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Bioefficacy of some plant extracts and conventional chemical pesticide on *Brevipalpus karachiensis* infesting *Adhatoda vasica* (Nees) (Acanthaceae)

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Abstract
Brevipalpus karachiensis Chaudhri *et al.* (Acari: Tenuipalpidae) is becoming a serious pest of *Justicia adhatoda* L. Nees in the medicinal plant garden of R.K. Mission, Narendrapur causing browning of leaves and defoliation. This paper presents the results of the experiment conducted with plant extracts along with a conventional pesticide as standard Propergite towards causing mortality, oviposition deterrency and repellency. The results indicate that among the plant extracts the highest mortality was recorded in 5 % concentration of *Lantana camara*, for ovicidal action the extract of *Ocimum sanctum* was found to be the best while for repellency the extract of *Tagetes patula* was superior to all others. The standard acaricide i.e., Propergite was superior to all tested plant extracts though the differences were not very well marked. Hence, the plant extracts will be very suitable alternative of chemical pesticide in management of *Brevipalpus karachiensis* on Vasak.

Keywords: *Brevipalpus karachiensis, adhatoda vasica,* mortality, ovicidal, repellency, bioefficacy, plant extract, propergite

Introduction
Recently, *Brevipalpus karachiensis* Chaudhri *et al.* (Acari: Tenuipalpidae) is becoming a serious pest of Vasak (*Adhatoda vasica* Nees) in the medicinal plant garden of Ramakrishna Mission, Narendrapur and its occurrence was noticed almost throughout the year during October 2023-April 2024. The infestation caused pinkish browning of leaves which started mainly from leaf margin and gradually the entire leaf lamina turned brown, withered and defoliated. Its population was observed on both sides of the leaf but its intensity was more on the ventral surface along the mid-rib. Its population per leaf varied from 50 - 200. In view of the importance of this mite, it was thought desirable to undertake a laboratory experiment with some plant extracts along with a conventional acaricide like Propergite towards causing mortality, oviposition deterrency and repellency. The results of that study are presented in this paper.

Materials and Methods
1. Mortality test
This was done following Roy *et al.* (2018). As many as 7 leaf extracts like *Nerium indicum, Mentha arvensis, Lantana camara, Mellitia pinnata, Ocimum sanctum, Tagetes patula, Acorus calamus* along with control and Propergite as standard acaricide, were assessed under laboratory condition during February 2024. About 300 grams of leaf of each test plant were taken and dried in a hot air oven of 45° C. The dried leaves were crushed in a grinder mixer and the powdered leaf was taken in a flask and to that acetone was added. This was shaken several times in a day for 3 days and then filtered through a fine cloth. The filtrate was taken in a Petridish (9 cm diameter) and was allowed to evaporate which took about 2 days. After evaporation, a solid crust was left on the Petridish which was the actual toxicant and was scrapped out and its weight was recorded. The required quantity of toxicant was mixed with required quantity of water to make the necessary concentration.

About 10 adult mites were released on excised leaf after thoroughly brushing it out to eliminate unwanted organisms, specially, the predators. The excised leaf was kept on wet cotton pad in a Petridish 10 cm diameter. The plant extract 5 % each and Propergite (0.03 %) were applied with a portable hand sprayer. Observations towards mortality were taken after 24, 48 and 72 hours. The mortality was calculated using the formula.

% Mortality = No. of mites after treatment/ No. of mites before treatment x 100 (Mc Gregor *et al.* 1970).

2. Oviposition deterrency
Adult females were released on excised leaves for allowing those to lay eggs. After 12 hours, all the adult females were removed so that all the eggs are of same size. The eggs were counted and then the plant extracts were applied. Observations towards hatchability were recorded at interval of 24, 48 and 72 hours. The hatchability data was calculated at different intervals.

