# PERSISTENCE AND TOXICITY OF TWO PLANT EXTRACTS TO SOME STORED PRODUCT INSECTS

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***Abstract***

This work aims at evaluation the efficiency of the acetone and petroleum ether extracts of Cubeb fruits *Piper cubeba* (L.) and Thyme flowering buds *Thymus vulgaris* (L.) against the adults of *Sitophilus oryzae* (L.), *Rhizopertha dominica* (F.) and *Tribolium castaneum* (Herbst). Also, persistence of the two plant extracts compared to malathion and pirimiphos- methyl (actellic) using the most sensitive insect species (*S. oryzae*), was investigated .Results showed that , the efficiency of the two plant extracts was concentration and exposure period –dependent. At the highest tested concentrations (2&1%w/w), the acetone extract of *P. cubeba* and petroleum ether extract of *T. vulgaris* were highly effective against *S. oryzae* and *R.dominica* adults, while, *T. castaneum* adults were the least sensitive . On the other hand, the petroleum ether extract of *P.cubeba* and the acetone extract of *T.vulgaris* indicated lower effectiveness against the three tested insects even after two weeks from treatment. The results also showed that, malathion and pirimihos methyl indicated clearly longer residual toxicity than the two plant extracts.

## INTRODUCTION

Insecticides residues cause cumulative food-chain concentration and development in insect resistance. Mostafa (1993) reported that, powdered leaves of *Mentha longifolia* (L.) caused the greatest larval mortality of *Trogoderma granarium* (Everts.) followed by *T. vulgaris* leave powder, *Piper. nigrum* (L.) and *Curcuma. Longa* (L.) rhizomes powder, while powder seeds of *Nigella. sativa* (L.) showed little activity.

The effect of several plant extracts as pest control against some stored product pests were studied by many investigators (Afifi *et al*, 1988 and El-Lakwah *et al*, 1992, 1993, 1995and2000).

Su(1984) reported that, ground black pepper at 1000 ppm provided good protection of stored grains by significantly reducing the $F_1$-progeny of *S. oryzae* for up to 6 months .Similarly, black pepper acetone extract at 300 ppm gave the same reduction rate for 6 months and decreased gradually ( at a low rate )to reach 40.88% after1 year of storage .

Persistence of plant extracts and insecticides were studied by some investigators (White, 1984 and Singh and Yadav, 1996).

Thus, the present work aims to study the efficiency of the two plant extracts *i.e*. Cubeb fruits *Piper cubeba* and Thyme flowering buds *Thymus vulgaris* (acetone and petroleum ether extracts) to some stored product insects and their persistence compared with that of Malathion and Actellic.

## MATERIALS AND METHODS

**1- Insect species used:**

Laboratory strains of the rice weevil *Sitophilus oryzae* (L.), the lesser grain borer *Rhizopertha dominica* (F.), and the red flour beetle *Tribolium castaneum* (Herbst.) were used in these experiments.

Tests were performed at the stored product pests laboratory of the Plant Protection Department, faculty of Agriculture, Moshtohor, Benha University.

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**1.1- Stock culture of the insects:**

The insect species were collected since 4 years and reared in glass jars (approx. 250 cc) each containing about 200 g of sterilized and conditioned wheat kernels in case of the rice weevil and the lesser grain borer or wheat flour in case of the red flour beetle, jars were covered with muslin and fixed with rubber band. The moisture content of the food was around 14%. About 300 adults of each insect species (1-2 weeks old) were introduced into the jars for laying eggs and then kept at 26 ± 2°C and 60 ± 5% RH. Three days later, all insects were separated from the food and the jars were kept again at the same controlled conditions in the rearing room. This procedure was repeated several times in order to obtain larger numbers of the adults needed to carry out the experiments. The foods in the jars were renewed, when it was necessary.

**2- Materials:**

**2.1- Insecticides used:** The following two organophosphorus insecticides were used:

**2.1.1-Malathion 57% EC:** produced by Kafr El-Zayat chemical and pesticides company, Egypt.

**Chemical name:** 0, 0 dimethyl-s-(1-2 dicarboxy ethyl) phosphodithioate. Malathion concentrations used were 16 ppm and 8 ppm.

