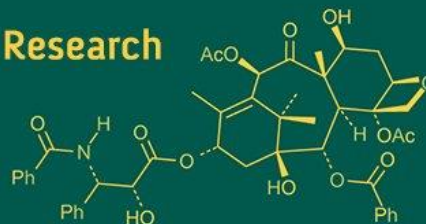
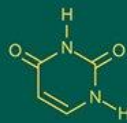
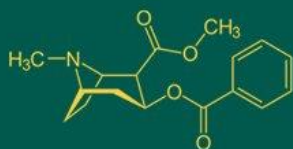


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Evaluate the efficacy of cow urine and botanicals against major sucking insect pest of acid lime

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Abstract

The field experiment was conducted at Barrister Thakur Chhedilal College of Agriculture and Research Station, Horticultural Orchard, Sarkanda, Bilaspur (Chhattisgarh) during *Hast Bahar* (September–February) 2022-23, to know the efficacy of cow urine and botanicals against major sucking insect pest of acid lime. Among the evaluated different doses and combinations of cow urine and botanicals, cow urine 100% + neem oil 2% was found highly effective against blackfly and psylla in acid lime. Cow urine 70% + neem oil 2% was the second best effective. However, cow urine 100%, cow urine 50% + neem oil 2% and cow urine 70% were also found equally effective followed by cow urine 50%, cow urine 30% + neem oil 2% and cow urine 30% found least effective in reducing insect pests population during present investigation.

Keywords: Cow urine, neem oil, acid lime, blackfly, citrus psylla

Introduction

Citrus, a fruit crop belonging to the Rutaceae family, holds significant global importance and is cultivated in tropical and subtropical climates worldwide. The genus *Citrus* includes various popular fruits such as mandarin (*Citrus reticulata*), sweet oranges (*Citrus sinensis*), acid lime (*Citrus aurantifolia*), lemon (*Citrus limon*), grapefruit (*Citrus paradisi*), and pomelos (*Citrus maxima*). Citrus is believed to have originated from South East Asia, particularly India and China, where the tropical and subtropical regions served as its native habitat (Samson, 1986)^[3].

Botanically, the genus *Citrus* L. is an evergreen tree in the family Rutaceae. As a commercial tree, it is composed of a scion (the variety) and the rootstock. These two parts are budded or grafted together, with the goal of combining the best properties of each to make a tree that produces plenty of quality fruit. The genus *Citrus* contains many species and hybrids. (Meagher, 2008.)^[2]

The carotenoid adds color to citrus fruit and its peel. The existence of Vitamin C, pectin, and Phenolic acid in citrus fruits is connected with several health advantages. Ascorbic acid, generally known as vitamin C, works as a strong antioxidant and has the ability to lessen the incidence of certain kinds of cancer, cardiovascular disorders, and arteriosclerosis. (Wang *et al.*, 2007)^[4].

The Khasi mandarin orchards suffer severe damage from major pests like trunk borers (*Anoplophora versteegi*), bark-eating caterpillars (*Inderbela quadrinotata*), citrus butterflies (*Papilio* spp.), leaf miners (*Phyllocnistis citrella*), blackflies (*Aleurocanthus woglumi*), whiteflies (*Dialeurodes citri*), psylla (*Diaphorina citri*), fruit flies (*Dacus dorsalis*), and others. (David & Ananthakrishnan)^[1].

Materials and Methods

The experiment was carried out on Barrister Thakur Chhedilal College of Agriculture and Research Station, Horticultural Orchard, Sarkanda, Bilaspur during *Hast Bahar* season 2022-23 in Randomized Block Design with three replications and ninth treatments. Citrus cultivar already existed, with a spacing of 6 metre between two rows and 6 metre within the rows. Various dose of biopesticide (cow urine+ neem oil) were used as spray for management of sucking insect pest of acid lime.

These biopesticides were applied with the help of knapsack sprayer. Pre and post foliar spray count observations were recorded. The pre foliar spray counts were recorded at one day before spraying of insecticides while post foliar spray observations were recorded at 5th, 10th, 15th days after spraying of insecticides. Total two sprayings were given first when the population cross ETL as well as insect populations are well established and second at 15th days after first spraying.

Results and Discussion

The population of insect pests was homogeneous in all the treatments before spray as treatment difference was non-significant.

1. Efficacy of cow urine and botanics against blackfly

1.1 First spray

The data presented in (Table 1 and Fig.1) on evaluate the efficacy of cow urine and botanics against sucking insect pest of acid lime revealed that the pre-treatments observations were non-significant to each other with incidence ranged from 17.67 to 20.42 blackfly/leaf during *Hast Bahar* 2022-23. After first spray, at 5 days the lowest infestation (13.56 blackfly/leaf.) of Blackfly was recorded in T₈-cow urine + neem oil @ 1000+20 ml/lt of water, followed by T₇ cow urine + neem oil @ 700+20 ml/lt of water (13.87 blackfly/leaf.), T₆-cow urine + neem oil @ 500+20 ml/lt of water (14.01 blackfly/leaf.). T₄-cow urine @ 1000 ml/lt of water (14.75 blackfly/leaf.), T₃-cow urine @ 700 ml/lt of water (15.68 blackfly/leaf), T₅-cow urine + neem oil @ 300+20 ml/lt of water (17.90 blackfly/leaf), T₁-cow urine @ 300 ml/lt of water (18.99 blackfly/leaf). The least effective treatment was T₂-cow urine @ 300 ml/lt of water (19.08 blackfly/leaf) infestation of blackfly but it was significantly superior over untreated control recorded 20.08 blackfly/leaf.

