## SHORT NOTE

# Larvicidal potency of Mexican poppy *( Argemone mexicana* L.) seed oil alone or mixed with selected vegetable oils against mosquito larvae

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The medical importance of mosquitoes as a vector for transmission of malaria is well documented. Phytochemicals have a major role in mosquito control programs (Hag *et. al.*,1999; Palsson and Jaenson, 1999; Markouk *et. al*., 2000; Sarktivadivel and Thilogavathy, 2003). Larviciding oils were used extensively to kill air breathing larvae by suffocation or toxicity. Some natural product oils were tested as larvicides and exerted significant toxicity such as neem oil (Dreyer, 1983;Fredros *et. al.*, 2007) Mexican poppy seeds produce fixed oil that was shown to have larvicidal activity when used as EC formulation. The $LC_{50}$ was 0.006% and $LC_{90}$ was 0.061% (Elfahal, 2009).

In the Sudan, Mexican poppy was probably introduced and is found on the Nile banks and rarely away from the banks. The oil of Mexican poppy seed is pale yellow in color and almost tasteless. It contains toxic alkaloids, namely, sanguinarine and dihydro-sanguinarine (Asolkar *et.al.*,1992; Sohrab,1954). Three isoquinoline alkaloids have been isolated from the seeds as dihydropalmitine hydroxide, berberine and protopine. The oil contains up to 40% free fatty acids ( Saurabh *et. al.*,2012). Mexican poppy seed oil is several times more toxic than can be accounted for by its sanguinarine content alone and dihydro sanguiarine, the major alkaloids (Takken *et. al.,* 1993).

The use of sunflower oil (and other vegetable oils) as a pesticide carrier and in the production of agrochemicals, surfactants and adhesives, has been explored. The objective of this study was to test the effectiveness of using Mexican poppy seed oil mixed with other edible oils as larvicidal preparations for controlling mosquitoes.

A known weight of seeds of Mexican poppy, groundnut, sunflower ,sesame and maize were powdered using a mechanical blender in 2009 at the Agricultural Research Corporation, Wad Medani, Sudan. The oil was extracted in n-hexane by shaking with electric shaker for 4 hours and left overnight in a darken container. The mixture was filtered through Whatman filter paper. Hexane was evaporated completely using rotary evaporator. The oil extracted from each plant seed was mixed with Mexican poppy oil to give the combinations of 0%, 25%, 75% and 100%. Mosquito (*Anopheles arabiensis*) third instar larvae were used for determination of potencies of plant extracts. Rearing was conducted under the standard

conditions described by Busvine (1971) and WHO (1981). Twenty larvae were introduced into dishes (7 cm diameter) containing 300 ml tap water with the pH of 6.8. Food in the form of finely ground dog biscuit was added to each dish followed by a known quantity of tested oil to give 0.25% concentration. Each treatment was replicated twice. Control group was also maintained throughout the experiment. The larvae were considered dead if they showed no sign of swimming movement even after gentle touching with a glass rod, WHO (1981). Observations on larval mortality were recorded for time intervals of 2 to 10 hrs. Data were transformed as necessary and analyzed using the standard analysis of variance procedure. Means were separated using Duncan's Multiple Range Test at 5% level of significance.

Table 1 shows the effect of Mexican poppy seed oil on mosquito larval mortality when mixed with different portions of groundnut oil. Larvicidal activity increased with time of assay for all mixtures. Pure Mexican poppy seed oil gave the highest mortality. All mixture with groundnut oil resulted in markedly reduced larval mortality to the extent of having no activity with pure groundnut oil.

Pure Mexican poppy seed oil showed increased larvicidal activity with bioassay incubation time approaching 100% mortality when the larvae were left for 10 hours in the assay medium (Table 2). This confirmed the result of Table 1. A dilution of 25% sunflower oil and 75 % Mexican poppy seed oil was still quite active, comparable to pure Mexican poppy, especially during the $8^{th}$ and $10^{th}$ hours of assay. With further dilutions, the larvicidal activity decreased. Pure sunflower oil was slightly larvicidal with longer incubation period (Table 2).

