FIELD EVALUATION OF SOME NON-CONVENTIONAL PESTICIDES ON FABA BEAN LEAF MINER AND ASSOCIATED PARASITOIDs

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Abstract

A field experiment was conducted to evaluate the efficiency of some non-conventional pesticides against the leaf miner, Liriomyza trifolii (Burgess) and its parasitoids on faba bean plants from November 2013 to March 2014. There were seven treatments viz, Beauvaria bassiana (biopower), diathane-M45, mineral oils (KZ and Kappi), (ethanol and ethyl acetate extracts of casuarina leaves) and untreated control. The results showed that, amongst the pesticides tested, Biopower 1.15%wp significantly reduced larvae population of leafminer by 83.54 and 79.48% mean percent mortality after the first spray and the second spray, respectively. Followed by ethanol extract of casuarina (63.51 and 60.49%). The rest of the treatments viz diathane M-45 (64.62 and 18.30), KZ oil (26.9 and 7.48%), also effective in minimizing the pest population after the first and the second spray application, respectively. Parasitoid species reared from larvae of L. trifoli werei, Diglyphus isaea (Walk.), D.crassinveris (Erdos.), Chrysocharis sp., Neochrysocharis sp. and Hemiptarsenus sp. (Hymenoptera: Eulophidae). Significantly higher seed yields were recorded from biopower, Diathane and ethanol casuarina leaves extract plots as compared to yields from KZ oil, ethyl acetate extract, Kappi oil and untreated control. Key words: L. trifoli, mineral oils, casuarina extract, parasitoids, Faba bean.

INTRODUCTION

Faba bean, Vicia faba L. is considered the most important legume crop due to its high nutritive value it is primary source of protein for grown from seed in Egypt for the majority of people. Faba bean plants are attacked by several insect pests.

The leaf miners, Liriomyza spp. [Diptera: Agromyzidae] are among the most damaging insects of the many insects associated with field crops, the serious pests on field crops, vegetables and ornamental plants all over the world. The faba bean leaf miner, L. trifoli is basically an invasive pest to Egypt's agro-climate and recorded as a harmful and wide spread on faba bean (El-Hemaesy, et al. 1974, Aly and Makady, 1990). It is indigenous to the new world, but has extended its geographical range to Asia, Africa and Europe (Saito, 1997).
**L. trifolii** larvae cause direct injury for the leaves as tunneling into the soft plant tissue causing, the characteristic serpentine "leaf mines" which are externally visible as whitish grey trick up of variable shape as result of feeding on the mesophyll tissues between the epidermal layers of leaves and subsequently reduce photosynthesis potential (Ledieu and Helyer, 1985).

The different biocides control against the leaf miners *Liriomyza* spp., significantly, reduced the number of larvae such as the fungicide, diathane-M45 on faba bean (Ibrahim and Abd-El-Moiety 1997). Likewise, the toxicity of *Casuarina equisetifolia* leaf extracts against the spiny bollworm *Earias insulana* (Boisd.) caused the highest reduction percentage (57.14%) in larval infestation (Zaki, 2012). In the same direction, the use of summer mineral oil (KZ 1%) against the citrus leaf miner, *Phyllocnists citrella* achieved the highest percentage reduction by the recommended rate.

Hymenopterous parasitoids reared from *L. trifolii* were, *Opium* sp. (Braconidae) El-Serwy (1993), *Chrysonotomyia* sp. (Eulophidae) also, *Halictoptera* sp. (Pteromalidae) Metwally (1991),El-Serwy (1993) and Shahin and El-Maghraby (1993) Extensive studies have been continuously encouraged and developed in the field of biological control of insect pests using many bio-control agents. Recent control strategies depend principally on knowing pest natural enemies relationship.

Use of insecticide is found one of the most effective ways to control leaf miner (Gerling 1986). But due to injudicious application, leaf miner had already acquired resistance to insecticides moreover, extensive chemical control often caused population resurgence due to a negative impact on natural enemies (Parrella and Jones, 1987).