After 10 days of first spray, different dose of cow urine and botanics were significantly superior to untreated control. Among the different treatments, lowest (12.26 blackfly/leaf) were found in T₈-cow urine + neem oil @ 1000+20 ml/lt of water followed by T₇ cow urine + neem oil @ 700+20 ml/lt of water (13.21 blackfly/leaf), T₆-cow urine + neem oil @ 500+20 ml/lt of water (13.30 blackfly/leaf), T₄-cow urine @ 1000 ml/lt of water (13.63 blackfly/leaf), T₃-cow urine @ 700 ml/lt of water (14.23 blackfly/leaf), T₅-cow urine + neem oil @ 300+20 ml/lt of water (16.04 blackfly/leaf), T₁-cow urine @ 300 ml/lt of water (18.75 blackfly/leaf), and the least effective treatment was T₂-cow urine @ 300 ml/lt of water (19.68 blackfly/leaf) which was significantly superior over untreated control with 19.67 blackfly/leaf infestation.

After 15 days of first spray, different dose of cow urine and botanics were significantly superior to untreated control. Among the different treatments, lowest (13.30 blackfly/leaf) blackfly were found in T₈-cow urine + neem oil @ 1000+20 ml/lt of water followed by T₇ cow urine + neem oil @ 700+20 ml/lt of water (13.60 blackfly/leaf), T₄-cow urine @ 1000 ml/lt of water (14.25 blackfly/leaf), T₆-cow urine + neem oil @ 500+20 ml/lt of water (14.35 blackfly/leaf), T₃-cow urine @ 700 ml/lt of water (15.43 blackfly/leaf), T₅-cow urine + neem oil @ 300+20 ml/lt of water (17.30%), T₂-cow urine @ 300 ml/lt of water (18.75 blackfly/leaf) and the least effective treatment was T₁-cow urine @ 300 ml/lt of water (19.28 blackfly/leaf) which was significantly

superior over untreated control with 20.42 blackfly/leaf infestation.

1.2 Second spray

Perusal of data presented (Table 1 and Fig. 2) on the evaluate the efficacy of cow urine and botanics against sucking insect pest of acid lime revealed that after second spray, at 5 days T₈-cow urine + neem oil @ 1000+20 ml/lt of water was most effective with 10.06 blackfly/leaf infestation, followed by T₇ cow urine + neem oil @ 700+20 ml/lt of water (10.19 blackfly/leaf), T₆-cow urine + neem oil @ 500+20 ml/lt of water (10.78 blackfly/leaf), T₃-cow urine @ 700 ml/lt of water (11.49 blackfly/leaf), T₄-cow urine @ 1000 ml/lt of water (11.70 blackfly/leaf), T₅-cow urine + neem oil @ 300+20 ml/lt of water (13.64 blackfly/leaf), T₂-cow urine @ 300 ml/lt of water (15.14 blackfly/leaf) and the least effective treatment was T₁-cow urine @ 300 ml/lt of water (16.30 blackfly/leaf) which was significantly superior over untreated control with 16.60 blackfly/leaf infestation.

After 10 days of first spray, different dose of cow urine and botanics were significantly superior to untreated control. Among the different treatments, lowest (8.97 blackfly/leaf) infestation was found in T₈-cow urine + neem oil @ 1000+20 ml/lt of water which was significantly superior over untreated control with 17.17 blackfly/leaf infestation followed by T₇ cow urine + neem oil @ 700+20 ml/lt of water (9.13 blackfly/leaf), T₆-cow urine + neem oil @ 500+20 ml/lt of water (9.49 blackfly/leaf), T₃-cow urine @ 700 ml/lt of water (10.13 blackfly/leaf), T₄-cow urine @ 1000 ml/lt of water (10.27 blackfly/leaf), T₅-cow urine + neem oil @ 300+20 ml/lt of water (12.45 blackfly/leaf), T₂-cow urine @ 300 ml/lt of water (14.73 blackfly/leaf) and the least effective treatment was T₁-cow urine @ 300 ml/lt of water (15.87 blackfly/leaf) which was significantly superior over untreated control with 17.16 blackfly/leaf infestation.

