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EFFICACY OF BIOPESTICIDES AGAINST *TETRANYCHUS URTICAE* KOCH INFESTING DODI *LEPTADENIA RETICULATA*

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ABSTRACT

A field experiment was carried out to test the efficacy of biopesticides against the red two spotted spider mite *Tetranychus urticae* Koch infesting dodi (Jivanti), *Leptadenia reticulata* (Ret.) Wight and Aruott. The findings revealed that azadirachtin 0.15 EC was found most effective incidence (3.19/ cm² leaf) followed by neemastra (3.27 mites/ cm² leaf), neem oil (3.34 mites/ cm² leaf) and neem seed kernal extract (3.42 mites/ cm² leaf). *Beauveria bassiana* 5% WP (5.31 mites/ cm² leaf), ashwagandha 7.5% leaf extract (5.37 mites/ cm² leaf) and *Metarhizium anisopliae* 1.15% (5.53 mites/ cm² leaf) were moderate in their effectiveness. Maximum incidence was noticed from the leaves treated with desi cow urine (5%).

Key words: *Leptadenia reticulata*, dodi, red two spotted spider mite, biopesticides, efficacy, azadirachtin, neemastra, ashwagandha, *Beauveria bassiana*, *Metarhizium anisopliae*, cow urine, neem

Dodi [*Leptadenia reticulata* (Ret.) is a twining shrub, has woody stem with leathery and pointed leaves that belongs Apocynaceae. It grows well in tropical and subtropical region with moderate rainfall and relative humidity. Its distribution has been identified in Gujarat, Punjab, Sikkim, Khasi Hills, Deccan Plateau, Kerala and Karnataka (Godara et al., 2015). Though dodi's origin was not known, the demand was high for its pharmaceutical and nutraceutical properties (Chermahini et al., 2011). Among several farms cultivating dodi, the adarsh herbal farm located in Sabarkantha (Gujarat) produces 25 to 30 MT and the production may raise upto 50 MT in future (Anonymous 2021).The products viz., dry powders and flowers costs Rs. 211/ kg and Rs. 80/kg, respectively (Pal et al., 2012). leptaden tablets (Mangeshikar, 1958) and speman pills (Madaan and Madaan, 1985) are products that have lactogenic and oligospermic effect, respectively. Owing to climatic change, *T. urticae* becomes a notable pest and causes enormous damage to dodi, an important crop in the middle Gujarat region, among other pests that target dodi, such as aphids, leaf bugs, psyllids, etc. Now a days, many acaricides were used in dodi fields which caused the 3R (Resistance, Residue and Resurgence) problem. Therefore, an experiment was carried out to assess the effectiveness of a few biopesticides against *T. urticae* infesting dodi, which decreases the need for chemicals and also controls the adverse effects on the environment and humans.

MATERIALS AND METHODS

To investigate the efficacy of eight bio-pesticides, a trial was conducted on red spider mite infesting dodi, *L. reticulate* (local variety) at Medicinal and Aromatic Plants Research Station, Anand Agricultural University, Anand during the year of 2020. Randomized block design with three replications were followed. Each plot (1.8 x 4.8 m) has 24 dodi plants with the spacing of 60 x 60 cm. Eight bio-pesticides viz., neem seed kernal extract [NSKE (5%)], neem oil (0.3%), ashwagandha [*Withania somnifera* (7.5%)], cow urine [desi (5%)], azadirachtin 0.15 EC, *B. bassiana* 5% Wettable Powder (WP), *M. anisopliae* 1.15% Wettable Powder (WP) and neemastra (100%) were used. The neemastra was prepared by following the standard methodology and used as foliar spray given by Devvrat (2020). The 7.5% ashwagandha leaf extract was prepared with standard protocol provided by Tehri and Gulati (2014) which was used as foliar spray. Neem seed kernel extract, *B. bassiana* 5% WP, *M. anisopliae* 1.15% WP and azadirachtin 0.15 EC were obtained from local markets. The first spray of bio-pesticides was applied when mite population reached the level of 5 mites/cm² leaf and subsequently, second spray was applied at 10 days interval by using high volume sprayer with required dose. The observations on two spotted red spider mites were recorded in five randomly tagged plants per plot and three leaves (top, middle and bottom) were selected from each plant to count the population of mites (nymph

and adult) in 1 cm^2 area of each selected leaf (Storck et al., 2012). The periods were before spray as well as 3, 5, 7 and 10 days after spray and the 10^{th} day observation of first spray was considered as before count for second spray. The data were collected statistically by using the two way analysis of ANOVA and Duncan's Multiple Range Test at 5% (DNMRT) were analyzed by using the SPSS computer program (IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.).

