FIELD APPLICATION OF SOME PLANT EXTRACTS FOR CONTROLLING THE PINK STEM BORER *SESAMIA CRETICA* LED.

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Abstract

Plant extracts – derived from the leaves of two plants sweat marjoran and rosemary also two biopesticides; "dipel 2X" and "biofly" and their mixtures and diazinox – were applied in the maize field during the early summer plantation April 2010, for controlling the pink stem borer *Sesamia cretica* led.

Data demonstrated that water, acetone extracts of sweat marjoran and water extract of rosemary achieved the highest reductions (95.2 – 98.8%) in egg-masses and (89.5 – 98 %) in number of larvae. For the two symptoms of infestation; the perforated leaves and the dead hearts; mixture of rosemarry with biofly caused the highest reduction for *S. cretica* infestation symptoms (96.3 – 94.7%, respectively). Data obtained from the laboratory tests were harmony with those obtained from field application which the LT_{50} values at 0.05% confidence limits were determined. From these data the importance of using plant extracts could be illustrated which definitely are promising agents which could be a good alternative tool for chemical pesticide trying to reduce its harmful effects not just on human but also on the environment as all.

INTRODUCTION

The pink stem borer *Sesamia cretica* Led. (Lepidoptera: Noctuidae) may be fairly considered the most serious pest for maize, as it attacks maize plants in the seedling stage causing dead heart and subsequently, rotten of plants (Gentry, 1965 and Awadallah, 1974).

Maize is one of the most important grain crops in Egypt, as it conforms to wheat in its economic importance. It plays an important role in several important industries to Egypt's economy as corn oil, fructose, sugar and starch production in order to avoid the hazards caused to the environment due to the repeated use of traditional chemical insecticides that are used commonly corn borers control (Tawfik *et al.,* 1974).

Abul-Nasr *et al.,* (1968) reported that the highest infestation of corn plants in Egypt by *S. cretica* occurs to plants sown in Mid-April.

Use of natural products from plant origin is a new trend as certain plant families are rich sources of natural substances that could be utilized in the

development of alternative safe methods for pest control (Wheeler and Isman 2001). The deleterious effects of plant extracts on insects are manifested in several ways including, growth retardation, feeding inhibition, oviposition deterrence and reduction of fecundity and fertility Sadek, (2003).

The present study aimed to assay the efficacy of rosemary and sweat marjoran extracts by different solvents against *S. cretica* infestation and subsequently the effect on the resultant yield and to find out alternative control methods rather than the chemical insecticides and its dangers simulating the world trend to safe the environment.

MATERIALS AND METHODS

Preparation of plant extracts:

Two plants species were chosen in the present investigation, *Magorana hortensis,* Moensh and *Rosmarinus officinal* L. both of them are belonging to family Labiatae. The plants were extracted in the laboratory, while, the biopesticides as commercial name dipel 2X and biofly were used as single or mixed with extracts. Common and scientific names of plants used in this study are in the following:

Scientific name	Family	English name	Part used
Magorana hortensis	Labiatae	Sweat marjoran	leaves
Rosmarinus officinal	Labiatae	Rosemary	leaves

Dipel 2X and biofly were used at two different concentrations as follows:

1- Dipel 2X: *Bacillus thuringiensis* kurstaki 7.1 gm / L (5%) and 8.5 gm / L (10%).
2- Biofly: *Buvaria bassiana* 1.5 cm^3 / L (5%) and 0.75 cm^3 / L (10%).

The studied plants were washed by water and dried in laboratory by electric fan, then grained in a high speed blender. Extracts prepared in the laboratory by different organic solvents (water, acetone, petroleum ether) at ratio 1 gm powder : 2cm^3 solvent in high speed grinder then filtered as mentioned with Afifi *et al.,* (1988).

A volume of 50 and 100 cm^3 of water was added to the former crude extracts to obtain two concentrations. Also, extracts in boiling water described by Emara *et al.,* (1994).

In this respect Diazinox (Diazinon) organophosphorous insecticide) was chosen as a positive control. Mixtures were obtained by adding the lowest concentration of each

bioinsecticides (dipel 2X and biofly) with the lowest concentration of water plant extracts.