**2.1.2-Pirimiphos-methyl (Actellic) 50% EC**: produced by ICI Agrochemical company, England.

**Chemical name** 0, 0dimethy- o- (2- diethyl amino-6-methyl-pyrimidin-4-yl) phosphorothioate. Actellic concentrations were 20 ppm and 10 ppm.

**2.2- Plant extracts used:**

The plants were bought from the market, the acetone and petroleum ether extracts of Cubeb (*Piper cubeba*) fruits and Thyme (*Thymus vulgaris*) flowering buds were investigated.

**3- Bioassay tests:**

**3.1- Extracts preparation:**

300 g from each plant were ground in an electric mill into fine powder. The ground plant material was soaked in the desired solvent in a large flask for 72 hrs. The flask was shaked for one hour in a shaker then its content was filtered. The solvent was evaporated at 50°C under reduced pressure using a rotary evaporator as described by Su (1985). The extract in the form of a crude gum was weighed and redissolved in the solvent to give 20% (w/v) stock solution.

Concentrations of 20, 10, 5, 2.5 and 1.25% w/v were prepared for all plant extracts by diluting the stock solution in the solvent. Five ml from each concentration were added to 50 g media to achieve 2, 1, 0.5, 0.25 and 0.125% (w/w) concentrations.

**3.2-Technique:**

Jars of about 250 ml volume which contained fifty grams of the treated media were left for two hours in case of the plant extracts and 24 hrs for the insecticides to evaporate the solvent.

Batches of 30 adult insects (1-2 weeks old) were introduced into each jars of treatment and the control. Three replicates for each concentration were used. The jars were covered with muslin cloth and fixed with rubber band. The treated jars were kept at 26 ± 2°C and 60 ± 5 RH. Mortalities were recorded after 2, 3, 5, 7 and 14 days from the treatment and corrected using Abbot's formula (1925). The dead adult insects were discarded from the jars at various inspection periods, and then at the last inspection all insects were also removed from the media for studying the $F_1$ progeny.

Number of $F_1$-progeny was inspected after 75 days from treatment and reduction percentages in $F_1$-progeny were calculated according to the following equation:

$$\text{Reduction \%} = \frac{\text{No. of adults emerged in control} - \text{No. of adults emerged in treatment}}{} \times 100$$

**4- Persistence of the tested insecticides and plant extracts:**

**4.1- Bioassay test:**

The residual toxicity of the plant extracts as well as the two insecticides was investigated using the adults of *S. oryzae* (1-7days old) which were the most sensitive at varying periods from initial treatment, whereby 20 adult insects were introduced to the treated wheat grains and the control in the jars at various intervals for a period extended to one year. Insect mortality was recorded after 3 and 7 days from introduction of the adults for the two insecticides and the plant extracts, respectively. Mortalities were corrected using Abbot's formula (1925).

The following initial concentrations of the two insecticides were prepared by dilution in water (Malathion at 16 and 8 ppm, pirimiphos-methyl at 20 and 10 ppm), while the plant extracts at 2 and 1% (w/w) were diluted in acetone or petroleum ether for the investigations.

## RESULTS AND DISCUSSION

**1. Effect of the plant extracts on the tested insects:**

**1.1. Cubeb fruits (*P. cubeba*) acetone extract:**

Data presented in Table (1) showed clearly that very high mortality values were recorded after 3 days from treatment with the acetone extract of *Piper cubeba* fruits at 2% (w/w) against *S. oryzae* and *R. dominica* adults (95.6 and 95.0 % respectively ). While, low mortality percentages (15.6 %) was observed at this period for *T. castaneum* adults.

The mortality was increased with increasing concentration and time of exposure. After 14 days from treatment, mortalities were increased to reach 100.0, 84.4, 21.1, 16.0 and 13.3%, 100.0, 67.8, 11.1, 6.7 and 2.2% and 85.5, 14.5, 13.3, 8.9 and7.8% at various tested concentrations for *S. oryzae*, *R. dominica* and *T. castaneum*, respectively. Inhibition in number of $F_1$- progeny was much higher than mortality values at the various concentrations except at 2%.