3. Repellency test
This was done following leaf disc choice test (Kim *et al.*, 2005) through following steps:-

- Leaf discs of the test plant were kept on wet cotton pad in Petridish (9 cm diameter) and each treatment had 5 replications.
- Half of each leaf was sprayed with the required concentration of the respective plant extract and the other half was kept unsprayed.
- Both the halves were joined with cellotape and 10 adult mites were released along the mid-rib. The fully joined leaf was kept in a Petridish (9 cm diameter) on wet cotton pad.
- Orientation of test mites on control were recorded after 2, 6, 10 hours interval. A control disc was also maintained.

Results
Mortality
The data pertaining to mortality at different intervals have been presented in Table 1. A perusal to that table indicates the following:

24 hrs interval

Among the plant extracts and at 24 hr interval the highest mortality was achieved in case of rhizome extract of *Acorus calamus* (49.39 ± 3.22) followed by leaf extract of *Nerium indicum* where percentage mortality was 48.32 ± 5.6. In case of standard pesticide like Propergite the percentage mortality at this interval was 80.10 ± 2.00 this means that Propergite has a much better knock down effect as compared to plant extract. The lowest mortality was in case of *Ocimum sanctum* where the percentage mortality was 21.35 ± 4.35. The treatments can be arranged in the following descending order *A. calamus* > *N. indicum* > *M. pinnata* > *L. camara* > *T. patula* > *M. arvensis* > *O. sanctum*. In control the mortality was 5.15 ± 1.11. So, Propergite was superior to plant extracts.

48 hrs interval

Among the plant extracts, unlike at 24 hrs the highest mortality was recorded in case of leaf extract of *Lantana camara* (72.35 ± 2.56) followed by *Mentha arvensis* (61.35 ± 3.98). The lowest mortality was in case of *Ocimum sanctum* (39.23 ± 5.10). The treatments can be arranged in the following descending order *L. camara* > *M. arvensis* > *A. calamus* > *T. patula* > *N. indicum* > *M. pinnata* > *O. sanctum*. In case of control the percentage mortality was 6.12 ± 1.99. In case of Propergite the percentage mortality was 90.15 ± 2.11 i.e., it was far superior to all other plant extracts.

72 hrs interval

Among the plant extracts the highest mortality was recorded in case of *Lantana camara* 82.35 ± 7.10 followed by *Acorus calamus* where the percentage mortality was 75.35 ± 5.11. The lowest mortality was as usual in *Ocimum sanctum* 46.30 ± 1.15. In case of control the percentage mortality was 8.25 ± 3.39. The percentage mortality in different treatments can be arranged in the following descending order *L. camara* > *A. calamus* > *M. arvensis* > *N. indicum* > *M. pinnata* > *T. patula* > *O. sanctum*. In case of Propergite the percentage mortality was 95.31 ± 3.11 and that again had shown superiority over plant extracts.

Mean mortality

So far as the mean mortality is concerned, among the plant extracts, the highest was in case of *Lantana camara* (65.68%) followed by *Acorus calamus* (61.70%) and the lowest was in case of *Ocimum sanctum* (35.63%). However, Propergite registered 88.52 ± 0.11.

Table 1: Percentage mortality of different plant extracts and Propergite of Brevipalpus karachiensis at different intervals after spraying.

			% Mortality of adults of *Brevipalpus karachiensis* at different intervals after treatment.			
Sl. No.	**Plants used**	**Parts used**	**24 hrs**	**48 hrs**	**72 hrs**	**Mean**
1.	*Nerium indicum* (5%)	Leaf	48.32±5.6	58.55±1.56	63.85±2.12	56.90
2.	*Mentha arvensis* (5%)	Leaf	29.35±8.6	61.35±3.98	67.35±1.20	52.68
3.	*Lantana camara* (5%)	Leaf	42.35±7.85	72.35±2.56	82.35±7.10	65.68
4.	*Mellitia pinnata* (5%)	Leaf	47.52±3.55	50.35±6.35	63.25±5.12	53.70
5.	*Ocimum sanctum* (5%)	Leaf	21.35±4.35	39.23±5.10	46.30±1.15	35.63
6.	*Tagetus patula* (5%)	Leaf	34.39±7.21	59.12±3.32	62.35±4.10	51.95
7.	*Acorus calamus* (5%)	Rhizome	49.39±3.22	60.35±01.86	75.35±5.11	61.70
8.	Propergite 57% EC (0.03%)	Market product	80.10±2.00	90.15±2.11	95.11±3.11	88.52±0.11
9.	Control		5.15±1.11	6.12±01.99	8.25±3.39	6.50