Field experiments

The experimental field study was arranged in compete randomized blocks design an area of about half feddan was cultivated with maize variety Giza 2 at the experimental farm of Agriculture Faculty, Benha university throughout the second week of April 2010 for the highest natural infestation with *S. cretica* Awadallah (1974) and Shalaby (1996) for treatments and control, each plot contained 5 rows. Each of the assayed materials was applied on 4 replicates / treatment. A hand sprayer (1 Liter) was used for field application at a rate of 2 cm^3 in the whorle of each plant. Spraying was applied two times; the first inspection after 15 days while the second after 22 days.

Data concerning the infestation symptoms of *S. cretica* were obtained as follows:

- Egg-masses (20 plants / plot) recorded after 24 hours from 1st spray
- Larvae (20 plants/ plot) recorded after 24 hours from 2nd spray
- Perforated leaves (50 plants / plot) recorded after 43 days from sowing date.
- Dead hearts (50 plants / plot) recorded after 43 days from sowing date.
- Harvest of maize yield was recorded after 120 days from sowing date, calculated as Ardab / feddan.

Bioassay studies:

To evaluate the toxic effect of the assayed materials at 5% concentration and calculate the LT_{50} values at 0.05 confidence limits and slope regression lines, 80 third instar larvae of *S. cretica* were chosen, divided into 4 replicates, (*i.e.* 20 larvae / for each) treatment and treated with the different plant extracts, biopesticides and their mixtures in addition to the recommended chemical pesticide. Durations were chosen 2, 6, 9 & 12 days from the starting day of the experiment which were conducted under laboratory conditions 31 °C ± 1 and 60 % R.H. ± 5. A computer program was used for calculating LT_{50}'s values Probit analysis was calculated according to Litchfield, and Willcoxon, (1949) using "LDP Line" soft ware www.ehabsoft.com/ldpline/DownloadForm.htm

RESULTS AND DISCUSSION

a – Effect on average number of egg-masses:

Data in Table (1), demonstrated that, the highest average number of egg-masses was 21 masses / 20 plants recorded in the untreated plants followed by the recommended chemical pesticide diazinox showing 42.9% reduction than control.

Sweat marjoran extracted in water and in acetone treatments caused the highest efficacy on the number of deposited egg-masses reaching 98.8 and 97.6% reduction when compared with control, respectively, followed by rosemary extracted in water, petroleum ether and sweat marjoran extracted in petroleum ether causing 95.2, 90.5 and 90.5% reduction, respectively. While, the remaining treatments had a significant intermediate efficacy and could be arranged in descendingly order as mixture of sweat marjoran with biofly and rosemary with dipel 2X (85.7 and 80.9%) reduction than control, respectively. Rosemarry extracted in acetone, biofly alone and sweat marjoran mixed with dipel 2X showed similar effect (5 egg-masses / 20 plants as 76.2% reduction than control). While, dipel 2X alone achieved 71.4% reduction than control and this proved lower than biofly alone. On the contrary, the least effective treatment 57.1% reduction was mixture rosemary with biofly (9 egg-masses / plant).

b – Effect on larval counts:

The highest efficiency against *S. cretica* larvae showing 98% and 96.1% reductions with an average of 0.75 & 1.5 larvae / 20 plants by sweat marjoran extracts in acetone and in water, respectively. The other treatments could be classified to three groups based on their efficiency in descending order: **I.** The first group caused high reduction ranged from 89.5% by rosemary extracted in water or mixed with dipel 2X showed 86.8% reduction. **II.** The second group caused intermediate reduction ranged from 73.7% (10 larvae / 20 plants) by rosemary extracted in petroleum ether to 57.9 reduction (16 larvae / 20 plants) by mixtures rosemary with biofly. **III.** The third group caused the lowest reduction including rosemary extracted in acetone, mixture sweat marjoran with dipel 2X (47.7%, 20 larvae / 20 plants) and biofly alone (34.2%, 25 larvae / 20 plants).

