TOXICITY AND PERSISTENCE OF SOME POISON BAITS AGAINST THE FOURTH NYMPHAL INSTAR OF TWO SPECIES OF GRASSHOPPERS

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Abstract

The efficiency of some insecticides as poison baits against 4th nymphal instar of the grasshoppers *Euprepocnemis plorans plorans* Charp. and *Heteracris annulosa* Walker were tested

The toxicity of lambda-cyhalothrin (Kindo) based on its Lc_{50} values as poison baits using different carriers after 24 and 72 hrs. against *E.plorans plorans* was arranged descendingly as follows : corn hull > wheat bran > groundnut husks > bean hay . Based on Lc_{90} values in ppm after 24 and 72 hrs., the descending order was wheat bran > groundnut husks > corn hull > bean hay. As for *H.annulosa,* the toxicity after 24 and 72 hrs. based on Lc_{50} or Lc_{90} was arranged in a descending order as follows: wheat bran >or = corn hull > groundnut husks > bean hay.Concerning fenitrothion (Sumithion) baits against *E.plorans plorans* based on Lc_{50} and Lc_{90} values after 24 and 72 hrs. , bean hay bait showed the highest toxicity followed descendingly with corn hull, wheat bran .and groundnut husks . In case of *H. annalosa,* the toxicity based on Lc_{50} or Lc_{90} after 24 hrs. could be arranged as follows: corn hull > groundnut husks > wheat bran > bean hay, but after 72 hrs. bean hay bait occupied the second position followed by groundnut husks and wheat bran. With respect to carbosulfan (Marshal) baits againt *E. plorans plorans* , the toxicity based on Lc_{50} after 24 or 72 hr. were arranged descendingly as follows : corn hull= or > groundnut husks > wheat bran > bean hay .Based on Lc_{90} values , corn hull bait was as toxic as groundnut husks bait followed descendingly by bean hay bait and finally wheat bran bait .

In case of *H. annulosa,* the arrangements were : groundnut husks > bean hay > corn hull > wheat bran based on Lc_{50} values after 24 or 72 hrs., while based on Lc_{90} after 24 hr values corn hull > bean hay > groundnut husks > wheat bran. In case of after 72 hrs. groundnut husks became the first. Generally , lambda-cyhalothrin as poison baits with all carriers , revealed higher toxicity than carbosulfan and fenitrothion against the two species of grasshoppers. However, *H. annulosa* was more susceptible to the toxicants tested than *E.plorans plorans* .

The persistences of the three insecticides as poison baits were tested against *E. plorans plorans.*

The persistence of lambda-cyhalothrin baits could be arranged descendingly as followed : bean hay > corn hull > groundnut husks > wheat bran .While in case of fenitrothion bean hay > corn hull> groundnut husks > wheat bran . While in case of fenitrothion bean hay>corn hull>groundnut husks>wheat bran.Carbosulfan poison baits were the least persistent one .

INTRODUCTION

Grasshoppers have become serious pests in Egypt especially in the newly reclaimed areas (El-Garhy *et al.*, 1988).

In 1927, the farmers of El-Dakhla and El-Kharga oases reported to the ministry of agriculture that great numbers of grasshoppers had invaded their fields and caused serious damage. The berseem grasshopper *Euprepocnemis plorans plorans* Charp. caused at least 95% damage in the cultivated fields of lower Egypt (Nakhla, 1957). In 1986 and 1988, the farmers of El-frafra oases in the New Vally, and the newly reclaimed areas in the south west of Alexandria, respectively reported complaints on the serious damage especially in maize crop by *E. plorans plorans* (El-Garhy *et al.*, 1988).

The use of poisoned baits had long been a common method of grasshoppers control (Nakhla, 1957).

The present work was conducted to investigate the relative efficacy of three formulated insecticides as poison baits i.e. sumithion , marshal and kindo with the preferential carriers , i.e., wheat bran, corn hull , bean hay and groundnut husks against two grasshoppers , *E.plorans plorans* and *Heteracris annulosa* Walker. Moreover , the work was extended to evaluate the persistence of the insecticides tested .