After 15 days of first spray, different dose of cow urine and botanics were significantly superior to untreated control. Among the different treatments, lowest (9.72 blackfly/leaf) infestation was found in T₈-cow urine + neem oil @ 1000+20 ml/lt of water which was significantly superior over untreated control with 16.25 blackfly/leaf infestation followed by T₆-cow urine + neem oil @ 500+20 ml/lt of water (9.86 blackfly/leaf), T₇ cow urine + neem oil @ 700+20 ml/lt of water (9.97 blackfly/leaf), T₃-cow urine @ 700 ml/lt of water (10.73 blackfly/leaf), T₄-cow urine @ 1000 ml/lt of water (10.86 blackfly/leaf), T₅-cow urine + neem oil @ 300+20 ml/lt of water (13.36 blackfly/leaf), T₂-cow urine @ 300 ml/lt of water (15.24 blackfly/leaf) and the least effective treatment was T₁-cow urine @ 300 ml/lt of water (16.22 blackfly/leaf) which was significantly superior over untreated control with 16.25 blackfly/leaf infestation.

Overall mean of number of blackfly/leaf (average of two spray)

The mean on number of blackfly/leaf recorded after first and second spray presented in Table 1 showed that T₈-cow urine + neem oil @ 1000+20 ml/lt of water and also with T₇ cow urine + neem oil @ 700+20 ml/lt of water recorded the lowest blackfly 11.31 blackfly/leaf and 11.66 blackfly/leaf, respectively. T₆-cow urine + neem oil @ 500+20 ml/lt of water (11.97 blackfly/leaf), T₄-cow urine @ 1000 ml/lt of water (12.58 blackfly/leaf), were found next best treatments. T₃-cow urine @ 700 ml/lt of water (12.95 blackfly/leaf), followed by T₅-cow urine + neem oil @ 300+20 ml/lt of

water (15.12 blackfly/leaf), while T₂-cow urine @ 500 ml/lit of water (17.57 blackfly/leaf) were less effective. of water (17.10 blackfly/leaf) and T₁-cow urine @ 300 ml/lit

Table 1: Efficacy of different dose of cow urine and botanics against citrus blackfly on acid lime at Bilaspur during Hast bahar

S.N	Treatment	Concentration/ formulation	DOSE- ml/lit. of water	Average population of blackfly										Over all mean
				1 st spray					2 nd spray					
				PTO	5 DAT	10 DAT	15 DAT	Mean	PTO	5 DAT	10 DAT	15 DAT	Mean	
1	Cow urine	30%	300	18.00 (4.24)	18.99 (4.36) ^{ab}	18.75 (4.33) ^a	19.28 (4.39) ^a	19.01 (4.36) ^b	18.08 (4.25)	16.31 (4.04) ^a	15.86 (3.98) ^{ab}	16.22 (4.03) ^a	16.13 (4.02) ^a	17.57 (4.19) ^b
2	Cow urine	50%	500	19.25 (4.39)	19.08 (4.37) ^a	19.65 (4.44) ^a	18.75 (4.33) ^a	19.16 (4.38) ^b	17.25 (4.15)	15.14 (3.89) ^{ab}	14.73 (3.83) ^b	15.24 (3.90) ^{ab}	15.04 (3.88) ^b	17.10 (4.13) ^b
3	Cow urine	70%	700	18.50 (4.30)	15.68 (3.96) ^{bcd}	14.23 (3.78) ^{bc}	15.43 (3.92) ^{bc}	15.11 (3.89) ^d	16.92 (4.11)	11.49 (3.38) ^{cd}	10.13 (3.18) ^d	10.73 (3.28) ^c	10.78 (3.28) ^d	12.95 (3.59) ^d
4	Cow urine	100%	1000	20.42 (4.52)	14.76 (3.85) ^{cd}	13.63 (3.69) ^{bc}	14.25 (3.77) ^{bc}	14.21 (3.77) ^e	17.42 (4.17)	11.70 (3.42) ^{cd}	10.27 (3.20) ^d	10.86 (3.30) ^c	10.94 (3.31) ^d	12.58 (3.54) ^d
5	Cow urine +Neem oil	30% + 2%	300+20	18.67 (4.32)	17.90 (4.23) ^{abc}	16.05 (4.00) ^{ab}	17.31 (4.16) ^{ab}	17.09 (4.13) ^c	16.75 (4.09)	13.64 (3.69) ^{bc}	12.45 (3.53) ^c	13.37 (3.65) ^b	13.15 (3.63) ^c	15.12 (3.87) ^c
6	Cow urine +Neem oil	50% + 2%	500+20	18.50 (4.30)	14.01 (3.75) ^d	13.30 (3.65) ^{bc}	14.35 (3.78) ^{bc}	13.89 (3.73) ^e	16.92 (4.11)	10.78 (3.28) ^d	9.49 (3.08) ^d	9.87 (3.14) ^c	10.05 (3.17) ^e	11.97 (3.45) ^e
7	Cow urine +Neem oil	70% + 2%	700+20	18.42 (4.29)	13.87 (3.73) ^d	13.21 (3.64) ^{bc}	13.61 (3.68) ^c	13.56 (3.68) ^{ef}	16.50 (4.06)	10.19 (3.19) ^d	9.12 (3.02) ^d	9.97 (3.16) ^c	9.76 (3.12) ^e	11.66 (3.40) ^{ef}
8	Cow urine +Neem oil	100% + 2%	1000+20	18.17 (4.26)	13.56 (3.69) ^d	12.26 (3.50) ^c	13.30 (3.64) ^c	13.04 (3.61) ^f	17.50 (4.18)	10.07 (3.16) ^d	8.96 (2.99) ^d	9.72 (3.12) ^c	9.59 (3.10) ^e	11.31 (3.35) ^f
9	Control	—		18.92 (4.34)	20.07 (4.45) ^a	19.67 (4.39) ^a	20.42 (4.49) ^a	20.05 (4.48) ^a	17.33 (4.16)	16.61 (4.07) ^a	17.17 (4.14) ^a	16.25 (4.02) ^a	16.67 (4.08) ^a	18.36 (4.28) ^a
10	SEm±			0.80	1.14	1.20	1.12	0.25	0.68	0.78	0.80	0.82	0.22	0.18
11	CD (p=0.05)			NS	3.45	3.64	3.39	0.74	NS	2.38	2.40	2.47	0.65	0.52

