UTILIZATION OF CERTAIN PLANT EXTRACTS TO REDUCE THE INFESTATION OF THE PINK STEM BORER *SESAMIA CRETICA* LED. IN MAIZE FIELDS

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Abstract

Leaves of lemongrass and Pigeon berry belonging to two different plant families were extracted in water, petroleum ether and acetone, in addition, to two biopesticides, a bacterial one (Dipel 2X) and entomopathogenic fungi (Biofly) and their mixtures with the two plants used extracted in water in controlling the pink stem borer *Sesamia cretica* Led. in maize fields during the early summer plantation 2010 season.

Data demonstrated that both of lemongrass extract in water, acetone and their mixtures with Biofly achieved the highest reduction percentages in egg-masses. Also, extract of Pigeon berry in acetone showed the highest reduction percentages in the two symptoms of infestation (perforated leaves and dead hearts), the same percentages were obtained either from Pigeon berry with Dipel or Dipel 2X alone in the dead heart cases. (The harvest maize yield was calculated after 120 days from sowing as ardab / feddan).

Data obtained from laboratory tests was almost in the same trend as those obtained in the field in which the shortest LT_{50} values at 5% concentration were calculated for all the treatmnets.

It could be concluded that plant extracts which resulted in the highest reduction percentage in egg-masses, larvae and dead heart cases were the same in obtaining the heaviest yield besides decreasing the environment pollution and definitely more save for farmers in comparison with the recommended chemical pesticide.

INTRODUCTION

Maize (*Zea mays* L.) is used for human food in rural areas, where it is mixed with wheat flour in bread industry. In addition, it is a major component in several important industries to Egypt economy such as corn oil, starch and fructose sugar (Shalaby, 1996).

The chemical control of maize posts by using pesticides give an effective control against pests, but unfortunately the use of such pesticides are very danger to human, animals and beneficial insects, therefore it is necessary to find out alternative control methods which are as effective as pesticides without any problems in application as plant extracts and their derivatives Tawfik *et al.,* (1974) and Hiremath, *et al.,* 1997.

The Pink stem borer, *Sesamia cretica* Led. (Lepidoptera, Noctuidae) is destructive to corn crop in Egypt it attacks corn plants in the seedling stage which define as the king of the cereal crops not only in Egypt but also all over the world (Abul Nasr, *et al*., 1968, Gentry, 1965). The pigeon berry extract had an insecticidal activity against third instar of diamondback moth larvae Sinchairsri. *et al.,* (1990). Also, Aspollah sukari *et al.,* (1992) extracted many components which were good protective from stored insects besides their bioavtivity towards them.

MATERIALS AND METHODS

1 - Field experiments

The field study was carried out in the Experimental Farm of the Faculty of Agriculture at Moshtohor during the second week of April 2010 early summer seasons to evaluate the efficiency of the target extracts. An area of about half a feddan – cultivated with maize variety (Giza 2) – was chosen for treatments and control and divided into 68 plots of 7 X 4 meters each containing 4 rows / plot. Each area was divided into four experimental plots as replicated, containing 5 rows / plot at distance of 70 cm between rows. The sowing was done as 3 – 4 seeds / hill on April, 15^{th} to obtain a considerable infestation by *S. cretica* El-Saadany (1965) and Awadallah *et al.,* (1993). The experiment was designed and arranged in compete randomized blocks and the normal agricultural practice were followed. A hand sprayer (one liter) was used for applying at a rate of 2 cm^3 in the whorl of each plant. Spraying was applied two times, 15 and 22 days from sowing date. Data concerning the infestation by *S. cretica* egg-masses and larvae (20 plants / plot) were recorded after 24 hours of spray. Perforated leaves and dead hearts were estimated as 50 plants / plot, after 35 days from sowing. At harvest all maize ears were calculated as ardab / feddan.