MATERIALS AND METHODS

Insecticides used

Three formulated insecticides were used in this study:

1. Lambda- cyhalothrin (Kindo) E.C. (5% a,i.) (Pyrethroid)
2. Fenitorthion (Sumithion) U.L.V. (95% a.i.) (Organophosphorus)
3. Carbosulfan (Marshsal) U.L.V. (20% a.i.) (Carbamate)

Test insects : The insects used during the study were the fourth nymphal instar of the grasshopper, *E. plorans plorans* and *H. annulosa*. The individuals were taken from a stock culture maintained for several generations at the Locust Research Section, Plant Protection Researech Institute. A.R.C. Dokki, Giza. The culture is usually provided with some insects brought from the New Valley every year.

Rearing Procedures : The insects were reared in the laboratory according to the technique of Hassanein (1975).

Laboratory evaluation of certain insecticides as poison baits against the grasshoppers, *E. Plorans plorans* and *H. annulosa* : Formulated grades of 3 insecticides which belong to three chemical groups were evaluated in this study, i.e. : (1) the pyrethroid, lambda-cyhalothrin 5 % E,C. (kindo), (2) the organophosphate, fenitrothion 95% U.L.V. (sumithion), and (3) the carbamate, carbosulfan 20% U.L.V. (marshal). The appropriate amount of the tested insecticide, 5 ml of acetone were added and thoroughly mixed. The insecticide/acetone solution was added to 100 gm of each of the chosen carriers and mixed well (El-Sayed et al., 1988). When the mixing was completed, a stock amount of the dry bait was taken and a series of dilutions, in carrier, were prepared (2/3 of the carrier which included stock solution + 1/3 of the carrier), (MacCuaig, 1966) . Preliminary experiments showed no difference between dry and wet toxicated baits against the grasshoppers. Moreover, it was found that molasses did not increase the attractiveness to the bait. The same was reported by Nakhla (1957).

Fourth nymphal instar of the grasshoppers, *E. plorans plorans* and *H.annulosa* were used . Fourth instar nymphs 3-5 days after their third moult were starved for 24 hrs. before baiting. Five gms of the tested bait was kept with five nymphs in plastic cylinder (diameter 8 cm and length 25 cm) opened at both ends and covered with a piece of cheese cloth for ventilation (El-Sayed et al. 1988) . For each insecticide, five concentrations of the bait were prepared and replicated four times, each replicate contained 5 individuals. Baited nymphs were kept in an incubator for 24 and 72 hrs. at 32 °C with a fluorescent lamp as a source of light. Mortality percentages were calculated after 24 hrs. from baiting and after 72 hrs. Nymphs were considered dead when unable to right themselves after being turned upside down (MacCuaig and Yeates, 1961). The method of Finney (1952) was adopted to establish the mortality regression lines .

The Lc_{50}, Lc_{90} values and slope of regression lines were calculated.

Persistence of poisoned baits against fourth nymphal instar of grasshopper : The same insecticides were tested for their persistent effects . A quantity equivalent to the respective Lc_{90} value of each insecticide was added to 5 ml acetone and added to 100 gms of each carrier and mixed well by using a spatula (El-Garhy et al., 1988). Twenty grams of poisoned bait were taken and introduced to the insects for determining the initial kill . After that, the poisoned bait was placed under natural field conditions for further sampling. The temperatures and relative humidity were recorded daily and by night along the period June and July and the average temperature and R.H. were estimated . To determine the residual activity of the tested insecticides; samples of poisoned baits from the previous treatments were taken at different intervals of 5, 10, 15, 20. 25. and 30 days, to be tested against 4th numphal instar of the berseem grasshopper, *E. plorans plorans*. Nymphs were starved for 24 hrs. before baiting. Fourth instar 3-5 days after their moult was used. Five gms of the tested bait was kept with 10 nymphs under plastic cylinder. For each insecticide, one concentration only (Lc_{90}) of the bait was prepared . Four replicates were used, each of 10 nymphs. Baited nymphs were kept in the incubator for 24 hrs. at 32 °C, lighted with a fluorescent lamp . Mortality counts were taken after 24 hrs. from baiting. Nymphs were considered dead when it could not right itself once upside down .

RESULTS AND DISCUSSION

1 . *E. plorans:* The efficiency of some insecticides as poison baits against the 4th instar nymphs of the grasshopper *E.plorans plorans* were studied .The toxicity of lambda-cyhalothrin based on its Lc_{50} values as poison baits using different carriers were arranged descendingly as follows: corn hull > wheat bran > groundnut husks > bean hay. Based on Lc_{90} values , the descending order was: wheat bran > groundnut husks > corn hull > bean hay, Table 1. As for Lc_{50} and Lc_{90} values of fenitrothion baits, bean hay bait showed the highest toxicity followed descendingly with corn hull then wheat bran and finally by groundnut husks bait .