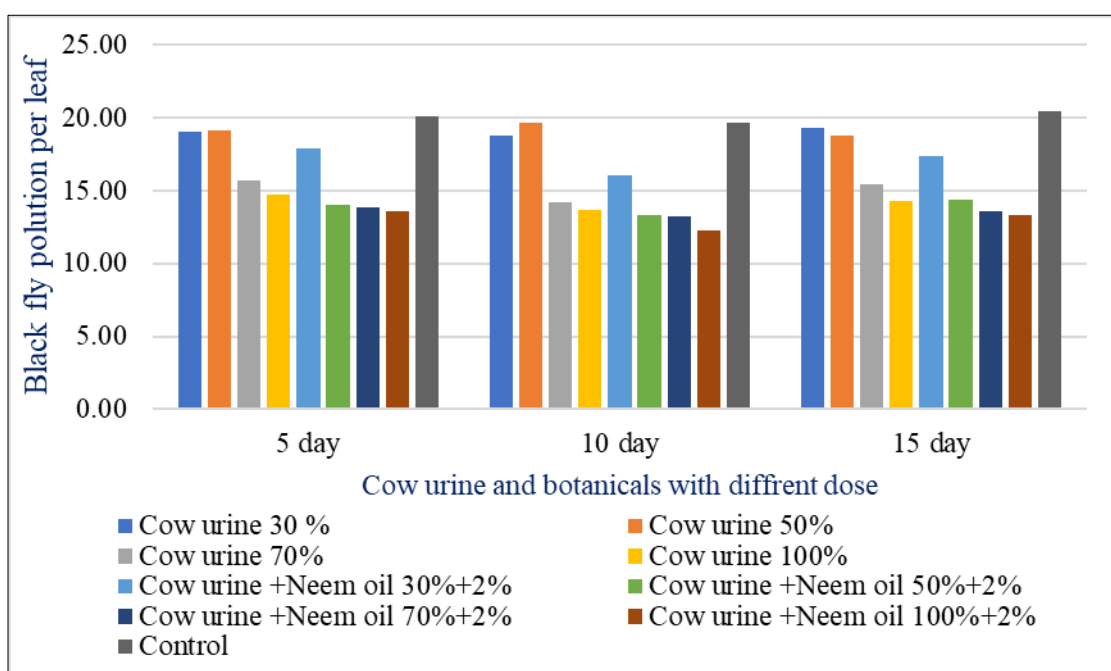


Fig. 1: Population of blackfly/leaf at different days after spray (DAS) during 1st spray of biopesticide