**1.2. Cubeb fruits (*P. cubeba*) petroleum ether extract:**

Data given in Table (2) indicated the impact of petroleum ether Cubeb fruits extract against the three tested insect species, the obtained mortalities after 14 days from treatment were 16.7, 14.4, 10.0, 8.9 and 6.7%, 15.6, 5.6, 3.3, 3.3 and 3.3% and 15.5, 14.4, 5.6, 2.2 and 2.2% for the adults of *S. oryzae*, *R. dominica* and *T. castaneum*, respectively. Reduction in $F_1$-progeny was 63.8, 51.9, 19.1, 10.0 and 8.2%, 34.8, 8.7, 6.0, 5.2 and 5.0% and 24.2, 17.7, 11.0, 6.5 and 4.6 % at the used concentrations for *S. oryzae*, *R. dominica* and *T. castaneum*, respectively.

The results revealed that the *Piper cubeba* fruits acetone extract was more effective than its petroleum ether extract with all tested insect species.

**1. 3 . Thyme flowering buds (*T. vulgaris*) acetone extract:**

The effect of *Thymus vulgaris* flowering buds acetone extract at different concentrations on mortalities and reduction in $F_1$-progeny of the three insect species is presented in Table (3).Mortality percentages were 45.6, 33.3, 21.1, 15.6 and 11.1% and 33.5, 8.9, 6.7, 5.6 and 3.3% after 14 days from treatment at all tested concentrations for *S. oryzae* and *R. dominica*, respectively. Lower toxicity effect was obtained by this material against *T. castaneum*. Reduction rates in $F_1$- progeny were approximately similar for the three insect species.

**1.4. Thyme flowering buds (*T. vulgaris*) petroleum ether extract:**

The effect of the petroleum ether of Thyme flowering buds extract on the tested insect species is summarized in Table (4). Results indicated that mortalities of petroleum ether *T. vulgaris* flowering buds extract at the highest concentration 2% (w/w) were 99.0 and 95.0% for *S. oryzae* and *R. dominica* after 3 days from treatment, while in case of *T. castaneum,* very low toxic effect was shown. Reduction percentages in $F_1$- progeny were 100.0, 100.0, 100.0, 60.0 and 20.3%, 100.0, 99.0, 92.9, 20.5 and 17.4% and 79.4, 69.2, 35.9, 10.3 and 4.9% for *S. oryzae*, *R. dominica* and *T. castaneum* at various concentrations, respectively. The results indicated clearly that the petroleum ether extract of Thyme flowering buds was more effective than its acetone extract with all tested insect species

Table 1. Effect of Cubeb fruits (*Piper cubeba*) acetone extract on adult mortalities and reduction in $F_1$–progeny of the three stored product insects.

| Concen-tration (% w/w) | % Adult mortalities after indicated period (days) ± S.D. | | | | | No. of $F_1$-progeny after 75 days | % reduction in $F_1$–progeny |
|---|---|---|---|---|---|---|---|
| | 2 | 3 | 5 | 7 | 14 | | |
| *S. oryzae* | | | | | | | |
| 2 | 17.8±11.7 | 95.6±2.0 | 100.0±0.0 | 100.0±0.0 | 100.0±0.0 | 0.0±0.0 | 100.0 |
| 1 | 1.1±0.17 | 27.8±8.4 | 61.1±5.1 | 74.5±6.9 | 84.4±5.1 | 25.0±7.6 | 87.0 |
| 0.5 | 0.0±0.0 | 2.2±1.9 | 11.1±8.4 | 18.9±8.4 | 21.1±5.1 | 120.5±4.0 | 37.3 |
| 0. 25 | 0.0±0.0 | 2.2±1.9 | 4.4±2.0 | 10.0±6.7 | 16.0± 2.0 | 145.7±5.6 | 24.3 |
| 0.125 | 0.0±0.0 | 1.1±0.15 | 2.2±1.9 | 7.8±5.1 | 13.3±3.4 | 160.0±2.5 | 16.8 |
| Control | - | - | - | - | - | 192.3±7.1 | - |
| *R. dominica* | | | | | | | |
| 2 | 90.0±3.0 | 95.0±2.0 | 100.0±0.0 | 100.0±0.0 | 100.0±0.0 | 0.0±0.0 | 100.0 |
| 1 | 17.8±5.1 | 42.2±5.1 | 55.6±5.1 | 65.5±6.9 | 67.8±6.9 | 38.3±3.1 | 90.5 |
| 0.5 | 1.1±0.15 | 7.8±5.1 | 8.9±1.9 | 10.0±3.3 | 11.1±1.9 | 189.0±4.0 | 52.8 |
| 0.25 | 1.1±0.15 | 4.5±3.9 | 6.7±5.8 | 6.7±5.8 | 6.7±5.8 | 272.3±4.9 | 32.1 |
| 0.125 | 1.1±0.17 | 1.1±1.9 | 1.1±0.17 | 1.1±0.17 | 2.2±1.9 | 280.0±3.0 | 30.2 |
| Control | - | - | - | - | - | 403.3±5.9 | - |
| *T. castaneum* | | | | | | | |
| 2 | 4.3±1.9 | 15.6±6.0 | 36.7±7.0 | 67.3±11.1 | 85.5±11.4 | 0.0±0.0 | 100.0 |
| 1 | 3.3±1.9 | 3.3±3.4 | 5.6±2.0 | 7.8±3.9 | 14.5±3.9 | 167.7±2.5 | 27.9 |
| 0.5 | 1.1±0.17 | 1.1±0.17 | 4.4±2.0 | 6.7±3.4 | 13.3±3.4 | 172.0±4.0 | 26.1 |
| 0.25 | 1.1±0.17 | 1.1±0.15 | 3.3±3.4 | 5.6±2.0 | 8.9±1.9 | 180.7±2.5 | 22.4 |
| 0.125 | 1.1±0.17 | 1.1±0.15 | 3.3±0.0 | 4.4±2.0 | 7.8±1.9 | 182.0±2.6 | 21.8 |
| Control | - | - | - | - | - | 232.7±3.1 | - |