Oviposition deterrency

All the plant extracts exhibited oviposition deterrency which varied from treatment to treatment as explained below:

24 hrs

At this interval the highest oviposition deterrency was noticed in case of rhizome extract of *A. calamus* (2.5 ± 1.19) followed by *Mentha arvensis* (2.7 ± 1.91). The lowest oviposition deterrency was in case of *O. sanctum* (4.10 ± 1.11). In case of control, this value was 7.35 ± 0.22. The values of oviposition deterrency could be arranged from highest to lowest order as *A. calamus* > *M. arvensis* > *L. camara* > *M. pinnata* > *T. patula* > *N. indicum* > *O. sanctum.* In case of propergite this value was 5.31 ± 2.19.

48 hrs

At this interval the highest percentage of oviposition deterrency was recorded in case of *Mentha arvensis* (4.10 ± 0.87) followed by 4.17 ± 1.53 in case of *M. pinnata*. The lowest oviposition deterrency was recorded in case of *A. calamus* (6.12 ± 2.11). In case of control, the value was 8.31 ± 0.99. Treatments can be arranged from highest to lowest deterrency as *M. arvensis* > *M. pinnata* > *O. sanctum* > *L. camara*> *N. indicum*> *T. patula* > *A. calamus.* In case of propergite the ovipositional deterrency was 7.55 ± 3.71.

72 hrs

At this interval the highest value was of *O. sanctum* (1.2 ± 0.39) followed by *N. indicum* where the corresponding value was 2.3 ± 1.19. The lowest was 7.4 ± 2.17 in case of *M. pinnata*. In case of control the corresponding value was 16.33 ± 0.33. In case of propergite this value was 10.5 ± 1.15.

Mean oviposition deterrency

The highest mean oviposition deterrency was recorded as 3.46 in case of *O. sanctum* followed by 3.8 in *M. arvensis*. In case of the poorest among treatments was *M. pinnata* where the mean ovicidal value was 5.02. In case of propergite the mean was 7.78.

Table 2: Percentage of oviposition deterrency of different plant extracts and Propergite of Brevipalpus karachiensis at different intervals after spraying.

			% Oviposition of leaf of *Brevipalpus karachiensis* at different intervals after spraying.			
Sl. No.	**Plants used**	**Parts used**	**24 hrs**	**48 hrs**	**72 hrs**	**Total (Mean)**
1.	*Nerium indicum* (5%)	Leaf	3.75±2.21	5.55±2.13	2.3±1.19	11.6 (3.86)
2.	*Mentha arvensis* (5%)	Leaf	2.7±1.91	4.10±0.87	4.60±1.75	11.4 (3.8)
3.	*Lantana camara* (5%)	Leaf	3.33±0.49	5.25±1.12	4.25±2.01	12.83 (4.27)
4.	*Mellitia pinnata* (5%)	Leaf	3.5±1.11	4.17±1.53	7.4±2.17	15.07 (5.02)
5.	*Ocimum sanctum* (5%)	Leaf	4.10±1.11	5.10±1.22	1.2±0.39	10.4 (3.46)
6.	*Tagetus patula* (5%)	Leaf	3.6±2.10	5.91±1.10	3.99±1.15	13.5 (4.5)
7.	*Acorus calamus* (5%)	Rhizome	2.5±1.19	6.12±2.11	5.55±3.38	14.17 (4.72)
8.	Propergite 57% EC (0.03%)	Market product	5.31±2.19	7.55±3.71	10.5±1.15	223.36 (7.78)
9.	Control		7.35±0.22	8.31±0.99	16.33±0.33	31.99 (10.66)

Repellency effect

So far as repellency effects of the tested plant extracts are concern it appeared that most of the plant extracts have shown repellency with different repellency indices.