The present work aimed to evaluate and throw light on the impact of the non-conventional pesticides against *L. trifolii*, and also their positive or negative efficiency on associated on *L. trifolii* parasitoids, in addition to determine the economic efficiency on the resultant yield.

**MATERIALS AND METHODS**

I- Field preparation and foliar spray experiments:

The present experiment was carried out throughout growing season of faba bean 2013/2014 at Experimental farm Research Station of Faculty of Agriculture at Moshtohor, Benha University. An area of about ¼ feddan (4200m²) was sown with common commercial variety seeds of faba bean, Giza 3 on November, 11th 2013. The area was divided into 28 plots, each of 2.5m×3m. The experimental plots were
arranged in complete randomized block design. Four replicates per treatment, four lines for each. All agricultural practices were followed without using any chemicals. Each of the following treatments and extracts were applied:

1. Biopower (1.15% WP), *Beauvaria bassiana* entomopathogenic fungus. 
   \(1 \times 10^8\) CFU/gm.
2. KZ oil-mineral oil (95% E.C.).
3. Kappi oil-mineral oil (96.5% E.C.).
4. Dithane M45: Fungicide (Manganese ethylene bis) dithiocarbamate Polymeric complex with zinc salt
5. Extract of dried Casuarina leaves in ethanol 95% .
6. Extract of dried Casuarina leaves in ethyl acetate.
7. Untreated control .

Applications of the assayed materials took place by using five liters hand sprayer. The pesticides application were done twice on 25 November and on 25 December. There was non-treated buffer zone of 1m between each plots to prevent spay drift to adjacent plots. Faba bean plants were examined after two weeks from sowing then weekly until harvesting date. 25 leaflets for each replicate were randomly picked before spraying and after 7, 14 and 21 days from each application and transferred to the laboratory in paper bags for inspection by the aid of stereo microscope and live larval counts were recorded.

**II. Preparation of crude extracts:**

Extractions were prepared as described by Afifi, *et al.* (1988). Fully grown green leaves of *Casuaria equisetifolia* were washed thoroughly by water and air dried in shade under laboratory conditions. The tested parts were ground in a high speed grinder. Every 50 gram of leaves powder was weighed, then put in (250 ml glass jar), to be extracted by different organic solvents (Ethyl alcohol 95% and ethyl acetate)The solvent was added at rate of 1 (gm powder): 2 (cm³ solvent). Jars were tightly closed to prevent solvent evaporation, then kept for 7 days in freezer, at \(-4\pm 1\)°C. The glass jars were shacked for 10 min. before being filtered. Filtration took place through funnel containing a piece of muslin cloth. The Petri-dishes used for receiving the plant extract were weighed, then left until dryness, then peti-dishes were weighed. The crude extract was, then, prepared at concentration 8000 µg / ml for both solvents. The crude extract was kept in refrigerator at 4 °C until time of application in the field.

**III - Parasitoids on *L. trifolii* larvae:**

To evaluate the effect of the previous treatments on the different parasitoids throughout experimental season, large number of *L. trifolii* larvae were collected from faba bean plants leaflets. The collected faba bean leaves per treatment were kept in
the laboratory in small glass containers (3 x 7cm²) at 25± 2 °C and 60± 5% RH. Emerged parasitoids were kept in 70% alcohol and glycerin placed in glass vials. They were daily checked for the emerging leaf miners and their parasitoids. It was identified in the identification unit, Biological Control Research Department, Plant Protection Research Institute, ARC. The relationship between the tested treatments and the population density of parasitoids were recorded.

IV- Effect of assayed pesticides on values of yield:
At harvest time, 100 plants from each treatment were picked and the numbers of pods were counted per plant, then 100 seed were weighed from each treatment. The obtained yield/ treatment was adjusted to find out the yield of seeds/ feddan.