Table 2. Effect of Cubeb fruits (*Piper cubeba*) petroleum ether extract on adult mortalities and reduction in $F_1$– progeny of the three stored product insects.

| Concen-tration (% w/w) | % Adult mortalities after indicated period (days) ± S.D. | | | | | No. of $F_1$-progeny after 75 days | % reduction in $F_1$– progeny |
|---|---|---|---|---|---|---|---|
| | 2 | 3 | 5 | 7 | 14 | | |
| *S. oryzae* | | | | | | | |
| 2 | 4.3±1.9 | 7.8±1.9 | 8.9±3.9 | 11.7±1.9 | 16.7±0.0 | 66.0±2.6 | 63.8 |
| 1 | 1.1±0.17 | 1.1±0.17 | 2.2±0.97 | 3.3±0.0 | 14.4±5.1 | 88.0±5.3 | 51.9 |
| 0.5 | 0.0±0.0 | 1.1±0.17 | 2.2±0.97 | 3.3±0.0 | 10.0±3.3 | 148.0±2.6 | 19.1 |
| 0. 25 | 0.0±0.0 | 0.0±0.0 | 2.2±0.97 | 2.2±0.95 | 8.9±1.9 | 164.7±5.5 | 10.0 |
| 0.125 | 0.0±0.0 | 0.0±0.0 | 0.0±0.0 | 1.1±0.17 | 6.7±3.4 | 168.0±5.5 | 8.2 |
| Control | - | - | - | - | - | 183.0±4.0 | - |
| *R. dominica* | | | | | | | |
| 2 | 4.5±1.9 | 5.6±2.0 | 7.8±1.9 | 8.9±1.9 | 15.6±2.0 | 344.5±5.5 | 34.8 |
| 1 | 2.2±1.9 | 2.2±1.9 | 2.2±0.95 | 2.2±0.97 | 5.6±2.0 | 485.3±4.5 | 8.7 |
| 0.5 | 0.0±0.0 | 0.0±0.0 | 1.1±0.17 | 1.1±0.15 | 3.3±3.4 | 497.3±2.5 | 6.0 |
| 0.25 | 0.0±0.0 | 0.0±0.0 | 0.0±0.0 | 1.1±0.17 | 3.3±3.4 | 501.7±2.1 | 5.2 |
| 0.125 | 0.0±0.0 | 0.0±0.0 | 0.0±0.0 | 1.1±0.17 | 3.3±3.4 | 502.7±2.5 | 5.0 |
| Control | - | - | - | - | - | 529.0±3.0 | - |
| *T. castaneum* | | | | | | | |
| 2 | 3.3±3.4 | 3.3±2.0 | 5.4±3.4 | 7.8±3.9 | 15.5±3.4 | 146.0±2.6 | 24.2 |
| 1 | 0.0±0.0 | 1.1±0.17 | 2.2±0.97 | 2.2±0.95 | 14.4±2.0 | 158.5±2.1 | 17.7 |
| 0.5 | 0.0±0.0 | 1.1±0.17 | 1.1±0.17 | 2.2±0.97 | 5.6±2.0 | 171.3±4.2 | 11.0 |
| 0.25 | 0.0±0.0 | 1.1±0.17 | 1.1±0.18 | 2.2±0.97 | 2.2±0.97 | 180.0±5.6 | 6.5 |
| 0.125 | 0.0±0.0 | 1.1±0.17 | 1.1±0.15 | 1.1±0.17 | 2.2±0.96 | 183.7±4.0 | 4.6 |
| Control | - | - | - | - | - | 192.6±2.1 | - |