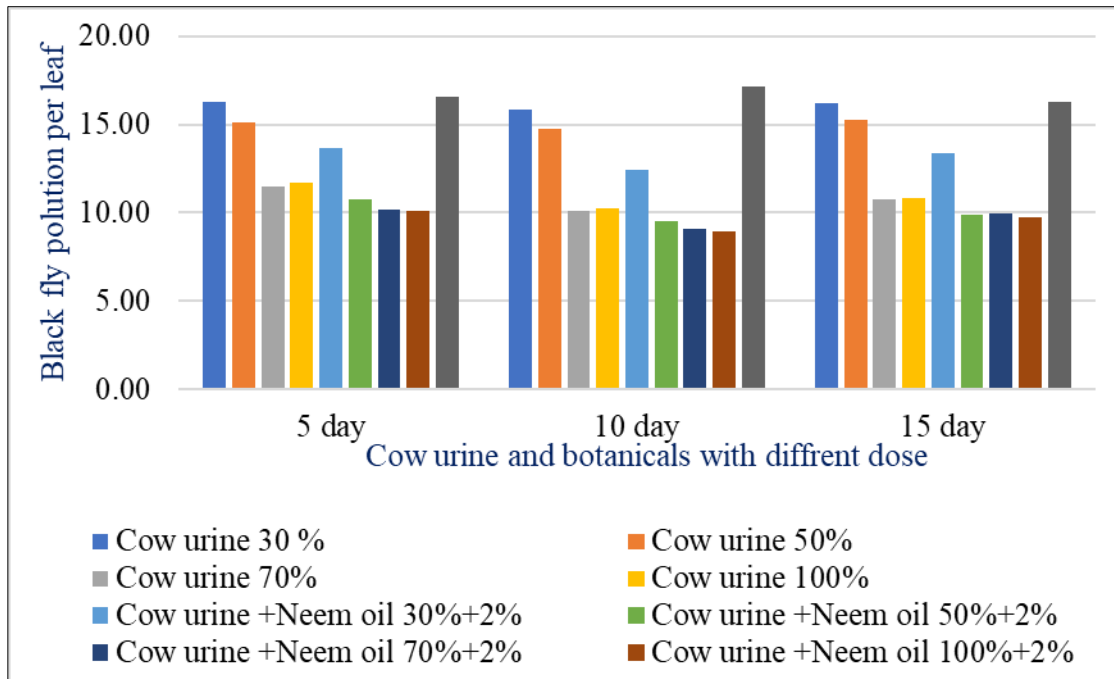


Fig. 2: Population of blackfly/leaf at different days after spray (DAS) during 2nd spray of biopesticide

2. Efficacy of cow urine and botanics against citrus psylla

2.1 First spray

The data presented in Table 2 and Fig.3. All the treatments after on 5 day of first spray were found significantly superior over untreated control, however, differed significantly with each other in their efficacy. the pre-treatments observations were non-significant to each other with incidence ranged from 5.00 to 5.67 psylla population during *Hast Bahar* 2022-23. The maximum reduction in number of nymphs and adult of citrus psylla/10 cm twigs was recorded in the treatment T₈-cow urine + neem oil @ 1000+20 ml/lit of water (2.63 citrus psylla/10 cm twigs), followed by T₇ cow urine + neem oil @ 700+20 ml/lit of water (3.27citrus psylla/10 cm twigs), T₃-cow urine @ 700 ml/lit of water (3.34 citrus psylla/10 cm twigs), T₄-cow urine @ 1000 ml/lit of water (3.69 citrus psylla/10 cm twigs), T₆-cow urine + neem oil @ 500+20 ml/lit of water (4.13 citrus psylla/10 cm twigs), T₂-cow urine @ 300 ml/lit of water (4.58 citrus psylla/10 cm twigs), T₅-cow urine + neem oil @ 300+20 ml/lit of water (4.70 citrus psylla/10 cm twigs), and the least effective treatment was T₁-cow urine @ 300 ml/lit of water (4.80 citrus psylla/10 cm twigs) which was significantly superior over untreated control with 5.63 psylla infestation. After 10 days of first spray, different dose of cow urine and botanicals were significantly superior to untreated control. Among the treatments, lowest (2.41 citrus psylla/10 cm twigs) were found in T₈-cow urine + neem oil @ 1000+20 ml/lit of water, followed by T₇ cow urine + neem oil @ 700+20 ml/lit of water (2.84 citrus psylla/10 cm twigs), T₃-cow urine @ 700 ml/lit of water (3.06 citrus psylla/10 cm twigs), T₄-cow urine @ 1000 ml/lit of water (3.27 citrus psylla/10 cm twigs), T₆-cow urine + neem oil @ 500+20 ml/lit of water (3.62 citrus psylla/10 cm twigs), T₅-cow urine + neem oil @ 300+20 ml/lit of water (3.90 citrus psylla/10 cm twigs), T₁-cow urine @ 300 ml/lit of water (3.37 citrus psylla/10 cm twigs) and the least effective treatment was T₂-cow urine @ 300 ml/lit of water (4.44 citrus psylla/10 cm twigs) which was significantly superior over untreated control with psylla infestation.

After 15 days of first spray, different dose of cow urine and botanicals were significantly superior to untreated control. Among the treatments, lowest (3.26 citrus psylla/10 cm twigs) infestation was found in T₈-cow urine + neem oil @ 1000+20 ml/lit of water (3.26 citrus psylla/10 cm twigs), followed by T₇ cow urine + neem oil @ 700+20 ml/lit of water (3.71 citrus psylla/10 cm twigs), T₃-cow urine @ 700 ml/lit of water (3.92 citrus psylla/10 cm twigs), T₄-cow urine @ 1000 ml/lit of water (4.18 citrus psylla/10 cm twigs), T₁-cow urine @ 300 ml/lit of water (4.20 citrus psylla/10 cm twigs), T₆-cow urine + neem oil @ 500+20 ml/lit of water (3.62 citrus psylla/10 cm twigs), T₅-cow urine + neem oil @ 300+20 ml/lit of water (3.90 citrus psylla/10 cm twigs) and the least effective treatment was T₂-cow urine @ 300 ml/lit of water (4.44 citrus psylla/10 cm twigs) which was significantly superior over untreated control with psylla infestation.