Concerning the effectiveness of carbosulfan baits based on its Lc_{50} values in the tested carriers were arranged as follows: corn hull = groundnut husks > wheat bran > bean hay .Whereas, in case of Lc_{90} values, corn hull bait was as toxic as groundnut

husks bait followed by bean hay bait and finally wheat bran bait. The order of toxicity of lambda –cyhalothrin and fenitrothion baits using different carriers 72 hrs. after treatment was the same as pre- mentioned after 24 hrs. The toxicity of carbosulfan baits 72 hrs. after application came in the same order pre- mentiond after 24 hrs. with the exception that corn hull / carbosulfan bait was more toxic than groundnut husks / carbosulfan bait .

These results are consistent with those of El-Sayed *et al.* (1988). They used cyhalothrin , fenitrothion and bendiocarb and some other insecticides as poison baits with wheat bran against the 5 th nymphal instar of the same grasshopper and found that cyhalothrin is more toxic than the other two insecticides.

The findings are in agreement with those of Metaweh and Ibrahim (1994) . They tested the toxicity of some insecticides against the grasshopper, *E. plorans plorans* and observed that fenitrothion had the least effect than lambda- cyhalothrin and carbosulfan.

2. *H. annulosa:* The effectiveness of some insecticides as poison baits against 4 th nymphal instar of the grasshopper , *H. annulosa* were also tested , Table 2.

The toxcity of lambda-cyhalothrin based on its Lc_{50} and Lc_{90} values were arranged descendingly as follows : wheat bran > corn hull > groundnut husks > bean hay after 24 and 72 hrs. post treatment.In case of fenitrothion the arrangement were: corn hull > groundnut husks > wheat bran > bean hay after 24 hrs. reaction time. However , after 72 hrs. bean hay bait occupied the second position followed with groundnut husks and wheat bran .

The efficiency of carbosulfan baits using the tested carrier 24 hrs. after treatment could be arranged as follows: groundnut husks > bean hay > corn hull > wheat bran , based on Lc_{50} values .Based on Lc_{90} values , corn hull bait showed the highest toxicity followed by bean hay then groundnut husks and finally wheat bran . 72 hrs. after treatment, the arrangements were not changed in case of Lc_{50}, but Lc_{90} values were changed to be : groundnut husks > corn hull > bean hay > wheat bran .

Foster *et al.* (1979) obtained satisfactory control to *Anabrus simplex* by using carbaryl as poison bait with wheat bran

Harb *et al.* (1988), came to this result . They sprayed some U.L.V . insecticides against the grasshoppers in the field and found that fenitrothion had the lowest effect among lambda-cyhalothrin the superior insecticide and carbosulfan the second.

In conclusion , the obtained results indicated that :

1. Lambda-cyhalothrin as poison baits with all carriers, revealed higher toxicity than that of fenitrothion and carbosulfan against the grasshoppers, *E. plorans plorans* and *H. annulosa.*
2. The grasshopper *H. annulosa* was more susceptible to the toxicants tested than *E. plorans plorans* .

The persistence of poison baits against the 4th nymphal instar of the grasshopper, *E. plorans plorans* : The effect of the three insecticides tested as poison baits were underaken to find out the efficiency against the most dominant grasshopper.

According to the persistence of the respective bait, the carriers could be arranged in descending order as follows : bean hay > corn hull > ground husks > wheat bran, Table 3.

Fenitrothion when mixed with corn hull as poison was the highest persistent followed descendingly with bean hay, wheat bran and finally groundnut husks. Fenitrothion poison baits were generally less persistent than the respective lambda-cyhalothrin poison baits.

Carbosulfan poison baits were the least persistent baits tested, followed by fenitrothion baits and lambda-cyhalothrin poison baits were the most persistent baits tested.

The results go in line with those of El- Garhy *et al.* (1988). They used fenitrothion and lambda-cyhalothrin as spray on the potted maize of *E.plorans plorans* and let the insects eat poisoned maize and noticed that fenitrothion was less toxic than lambda-cyhalothrin.

MacCuaig and Gezachew Sahle (1974) findings agree with the present results. They found that fenitrothion as a bait was effective in killing locust nymphs.