Table 3. Effect of Thyme flowering buds (*Thymus vulgaris*) acetone extract on adult mortalities and reduction in $F_1$– progeny of the three stored product insects.

| Concen-tration (% w/w) | % Adult mortalities after indicated period (days) ± S.D. | | | | | No. of $F_1$-progeny after 75 days | % reduction in $F_1$– progeny |
|---|---|---|---|---|---|---|---|
| | 2 | 3 | 5 | 7 | 14 | | |
| *S. oryzae* | | | | | | | |
| 2 | 4.4±2.0 | 13.3±3.4 | 27.8±3.3 | 32.5±5.1 | 45.6±8.3 | 87.0±3.6 | 55.1 |
| 1 | 2.2±1.9 | 10.0±3.3 | 23.3±6.7 | 25.5±6.9 | 33.3±6.7 | 109.3±6.0 | 43.5 |
| 0.5 | 0.0±0.0 | 5.6±2.0 | 10.0±0.0 | 14.4±2.0 | 21.1±3.8 | 145.0±6.6 | 25.1 |
| 0. 25 | 0.0±0.0 | 1.1±0.95 | 10.0±3.3 | 13.3±3.4 | 15.6±2.0 | 159.0±4.0 | 17.9 |
| 0.125 | 0.0±0.0 | 1.1±0.95 | 4.4±2.0 | 7.8±1.9 | 11.1±0.97 | 165.0±4.6 | 14.8 |
| Control | - | - | - | - | - | 193.7±7.8 | - |
| *R. dominica* | | | | | | | |
| 2 | 6.7±0.0 | 8.8±1.9 | 11.1±6.1 | 15.5±2.0 | 33.5±3.4 | 200.0±6.0 | 49.9 |
| 1 | 2.2±0.99 | 4.4±2.0 | 5.6±2.0 | 7.8±1.9 | 8.9±1.9 | 336.0±4.6 | 15.9 |
| 0.5 | 1.1±0.85 | 2.2±0.97 | 2.2±0.97 | 4.4±2.0 | 6.7±3.4 | 362.3±3.5 | 9.2 |
| 0.25 | 0.0±0.0 | 2.2±0.95 | 2.2±0.91 | 2.2±0.97 | 5.6±2.0 | 370.7±8.0 | 7.2 |
| 0.125 | 0.0±0.0 | 1.1±0.17 | 1.1±0.16 | 1.1±0.16 | 3.3±3.4 | 383.7±4.5 | 3.9 |
| Control | - | - | - | - | - | 399.3±9.7 | - |
| *T. castaneum* | | | | | | | |
| 2 | 0.0±0.0 | 3.3±1.7 | 4.4±2.0 | 13.3±3.4 | 16.7±3.4 | 121.0±4.0 | 47.2 |
| 1 | 0.0±0.0 | 0.0±0.0 | 2.2±0.96 | 3.3±3.4 | 5.6±5.1 | 149.0±4.5 | 35.0 |
| 0.5 | 0.0±0.0 | 0.0±0.0 | 2.2±0.96 | 3.3±0.0 | 4.4±2.0 | 174.0±4.6 | 24.1 |
| 0.25 | 0.0±0.0 | 0.0±0.0 | 0.0±0.0 | 1.1±0.17 | 2.2±0.96 | 182.7±2.5 | 20.3 |
| 0.125 | 0.0±0.0 | 0.0±0.0 | 0.0±0.0 | 1.1±0.17 | 1.1±0.18 | 184.0±4.6 | 19.7 |
| Control | - | - | - | - | - | 229.3±7.0 | - |