2.2 Second spray.

The data presented in Table 2 and Fig.4. All the treatments after on 5 day of second spray were found significantly superior over untreated control, however, differed significantly with each other in their efficacy. the pre-treatments observations were non-significant to each other with incidence ranged from 5.41 to 6.00 psylla population. The maximum reduction in number of nymphs and adult of citrus psylla/10 cm twigs was recorded in the treatment T₈-cow urine + neem oil @ 1000+20 ml/lit of water (2.27 citrus psylla/10 cm twigs), followed by T₇ cow urine + neem oil @ 700+20 ml/lit of water (3.04 citrus psylla/10 cm twigs), T₄-cow urine @ 1000 ml/lit of water (3.32 citrus psylla/10 cm twigs), T₃-cow urine @ 700 ml/lit of water (3.36 citrus psylla/10 cm twigs), T₆-cow urine + neem oil @ 500+20 ml/lit of water (3.62 citrus psylla/10 cm twigs), T₅-cow urine + neem oil @ 300+20 ml/lit of water (4.47 citrus psylla/10 cm twigs), T₁-cow urine @ 300 ml/lit of water (4.98 citrus psylla/10 cm twigs), and the least effective treatment was T₂-cow urine @ 300 ml/lit of water (5.00 citrus psylla/10 cm twigs) which was significantly superior over untreated control with 5.66 citrus psylla/10 cm twigs infestation.

After 10 days of second spray, different dose of cow urine and botanicals were significantly superior to untreated control. Among the treatments, lowest (2.44 citrus psylla/10 cm twigs) infestation was found in T₈-cow urine + neem oil @ 1000+20 ml/lt of water, followed by T₄-cow urine @ 1000 ml/lt of water (2.65 citrus psylla/10 cm twigs), T₇ cow urine + neem oil @ 700+20 ml/lt of water (2.93 citrus psylla/10 cm twigs), T₆-cow urine + neem oil @ 500+20 ml/lt of water (3.11 citrus psylla/10 cm twigs), T₃-cow urine @ 700 ml/lt of water (3.34 citrus psylla/10 cm twigs), T₅-cow urine + neem oil @ 300+20 ml/lt of water (3.42 citrus psylla/10 cm twigs), T₂-cow urine @ 300 ml/lt of water (3.67 citrus psylla/10 cm twigs) and the least effective treatment was T₁-cow urine @ 300 ml/lt of water (4.13 citrus psylla/10 cm twigs) which was significantly superior over untreated control with psylla infestation.

After 15 days of second spray, different dose of cow urine and botanicals were significantly superior to untreated control. Among the treatments, lowest (2.61 citrus psylla/10 cm twigs) infestation was found in T₈-cow urine + neem oil @ 1000+20 ml/lt of water, followed by T₇ cow urine + neem oil @ 700+20 ml/lt of water (3.04 citrus psylla/10 cm twigs), T₄-cow urine @ 1000 ml/lt of water (3.14 citrus psylla/10 cm twigs), T₃-cow urine @ 700 ml/lt of water (3.28 citrus psylla/10 cm twigs), T₆-cow urine + neem oil @ 500+20 ml/lt of water (3.53 citrus psylla/10 cm twigs), T₂-

cow urine @ 300 ml/lt of water (4.05 citrus psylla/10 cm twigs), T₅-cow urine + neem oil @ 300+20 ml/lt of water (4.17 citrus psylla/10 cm twigs) and the least effective treatment was T₁-cow urine @ 300 ml/lt of water (4.76 citrus psylla/10 cm twigs) which was significantly superior over untreated control with psylla infestation.

Overall mean of number of nymphs and adult of citrus psylla/10 cm twigs (average of two spray)

The mean on number of nymphs and adult of citrus psylla/10 cm twigs recorded after first and second spray presented in Table 4.9 showed that T₈-cow urine + neem oil @ 1000+20 ml/lt of water and also with T₇ cow urine + neem oil @ 700+20 ml/lt of water recorded the lowest citrus psylla, 2.61 citrus psylla/10 cm twigs and 3.14 citrus psylla/10 cm twigs, respectively. T₄-cow urine @ 1000 ml/lt of water (3.37 citrus psylla/10 cm twigs), T₃-cow urine @ 700 ml/lt of water (3.41 citrus psylla/10 cm twigs) were found next best treatments., followed by T₆-cow urine + neem oil @ 500+20 ml/lt of water (3.78 citrus psylla/10 cm twigs), T₅-cow urine + neem oil @ 300+20 ml/lt of water (4.26 citrus psylla/10 cm twigs), while T₂-cow urine @ 300 ml/lt of water (4.49 citrus psylla/10 cm twigs) and T₁-cow urine @ 300 ml/lt of water (4.53 citrus psylla/10 cm twigs) were less effective.

