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Bio-efficacy of some green pesticides against *Brevipalpus Karachiensis* Chaudhri *et al*. (Acari: Tenuipalpidae) infesting *Justicia Adhatoda* l. Nees (Family: acanthaceae) under laboratory condition

Afsana Mondal[1], Dr. Salil Kumar Gupta[2]
[1-2] Medicinal Plants Research and Extension Centre, R.K. Mission, Narendrapur, Kolkata, West Bengal, India

Abstract
Laboratory bioassay with 4 green pesticides, *viz.* custard apple, and citrus each of 2% and 5% concentrations, Neem oil (1ml+10ml water and 2ml+10ml water) and chili paste+ water 6gm+50 ml water and 12gm+50 ml water, against *Brevipalpus karachiensis* Chaudhri *et al.* revealed that all the green pesticides proved their acaricidal effects with varying degrees of efficacies. Among the green pesticides the overall mortality at lower concentration, custard apple 2% recorded highest mortality of 74.48% followed by Citrus 2% of 73.54% while Neem oil+ water was the poorest among all (mortality 61.73%). At higher concentration, chili paste +water was the best (79.79% mortality) followed by citrus 5% (78.49%) and Neem oil was the poorest recording mortality of 74.07%. Since chili paste + water treatment (12gm+50ml water) appears to be easily available, performed best and least costly, this treatment may be used for control of this mite on *Justicia Adhatoda*.

Keywords: green pesticides, *Brevipalpus Karachiensis*, bioassay, *Justicia Adhatoda*.

1. Introduction
Gupta (2005) recorded *Brevipalpus karachiensis* occurring on *Justicia adhatoda* in the medicinal plant garden of R. K. Mission, Narendrapur. Recently, the infestation of this mite became so serious that it caused devastating damage on most of the leaves resulting in appearance of first yellowish and then production of chocolaty brown patches especially towards the leaf margin. Such leaves gradually dried up and defoliated. Since the concerned plant is of great medicinal value being used as home remedial measure against cough, cold, fever, bronchitis and hoofing cough, it was thought desirable to control this mite for prevention of the menacing damage done by this on this important medicinal plant. Further, as it is not supposed to use any chemical pesticides on medicinal plants, the use of green pesticides was thought to be the best option. Keeping that in view, this laboratory experiment was undertaken for bioassay of some green pesticides on this pest mite. It may not be out of place to mention here that all the plants/ extracts/ parts used here are easily available around us. The result of this study is presented in this paper.

Material and Methods
The mite infested leaves of *Justicia adhatoda* were collected from medicinal plant garden of R.K.Mission, Narendrapur and the mass culture of this mite was maintained in laboratory by keeping the leaves on wet cotton pads in Petridish of 15cm diameter. The methanol leaf extract of custard apple, *Anona squamosa* and citrus, *Citrus limonum*, both prepared using the technique of Gupta *et al*. (2007) [1] and Wang *et al.* (2009) [3] were used. The excised leaves were treated with the green pesticides using leaf-dip technique of Helle and Sabelis (1985). The dipped excised leaves were air dried and test mites numbering 10 per leaf bits were released on treated leaves kept on wet cotton pad in Petridish of 15 cm diameter. For each treatment, 3 replications were maintained. In addition, 1 control treatment was also maintained where only water was sprayed and then air dried. In case of chili paste, the measured quantity of green chili was crushed in a mortar and required amount of that (6gm+50 ml water in one treatment and 12gm+50ml water for another treatment) were prepared and applied on mite infested leaves (10 mites per leaf X 3 replications X 2 treatments = 6 excised leaves). In case of Neem oil, a commercial brand of Neem oil having azedirachtin content of 4-5% was used after mixing with measured quantity of distilled water (1ml+ 10ml water for one treatment and 2ml+10ml water for another treatment). Altogether there were 25 treated excised leaves (8 treatments X3 replications + 1 control). The observations towards mortality were recorded after every 24 hours till 192 hours. The necessary statistical analysis of the data was done. The percentage mortality was calculated using the following formula:

$$\text{Percentage mortality} = \frac{\text{Number of Dead Mites}}{\text{Total Number of Mites}} \text{ X } 100$$