RESULTS AND DISCUSSION

Three days after the first spray the minimum (4.00/ cm^2 leaf) population of mite was noticed in azadirachtin 0.15 EC which was superior over all other treatments. While, the maximum (9.06/cm^2 leaf) population of mite was observed from the leaves treated with desi cow urine (5%) followed by *M. anisopliae* 1.15 per cent WP (6.51 mites/cm^2 leaf). More or less similar trend in efficacy was recorded at five days after treatment. After seven days of first spray, azadirachtin (3.42/cm^2 leaf), neemastra (3.58/cm^2 leaf), neem oil (3.60/cm^2 leaf) and NSKE (3.76/cm^2 leaf) were superior. Azadirachtin (3.69/ cm^2 leaf) succeeded neemastra (3.82/ cm^2 leaf) as the most effective and at par with each other at ten days after the first spray. While, *B. bassiana* 5% WP (6.37/ cm^2 leaf) ashwagandha (6.45/ cm^2 leaf), *M. anisopliae* 1.15% WP (6.61/ cm^2 leaf) and desi cow urine (9.40/ cm^2 leaf) were moderate in effectiveness. Data of the first spray revealed that azadirachtin (3.68/ cm^2 leaf) followed by neemastra (3.78/ cm^2 leaf) were found significantly superior. The leaves treated with desi cow urine recorded maximum incidence (8.83/ cm^2 leaf) (Table 1).

The data of three days after second spray showed that azadirachtin (3.00/ cm^2 leaf) followed by neemastra (3.10/ cm^2 leaf) were effective. Desi cow urine recorded the highest incidence of 7.76 mites/ cm^2 leaf. In five days after second spray, minimum of 2.76 mites/ cm^2 leaf was noticed in azadirachtin followed by neemastra (2.81/ cm^2 leaf) while, maximum (6.95/ cm^2 leaf) was recorded in desi cow urine. At seven days after second spray, azadirachtin, neemastra, neem oil, and NSKE were found effective. Highest (6.65/ cm^2 leaf) incidence was noticed with desi cow urine. Same trend was observed at ten days of second spray. With second spray the minimum of 2.69 mites/ cm^2 leaf was recorded with azadirachtin which was at par with neemastra (2.75/ cm^2 leaf), neem oil (2.78/ cm^2 leaf) and NSKE (2.86/ cm^2 leaf). The maximum (6.89/ cm^2 leaf) was noted on the leaves treated with desi cow urine.

The pooled data reveal that azadirachtin 0.15 EC reduced the incidence of 3.19/cm^2 leaf and found effective and also superior. Umamaheshwari et al. (1999) also reported that neem oil (1%) produced higher mortality (91.40%) in 48 hr. Pavela (2009) stated that 0.5% neem reduced the *T. urticae* at 60-70% in green house grown cucumber. Solangi et al. (2015) reported that two sprays of neem extract can reduce *T. urticae* in okra. 3% neem oil can reduce *T. urticae* at 74% in tomato (Premalatha et al., 2017). In brinjal, the mite was reduced upto 50% because of 0.03% azadirachtin (Anonymous, 2000). Raghavendra et al. (2017) observed that incidence reduced upto 80.58% and 80.72% because of the application of 3% and 5% neem oil in mulberry leaf discs. Ramaraju (2001) reported that 5% neem seed kernel extract reduced the mite infestation to 42.95 to 59.95% in brinjal. At the same time, the leaves treated with *B. bassiana* 5% WP, ashwagandha leaf extract and *M. anisopliae* 1.15% WP show limited efficacy and desi cow urine showed least efficacy Tehri and Gulati (2014) reported that ashwagandha leaf extract (7.5%) reduced the mite incidence in cucumber. Gatarayiha et al. (2011), 2 g *B. bassiana* could reduce mite upto 40.7 to 56.3% in egg plant. Wakgari and Yigezu (2018) revealed that *A. indica* seed extract gave 90.13 - 94.95% mite mortality in spray and dip bioassay. Yucel (2021), reported that *B. bassiana* 5% WP significantly reduces the mite.

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AUTHOR CONTRIBUTION STATEMENT

Prabhahran V carried out the screening of efficacy of bio-pesticides against *Tetranychus urticae*. Syed Mohamed Ibrahim S also helped in the monitoring of field works and data collection. Prithiv raj V conceived of the study and carefully monitored the management work. All authors read and approved the final manuscript.

CONFLICT OF INTEREST

No conflict of interest.