Table 1. Toxicity of some insecticides as poison baits to the 4th nymphal instar of the grasshopper *E. plorans plorans.*

Post treatment period	Carriers	24 hrs.			72 hrs.		
Insecticides		Slope	LC50 ppm wt-wt	LC90 ppm wt-wt	Slope	LC50 ppm wt-wt	LC90 ppm wt-wt
Lambda-cyhalothrin	Wheat bran	3.43	0.0011	0.0026	3.501	0.0010	0.0023
	Corn hull	1.88	0.0008	0.0038	1.697	0.0006	0.0038
	Bean hay	1.65	0.0049	0.0290	2.720	0.0024	0.0075
	Groundnut husks	3.30	0.0013	0.0034	3.300	0.0011	0.0026
Fenitrothion	Wheat bran	4.44	0.0200	0.0400	5.41	0.0180	0.0320
	Corn hull	3.94	0.0170	0.0350	4.60	0.0142	0.0280
	Bean hay	2.86	0.0110	0.0330	3.24	0.0075	0.0188
	Groundnut husks	4.35	0.0320	0.0640	4.80	0.0320	0.0600
Carbosulfan	Wheat bran	1.88	0.0290	0.1430	3.12	0.0230	0.0590
	Corn hull	2.98	0.0110	0.0300	3.91	0.0088	0.0190
	Bean hay	2.18	0.0310	0.1230	2.19	0.0280	0.1000
	Groundnut husks	2.96	0.0110	0.0300	2.90	0.0100	0.0270

Table 2. Toxicity of some insecticides as poison baits to the 4th nymphal instar of the grasshopper *Heteracris annulosa.*

Post treatment period	Carriers	24 hrs.			72 hrs.		
Insecticides		Slope	LC50 ppm wt-wt	LC90 ppm wt-wt	Slope	LC50 ppm wt-wt	LC90 ppm wt-wt
Lambda-cyhalothrin	Wheat bran	3.47	0.00031	0.00072	3.19	0.00027	0.00070
	Corn hull	2.91	0.00034	0.00094	2.94	0.00027	0.00076
	Bean hay	4.38	0.00220	0.00440	4.17	0.00200	0.00400
	Groundnut husks	3.79	0.00071	0.00160	4.13	0.00062	0.00130
Fenitrothion	Wheat bran	4.0	0.026	0.025	4.90	0.025	0.047
	Corn hull	3.50	0.012	0.029	4.48	0.011	0.023
	Bean hay	4.20	0.035	0.074	4.94	0.018	0.033
	Groundnut husks	3.70	0.022	0.050	4.00	0.020	0.044
Carbosulfan	Wheat bran	4.10	0.0240	0.051	3.83	0.0210	0.047
	Corn hull	4.37	0.0100	0.020	4.19	0.0095	0.019
	Bean hay	3.50	0.0090	0.220	3.20	0.0085	0.021
	Groundnut husks	2.10	0.0059	0.024	2.80	0.0055	0.017

Table 3. Persistence of some insecticides with preferable carriers as poison baits against the 4th nymphal instar of the grasshopper, *E. Plorans Plorans.*

Insecticides	Poison baits	Rate of application ppm wt/wt	Initial mortality *	% Residual mortality at the indicated days**							LT_{50} ***
				5	10	15	20	25	30	35	
Lambda-cyhalothrin	Wheat bran	0.0026	90	52.5	15.0	5.0	0	0	0	0	5.5
	Corn hull	0.0038	90	90.0	80.0	60.0	40.0	0	0	0	17.0
	Bean hay	0.0290	95	95.0	95.0	85.0	82.5	60	30	0	26.0
	Groundnut husks	0.0034	90	77.5	67.5	27.0	0	0	0	0	11.0
Fenitrothion	Wheat bran	0.040	90	60.0	17.5	0	0	0	0	0	5.5
	Corn hull	0.035	90	80.0	52.5	10	0	0	0	0	10.5
	Bean hay	0.033	87.5	55.0	25.0	0	0	0	0	0	5.5
	Groundnut husks	0.064	90	62.5	5.0	0	0	0	0	0	5.5
Carbosulfan	Wheat bran	0.143	95	75	50	12.5	0	0	0	0	10.0
	Corn hull	0.030	95	80	60	17.5	0	0	0	0	10.5
	Bean hay	0.123	95	63	40	5.0	0	0	0	0	7.0
	Groundnut husks	0.030	87.5	75	40	32.5	10	0	0	0	8.0

* Samples of sprayed baits were taken directly after application and the insects fed on for 24 hours.