2 - Preparation of plant extracts

Extracts were prepared as described by Afifi *et al.,* (1988) Samples of lemongrass and green duranta leaves were spread in shade for one week to dry. Every 100 gm of dried plant leaves were extracted in the laboratory. The dried powder leaves were mixed with water and different polaritic organic solvents (acetone, perolium ether) at ratio of 1 gm powder, : 2 cm^3 solvents, blended in high speed electric blender for 15 minutes then filtered on anhydrous sodium sulphate. Then the solvent was evaporated by the aid of an electric fan. A volume of 50 and 100 cm^3 of water was mixed with the residue to obtain 2 concentrations Emara, *et al.,* (1994).. The resultant solution was kept at 5°C until used.

3 - Application of the assayed materials and recording results

A one liter sprayer was used for applying the liquid materials at rate of about 2 cm^3 direct to the whorl of each plant. Treatments were applied for 2 successive times after 15 days from sowing for *S. cretica* egg-masses were examined per 20 plants for each treatment and after 7 days from the first spraying larvae were counted in 20 plants per treatment. While, perforated leaves and dead hearted were estimated for 50 plants for each treatment after 43 days from sowing. At harvest, maize ears were picked from all plots of each treatment, dried and weighed after 120 days from sowing.. The obtained yield / treatment (as dry ears) was calculated to find out the dry ears ardab / feddan.

3 - Products used

Three commercial as well as two plants were chosen in the present experiment to clarify their effect against *S. cretica* infestation in the field.

Products	Active ingredient a.i.	Concentrations	
		conc. 1	conc. 2
Dipel 2X	*Bacillus thuringiensis* kurstaki	17.1 gm / L	8.5 gm / L
Biofly	*Buvaraia bassiana*	1.5 cm^3 / L	0.75 cm^3 / L
Diazinox	Diazinon (organophosphorous)	6 Kg / Feddan	

The scientific and English name of tested plants and the parts used from them are demonstrated in the following table:

Scientific name	Family	English name	Part used
Cymbogon citrates	Gramineae	Lemongrass	Leaves
Duranta repens	Verbenaceae	Pigeon berry	Leaves

Mixtures were obtained by adding the lowest concentrations of both of plant extracted in water and also for the two products used (Diple 2X or Biofly).

4 – Bioassay studies on the used extracts

All the experiments were conducted under laboratory conditions 31 ± 1 °C and 60 ± 5% R.H. to calculate LT_{50} values at 0.05 confidence limits and slope regression lines for each of the studied plant extracts, bioproducts formulations and chemical pesticide on the third instar of *S. cretica* larvae El-Hefny (2006).

The larvae in each concentration were starved for about 4 hours before the beginning of the experiment and were divided into 4 replicates 20 larvae for each. Mortality counts were taken at 2, 6, 9 & 12 days from the beginning of treatment and LT_{50}'s values Probit analysis was calculated according to Litchfield, and Willcoxan, (1949) using "LDP Line " soft ware Bakr (2010).

RESULTS AND DISCUSSION

I. Field results

1 – Egg-masses

As shown in Table (1), all treatments caused highly significant reductions in average counts of *S. cretica* egg-masses than control which achieved average 21 egg-masses / 20 plants. Three treatments caused high efficacy, lemongrass extracted in water, in acetone and mixture of it with biofly (average 0.5 larvae / 20 plants, 97.6% reduction than control, followed by lemongrass extracted in petroleum ether and Pigeon berry extracted in acetone occupied the second rank (95.2% reduction). On the contrary, the recommended chemical pesticide Diazinox was the least effective against *S. cretica* infestation, 12 egg-masses / 20 plants representing 42.9% reduction than control. While, mixture of Pigeon berry with biofly had the intermediate efficiency (2 egg-masses / 20 plants achieving 90.5% reduction than control. The mixtures of Dipel 2X with either lemongrass or Pigeon berry caused the same effect 3 egg-masses / 20 plants achieving 85.7% reduction than control. The remaining treatments could be classified into two groups, the first had low efficiency effect which included Pigeon berry extracted in water, Biofly alone (76.2% reduction) while the second included Pigeon berry extracted petroleum ether, Dipel 2X biopesticide alone, (71.4%) reduction than control Table (1).