V- Statistical analysis:
To evaluate the efficiency of tested pesticides and extracts against L. trifoli, the percentage of population density reduction was calculated according the formula given by Henderson and Tilston (1955) as follow: Reduction % = 100[1-(Ta×Cb)/(Tb×Ca)]

Percentages of parasitism by parasitoids species associated with L. trifoli on faba bean plants were determined with their reduction percentages. Reduction percentages of parasitism were calculated as: % Reduction in parasitism = [(No. of parasitized larvae in treatment /No. of parasitized larva in control) ×100] -100

Also, the data of yield/ treatment obtained was statistically evaluated by analysis of variance (ANOVA) and the treatment were compared by least significant difference (L.S.D.) at 5% level.

RESULTS AND DISCUSSION

1- Effectiveness of assayed formulations and plant extracts against L. trifoli larvae infesting faba bean plants in the field.

1.1- First spray:
Data in Table (1) show the mean numbers and % reduction of the leaf miner L. trifoli larvae infesting faba bean plants during three weeks after application of seven treatments. Biopower treatment achieved the highest efficacy and significantly to reduce the numbers of L. trifoli larvae by 71.01, 91.51 and 88.10% reduction after the first, second and third week, respectively being (83.54%) as mean reductions. This was followed by dithane M-45, Casuarina leaves extract in ethanol being (64.62 and 63.51) as mean reduction. Mineral oils (KZ and Kappi) treatments had moderate
effects. (Table 1). KZ oil treatment gave the lowest effect on *L. trifolii* larval population (after second and third weeks of application). It gave 22.24 and 16.47% reduction after the second and third week of applications. While, kappi oil treatment caused 34.12 and 29.62% reductions during the same intervals, respectively.

Casuarina leaves extract in ethyl acetate had no detrimental effect against *L. trifolii* population. It gave lower than 50% reduction in leaf miner population (after first week of application). However, under conditions of the experiment biopower, dithane M-45. Casuarina leaves extract in ethanol and Casuarina leaves extract in ethyl acetate considered effective for reducing leaf miner population (after second and third week of application) offering more than 50% reduction.

Table 1. Effect non-conventional pesticides on the number of *L. trifolii* larvae in faba bean fields

<table>
<thead>
<tr>
<th>Treatments</th>
<th>1st Spray</th>
<th>2nd Spray</th>
<th>3rd Spray</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mean No. before treatment</td>
<td>Reduction %</td>
<td>Reduction %</td>
</tr>
<tr>
<td>Casuarina ext. in ethanol</td>
<td>90</td>
<td>45.83</td>
<td>57.93</td>
</tr>
<tr>
<td>KZ-oil</td>
<td>65.38</td>
<td>45.9</td>
<td>42.00</td>
</tr>
<tr>
<td>Casuarina ext. in ethyl acetate</td>
<td>70.69</td>
<td>66.6</td>
<td>22.17</td>
</tr>
<tr>
<td>Biopower</td>
<td>127.94</td>
<td>44.9</td>
<td>71.01</td>
</tr>
<tr>
<td>Kappi oil</td>
<td>65.47</td>
<td>45.8</td>
<td>42.21</td>
</tr>
<tr>
<td>Diathane M-45</td>
<td>75</td>
<td>55.8</td>
<td>38.54</td>
</tr>
<tr>
<td>Control</td>
<td>101.2</td>
<td>122.5</td>
<td>110</td>
</tr>
</tbody>
</table>

The tested materials could be arranged descendingly according to their effect on leaf miner *L. trifolii* larvae population as: biopower • dithane M-45 • Casuarina leaves extract in ethanol • Casuarina leaves extract in ethyl acetate • Kappi oil • KZ oil.