** Samples were taken at indicated days after application and the insects fed on for 24 hours.

*** Time required for 50% mortality.

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سميه وثبات بعض الطعوم السامة على العمر الحورى الرابع لنطاط البرسيم العادى ايوبريبوكينمزبلورنس ونطاط البرسيم المتشابه هيتراكريس آنيولوزا

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تم دراسة كفاءة بعض المبيدات كطعوم سامة على العمر الرابع الحورى لنطاط البرسيم ونطاط البرسيم المتشابه . يمكن ترتيب كفاءة المواد الحاملة للطعوم السامة لمبيد اللامبيداسيها لثرين (الكندو) حيث قيمة التركيز النصفى القاتل (Lc_{50}) بعد ٢٤ و٧٢ ساعه من المعاملة فى حالة نطاط البرسيم العادى كما يلى : ردة الذرة > ردة القمح > قشر الفول السودانى > تبن الفول البلدى.

أما فى حالة التركيز الذى يقتل ٩٠٪ من الافراد المعاملة اصبح الترتيب : ردة القمح > قشر الفول السودانى > ردة الذرة > تبن الفول البلدى.

بالنسبة لنفس المبيد ولكن على نطاط البرسم المتشابة بالتركيزين السابقين وفترتى المعاملة ردة القمح > او = ردة الذرة > قشر الفول السودانى > تبن الفول البلدى

بالنسبة لمبيد الفينتروثيون (السوميثيون) على نطاط البرسيم العادى بالتركيز & Lc_{50} Lc_{90} بعد فترتى المعاملة ٢٤، ٧٢ ساعه كان تبن الفول البلدى أفضل من ردة الذرة يليهم ردة القمح ثم قشر الفول السودانى فى الطعم السام .- ونفس المبيد ولكن مع نطاط البرسيم المشابة بالتركيزين Lc_{50} & Lc_{90} بعد ٢٤ ساعه من المعاملة كان ترتيب الطعوم السامة كالاتى:

ردة الذرة > قشر الفول السودانى > ردة القمح > تبن الفول البلدى ولكن بعد ٧٢ ساعه احتل تبن الفول البلدى المركز الثانى وتبعه قشر الفول السودانى ثم ردة القمح.

فى حالة مبيد الكاربوسلفان (المارشال) على نطاط البرسم العادى بالنسبة للتركيز Lc_{50} بعد فترتى المعاملة كان الترتيب : ردة الذرة = أو > قشر الفول السودانى > ردة القمح > تبن الفول البلدى . فى حالة الـ Lc_{90} اصبحت ردة الذرة مساوية لقشر الفول السودانى فى الكفاءة فى الطعوم السامة يليهم تبن الفول البلدى وفى المؤخرة ردة القمح ونفس المبيد على نطاط البرسيم المتشابه كان الترتيب قشر الفول السودانى > تبن الفول البلدى> ردة الذرة > ردة القمح بالنسبة لـ Lc_{50} وبعد فترتى المعاملة بينما الـ Lc_{90} بعد ٢٤ ساعه من المعاملة كان الترتيب ردة الذرة > تبن الفول البلدى> قشر الفول السودانى > ردة القمح وبعد ٧٢ ساعه من المعاملة اصبح قشر الفول السودانى فى المقدمة .

عموماً كان مبيد اللامبيدا سيهالثرين هو الاكثر سميه كطعوم سامة مع كل الحوامل المختبرة ضد نوعى النطاط وكان نطاط البرسيم المتشابه اكثر حساسية من نطاط البرسيم العادى لكل الطعوم السامة المختبرة .

اختبر أيضاً ثبات الثلاثة مبيدات على حوريات العمر الرابع لنطاط البرسيم العادى وكان ترتيب ثبات الطعوم السامة فى حالة مبيد اللامبيداسيهالثرين تبن الفول البلدى > ردة الذرة > قشرة الفول السودانى > ردة القمح .وفى حالة مبيد الفينتروثيون كان الترتيب : تبن الفول البلدى > ردة الذرة > قشرة الفول السودانى > ردة القمح .وعموماً كان مبيد الكاربوسلفان أقل المبيدات المختبرة ثباتاً كطعوم سامة يليه مبيد الفينتروثيون ثم مبيد اللامبيداسيهالثرين .