2 – Larval counts

The number of larvae were harboured in the control replicates of were significantly the highest larval as 27 larvae / 20 plants followed by Biofly treatment alone with 14 larvae, 48.1% reduction than control. The highest reduction percentages of *S. cretica* larvae for number of larvae (96.3%) was achieved by treatment with pigeon berry extracted in acetone and mixture of lemongrass with biofly.

Efficacy of extracts of lemongrass, pigeon berry extracted in water as well as and mixture of pigeon berry with Biofly ranked the second level in efficacy being 88.9% reduction than control with average 3 larvae / 20 plants followed by Dipel 2X with 4 larvae / 20 plants. And the recommended chemical pesticide Diazinox, 85% reduction than control.

3 – Perforated leaves

Number of perforated leaf plants was recorded in untreated plots as 18 plants / 50 plants was recorded perforated leaves / 50 plants. The least number of plants containing perforated leaves among all the treatments was recognized in plots treated with Pigeon berry plant extracted in acetone (94.4% reduction than control followed with low significance with Pigeon berry mixed with biofly and Pigeon berry extracted in

water, (11.1%) representing the same percentage 88.9% reduction than control. The following treatments were insignificant with the previous treatments Pigeon berry mixed with Dipel 2X (86.1%) and Dipel 2X (83.3%).

While, lemongrass mixed with biofly, lemongrass extracted in petroleum ether, Pigeon berry extracted in petroleum ether, Biofly, Diazinox, mixture of lemongrass and Dipel 2X caused 77.8, 77.8, 72.2, 66.7, 66.7 and 61.1%, respectively. Lemongrass extracted in water caused the least efficiency as 38.9% reduction than control followed by lemongrass extracted in acetone (55.6%).

4 - Dead hearts

The main symptoms for *S. cretica* infestation is the dead heart plants, and it was recorded in 50 plants / treatment. Pigeon berry extracted in acetone, mixed with Dipel 2X and Dipel 2X treatments ranked the first in efficiency list recording 94.7% reduction than control.

While, each of lemongrass extracted in water and Pigeon berry mixed with Biofly came in the second degree recording 89.5% reduction than control, followed insignificantly with Pigeon berry extracted in petroleum ether 84.2% reduction.

Lemongrass extracted in petroleum ether and Pigeon berry extracted in water caused 52.6% reduction than control to be the least in efficiency followed by lemongrass extracted in acetone and lemongrass mixed with Dipel 2X (42.1%). While, the chemical pesticide Diazinox achieved 68.4% reduction than control.

5 – The resultant yield

Different percentage of the increase were recorded in maize ear yield due to application of two plant extracts. The heaviest yield (25 ardab / feddan, i.e. 93.8% increase than control, 12.9 ardab / feddan) was recorded from plants treated with mixture of lemongrass with Biofly. The same plant extracted in water came the next and recording 24.5 ardab / feddan, 89.9% increase than control. However, pigeon berry extracted in acetone mixture of it with Biofly and it with Dipel 2X ranked the third and fourth `in increase than control being 82.2, 74.4 a nd 74.4%, respectively. On the contrary, biopesticide (Biofly) was the least effective in increase of ears' yield (14.5 ardab / feddan).

The remaining treatments caused increase in yield ranged from 15.5 to 22.1 ardab / feddan as 20.2 and 71.3% increase than control for mixture of lemongrass with Dipel 2X and Dipel 2X alone, respectively.

II. Laboratory bioassay tests on *S. cretica* larvae

The third larval instar of *S. cretica* were fed on maize treated with the assayed materials, and the mortality was recorded after different durations, 2, 6, 9 & 12 days. LT_{50} values after feeding on maize treated with the materials all at 5% concentration

were tabulated in Table (2) and Fig (1). The shorter values were obtained from treatments by mixture of lemongrass with Biofly, lemongrass extracted in water and Pigeon berry extracted in acetone being 2.25, 2.86 and 2.96 days, respectively.