1.2-Second spray

Regarding data in Table (2) Biopower and Casuarina leaves extract in ethanol treatments gave the highest efficacy on *L. trifolii* larval population. Biopower gave 80.32, 75.76 and 82.36% reductions after the first, second and third weeks of application, respectively. While, Casuarina leaves extract in ethanol treatment ranked the second, with percentage reduction 55.19, 58.00 and 68.27% reduction during the
same weeks, respectively (Table, 2). In this respect, the present results are in
accordance with that of Jacob et al., (2007) who studied the influence of casuarina
leaf extract on growth, yield and insect pests in vegetables. The Recommendation that
spraying with casuarina reduced fruit borer infestation. In the same side,

Zaki (2012) found that leaf extract caused reduction percentage of 57.14 and
42.25% in larval infestation of the pink bollworm after one and two weeks from
sprays, respectively. Also, it caused reduction in the number of Jassids and white fly
after 3, 7 and 10 days after spray. The same result was obtained by Ibrahim and Abd-
El-Moiety (1997) found that spraying of dithane-M45 against leaf miner every two
weeks on faba bean plant achieved 60% reduction than control as general mean for
two study seasons 94/95 and 95/96. While, Kappi oil, KZ oil, Casuarina leaves extract
in ethyl acetate and dithane M-45 treatments caused lower effect than 50% reduction
of leaf miner larvae after first, second and third week of application, respectively.

The treatments could be arranged descending according to their average of leaf
miner as percentage of total reduction as follows: biopower • Casuarina leaves extract
in ethanol • dithane M-45 • Casuarina leaves extract in ethyl acetate • KZ oil • Kappi
oil.

2-Common parasitoid species attacking L. trifolii :

Five parasitoid species were collected from larvae and pupae of L. trifolii belonging
to one order (Hymenoptera) and one family (Eulophidae). The secured parasitoids
were (1) Diglyphus isaea (Walk), (2) D. crassinervius (Erdos.), (3) Chrysocharis sp.,(4)
Neochrysocharis sp. and (5) Hemiptarsenus sp. Several authors recorded the
mentioned parasitoids from L. trifolii such as, El-Serwy (1993),Shahin and El-Maghrraby

2.1. Effect of different treatments on parasitism and percentages of
parasitism reduction:

The mean percentages of reduction in parasitism on L. trifolii as compared to
untreated control were, 10.3, 51.5, 54.4, 58.8,63.2 and 66.8% by KZ oil , Kappi oil,
Casuarina leaves extract in ethanol, Casuarina leaves extract in ethyl acetate ,
Biopower and dithane M-45, respectively (Table 3). The mean numbers of parasitized
L. trifolii (IS) were, 30.5, 16.5, 15.5,14, 12.5, 11.5 and 34 individuals for KZ oil, Kappi
oil, Casuarina leaves extract in ethanol, Casuarina leaves extract in ethyl acetate,
Biopower, dithane M-45, and untreated controls, respectively. The means of L. trifolii
percentages of parasitism were, 35.9, 16.3, 14.5, 10.6, 10.3, 9.8 and 10.8% for KZ oil,
Casuarina leaves extract in ethanol, Kappi oil, dithane M-45 , Biopower,Casuarina
leaves extract in ethyl acetate and untreated control, respectively (Table 3). Obtained
results showed that KZ oil and Casuarina leaves extract in ethyl acetate had the
highest and the lowest efficacies on parasitism %, respectively. Also, the obtained data showed that dithane M-45 and KZ oil were correlated with the highest and the lowest percentages reduction of parasitism, respectively (Table 3).