2 hrs

The highest repellency effect index was 72.12 in case of *T. patula* followed by 60.13 in case of *A. calamus*. The poorest repellency was observed in case of *A. arvensis* where value was 39.12. The repellency index from maximum to minimum could be arranged in the descending order as *T. patula* > *A. calamus* > *O. sanctum* > *M. pinnata* > *L. camara* > *N. indicum* > *M. arvensis.* As regards propergite, the repellency index value was 70.11 i.e., much higher as compared to tested plant extracts.

6 hrs

At this interval the highest repellency was in *T. patula* (83.19) followed by *A. calamus* (78.33) and the poorest was 59.66 in case of *N. indicum*. The repellency index values may be arranged from highest to lowest descending order as *T. patula* > *A. calamus* > *M. pinnata* > *M. arvensis* > *O. sanctum* > *L. camara* > *N. indicum.* In case of propergite the value was 83.22.

10 hrs

At this interval *T. patula* recorded the highest repellency as was found in case of 2 hrs and 6 hrs and it was followed by *A. calamus* but its performance was similar to *M. pinnata* 90.11 followed by 81.25 in case of *A. calamus*. The poorest was 71.99 in case of *N. indicum*. The repellency indices may be arranged from highest to lowest as *T. patula* > *A. calamus* = *M. pinnata* > *O. sanctum* > *M. arvensis* > *L. camara* > *N. indicum.* In case of propergite the value was 90.05.

Mean

Among the plant extracts, the mean values of repellency may be arranged from highest to lowest as *T. patula* > *A. calamus* > *O. sanctum* > *M. pinnata* > *L. camara* > *M. arvensis* > *N. indicum.*

Table 3: Repellency indices of different plant extracts and Propergite of Brevipalpus karachiensis at different intervals after spraying.

			Repellency index of different plant extracts in respect of *Brevipalpus karachiensis* at different intervals after spraying.			
Sl. No.	**Plants used**	**Parts used**	**2 hrs**	**6 hrs**	**10 hrs**	**Mean**
1.	*Nerium indicum* (5%)	Leaf	40.25	59.66	71.99	57.30
2.	*Mentha arvensis* (5%)	Leaf	39.12	72.13	79.44	63.59
3.	*Lantana camara* (5%)	Leaf	49.15	69.13	75.98	64.75
4.	*Mellitia pinnata* (5%)	Leaf	50.35	75.13	81.25	68.91
5.	*Ocimum sanctum* (5%)	Leaf	60.11	70.51	80.22	70.28
6.	*Tagetus patula* (5%)	Leaf	72.12	83.19	90.11	81.80
7.	*Acorus calamus* (5%)	Rhizome	60.13	78.33	81.25	73.23
8.	Propergite 57% EC (0.03%)	Market product	70.11	83.22	90.05	81.12

Discussion

Mortality test

1. From the 8 treatments, 6 of plant extracts and 1 of rhizome extract and one standard chemical pesticide i.e., Propergite it appeared that the leaf extract of *Ocimum sanctum* was the poorest of all registering lowest percentage of mortality at all the intervals.
2. So far as highest mortality is concerned excepting at 24 hrs interval, in both 48 and 72 hrs interval as well as the highest mean percentage of mortality were recorded in *Lantana camara* but at 24 hrs interval the mortality was highest in rhizome extract of *A. calamus* though not much difference was recorded in percentage mortalities.
3. Likewise, at 72 hrs as well as mean percentage mortality rhizome extract of *A. calamus* was the second best.
4. At all intervals, the Propergite registered highest mortality proving its superiority over plant extracts.
5. Despite this, it is always advisable to use plant extracts (*Nerium indicum, Mentha arvensis, Lantana camara, Mellitia pinnata, Ocimum sanctum, Tagetes patula, Acarus calamus*) as being the effective medicinal plant extracts the use and chemical pesticide should be avoided.
6. The overall analysis of data indicates that all the plant extracts were quite effective in causing mortality of the

test mite and could be employed for suppression of the test mite.