Intermediate LT_{50}'s values occurred by Pigeon berry extracted in water, mixtures of Pigeon berry with Dipel 2X and Biofly, and Dipel 2X alone Pigeon berry extracted in petroleum ether and lemongrass extracted in acetone recording 3.11, 3.19, 3.19, 3.19, 3.28 and 3.75 days, respectively.

While, the longest period 10.82 days was obtained when larvae were fed on maize stems treated by mixture of lemongrass with Dipel 2X, while Biofly alone achieving 8.39 days followed by the chemical treatment Diazinox 5.6 days.

The obtained results in this study could be in harmony with that obtained by Sinchairsri. *et al.,* (1990) who examined 40 gm / ml of *D. repens* crude extracts in which bioassay tests were done in vitro which caused insecticidal activity to the 3rd instar of diamondback moth larvae. They observed the highly insecticidal activities (80 – 100%) mortality of larvae. Roongsook and Narong (1990) obtained a crude extract from *D. repens* which was tested on the 3rd instar of diamondback moth larvae achieving (80 – 100%) mortality at 40 mg / ml of crude extract. Also, in the same trend Sukari *et al.,* (1992) mentioned the major components in lemongrass which they are Piperitenone oxide, Eugenol, Citral, geranoil, Monoterpenes and Sesquiterpenes. Rajapakse and Ratnasekera (2008) obtained plant oils from leaves of lemongrass and they were bioassayed under laboratory conditions for their ability to protect stored legumes from damage by cowpea weevil (*Callosobruchus maculatus*) and adzuki bean seed weevil (*Callosobruchus chinensis*) showed some bioactivity, and caused significant adult mortality high egg mortality effect. Bakr and Abou-Zaid (2009) showed that vapours of lemongrass was the most effective against all tested stages of *Tetranychus urticaekoch*.

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الاستفادة من بعض المستخلصات النباتية فى خفض الاصابة بدودة القصب الكبيرة فى حقول الذرة الشامـــية

شنـــــوده سيـــــد يعقـــــوب

معهد بحوث وقـــاية النباتات – مركز البحـــوث الزراعيـــة – الدقى

تم استخدام بعض مستخلصات أوراق نباتى حشيشة الليمون والدورانتا الخضراء اللذين ينتميان لعائلتين نباتين مختلفتين بعدة مذيبات (المـــاء، بتروليم أيثر، الاسيتون) وكذلك المبيد الحيوى البكتيرى دايبل 2X والمبيد الفطرى بيوفلاى وخلائطهما مع مستخلص النبات فى المـــاء وذلك فى مكافحة دودة القصب الكبيرة فى حقول الذرة الشامية خلال العروة الصيفية المبكرة لموسم 2010 وأوضحت النتائج ان كل من مستخلص حشيشة الليمون فى الماء والاسيتون وكذلك خليطهما مع البيوفلاى حققوا اعلى نسبة خفض فى تعداد البيض. كما حقق مستخلص الدورانتا فى الاسيتون اعلى نسبة نقص فى تعداد النباتات المصابة بظاهرة الاوراق المثقبة والقلب الميت كذلك حقق كل من خليط الدورانتا مع الدايبل والدايبل منفردا. كذلك تم حساب حصاد محصول الذرة بعد 120 يوم من الزراعة بالاردب / فدان.

أوضحت نتائج الاختبارات الحيوية معمليا توافقا مع تلك المتحصل عليها فى الحقل حيث تم حساب قيم LT_{50} لكل المستخلصات النباتية عند تركيز 5% .

ممـــا سبق يتضح أن المستخلصات النباتية التى حققت اعلى نسبة خفض فى تعدد لطع البيض واليرقـــات والقلب الميت هى التى حققت اعلى محصول بأقل تلوث للبيئة والمزارعين بالمقارنة بالمبيد الكيماوى الموصى به.