Table 2. Effect of non-conventional pesticides on the numbers of L. trifolii larvae on faba bean plants.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>mean No. before treatment</th>
<th>2nd Spray</th>
<th>Reduction %</th>
<th>Reduction %</th>
<th>Reduction %</th>
<th>Mean Reduction %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>After 1week</td>
<td></td>
<td>After 2weeks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Casuarina ext. in ethanol</td>
<td>190.38</td>
<td>52.08</td>
<td>55.19</td>
<td>46.86</td>
<td>58.00</td>
<td>40.7</td>
</tr>
<tr>
<td>KZ-oil</td>
<td>177.27</td>
<td>97.22</td>
<td>10.17</td>
<td>95.18</td>
<td>14.69</td>
<td>85.8</td>
</tr>
<tr>
<td>Casuarina ext. in ethyl acetate</td>
<td>171.2</td>
<td>87.5</td>
<td>16.29</td>
<td>87.56</td>
<td>12.74</td>
<td>85.51</td>
</tr>
<tr>
<td>Biopower</td>
<td>208.03</td>
<td>25</td>
<td>80.32</td>
<td>29.56</td>
<td>75.76</td>
<td>24.72</td>
</tr>
<tr>
<td>Kappi oil</td>
<td>158.04</td>
<td>91.07</td>
<td>5.61</td>
<td>92.24</td>
<td>0.42</td>
<td>89</td>
</tr>
<tr>
<td>Diathane M-45</td>
<td>179.69</td>
<td>78.57</td>
<td>28.38</td>
<td>87.5</td>
<td>16.92</td>
<td>78</td>
</tr>
<tr>
<td>Control</td>
<td>245.69</td>
<td>150</td>
<td>144</td>
<td>165.51</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.2. Effect of assayed formulations and plant extracts on the average yield and number of pods per plant:

Data in Table (4) show the effect of foliar spray of faba bean plants with the assayed formulations and extracts on the average weight of 100-seeds, number of pods/plant and seed yield/ feddan. There were significant differences between the different treatments of bio-insecticides and mineral oils.

All treatments caused increasing in the weight of seed yield, especially those of biopower which achieved the highest yield (112.28 Kg seeds/ feddan, respectively), followed by treatments with dithane M-45 and Casuarina leaves extract in ethanol which showed significant differences than the remaining treatments which achieved 103.04 and 99.12 kg/ feddan, respectively. Likewise, the highest mean number of pods/plant were obtained by dithane M-45. Followed by biopower, KZ oil and Casuarina leaves extract in ethanol, respectively Table (4).
Table 3. Effect of non-conventional pesticides on the number of parasitized *L. trifolii* larvae, % parasitism and % reduction of parasitism on faba bean plants.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Mean number of parasitized larvae</th>
<th>% parasitism</th>
<th>% reduction parasitism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Casuarina ext. in ethanol</td>
<td>15.5</td>
<td>16.3</td>
<td>54.4</td>
</tr>
<tr>
<td>KZ-oil</td>
<td>30.5</td>
<td>35.9</td>
<td>10.3</td>
</tr>
<tr>
<td>Casuarina ext. in ethyl acetate</td>
<td>14</td>
<td>9.8</td>
<td>58.8</td>
</tr>
<tr>
<td>Biopower</td>
<td>12.5</td>
<td>10.3</td>
<td>63.2</td>
</tr>
<tr>
<td>Kappi oil</td>
<td>16.5</td>
<td>14.5</td>
<td>51.5</td>
</tr>
<tr>
<td>diathane M-45</td>
<td>11.5</td>
<td>10.6</td>
<td>66.8</td>
</tr>
<tr>
<td>Control</td>
<td>34</td>
<td>10.8</td>
<td></td>
</tr>
</tbody>
</table>