Oviposition deterrency

1. From the oviposition deterrency data it is amply clear that all the tested plant extracts had oviposition deterrency effect.
2. From the mean values in use of plant extracts, it appears that *O. sanctum* leaf extract recorded the highest deterrency and the same was also seen at 72 hrs interval but initially that is at 24 hrs interval it has the poorest among all and at 48 hrs interval it was midway that is third best. So far as propergite is concerned it also had shown ovicidal deterrency effect and mean value was 7.78 %.

Repellency test

1. All the tested plant extracts registered repellency effects which varied from plant to plant and increased with the increase of time interval.
2. The *T. patula* extract recorded the highest repellency index at all the intervals which was better as compared to all treatments excepting Propergite.
3. Propergite all along had shown little repellency index compared to plant extracts but had not much different from *T. patula*.
4. From the result obtained it appeared that application of the plant extracts could be alternatives of chemical pesticides as it will avoid the attack of pest and hence the damage could be minimised.

Gupta *et al.* [2] conducted laboratory experiment with some plant extracts like Vasak on *Brevipalpus phoenicis* and reported good performance of the tested extract. Dimetry [1] listed several botanical pesticides and reported those were highly effective, safe to the natural enemies and suggested the use of Neem, Nicotine, Tobacco, Sabadilla, Rotenone in pest control. Singh [6] reviewed the botanical pesticides in pest management program and suggested their use. Ismail [3] in his study on repellency using *Tagetus patula* against *Tetranychus urticae* reported ovicidal and repellency activities of *T. patula.* Prakash and Roa [5] while reviewing the performance of botanical pesticides advocated their use for pest management in agriculture. Roy *et al.* [4] got good result with *Clerodendrum viscosum* against tea mite and suggested its inclusion in IPM for tea pest. Considering the above, the inclusion of plant extracts in control of *B. karachiensis* is advisable as not only mortality but also ovicidal and repellency effects are also promising.

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Reference

1. Dimetry NZ. Prospects of botanical pesticides for the future in integrated pest management programme (IPM) with special reference to neem uses in Egypt. Archives of Phytopathology and Plant Protection,2012:45(10):1138-1161.
2. Gupta SK, Biswas H, Das SN. Bioeffectiveness of some plant extracts towards causing mortality of Brevipalpus phoenicis (Geij,) (Acari: Tenuipalpidae), a new pest of medicinal plants, Vasak (Justicia adhatoda) L. Nees (Acanthaceae). In: Bioprospecting and application of medicinal plants in ailments (Gupta SK, Mitra BR) RKM, Narendrapur, 2007, 121-126.
3. Ismail MS, Tag HM, Rizk MA. Acaricidal, ovicidal and repellent effects of Tagetus patula leaf extract against Tetranychus urticae Koch (Acari: Tetranychidae). Journal of Plant Protection Research,2019:59(2):151-159.
4. Roy S, Mukhopadhyay A, Gurusubramanian G. Anti-mite activities of Clerodendrum viscosum Ventenat (Verbenaceae) extracts on tea red spider mite, Oligonychus coffeae Nietner (Acarina: Tetranychidae). Archives of Phytopathology and Plant Protection,2011:14(16):1550-1559.
5. Prakash A, Roa J. Botanical pesticides in agriculture. Boca Raton (FL): CRC Lewis Publisher, 1997, 481.
6. Singh RP. Botanicals in pest management: an ecological perspective. In: Dhaliwal GS, Singh B, editors. Pesticides and environment. New Delhi (India): Commonwealth Publishers, 2000, 279-268.