c – Effect on number of plants containing perforated leaves

The highest average counts of plants containing perforated leaves was recorded in untreated plots showing 20 from 50 examined plants. While, rosemary mixed with biofly, sweat marjoran extracted in water and petroleum ether and dipel 2X caused the highest efficacy showing 0.75, 1 and 1 plant containing perforated leaves / 50 plants, indicating 96.3, 95, 95 and 92.5% reduction than control. However rosemary extracted in water (gave 90% reduction *i.e.* 2 perforated leaves / 50 plants). The remaining treatments could be arranged in descending order as mixtures rosemary with dipel 2X, sweat marjoran with biofly, biofly only diazinox and rosemary extracted in acetone caused 70, 70, 70, 70, 70 & 60% reduction, respectively. The least effective material was mixture of sweat marjoran with dipel 2X being 45% reduction.

d – Effect on dead hearts cases

The best treatments which caused high reduction than control were rosemary extracted in petroleum ether, in water, mixed with biofly and dipel 2X indicating 96.1, 94.7, 94.7 and 94.7%, respectively. The remaining treatments had an intermediate effect as they were Diazinox, biofly, sweat marjoran extracted in acetone and in water being 84.2% reduction than control, followed by sweat marjoran mixed with biofly, mixture of rosemarry with dipel 2X, sweat marjoran extracted in petroleum ether and mixed with dipel 2X achieving 78.9, 63.2, 36.8% and 36.8%, respectively. While the least reduction percentage was recorded from plants treated with rosemarry extracted in acetone (36.3%).

e- Dry ears yield:

All treatments caused high significant increase in calculated ears yield / feddan, especially extracts of rosemarry in water and petroleum ether recorded 23.5 ardab / feddan *i.e.* 89.5% increase than control. Sweat marjoran extracted in water came the second by 22.9 ardab / feddan *i.e.* 84.7% increase than control. While dipel 2X recorded 21.1 ardab / feddan *i.e.* 70.1% increase than control, Table (1).

2 . Bioassay tests:

Among all the assayed materials, shorter LT_{50}'s values which difinitely indcated to higher efficacy were obtained when larave were fed on maize treated by sweat marjoran extracted in acetone, sweat marjoran extracted in water, rosemary extracted in water (2.96, 3.24 and 3.75 days, respectively). While, the LT_{50} values for the remaining treatments could be arranged in desecnding order as rose extracted in petroleum ether 5.64 days, sweat in petroleum 6.51 days, mixture of rosemarry with biofly 6.71 days, rosemary extracted in acetone 7.28 days mixture of rose with dipel 2X 7.72 days, sweat marjoran with biofly 8.19 days and sweat marjoran with 8.27, days (Table, 1).

The previous results were in agreement with that obtained by Miresmailli *et al.,* (2006) who conducted bioassay tests of *R. officinalis* L. essential oil and blends of its major constituents using host-specific strains of the two-spotted spider mite, *Tetranychus urticae* Koch, on bean and tomato plants. Toxicity of natural oil and blends of selected constituents indicated a synergistic effect among the active and inactive constituents, with the presence of all constituents necessary to equal the toxicity of the natural oil.

Also, Abbassy *et al.,* (2010) evaluated the insecticidal activity of the essential oil from leaves of *Marjorana hortensis* against fourth instar larvae of *Spodoptera littoralis* Boisduval (Lepidoptera: Noctuidae) and adults of *Aphis fabae* L. (Hemiptera: Aphididae). The oil showed a remarkable toxic effect against *S. littoralis* in a topical application assay also exhibited a pronounced toxic effect against *A. fabae* adults.

Table 1. Effect of plant extracts on *S. cretica* Led. in maize fields throughout the early summer season, April 2010.

