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Bio-efficacy of some green pesticides towards mortality and repellency against *Petrobia harti* Ewing (Acari: Tetranychidae) infesting medicinal weed, *Oxalis corniculata* L. (Oxalidaceae)

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Abstract
The laboratory trial of five green pesticides towards causing mortality of *Petrobia harti* (Ewing) indicates that the leaf extract of *Clerodendron inerme*, followed by extract of *Tagetes erecta* both at 1.5% registered mean mortality of 92.50% and 82.63%, respectively. Regarding repellency test with 5 plant extracts, viz. Lemon grass (*Cymbopogon martini*), Nishinda (*Vitex negundo*), Marigold(*Tagetes erecta*), Lemon leaf (*Citrus limon*), Tulsi (*Ocimum sanctum*), it revealed that marigold extract had shown highest repellency (70%) followed by Tulsi(65%).

Keywords: *Petrobia harti, Oxalis corniculata,* mortality, repellency, plant extracts, pesticides.

1. Introduction
In view of the fact that synthetic chemical pesticides have highly hazardous effect on both environment and human beings besides are known to develop resistance, residue, etc. the application of chemical pesticides are being reduced gradually throughout the world. Hence, attempts are being made to find out suitable alternatives for pest control purpose. In this regard, the use of green pesticides (leaf extracts) are appearing to be quite promising. In view of this, some of the plant extracts like- Bhat (*Clerodendron inerme*), Neem (*Azadirachta indica*), Lemon grass (*Cymbopogon martini*), Nishinda (*Vitex negundo*), Marigold (*Tagetes erecta*), were assessed against *Petrobia harti* which seriously infested a medicinal weed, *Oxalis corniculata*. Monocrotophos was taken as standard acaricide. Along with mortality, another experiment for repellency was conducted on the same mite (*Petrobia harti*) where in the plant extracts of Nishinda (*Vitex negundo),* Neem (*Azadirachta indica*), Lemon grass *(Cymbopogon martini),* Marigold (*Tagetes erecta*) and Lemon leaf (*Citrus limon*) were assessed on the same medicinal weed *(Oxalis corniculata).*

2. Material and Methods
The test mite, *Petrobia harti* was found seriously infesting a medicinal weed, *Oxalis corniculata* causing chlorosis and the same mite was cultured in the laboratory in earthen pots at room temperature (30 ± 2 °C).

A. Preparation of crude extracts: The test mite was collected from cultured pots. The respective plant extracts Bhat (*Clerodendron inerme*), Neem (*Azadirachta indica*), Lemon grass *(Cymbopogon martini),* Nishinda (*Vitex negundo),* Marigold (*Tagetes erecta*), Tulsi (*Ocimum sanctum*) and Lemon leaf (*Citrus limon*) were prepared using acetone as solvent and the dried leaves of host plants were powdered in a mortar and those were kept in a conical flask (150cc), immersed in acetone and then was shaken vigorously for 2 days. On third day, the supernatant liquid was taken out, filtered and kept in Petridish for allowing it to evaporate. After the evaporation was over, the crust left on the Petridish was scrapped out. Its weight was taken and the respective percentage concentrations were prepared by mixing with required quantity of water.

B. Assessing Acaricidal Activity: The leaf-disc technique (Helle and Sabelis, 1985) [2] was followed for determining mortality percentage of plant extracts in bio-assay study. For control treatment, distilled water was sprayed. The leaf-discs of 1.5 cm diameter were immersed in the desired concentration of the extracts for 1 minute and then were taken out and kept under a ceiling fan for drying. Thereafter, those were kept on wet cotton pads in Petri dishes and 10 adult mites were released on each leaf-disc. The observations were recorded 24, 48 and 168 hours after treatment. The mites were considered to be dead when they made no movement of their appendages with a prick of a needle. Each treatment was replicated 4 times. The percentage mortality was calculated by using the formula as:-

$$\text{Percentage (\%) Mortality} = \frac{\text{No. Of Dead Mites}}{\text{Total No. Of Mites}} \times 100$$

(Mc. Donald *et al.* 1970)

Statistical Analysis: The data was subjected to statistical analysis using SPSS software 2008.