Sesame seed oil alone (100%) seems to have very little larvicidal activity. However, it markedly augmented the action of diluted *Argemone* oil, more than what was observed for sunflower oil. This suggests a synergistic effect for sesame oil. Morton (1954) stated that sesame oil increased the insecticidal potency of pyrethrin (Table 3). The larvicidal activity of *Argemone* seed oil did not decrease with the dilutions made using maize grain oil. Pure maize grain oil exhibited a dramatic larvicidal activity (Table 4).

Table 1. Effect ofratio of groundnut to Mexican poppy oil on mosquito larval mortality

| Ratio of groundnut to Mexican Poppy oil | Bioassay time(hrs) 2 | 4 | 6 | 8 | 10 |
|---|---|---|---|---|---|
| 0:100 | (6)3.2b | (14)4.8 d | (15)4.9c | (16)5.0 c | (18)5.2c |
| 25:75 | (1) 1.8 a | (2) 2.5 c | (3) 2.7 b | (4) 3.0b | (4)3.0b |
| 50:50 | (1)2.0 a | (1) 2.0 b | (2)2.4 b | (2)2.4b | (2) 2.5b |
| 75:25 | (1) 2.2 a | (1)2.2 bc | (2)2.4 b | (2)2.5 b | (2) 2.5b |
| 100:0 | (0) 1.0 a | (0) 1.0 a | (0) 1.0 a | (0) 1.0a | (0)1.0 a |
| Control | (0) 1.0 a | (0) 1.0 a | (0) 1.0 a | (0) 1.0 a | (0) 1.0 a |
| SE (±) | 0.29 | 0.38 | 0.39 | 0.42 | 0.44 |
| CV(% ) | 32 | 41 | 38 | 42 | 41 |

Mean tested larvae were 20. Data were transformed to $\sqrt{x+1}$, actual figures in parentheses. Means ineach column having the same letter(s) are not significantly different according to Duncan's Multiple Range Test at 5% level of significance.

Table 2. Effect of ratio of sunflower to Mexican poppy oil on mosquito larval mortality.

| Ratio of sunflower to Mexican poppy oil | Bioassay time(hrs) 2 | 4 | 6 | 8 | 10 |
|---|---|---|---|---|---|
| 0:100 | (8)3.9c | (10)4.2c | (14) 4.7d | (17) 5.1d | (20)5.4d |
| 25;75 | (3) 2.8cb | (10) 4.1c | (11)4.2c | (19)5.3d | (20) 5.4d |
| 75:25 | (1)1.7ba | (2) 1.5b | (3) 2.7b | (4) 2.9c | (11) 4.3c |
| 100:0 | (0) 1.0a | (0) 1.0a | (2) 2.4b | (2) 2.4b | (3) 2.7b |
| control | (0) 1.0a | (0) 1.0a | (0) 1.0a | (0) 1.0a | (0) 1.0a |
| SE(±) | 0.39 | 0.47 | 0.44 | 0.44 | 0.57 |
| CV(%) | 50 | 50 | 38 | 44 | 37 |

Mean tested larvea were larvae 20. Data were transformed to$\sqrt{x+1}$, actual figures in parentheses. Means in each column having the same letter(s) are not significantly different according to Duncan's Multiple Range Test at 5% level of significance.

Table 3. Effect of ratio of sesame to Mexican poppy oil on mosquito larval mortality.

| Ratio of sesame to Mexican poppy | Bioassay time (hrs) 2 | 4 | 6 | 8 | 10 |
|---|---|---|---|---|---|
| 0;100 | (5) 3.3c | (5) 3.3c | (10) 4.2b | (15) 4.8b | (18) 5.2c |
| 25:75 | (1) 2.0b | (4) 3.0b | (9) 3.9b | (14) 4.8b | (18)5.2c |
| 75:25 | (1) 1.5b | (2) 2.5b | (6) 3.4b | (13) 4.5b | (17) 5.1c |
| 100:0 | (0)1.0a | (1) 1.5a | (1) 1.5a | (1) 1.5a | (2) 2.2b |
| Control | (0)1.0a | (0)1.0a | (0)1.0a | (0)1.0a | (0)1.0a |
| SE(± ) | 0.30 | 0.31 | 0.45 | 0.58 | 0.60 |
| CV(%) | 40 | 36 | 44 | 50 | 46 |