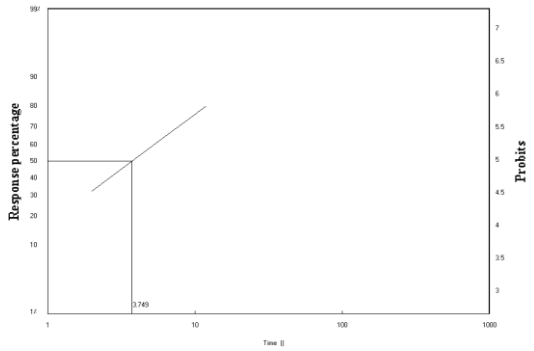
Treatments		Egg masses / 20 plants		no. of larvae / 20 plants		no. of perforated leaves / 50 plants		no. of dead hearts / 50 plants		calculated ears yield / feddan	
		Mean.	% reduction	Mean.	% reduction	Mean..	% reduction	Mean..	% reduction	Ardab / feddan	% increase
Rosemarry	extracted in water	1	95.2	4	89.5	2	90	1	94.7	23.5	89.5
	extracted in p. ether	2	90.5	10	73.7	1	95	0.75	96.1	23.5	89.5
	extracted in acetone	5	76.2	20	47.7	8	60	14	26.3	13.8	11.2
	mixed with biolfly	9	57.1	16	57.9	0.75	96.3	1	94.7	20	61.3
	mixed with Dipel	4	80.9	5	86.8	6	70	7	63.2	17.6	41.9
Sweat marjoran	extracted in water	0.25	98.8	1.5	96.1	1.5	92.5	3	84.2	22.9	84.7
	extracted in p. ether	2	90.5	5	86.8	6	70	12	36.8	16.2	30.6
	extracted in acetone	0.5	97.6	0.75	98	2	90	3	84.2	19.3	55.6
	mixed with biolfly	3	85.7	15	60.5	6	70	4	78.9	16.9	36.5
	mixed with Dipel	5	76.2	20	47.4	11	45	12	36.8	14	12.9
	Biofly	5	76.2	25	34.2	6	70	4	84.2	14	12.9
	Dipel	6	71.4	4	89.5	1	95	1	94.7	21	70.1
	Diazinox	12	42.9	12	68.4	6	70	4	84.2	18	45.1
	Control	21	–	38	–	20	–	19	–	12.4	–
	F value	171.8		124		91.3		9.3		35	
	LSD	1.12		2.3		1.4		1.7		0.14	

Table 2. LT_{50} values for *S. cretica* larval feeding on maize plants treated by 5% concentration of different materials

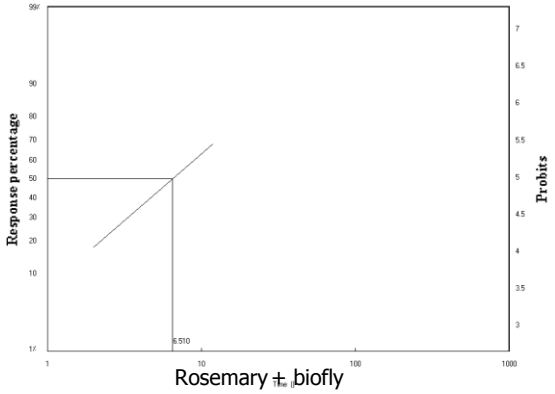
Treatments	LT_{50} days at 5%	Slope (b)	Confidence limits 0.05	
			LT_{50}	Slope
Rosemary extracted in water	3.75	1.67	–	–
Rosemary extracted in p. ether	5.64	1.6	–	–
Rosemary extracted in acetone	7.28	1.22	5.74	9.68
Rosemary + Biofly	6.71	1.33	–	–
Rosemary + Dipel 2X	7.72	1.62	–	–
Sweat marjoran extracted in water	3.24	1.23	2.12	4.21
Sweat marjoran extracted in p. ether	6.51	1.8	–	–
Sweat marjoran extracted in acetone	2.96	1.58	–	–
Sweat marjoran + Biofly	8.19	0.86	6.00	10.41
Sweat marjoran + Dipel 2X	8.27	8.19	6.21	12.57
Biofly	8.39	0.98	6.25	13.05
Dipel 2X	3.19	1.25	–	–
Diazinox	5.6	0.85	3.74	8.14

Fig 1. Probit – regression time showing response of 3rd instar larvae fed on tender pieces of maize stem treated with different assayed materials