3. Results and Discussions:

A. Mortality of *Petrobia harti* (Ewing) on *Oxalis corniculata* L. by application of green pesticides:

The mortality achieved at different intervals after spraying is given below –

i) **24 Hours:** At this interval Bhat leaf extract registered the highest mortality which was 91.62% and that was significantly superior to all other treatments. This was followed by Nishinda and Marigold extracts registering 81.71% and 79.35%, respectively and both were at par but was inferior to Bhat extract though superior to Neem and Lemon grass extracts. The conventional pesticide, Monocrotophos was also at par with Nishinda and Marigold registering 78.70% mortality. The treatment next in descending order was Neem giving 65.27% mortality and was superior to Lemon grass extract where the percentage mortality was 54.73%. There was no mortality in control. It was apparent that all the test plant extracts were having good acaricidal property.

ii) **48 Hours:** At this interval the percentage mortality in all the treatments increased further, the highest was 92.66% in case of Bhat which was significantly superior to all other treatments. The next in order was Marigold and Nishinda registering mortality of 80.47% and 77.74%, respectively. Monocrotophos also registered 79.44% which was statistically at par with Marigold and Nishinda. The poorest performance was in case of Neem and Lemon grass extracts where the mortality was 73.49% and 73.12%, respectively and both being at per. At this interval no mortality was observed in control treatment.

iii) **168 Hours:** As was observed in earlier 2 intervals, Bhat leaf extract maintained its superiority over others registering 93.24% mortality and was closely followed by Marigold extract giving 88.19% mortality and that was superior to other remaining treatments. Monocrotophos which was at par with Marigold and Nishinda during earlier 2 intervals but its performance was not at par with the said treatments at this interval registering mortality only of 79.16%. Nishinda and Neem extracts were statistically at par registering mortality of 76.58% and 74.25% respectively. No mortality was recorded in control treatment.

Mean Percentage Mortality

So far as mean percentage mortality was concerned, the treatments can be arranged in the following descending order –

Bhat (92.50% mortality) > Marigold (82.63% mortality) > Monocrotophos (79.10% mortality)> Nishinda (78.67% mortality) > Neem (71.03% mortality) > Lemon grass (62.61% mortality).

Table 1: Percentage mortality of *Petrobia harti* infesting *Oxalis corniculata* using different plant extracts at different intervals after spraying.

Percentage mortality of *Petrobia harti* on *Oxalis corniculata* by application of different plant extracts at different intervals after spraying						
Treatments(Plant Extracts)	**Concentration**	**Initial Population**	**Mean % Mortality at different interval after spraying**			
			24 Hours	**48 Hours**	**168 Hours**	**Mean**
Neem (*Azadirachta indica*) T1	1.50%	10	65.27 (53.89)	73.49 (60.12)	74.25 (59.54)	71.03 (57.85)
Nishinda (*Vitex negundo*) T2	1.50%	10	81.71 (64.69)	77.74 (61.95)	76.58 (61.19)	78.67 (62.61)
Lemon Grass (*Cymbopogon martinii*) T3	1.50%	10	54.73 (47.73)	73.12 (58.89)	60.00 (50.84)	62.61 (52.48)
Marigold (*Tagetes erecta*) T4	1.50%	10	79.35 (62.90)	80.47 (63.88)	88.19 (64.95)	82.63 (63.91)
Bhat (*Clerodendron infortunatum*) T5	1.50%	10	91.62 (73.17)	92.66 (74.33)	93.24 (74.95)	92.50 (74.15)
Monocrotophos (36 WSC)	0.04%	10	78.70 (62.58)	79.44 (63.11)	79.16 (63.09)	79.10 (62.92)
Control	-	10	0	0	0	0
SEM ±	-	10	1.6222	1.653	1.74	-
CD at 5%	-	10	4.09	4.16	4.38	-