(McDonald *et al.* 1970)

Results and Discussion
The data pertaining to percentage mortality achieved at different intervals after application of green pesticides on *Brevipalpus karachiensis* Chaudhri *et al.* under laboratory condition has been given in Table -1. A perusal to that Table indicated the following:

Table 1: Percentage mortality of *Brevipalpus karachiensis* on *Justicia adhatoda* using different green pesticides under laboratory condition

Treatments	Initial Population	% Mortality at different intervals.								
		24 hours	48 hours	72 hours	96 hours	120 hours	144 hours	168 hours	192 hours	Mean Mortality
Custard apple 2% (T_1)	10	47.53	55.00	64.35	71.55	89.35	93.55	100.00	-	74.48
Custard apple 5% (T_2)	10	52.19	67.22	71.91	79.15	91.50	100.00	-	-	76.99
Citrus 2% (T_3)	10	40.00	58.87	66.11	74.44	81.22	94.11	100.00	-	73.54
Citrus 5% (T_4)	10	53.33	67.55	75.40	83.15	91.50	100.00	-	-	78.49
Neem Oil 1ml/10ml water (T_5)	10	23.12	33.51	50.10	59.11	65.17	77.35	85.53	100.00	61.73
Neem Oil 2ml/10ml water (T_6)	10	46.67	56.23	66.67	72.53	86.31	90.11	100.00	-	74.07
Chili paste + Water (6gm+50ml) (T_7)	10	46.67	50.00	63.33	71.82	85.37	93.39	100.00	-	72.94
Chili paste + Water (12gm+50ml) (T_8)	10	60.00	67.89	73.51	84.22	93.11	100.00	-	-	79.79
Control (T_9)	10	-	-	-	-	-	-	-	-	-
CD at 5% level		6.33	7.13	6.31	7.44	8.13	7.35	6.16	-	6.97

At 24 hours interval

All the plant extracts had shown their acaricidal effects. At this interval and at lower concentration, the custard apple extract recorded the highest mortality of 47.53% which was at par with chili paste + water (6gm+50ml) (T_7) registering mortality of 46.67%. These two were significantly superior to citrus 2% (T_3) 40.00% mortality and the latter was superior to Neem oil (1ml/10ml) (T_5) 23.12%.

At higher concentration, the highest percentage mortality was recorded in chili paste +water (12gm+50ml) (T_8) where it was 60.00% being significantly superior to all other treatments. This was followed by custard apple 5% (T_2) (52.19%), citrus 5% (T_4) (53.33%) and Neem oil (2ml/10ml) (T_6) (46.67%) all were at par. No mortality was recorded in case of control treatment.

At 48 hours interval

At this interval and at lower concentration, the highest mortality was recorded in case of citrus 2% (T_3) (58.87%) and it was at par with custard apple 2% (T_1) (55.00%) as well as with chili paste + water(6gm+50ml) (T_7), where the percentage mortality was 50.00. Neem oil (1ml/10ml) (T_5) was the poorest among all where the mortality percentage was only 33.51%.

At higher concentration, custard apple 5% (T_2), citrus 5% (T_4) and chili paste + water (12gm+50ml) (T_8) all were at par registering percentage mortality of 67.22, 67.55 and 67.89, respectively while Neem oil (2ml/10ml) (T_6) was the poorest among all registering mortality of 56.23%. No mortality was recorded in control.

At 72 hours interval

At lower concentration, custard apple 2% (T_1), citrus 2% (T_3) and chili paste + water (6gm+50ml) (T_7) all were significantly at par registering percentage mortality of 64.35, 66.11 and 63.33, respectively and Neem oil (1ml/10ml) (T_5) was the poorest where the percentage mortality was 50.10.

At higher concentration, custard apple 5% (T_2), citrus 5% (T_4) and chili paste + water (12gm+50ml) (T_8) all were at par registering percentage mortality of 71.91, 75.40 and 73.51, respectively and all three were superior to Neem oil (2ml/10ml) (T_6), which registered 66.67% mortality. No mortality was recorded in control.