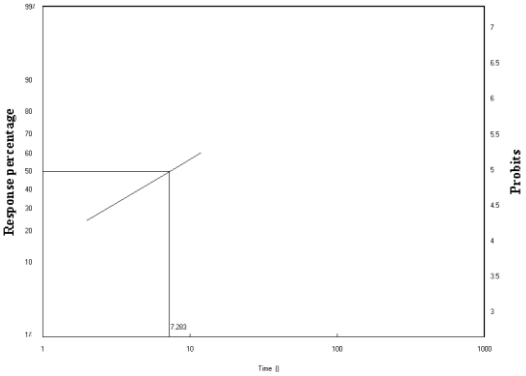
Rosemary extracted in water



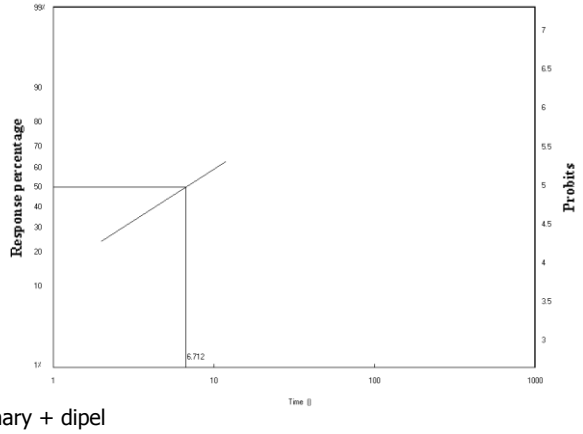
Rosemary extracted in petroleum



Rosemary extracted in acetone



Rosemary + biofly



Rosemary + dipel

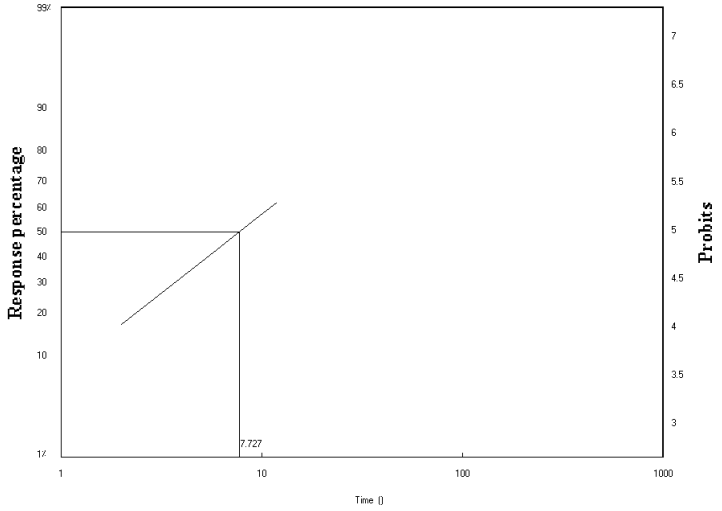
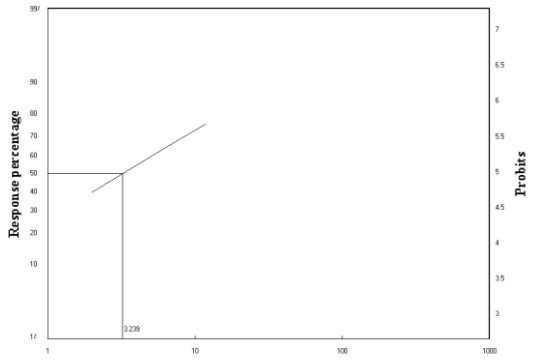
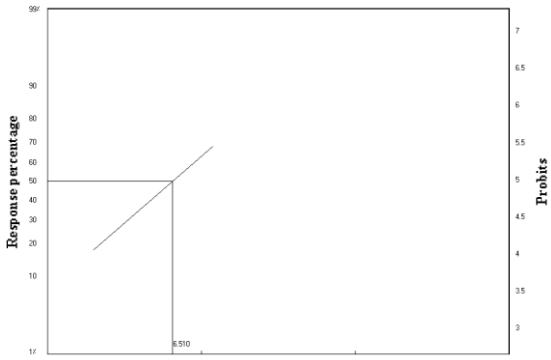


