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ENTOMOLOGY

Evaluation of Plant based Aqueous Extracts against the Major Sucking Pests of Brinjal (*Solanum melongena* L.)

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ABSTRACT

Brinjal holds a distinct place in the domain of vegetables. The production and productivity is extremely lowered by the interference of borers and sap feeders. An experiment was conducted to evaluate the efficacy of different botanicals on the sucking pests of brinjal *viz.*, leaf hoppers (*Amrasca biguttula biguttula* Ishida), whitefly (*Bemisia tabaci* Gennadius), mealy bug (*Phenacoccus solenopsis* Tinsley) and red spider mite (*Tetranychus urticae* Koch) during March - July, 2021. The results on the evaluation of aqueous extracts revealed that the commercial formulation Azadirachtin 0.003 EC was identified as an effective treatment (46.70% -75.84%) against the infestation of sucking pests. Among the aqueous plant extracts, Neem Seed Kernel Extract (NSKE) 5% showed 63.48% reduction of leaf hoppers, 64.48 % of whitefly, 43.72 % of mealy bug, 42.68 % of red spider mite. Next effective results were obtained from Ginger, Garlic and Green chilli (3G) extract with 61.75 % population decline of leaf hopper, 57.86 % of whitefly, 41.35 % of mealy bug and 36.78 % of red spider mite. *Citrullus* extract 5% was found to be a moderately effective treatment with 49.20% mortality of leaf hoppers, 46.87% of whitefly, 39.20 % of mealy bug and 26.27% of red spider mite. The standard insecticide check Thiamethoxam 25 WG was found to be superior in keeping the sucking pests population under check (62.15 % - 81.16 %) than the other aqueous extracts. The hierarchy of effectiveness was in the order of Thiamethoxam 25 WG >Azadirachtin 0.003 EC > Neem Seed Kernel Extract 5% > Ginger, Garlic and Green chilli3G extract 5% > *Citrullus* extract 5% > 3G extract 3% > Panchakavya 5%.

HIGHLIGHTS

- Brinjal holds a significant position in vegetable market since it is widespread in cultivation and rich in nutrition.
- Approximately about 67 per cent yield loss is occurred due to the infestations of sucking pests in brinjal
- Application of aqueous plant extracts can minimise the yield loss and improves the crop growth.

Keywords: Brinjal, botanicals, leaf hopper, whitefly, mealy bug, red spider mite

Vegetables shares an important source of phytoneutraceuticals such as vitamins, minerals, dietary fibres and free radical scavenging antioxidants (Dhandevi *et al*. 2015). Fruits and vegetables have a quite broad range of nutrient content, yet they are still a major source of potassium and dietary fibre. Eggplant (*Solanum melongena* L.) belonging to Solanaceae is one among the top ten vegetables produced in the world. It is highly preferred vegetable around the world as it is cultivated from India to Deccan plateau and hence avail cheaply throughout the year. Asia shares 93.2 % in global eggplant production. India

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is considered as the native to brinjal and is widely domesticated in China, India and Pakistan (Ali *et al*., 2016). Besides its significance in global trade, eggplant is susceptible to number of sucking pests like aphid, jassid and whitefly, mealy bug and red spider mite. The young plants are more vulnerable to jassid attack than the older plants due to intensive sucking of green sap present in the leaves and the tender parts of plants by both nymphs and adults which results in yellowing, malformation, necrosis and complete drying of affected plants. Rosaiah (2001) has reported that due to jassids (*Amrasca bigittula biguttula*), whitefly (*Bemisia tabaci*) and shoot and fruit borer (*Leucinodes orbonalis*) the yield loss incurred was about 70 - 90 per cent. Red spider mite resides in under surface of leaves in large colonies by forming fine webs and affects the plant cells and tissues by piercing and sucking plant sap. As a result of mite incidence in brinjal plants, yield reduction has been observed 26 - 39 per cent in Bangalore and in Gujarat it was about 15.29 - 81.10 per cent (Patel *et al*. 2020). Relaying on insecticides solely alters the usual physical and biological mechanisms of an environment (Rahman *et al*. 2009). Being a vegetable crop, repeated application of pesticides might leave a toxic residues. Hence, it is in need to look for alternative options to minimise the pesticide load on crops and increased concern towards the health and environment (Acharya *et al*. 2017). Utilisation of varied botanicals at different intervals might check the insect pest population from reaching its economic damage. The present study focussed on the evaluation of efficiency of aqueous plant extracts against sucking pests of brinjal under field conditions.