At 96 hours interval

At lower concentration, custard apple 2% (T_1), citrus 2% (T_3) and chili paste + water (6gm+50ml) (T_7) were at par registering % mortality of 71.55, 74.44 and 71.82 being superior to Neem oil (1ml/10ml) (T_5) where the percentage mortality was 59.11.

At higher concentration, custard apple 5% (T_2), citrus 5% (T_4) and chili paste + water (12gm+50ml) (T_8) were at par where percentage mortality was recorded as 79.15, 83.15 and 84.22 respectively and all were superior to Neem oil (2ml/10ml) (T_6) where the percentage mortality was 72.53 and no mortality was recorded in control.

At 120 hours interval

At lower concentration, the percentage mortality was at par in case of custard apple 2% (T_1), citrus 2% (T_3) and chili paste + water (6gm+50ml) (T_7) registering percentage mortality of 89.35, 81.22 and 85.37, respectively and were significantly superior to Neem oil (1ml/10ml) (T_5) where the percentage mortality was 65.17%.

At higher concentration, all four treatments like custard apple 5% (T_2), citrus 5% (T_4), Neem oil (2ml/10ml) (T_6) and chili paste + water (12gm+50ml) (T_8) were at par and the percentage mortality was 91.50, 91.50, 86.31 and 93.11, respectively. Control treatment registered no mortality.

At 144 hours interval

At lower concentration, custard apple 2% (T_1), citrus 2% (T_3) and chili paste + water (6gm+50ml) (T_7) were at par recording percentage mortality of 93.55, 94.11 and 93.39, respectively and all being superior to Neem oil (1ml/10ml) (T_5), the percentage mortality was 77.35.

At higher concentration, custard apple 5% (T_2), citrus 5% (T_4) and chili paste + water (12gm+50ml) (T_8) registered 100% mortality and were superior to Neem oil (2ml/10ml) (T_6) and the percentage mortality was 90.11. No mortality was recorded in control.

At 168 hours interval

At lower concentration, custard apple 2% (T_1), citrus 2% (T_3) and chili paste + water (6gm+50ml) (T_7) all recorded 100% mortality and all were significantly superior to Neem oil (1ml/10ml) (T_5) where the percentage mortality was 85.53.

At higher concentration, Neem oil (2ml/10ml) (T_6) had

shown further improvement in mortality reaching to 100% level and no mortality was recorded in case of control.

At 192 hours interval

At lower concentration, Neem oil (1ml/10ml) (T_5) had shown further improvement to reach up to 100% mortality and control treatment had shown no mortality. At higher concentration, 100% mortality was recorded in the other treatments at the previous interval.

Mean mortality

At lower concentration, the mean percentage mortality can be arranged in the following descending order: custard apple 2% (T_1) (74.48) > citrus 2% (T_3) (74.54) > chili Paste + water (6gm+50ml) (T_7) (72.94) > Neem oil (1ml/10ml) (T_5) (61.73).

Likewise, at higher concentration, the mean percentage mortality can be arranged in the following descending order: chili paste + water (12gm+50ml) (T_8) (79.79) > citrus 5% (T_4) (78.49) > custard apple 5% (T_2) (76.99) > Neem oil (2ml/10ml) (T_6) (74.07).

Conclusion

From the laboratory experiment done, the following conclusion can be derived:

- All the green pesticides which were tested against *Brevipalpus karachiensis* on *Justicia adhatoda*, had shown acaricidal activity and mean percentage mortality ranged between lowest of 61.73 and reaching up to 100 level.
- In all the cases, the percentage mortality increased with the increase of time interval after application.
- No mortality was recorded in control.
- Among lower concentrations, the lowest mortality was recorded in Neem Oil (1ml/10ml) (T_5) and highest was in custard apple 2% (T_1), while at higher concentrations, lowest and highest mortalities were in Neem oil (2ml/10ml) (T_6) and chili paste + water (12gm+50ml) (T_8), respectively.
- Since the present result is based upon laboratory experiment, it gives an inkling regarding efficacy of green pesticides against this mite and that needs to be confirmed by conducting a field experiment.

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