Fig 2. Probit – regression time showing response of 3rd instar larvae fed on tender pieces of maize stem treated with different assayed materials

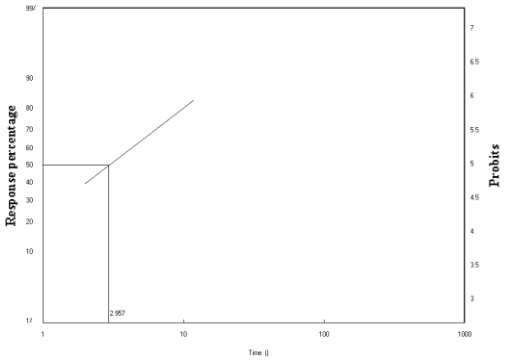
Sweat marjoran extracted in water



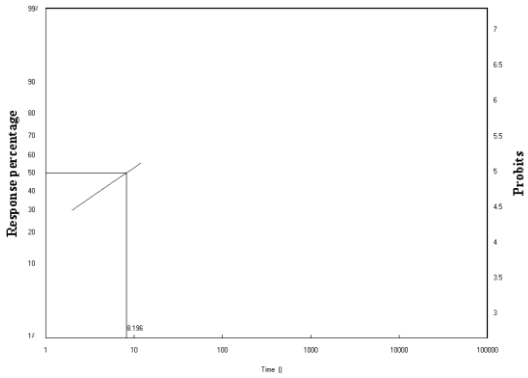
Sweat marjoran extracted in petroleum



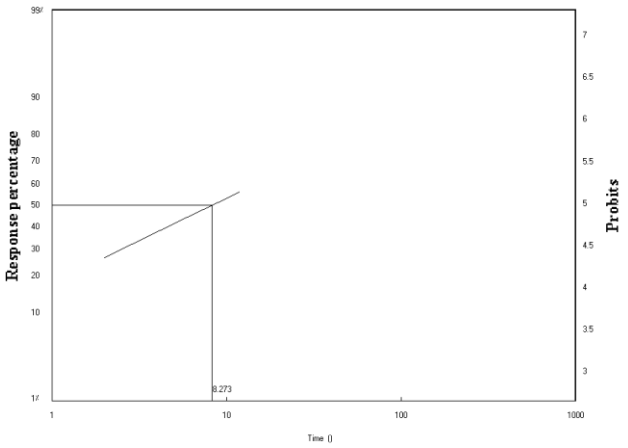
Sweat marjoran extracted in acetone



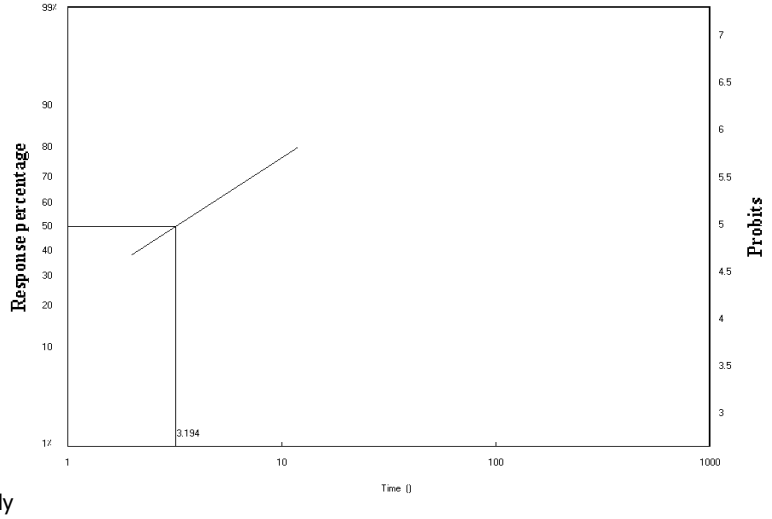
Sweat marjoram + biofly



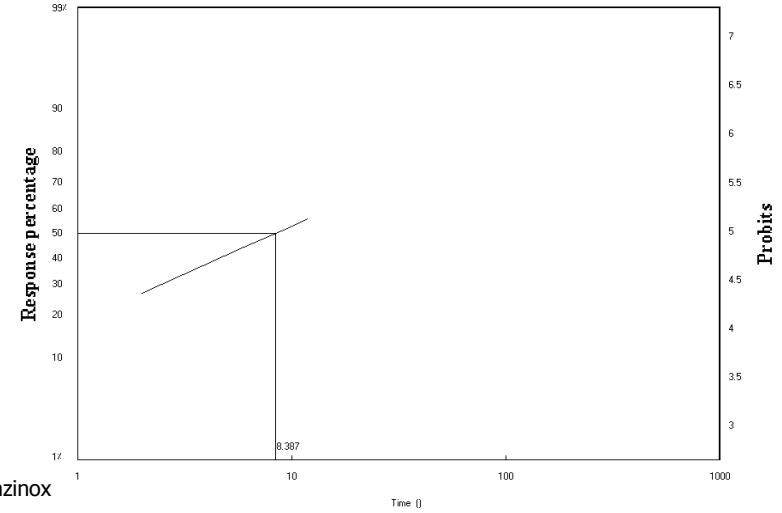
Sweat marjoran + dipel



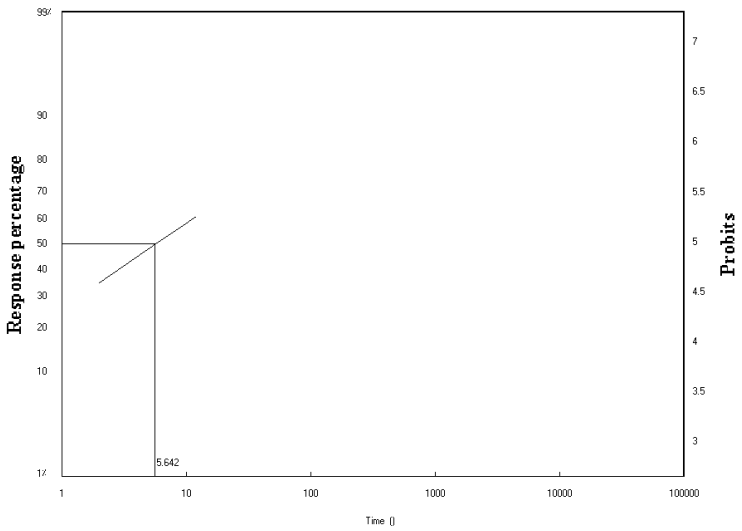
Dipel



Biofly



Diazinox



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التطبيقات الحقلية لبعض المستخلصات النباتية المستخدمة فى مكافحة دودة القصب الكبيرة

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تم اختبار بعض المستخلصات النباتية كتطبيق حقلى لمكافحة دودة القصب الكبيرة على