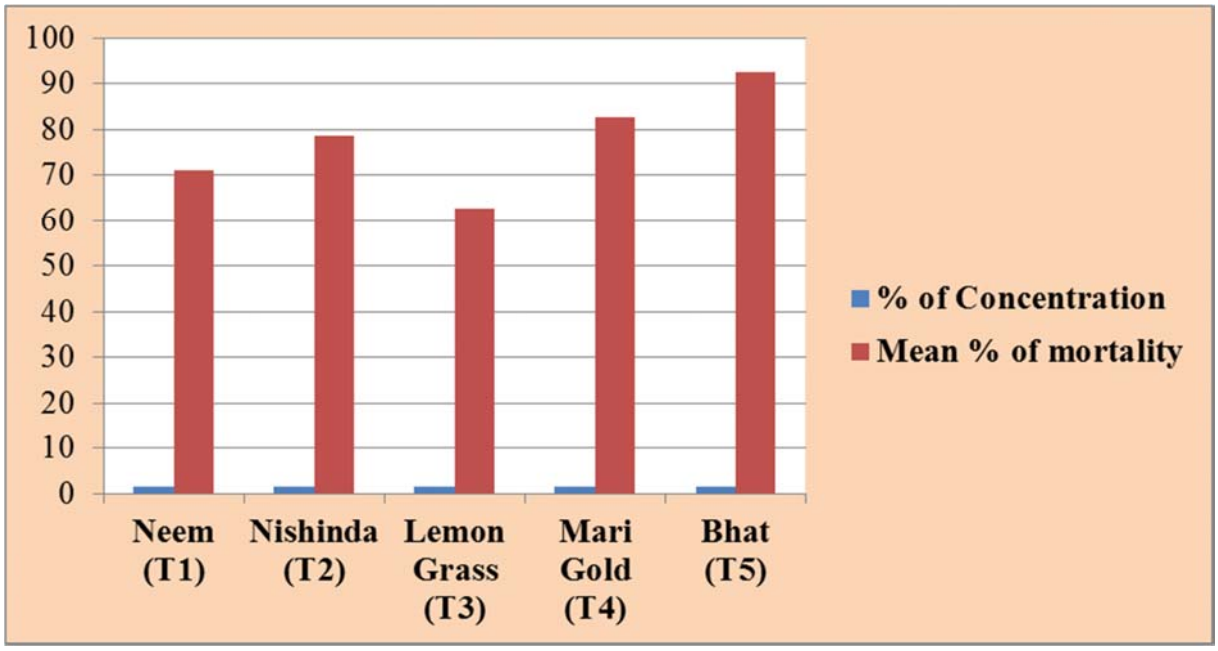

Fig 1: Graphical presentation showing mean percentage mortality of *Petrobia harti* on *Oxalis corniculata* using different plant extracts.

Discussions

Moitra & Gupta (2006)[4] reported 100% mortality of *Petrobia harti* on *Oxalis corniculata* using neem leaf extract as well as 100% mortality in case of *Brevipalpus californicus on Mentha* .Yathiraj & Jagadish (1999)[6] reported 60.25%, 72.5%, 58,75%, 56.25% and 51.25% at 5%,4%,3%,2% and 1% concentration respectively for Nishinda against *Tetranychus urticae.* Umamaheswari *et al*. (1999) [5], Selvanarayanan (1999), also got very good results against tetranychid mites. Yathiraj & Jagadish (1999)[6]reported 63.75%, 55.00%, 37.50%, 28.75% and 6.25% in case of T*etranychus urticae* using leaf extract of *Clerodendron inerme*. Gupta *et al.* (2007) reported 26.66%, 40.00%, 46.66%, 60.00% and 86.66% at 1% and the corresponding in figures at 1.5% were 33.33%, 46.66%, 53.33%, 66.66% and 93.33% respectively after 24, 48, 72, 96 and 120 hours against *Brevipalpus phoenicis* infesting Marigold. Yathiraj & Jagadish (1999) [6] also reported good performance of *Vitex negundo* leaf extract against *Tetranychus urticae.* Therefore, mortality recorded in present study is more or less close to the observation made by previous workers.

B. Repellency Test Of *Petrobia harti* On *Oxalis corniculata* By Application of Green Pesticides

The repellency test performed under Lab condition on *Petrobia harti* infesting *Oxalis corniculata* provided the following results –

Among the 5 plant extracts, viz Lemon grass (*Cymbopogon martini*), Nishinda (*Vitex negundo*), Marigold(*Tagetes erecta*), Tulsi (*Ocimum sanctum*) and Lemon leaf (*Citrus limon*), the highest percentage of repellency was observed in case of Marigold (70.00%) and the poorest being 56.67% in case of Lemon leaf extract.

Mean Percentage Repellency

All the plant extracts had shown different degrees of repellency ranging from 56.67% to70.00%. So far as mean percentage of repellency was concerned, the treatments can be arranged in the following descending order –

Marigold (70.00% repellency) > Tulsi (65.00% repellency) > Nishinda (63.34% repellency) > Lemon grass (61.67% repellency) > Lemon leaf (56.67% repellency).

It was already reported that Marigold has a good repellent property and due to this reason it is suggested to have Marigold plantation as hedge all around the crop field which will repel the pests from attacking the main crop.

Table 2: Mean percentage repellency of different plant extracts against *Petrobia harti* infesting *Oxalis corniculata* at 1, 2, 3 and 4 hours after application.