Table.2: Efficacy of different dose of cow urine and botanicals against citrus Psylla on acid lime at Bilaspur during Hast bahar

S. N	Treatment	Concentration/ formulation	DOSE- ml/lit. of water	citrus psylla/10 cm twigs (no.)										Over all mean
				1st spray					2nd spray					
				PTO	5 DAT	10 DAT	15 DAT	Mean	PTO	5 DAT	10 DAT	15 DAT	Mean	
1	Cow urine	30%	300	5.25 (2.29)	4.8 (2.19) ^{ab}	4.28 (2.06) ^b	4.21 (2.05) ^a	4.43 (2.10) ^{bc}	5.42 (2.33)	4.98 (2.23) ^{ab}	4.14 (2.03) ^b	4.76 (2.18) ^{ab}	4.63 (2.15) ^b	4.53 (2.12) ^b
2	Cow urine	50%	500	5.17 (2.27)	4.58 (2.14) ^b	4.44 (2.11) ^b	5.17 (2.27) ^{ab}	4.73 (2.17) ^b	6.00 (2.45)	5.00 (2.22) ^{ab}	3.67 (1.91) ^{bc}	4.06 (2.01) ^{bc}	4.24 (2.06) ^{bc}	4.48 (2.11) ^b
3	Cow urine	70%	700	5.08 (2.25)	3.48 (1.86) ^{cd}	3.06 (1.75) ^e	3.92 (1.98) ^{def}	3.49 (1.87) ^{ef}	5.58 (2.36)	3.37 (1.83) ^{cd}	3.34 (1.82) ^{cd}	3.28 (1.81) ^{de}	3.33 (1.83) ^d	3.41 (1.85) ^d
4	Cow urine	100%	1000	5.25 (2.29)	3.69 (1.92) ^{cd}	3.27 (1.81) ^{de}	4.19 (2.04) ^{cde}	3.27 (1.93) ^{de}	5.42 (2.33)	3.24 (1.79) ^{cd}	2.65 (1.62) ^{ef}	3.14 (1.77) ^{de}	3.01 (1.73) ^d	3.36 (1.83) ^d
5	Cow urine +Neem oil	30% + 2%	300+20	5.00 (2.23)	4.70 (2.16) ^b	3.90 (1.98) ^{bc}	4.89 (2.21) ^{abc}	4.50 (2.12) ^{bc}	5.50 (2.34)	4.47 (2.11) ^b	3.42 (1.85) ^{cd}	4.17 (2.04) ^{bc}	4.02 (2.00) ^c	4.26 (2.06) ^b
6	Cow urine +Neem oil	50% + 2%	500+20	5.50 (2.35)	4.14 (2.03) ^{bc}	3.63 (1.90) ^{cd}	4.60 (2.14) ^{bcd}	4.12 (2.03) ^{cd}	5.50 (2.34)	3.63 (1.90) ^c	3.11 (1.76) ^{cde}	3.53 (1.87) ^{cd}	3.42 (1.85) ^d	3.77 (1.94) ^c
7	Cow urine +Neem oil	70% + 2%	700+20	5.00 (2.23)	3.27 (1.80) ^{de}	2.84 (1.69) ^{ef}	3.71 (1.92) ^{ef}	3.27 (1.81) ^f	5.58 (2.36)	3.04 (1.74) ^d	2.92 (1.71) ^{def}	3.04 (1.74) ^{de}	3.00 (1.73) ^d	3.14 (1.77) ^d
8	Cow urine +Neem oil	100% + 2%	1000+20	5.67 (2.38)	2.63 (1.62) ^e	2.41 (1.55) ^f	3.26 (1.80) ^f	2.77 (1.66) ^g	5.42 (2.33)	2.28 (1.50) ^e	2.44 (1.56) ^f	2.61 (1.61) ^e	2.44 (1.56) ^e	2.61 (1.61) ^e
9	Control	—		5.25 (2.29)	5.63 (2.36) ^a	5.58 (2.35) ^a	5.47 (2.33) ^a	5.56 (2.36) ^a	5.67 (2.38)	5.67 (2.37) ^a	5.83 (2.41) ^a	5.58 (2.35) ^a	5.69 (2.39) ^a	5.63 (2.37) ^a
10	SEm±			0.36	0.29	0.22	0.27	0.15	0.23	0.24	0.25	0.29	0.17	0.13
11	CD (p=0.05)			NS	0.87	0.65	0.81	0.45	NS	0.70	0.76	0.88	0.51	0.36