Table 4. Effect of Thyme flowering buds (*Thymus vulgaris*) petroleum ether extract on adult mortalities and reduction in $F_1$ – progeny of the three stored product insects.

| Concen-tration (% w/w) | % Adult mortalities after indicated period (days) ± S.D. | | | | | No. of $F_1$-progeny after 75 days | % reduction in $F_1$– progeny |
|---|---|---|---|---|---|---|---|
| | 2 | 3 | 5 | 7 | 14 | | |
| *S. oryzae* | | | | | | | |
| 2 | 95.6±2.0 | 99.0±1.7 | 100.0±0.0 | 100.0±0.0 | 100.0±0.0 | 0.0±0.0 | 100.0 |
| 1 | 18.9±7.0 | 52.2±5.1 | 100.0±0.0 | 100.0±0. | 100.0±0.0 | 0.0±0.0 | 100.0 |
| 0.5 | 3.3±1.7 | 23.3±3.4 | 72.2±1.9 | 84.5±3.9 | 98.9±1.9 | 0.0±0.0 | 100.0 |
| 0. 25 | 2.2±0.96 | 18.9±3.8 | 26.7±6.7 | 40.0±8.8 | 84.5±6.9 | 51.7±3.2 | 60.0 |
| 0.125 | 0.0±0.0 | 3.3±1.1 | 12.2±5.1 | 18.9±1.9 | 45.7±2.0 | 103.0±3.6 | 20.3 |
| Control | - | - | - | - | - | 129.3±4.2 | - |
| *R. dominica* | | | | | | | |
| 2 | 94.4±5.1 | 95.0±2.0 | 100.0±0.0 | 100.0±0.0 | 100.0±0.0 | 0.0±0.0 | 100.0 |
| 1 | 35.4±8.3 | 48.9±5.1 | 61.1±5.1 | 82.2±5.1 | 95.6±5.1 | 5.0±1.0 | 99.0 |
| 0.5 | 17.8±3.9 | 27.8±5.1 | 34.5±6.9 | 38.9±8.4 | 45.6±8.4 | 37.0±2.6 | 92.9 |
| 0.25 | 5.6±2.0 | 6.7±3.4 | 8.9±3.8 | 13.3±3.4 | 16.7±3.4 | 414.3±6.0 | 20.5 |
| 0.125 | 4.4±2.0 | 6.7±3.4 | 7.8±5.1 | 11.1±3.8 | 16.7±3.4 | 430.7±4.0 | 17.4 |
| Control | - | - | - | - | - | 521.3±5.0 | - |
| *T. castaneum* | | | | | | | |
| 2 | 6.7±0.0 | 11.1±3.8 | 16.5±3.4 | 25.8±5.1 | 45.6±6.1 | 30.6±3.1 | 79.4 |
| 1 | 4.4±2.0 | 8.9±1.9 | 14.4±2.0 | 22.2±3.9 | 40.0±3.3 | 45.7±4.5 | 69.2 |
| 0.5 | 3.3±0.0 | 4.4±2.0 | 7.8±1.9 | 10.0±3.3 | 25.6±5.1 | 95.0±5.0 | 35.9 |
| 0.25 | 1.1±0.17 | 1.1±0.17 | 3.3±1.9 | 5.6±5.1 | 21.1±1.9 | 133.0±4.0 | 10.3 |
| 0.125 | 1.1±0.16 | 1.1±1.9 | 2.2±0.97 | 3.3±3.4 | 3.3±3.4 | 141.0±3.6 | 4.9 |
| Control | - | - | - | - | - | 148.3±6.5 | - |

**2- Residual toxicity of the two insecticides and plant extracts to the adults of *S. oryzae*:**

Two concentrations were prepared according to the acute toxicity range of the two insecticides (Malathion and pirimiphos-methyl) and acetone or petroleum ether extracts of the two plants. Adults of *S. oryzae* were exposed to the treated media in periods extending to one year for the insecticides and to 2 months in case of plant extracts. Results are shown in Tables (5 & 6) as follows:

**2.1. Malathion:**

Data of the residual toxicity of malathion to the adults of *S. oryzae* are given in Table (5) .The results indicated that the protection effect of malathion at 8 ppm was reduced gradually with the increase of the storage period to reach about 61.7 % after 6 months, while at 16 ppm the protection effect was very high (93.0%), then decreased gradually till reach 30.0% after 12 months.