Mean tested larvae were 20. Data were transformed to $\sqrt{x+1}$, actual figures in parentheses. Means in each column having the same letter(s) are not significantly different according to Duncan's Multiple Range Test at 5% level of significance.

Table 4. Effect of ratio of maize to Mexican poppy oil on mosquito larval mortality.

| Ratio of maize to Mexican poppy oil | Bioassay time (hrs) 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 0:100 | (14) 4.8c | (17) 5.8b | (18) 5.2c | (18) 5.2b |
| 25:75 | (14) 5.8c | (16) 4.9b | (17) 5.1cb | (18) 5.2b |
| 75:25 | (16) 4.9c | (17) 5.1b | (18) 5.2c | (18) 5.2b |
| 100:0 | (6)3.5b | (15) 4.8b | (17)5.1b | (18) 5.2b |
| Control | (0) 1.0a | (0) 1.0a | (0) 1.0a | (0) 1.0a |
| SE(±) | 0.50 | 0.53 | 0.55 | 0.40 |
| CV(% ) | 32 | 26 | 30 | 20 |

Mean tested larvae were 20. Data were transformed to $\sqrt{x+1}$, actual figures in parentheses. Means in each column having the same letter(s) are not significantly different according to Duncan's Multiple Range Test at 5% level of significance.

In conclusion, groundnut oil showed poor mortality alone or in mixture with Mexican poppy oil. The Mexican poppy oil mixed with sunflower ,sesame or maize was found effective in controlling mosquito larvae. Maize oil alone showed larvicidal activity comparable to Mexican poppy oil. Oil formulations are relatively less toxic, eco-friendly and insects are unable to develop resistance and may be used as alternatives to other pesticides for the control of mosquito larvae. The larvicidal efficacy shown by these oils against mosquito larvea should be tested in the field for further verification.

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# فعالية زيت بذور الأرجمون (*Argemone mexicana* L.) و خليطه بزيوت نباتية مختاره كقاتلات ليرقة البعوض

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## الخلاصة

البعوض عائل مهم لمرض الملاريا . قاتلات االيرقات الزيتية تستعمل لقتل اليرقات بواسطة السمية او الاختناق. بذور الارجمون مكسكانا تنتج زيت ثابت يحتوي علي قلويدات سامة، اظهرت سمية ضد يرقات البعوض عند استخدامها في صور مستحلب مركز. في هذه الدراسة تم استخدام زيت بذور الارجمون مخلوطا" مع زيوت طعام كتجهيزات قاتلة لليرقات. استخدمت للتخفيفات الزيوت المستخلصة من بذور الفول السوداني , زهرة الشمس, السمسم والذره الشامية. تم تقييم زيت الأرجمون علي يرقات البعوض بعد تخفيفه بالنسب (25%,75%,100%) من الزيوت المذكورة. اظهر الزيت النقي لبذور الأرجمون سمية متزايدة مع زمن التعرض وصلت حتي 100%. عند مقارنة تأثير الزيوت الأخرى مع زيت الأرجمون وجد ان زيت الفول السوداني له خاصية تضاد مع زيت الأرجمون. زيت السمسم اظهر سمية بسيطة جدا" عند استعماله منفردا" مع انه تسبب في زيادة فعالية الأرجمون بعد التخفيف به اكثر من زيت زهرة الشمس. اظهر زيت الذرة الشامية النقي فاعلية كقاتل يرقات تماثل فاعلية الأرجمون وعند خلط تخفيفاته مع زيت الأرجمون لم تتأثر فعاليته.