94.2 a
4 µl	48	71.4 a	88.4	41.0 a	84.0 a	57.3 a	95.0 a
	24	71.4 a	87.2N.S	43.4 a	80.2ab	60.6 a	92.1 a

Means followed by similar letters are not significantly different from each otfer according to DMR test.

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