**2.2- Pirimiphos-methyl:**

On the other side, pirimiphos-methyl gave high and moderate protection effect to the adults of *S. oryzae* for 1 year at the two tested concentrations,100.0and 66.7% at 20 ppm, 10 ppm, respectively .

**2.3- Plant extracts:**

Two concentrations 2 and 1 % (w/ w) from each plant extract were tested to the adults of *S. oryzae* for determining residual toxicity of the plant extract. The obtained results are given in Table (6). The results showed that the initial concentration of Cubeb fruits acetone extract gave 98.0 and 71.7% kill with the high and low concentration, respectively. For the petroleum ether extract, higher mortality values were18.3 and 16.7% with high concentration at 0- time and 7 days, respectively. Meanwhile, the initial concentrations of Thyme flowering buds petroleum ether extract caused 93.3 & 87.0% mortalities for the high and lower concentration, respectively. While, the acetone extract of this plant gave obviously lower mortality values at the two tested concentrations (39.2and 26.0%).The results indicated clearly that, *S. oryzae* adult mortality decreased obviously with extending the time after the application of each plant extract.

At 7 days, mortality values reduced at the highest tested concentration to reach 76.7, 16.7, 16.3and 20.0 %for the various plant extracts, respectively.

These values decreased to 3.7, 6.7, 0.0, and 0.0% mortality at 14 days interval from treatment. At one month intervals, zero mortality was achieved with all concentrations of the plant extracts except for the petroleum ether of Cubeb fruits leaves which gave 1.7 % mortality.

This result indicated clearly that all the tested plant extracts have obviously lower persistence compared with the two organophosphorus insecticides.

Tables 5. Residual toxicity of malathion and pirimiphos-methyl to *S. oryzae* adults.

| Time (month) | % adults mortality after 3 days from exposure | | | | |
|---|---|---|---|---|---|
| | Malathion | | Pirimiphos-methyl | | Control |
| | 16ppm | 8ppm | 20ppm | 10ppm | - |
| 0 | 100.0 | 100.0 | 100.0 | 100.0 | - |
| 0.5 | 100.0 | 100.0 | 100.0 | 100.0 | - |
| 1 | 100.0 | 98.0 | 100.0 | 100.0 | - |
| 2 | 100.0 | 86.7 | 100.0 | 100.0 | - |
| 3 | 96.7 | 73.3 | 100.0 | 100.0 | - |
| 4 | 95.7 | 71.7 | 100.0 | 100.0 | - |
| 5 | 93.3 | 70.0 | 100.0 | 100.0 | - |
| 6 | 93.0 | 61.7 | 100.0 | 100.0 | - |
| 7 | 90.0 | 45.4 | 100.0 | 98.3 | - |
| 8 | 80.0 | 36.7 | 100.0 | 96.7 | - |
| 9 | 55.0 | 26.7 | 100.0 | 93.3 | - |
| 10 | 46.7 | 23.3 | 100.0 | 85.0 | - |
| 11 | 39.3 | 20.0 | 100.0 | 76.7 | - |
| 12 | 30.0 | 18.3 | 100.0 | 66.7 | - |

Tables 6. Residual toxicity of the tested plant extracts to *S. oryzae* adults.