Repellency test on *Petrobia harti* infesting *Oxalis corniculata* by application of different plant extracts at different interval (At 1,2,3 and 4 hours after application)							
Treatments(Plant Extracts)	**Concentration**	**Initial Population**	**Mean % Repellency at different interval (after 4 hours of application)**				
			1 Hour	**2 Hours**	**3 Hours**	**4 Hours**	**Mean**
Lemon Grass (*Cymbopogon martinii*) T1	1.5%	10	26.67	60.00	80.00	80.00	61.67
Nishinda (*Vitex negundo*) T2	1.5%	10	40.00	60.00	66.67	86.67	63.34
Marigold (*Tagetes erecta*) T3	1.5%	10	53.33	60.00	80.00	86.67	70.00
Lemon Leaf (*Citrus limon*) T4	1.5%	10	40.00	40.00	60.00	86.67	56.67
Tulsi (Ocimum sanctum) T5	1.5%	10	46.67	53.33	66.67	93.33	65.00
Control	-	10	0	0	0	0	0

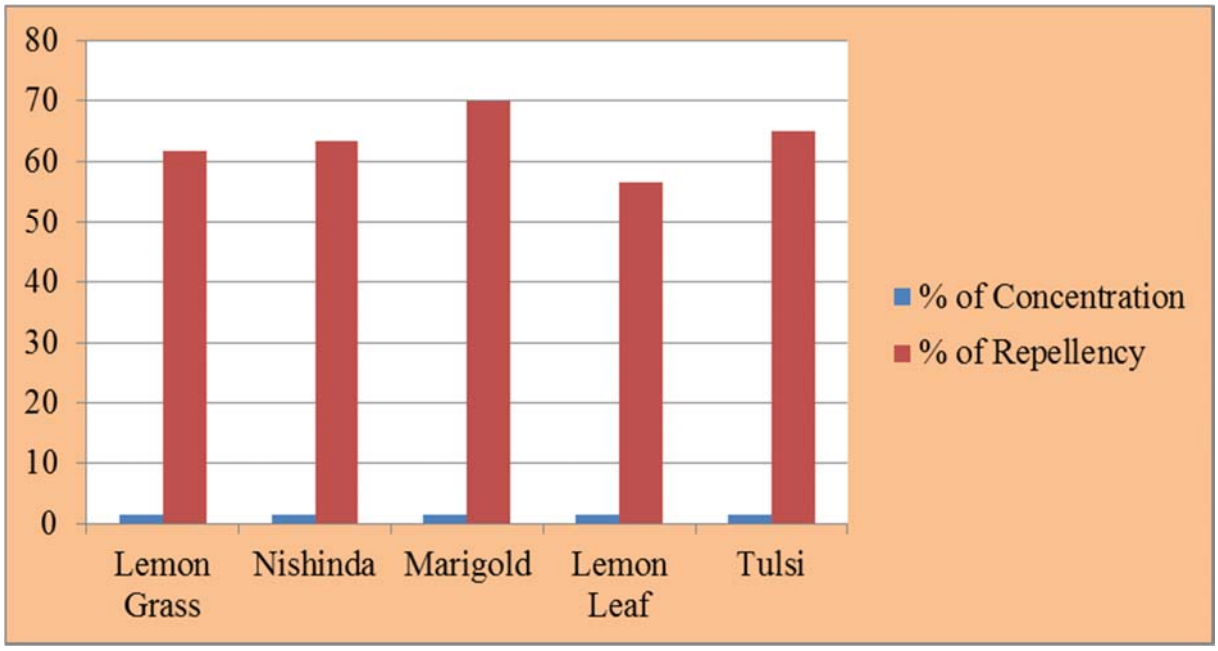

Fig 2: Graphical presentation showing mean percentage repellency of different plant extracts against *Petrobia harti* on *Oxalis corniculata* at 4 hours after application.

4. Conclusion

From the above experiment the following conclusion can be drawn –

A. For Mortality

1. All plant extracts which were tested had shown acaricidal properties and their mean percentage mortality ranged between 62.61% to 92.50%.
2. Among all the treatments, Bhat leaf extracts was found to be the best and was closely followed by Nishinda and Marigold extracts.
3. Lemon grass extract was the poorest among all.
4. Monocrotophos which is a conventional pesticide was found to be no way superior to plant extracts.
5. This experiment provided an inkling that plant extracts could be suitable alternatives of synthetic chemical pesticides in management of mite pest.

B. For Repellency

1. All the plant extracts had shown different degrees of repellency ranging from 56.67% to 70.00%.
2. Among all the treatments, Marigold plant extracts was found to be the best and was closely followed by Tulsi and Nishinda extracts.
3. Lemon leaf extracts was the poorest among all.
4. This experiment suggested that Marigold plantation all around the crop fields is significantly good to repel the pests from attacking the main crop and also helpful in management of mite pest.

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