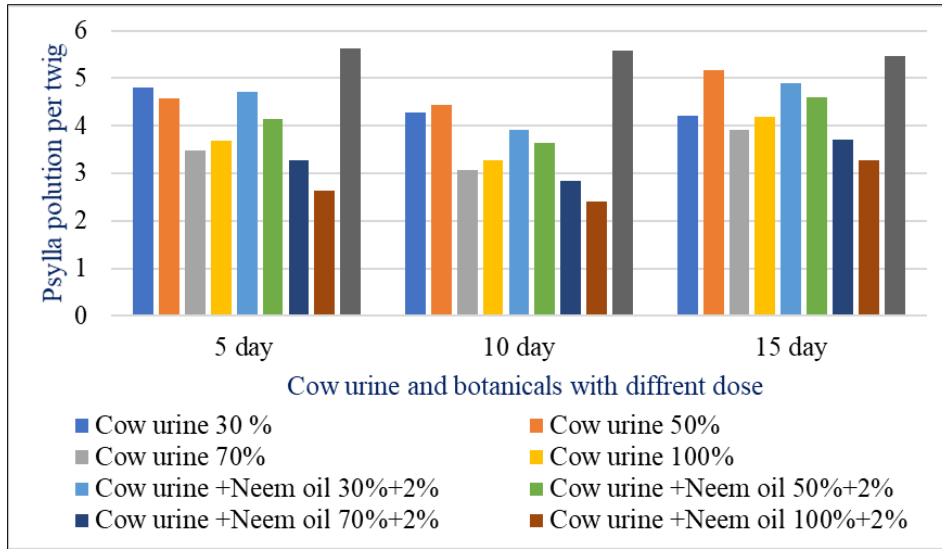


Fig. 3: Population of Psylla/10 twig at different days after spray (DAS) during 1st spray of biopesticide

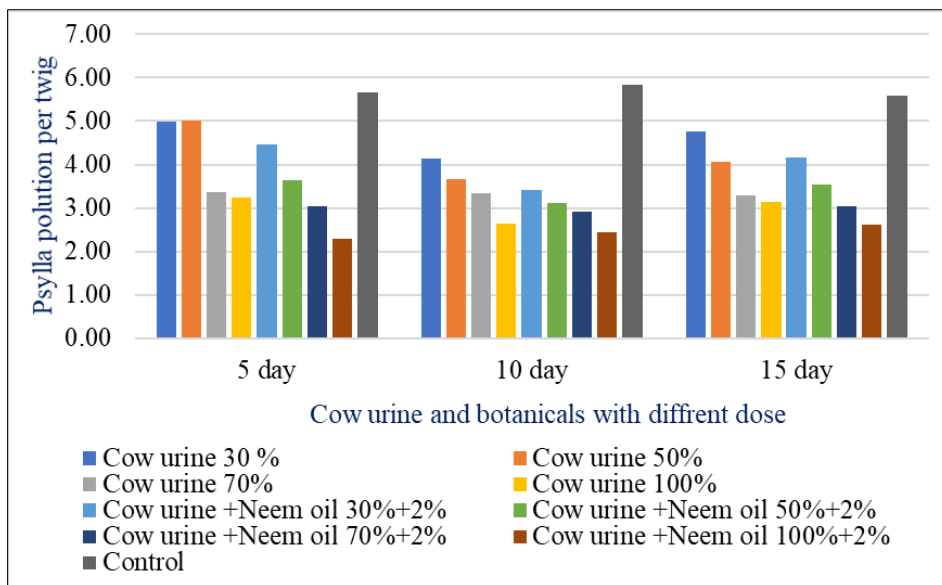


Fig. 4: Population of Psylla/10 twig at different days after spray (DAS) during 1st spray of biopesticide

Conclusion

The mean on number of blackfly/leaf recorded after first and second spray showed that T₈-cow urine + neem oil @ 1000+20 ml/lt of water and also with T₇ cow urine + neem oil @ 700+20 ml/lt of water recorded the lowest blackfly 11.31 blackfly/leaf and 11.66 blackfly/leaf, respectively. T₆-cow urine + neem oil @ 500+20 ml/lt of water (11.97 blackfly/leaf), T₄-cow urine @ 1000 ml/lt of water (12.58 blackfly/leaf), were found next best treatments. T₃-cow urine @ 700 ml/lt of water (12.95 blackfly/leaf), followed by T₅-cow urine + neem oil @ 300+20 ml/lt of water (15.12 blackfly/leaf), while T₂-cow urine @ 300 ml/lt of water (17.10 blackfly/leaf) and T₁-cow urine @ 300 ml/lt of water (17.57 blackfly/leaf) were less effective.

The mean on number of nymphs and adult of citrus psylla/10 cm twigs recorded after first and second spray showed that T₈-cow urine + neem oil @ 1000+20 ml/lt of water and also with T₇ cow urine + neem oil @ 700+20 ml/lt of water recorded the lowest citrus psylla, 2.61 citrus psylla/10 cm twigs and 3.14 citrus psylla/10 cm twigs, respectively. T₄-cow urine @ 1000 ml/lt of water (3.37 citrus psylla/10 cm twigs), T₃-cow urine @ 700 ml/lt of water (3.41 citrus psylla/10 cm twigs) were found next best

treatments., followed by T₆-cow urine + neem oil @ 500+20 ml/lt of water (3.78 citrus psylla/10 cm twigs), T₅-cow urine + neem oil @ 300+20 ml/lt of water (4.26 citrus psylla/10 cm twigs), while T₂-cow urine @ 300 ml/lt of water (4.49 citrus psylla/10 cm twigs) and T₁-cow urine @ 300 ml/lt of water (4.53 citrus psylla/10 cm twigs) were less effective.

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