| Plant extract | Concent-ration % (w/w) | % Adults mortality after 7 days from exposure at various intervals (days) | | | | |
|---|---|---|---|---|---|---|
| | | 0 | 7 | 14 | 30 | 60 |
| Cubeb fruits acetone extract | 2 | 98.0 | 76.7 | 3.7 | 0.0 | 0.0 |
| | 1 | 71.7 | 36.7 | 3.1 | 0.0 | 0.0 |
| Cubeb fruits petroleum ether extract | 2 | 18.3 | 16.7 | 6.7 | 1.7 | 0.0 |
| | 1 | 11.7 | 4.5 | 1.7 | 0.0 | 0.0 |
| Thyme flowering buds acetone extract | 2 | 39.2 | 16.3 | 0.0 | 0.0 | 0.0 |
| | 1 | 26.0 | 5.0 | 0.0 | 0.0 | 0.0 |
| Thyme flowering buds petroleum ether extract | 2 | 93.3 | 20.0 | 0.0 | 0.0 | 0.0 |
| | 1 | 87.0 | 16.7 | 0.0 | 0.0 | 0.0 |
| Control | Acetone | - | - | - | - | - |
| | Petroleum ether | - | - | - | - | - |

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# بقاء وسمية مستخلصين نباتيين على بعض حشرات المواد المخزونة

**فارس أمين محمد اللقوة[1] ، محمد خيرت إبراهيم صالح[1] ، عبد العزيز السيد عبد العزيز رافع[2]، محروس السيد حسن نصر[2]**

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أجريت دراسة معملية بغرض دراسة التأثير السام لمستخلصات الأسيتون والاثير البترولى لثمار الكباب الصينى والبراعم الزهرية للزعترعلى درجة حرارة 26 ± 2°م ورطوبة نسبية 65 ± 5% مع ثلاثة أنواع من الحشرات التى تصيب المواد المخزونة وهى سوسة الأرز وثاقبة الحبوب الصغرى وخنفساء الدقيق الكستنائية وقد أوضحت النتائج أن التأثير السام للمستخلصات النباتية تحت الدراسة تتوقف على التركيز وفترة التعريض ، وتوقفت حساسية الحشرات كذلك على نوع الحشرة حيث كانت الحشرات الكاملة لسوسة الأرز أعلى حساسية من الأنواع الحشرية الأخرى. وفى نفس الوقت إختلفت سمية المستخلصات النباتية من نوع نباتى إلى آخر.

وتبين بوضوح أن المستخلص الأسيتونى لثمار الكباب الصينى وكذلك مستخلص الاثير البترولى للبراعم الزهرية للزعتر هما أشد المستخلصات النباتية تأثيراً على الحشرات المختلفة.

فعلى سبيل المثال ، بعد 5 أيام من المعاملة أعطى المستخلص الأسيتونى للكباب الصينى عند التركيز المرتفع 2% (وزن/وزن) نسب موت عالية مقدارها 100 ، 100 ، 36.7% للحشرات الكاملة لسوسة الأرز ، ثاقبة الحبوب الصغرى ، خنفساء الدقيق الكستنائية على التوالى. بينما كانت نسب الموت الناتجة من استخدام مستخلص الإثير البترولى لنفس النبات منخفضة جداً (8.9 ، 7.8 ، 5.4%) للحشرات الثلاثة على التوالى .

وفى حالة المستخلص الأسيتونى للبراعم الزهرية للزعتر عند تركيز 2% (وزن/وزن) وفترة تعريض 5 أيام فقد سجّل نسب موت منخفضة مقدارها 27.8 ، 11.1 ، 4.4% للحشرات الثلاثة على التوالى .

أما مستخلص الإثير البترولى لهذا النباتفقد حقق نسب موت عالية (100 ، 100 ، 16.5%). وهذه النتائج تشير الى أن الحشرات الكاملة لخنفساء الدقيق الكستنائية كانت أقل الحشرات حساسية بينما كانت الحشرات الكاملة لسوسة الأرز ذات حساسية عالية للمستخلصات تحت الدراسة .

وبدراسة سمية الأثر المتبقى للستخلصات النباتية مقارنة بمبيدى الملاثيون والأكتلك على حشرة سوسة الأرز أوضحت النتائج أن متبقيات مبيد الأكتلك (بيريميفوس–الميثيل) قد مكثت لمدة أطول من بقاء متبقيات مبيد الملاثيون وأعطت وقاية لحبوب القمح لمدة عام ضد الحشرات الكاملة لسوسة الأرز .

ومن ناحية أخرى فقد أعطت المستخلصات النباتية تحت الدراسة أقصر فترة حماية لحبوب القمح ضد هذه الحشرة وهذا يوضح أن بقائها على حبوب القمح يستمر لمدة قصيرة مقا رنة بمبيد ى الأكتلك أو الملاثيون .