Table 4. Effect of non-conventional pesticides on the average weights yield.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Average weight of 100-seeds (gm)</th>
<th>Mean No. of pods/ Plant</th>
<th>Mean seed yield /fed (Kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Casuarina ext. in ethanol</td>
<td>0.08a</td>
<td>1.67ab</td>
<td>99.12</td>
</tr>
<tr>
<td>KZ-oil</td>
<td>0.07a</td>
<td>1.78ab</td>
<td>78.4</td>
</tr>
<tr>
<td>Casuarina ext. in ethyl acetate</td>
<td>0.08c</td>
<td>1.05c</td>
<td>70</td>
</tr>
<tr>
<td>Biopower</td>
<td>0.09a</td>
<td>1.86a</td>
<td>112.28</td>
</tr>
<tr>
<td>Kappi oil</td>
<td>0.08a</td>
<td>1.47ab</td>
<td>63</td>
</tr>
<tr>
<td>Dithane M-45</td>
<td>0.08a</td>
<td>2.25a</td>
<td>103.04</td>
</tr>
<tr>
<td>Control</td>
<td>0.07a</td>
<td>1.11b</td>
<td>61.6</td>
</tr>
<tr>
<td>L.S.D. 0.05%</td>
<td>0.003a</td>
<td>0.18</td>
<td>12.48</td>
</tr>
</tbody>
</table>

These results agree with those of Ibrahim and Abd-El-Moiet (1997) who studied the effects of *L. trifolii* larval damage on yield of celery in Florida. The authors indicated highly significant negative simple correlation between the infested leaflets by the leaf miners and the yield.

REFERENCES


FIELD EVALUATION OF SOME NON-CONVENTIONAL PESTICIDES ON FABA BEAN LEAF MINE AND ASSOCIATED PARASITOIDS

التقييم الحقيقي لبعض المبيدات غير التقليدية على صاخبة الأوراق
أوراق نباتات الفول البلدي وعلي بعض الطفيليات المصاحبة لها

شنوده سيد يعقوب, رشا علي الحسوري, حازم عبد الربع أبو الفضل

1 - معهد بحوث وقاية النباتات- مركز البحوث الزراعية- الدقي- الجيزة- مصر
2 - كلية الزراعة- جامعة بنها

تم اجراء تجربة في حقول الفول البلدي لتقييم كفاءة بعض المبيدات غير التقليدية في مكافحة
صاخبة الأوراق الأوراق التي تصبح نباتات الفول البلدي في الفترة من نوفمبر 2013 إلى مارس
2014 وذلك باستخدام المبيد الفطري (دياثي- م 45) والفطر الممرض للحشرات (باب بار
والزيوت المعدنية (كرد، وكاب،) ومستخلصي أوراق الكازورينا بالإيثانول والإيثيل أسيتات
وتأثيراتهم على أعداد طفيليات اليرقات. وأوضحت النتائج ان المبيد الحيوي بيباوار حقق أعلى نسبة
خفض كلية في تعداد صاعات الأوراق من المقارنة بعد الرشة الأولى و بعد الرشة الثانية ويبلغ
8.93% (على الترتيب، بلية المعاملة بالمستخلص الإيثانول لأوراق الكازورينا (14.07)
و 69.64% بعد الرشة الأولي و الرشة الثانية على التوالي، وما تبقى من معاملات كان المبيد
الفطري دياثي- م 45 (26.95) بينما كانت كفاءة التأثير متوسطه بعد المعاملة بالإيثيل
أسيتات أوراق الكازورينا بنسبة (46.63%) ، بلية الزيت المعدني كرد (26.95)
و 69.64% ، وكان التأثير ضعيف علي أعداد حشرة صاعات الأوراق من المقارنة بعد الرشة الأولى و الثانية على
التوالي. ومن ناحية أخرى، كانت أنواع الطفيليات التي زيت على اليرقات (Walk), D.crassinveris (Walk.), Chrysoscharis sp., Neochrysoscharis sp. and خللال فترة الدراسة واخيرا تم الحصول Hemiptarsenius sp. (Hymenoptera: Eulophidae)
على مصروف بدور مرتفع معهوب بعد معاملات المبيد بيباوار، دياثي- م 45، والمستخلص
الأيثانول لأوراق الكازورينا مقارنة بمصروف البور بعد المعاملة بزيت كرد ومستخلص الأستيل
أسيتات أوراق الكازورينا وزيت الكابي والمقارنة.