Table 1. Efficacy of biopesticides against *T. urticae* infesting dodi (after first and second spray)

Tr. No.	Treatments	Conc. (%)	No. of mites/ cm² leaf at indicated days after first spray						No. of mites/ cm² leaf at indicated days after second spray				
			Before spray	3	5	7	10	Mean	3	5	7	10	Mean
T_1	NSKE	5.0	3.13 (9.42)	2.17^{def} (4.29)	2.05^{d} (3.81)	2.06^{de} (3.76)	2.14^{de} (4.07)	2.10^{d} (3.98)	1.94^{d} (3.29)	1.82^{cde} (3.04)	1.79^{cd} (2.71)	1.76^{de} (2.61)	1.83^{d} (2.86)
T_2	Neem oil	0.3	3.36 (10.80)	2.15^{ef} (4.17)	2.04^{d} (3.78)	2.02^{e} (3.60)	2.08^{e} (4.04)	2.07^{d} (3.89)	1.93^{d} (3.28)	1.83^{cde} (2.84)	1.75^{cd} (2.59)	1.74^{e} (2.53)	1.81^{d} (2.78)
T_3	Ashwagandha (*Withania somnifera*)	7.5	3.16 (9.58)	2.61^{cde} (6.30)	2.57^{bc} (6.09)	2.45^{cd} (5.52)	2.64^{bcd} (6.45)	2.57^{c} (6.09)	2.42^{c} (5.37)	2.27^{bcd} (4.67)	2.22^{bc} (4.29)	2.18^{c} (4.25)	2.27^{c} (4.64)
T_4	Desi cow urine	5.0	3.23 (9.98)	3.09^{ab} (9.06)	3.07^{ab} (8.94)	2.90^{ab} (7.95)	3.14^{ab} (9.40)	3.05^{b} (8.83)	2.87^{ab} (7.76)	2.73^{ab} (6.95)	2.68^{ab} (6.65)	2.59^{b} (6.22)	2.72^{b} (6.89)
T_5	Azadirachtin 0.15 EC	0.0006	3.26 (10.18)	2.11^{f} (4.00)	2.03^{d} (3.62)	1.98^{e} (3.42)	2.04^{e} (3.69)	2.04^{d} (3.68)	1.84^{d} (3.00)	1.80^{e} (2.76)	1.69^{d} (2.60)	1.71^{e} (2.42)	1.76^{d} (2.69)
T_6	*Beauveria bassiana* WP 5% (1× 10^9 cfu/ g)	0.4	3.17 (9.76)	2.62^{bcd} (6.49)	2.56^{c} (6.06)	2.45^{cd} (5.55)	2.62^{cd} (6.37)	2.56^{c} (6.11)	2.38^{c} (5.18)	2.26^{bcde} (4.63)	2.21^{bc} (4.18)	2.13^{cd} (4.07)	2.24^{c} (4.51)
T_7	*Metarhizium anisopliae* 1.15% WP (1× 10^9 cfu/ g)	0.4	3.19 (9.82)	2.65^{bc} (6.51)	2.58^{bc} (6.25)	2.52^{bc} (5.89)	2.66^{bc} (6.61)	2.60^{c} (6.31)	2.44^{bc} (5.46)	2.29^{bc} (4.75)	2.24^{bc} (4.46)	2.18^{c} (4.33)	2.28^{c} (4.75)
T_8	Neemastra	100	3.28 (10.24)	2.11^{f} (4.07)	2.04^{d} (3.67)	2.01^{e} (3.58)	2.06^{e} (3.82)	2.05^{d} (3.78)	1.88^{d} (3.10)	1.82^{de} (2.81)	1.76^{cd} (2.63)	1.71^{e} (2.47)	1.79^{d} (2.75)
T_9	Control	-	3.45 (11.46)	3.53^{a} (12.00)	3.58^{a} (12.30)	3.28^{a} (10.29)	3.62^{a} (12.62)	3.51^{a} (11.80)	3.28^{a} (10.26)	3.17^{a} (9.56)	3.14^{a} (9.33)	3.12^{a} (9.27)	3.18^{a} (9.60)
S.Em.±			0.21	0.14	0.15	0.12	0.15	0.07	0.13	0.14	0.15	0.12	0.07
CD (p= 0.05)			NS	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
C.V.%			11.04	9.68	10.50	8.36	10.42	9.65	9.75	10.96	11.63	9.43	10.50

Figures in parentheses transformed values of $\sqrt{(X+1)}$ transformed values; Treatment mean with common superscript letter (s) not significant by DNMRT (p= 0.05).

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