نباتات الذرة الشامية خلال العروة الصيفية المبكرة ابريل 2010 حيث تتلقى أعلى اصابة حقلية وهى مستخلصات أوراق نبات حصا اللبان والبردقوش وكذلك اثنان من المبيدات الحيوية الممرضة للحشرات احدهما بكتيري "دايبل 2X" واخر فطرى "بيوفلاى"، وخلائطهما مع المستخلصات المائية للنباتات سالفة الذكر اضافة الى المبيد الكيميائى الموصى به ديازينوكس.

وأوضحت النتائج أن مستخلص الماء والاسيتون للبردقوش والمستخلص المائى لاوراق حصا اللبان حققا أعلى فى معدل خفض تعداد لطع البيض(95.2 – 98.8%) وتعداد اليرقات (89.5 – 98 %). وبالنسبة لمظهرى الاصابة وهما الاوراق المثقبة والقلب الميت فقد حقق خليط مستخلص حصا اللبان مع البيوفلاى وكذلك مستخلص البردقوش فى البيتروليم ايثر اعلى نقص لمظهرى الاصابة (96.3 – 94.7 %) على الترتيب. واوضحت نتائج الاختبارات المعملية الحيوية توافقا مع تلك التى تم الحصول عليها فى الحقل وتم حساب المدة الزمنية بالايام اللازمة لقتل 50% من التعداد المعامل وذلك للمعاملات المختلفة.