MATERIALS AND METHODS

An experiment was conducted to evaluate the relative efficacy of botanicals at farmer field, Keezhaveliyur, Trichy during March – July 2021. The field experiment was laid out in Randomised Block Design (RBD) with ten treatments and each treatment was triplicated. All the treatments were imposed once after the pests reached its threshold level. The treatment includes plant extracts of two different concentrations along with standard insecticide check Thiamethoxam 25WG and untreated check. In Tamil Nadu, the local variety called Manapparai brinjal was most popular and intensively cultivated among the farmers of Trichy region and marketed to entire country. Brinjal seedlings were transplanted at a spacing of 60 x 60 cm during first fortnight of March. All the recommended packaging and practices of TNAU (Crop Production Guide 2021) were followed excluding plant protection measures.

PREPARATION OF PLANT EXTRACT

1. Neem Seed Kernel Extract

Dried neem seeds were collected from the college campus and the kernels inside were taken by broken the neem seeds and shade dried. Using electrical blender kernels were finely ground. About 50 g of powder was immersed in a known quantity of water for overnight and was filtered using muslin cloth. Finally the filtrate was made into a volume of one litre which is equivalent to the concentration of 5%.

2. Preparation of Ginger, Garlic and Green chilli extract

One kg of ginger, garlic and green chilli each was ground separately using one litre of cow urine per kg of each ingredients. The blended ingredients were mixed with 3 kg of cow urine and left for fermentation. After 15 days the fermented mixture was filtered using muslin cloth and 5 per cent concentration was prepared.

3. Preparation of *Citrullus* fruit extract

The fruits were collected and washed to remove the impurities found on the fruits. The fruits were cut into pieces and left shade dry and ground using electric blender. 50 g of ground powder was weighed and dissolved in 1000 ml of distilled water and kept for 24 h. Then it was filtered through filter paper and filtrate was used.

4. Preparation of Panchakavya

Panchagavya was prepared as by mixing the following ingredients. Cow dung – 0.5 kg, Cow urine – 1.0 L, Cow milk – 1.0 L, Curd 1.0 L, Ghee 1.0 L, and water 1.0 L. These components were mixed thoroughly in a 25.0 L concrete pot and left in the shade for 21 days with intermittent shaking. This 100% concentrated Panchakavya was utilized for field evaluation.

OBSERVATION METHODOLOGY

From each test plot five plants were randomly chosen and tagged for registering the pest observations. From each tagged plants three leaves (one from bottom, one from middle and one from top) were taken and population of nymphs and adults of jassids, whitefly, mealy bug and red spider mite was counted. For recording mite population one square centimeter leaf area was marked and the numbers found within one cm^2 was taken using hand lens. Observations were recorded on one day prior to implying treatments and on 3, 7, 10 and 14 days after spray. Mean population of sucking pests were calculated and per cent reduction over control was worked out by the formula given below:

Pest reduction over control =

$$\frac{\text{Pest population in control plot} - \text{Pest population in treatment}}{\text{Pest population in control plot}} \times 100$$

RESULTS AND DISCUSSION

(A) Leaf hopper

The aqueous plant extracts has shown its effectiveness in keeping the pests below the damage level. The plot sprayed with Neem Seed Kernel Extract (NSKE) 5% recorded maximum reduction of hopper (63.48 %) followed by Ginger, Garlic and Green chilli extract (3G) 5% of 61.75 % which was on par with NSKE 5% (Table 1). Karkar*et al*., 2014 reported that the NSKE 5% was significantly reduced the population of leaf hoppers (2.27 numbers/leaf) than leaf extracts of neem, jatropha, naffatia, custard apple and ailanthus each at 10 per cent concentrations in brinjal plants. Similar results were revealed by Ali *et al*. (2016) that neem leaf extract showed 55.95 % effect against jassids. The results were envinced by Khanzada and Khanzada, 2018 who observed that the maximum reduction in jassid population over control (64.28 %) was noticed in Neem Seed Kernel Extract treated plots, followed by Garlic extract (57.13 %) at vegetative stage of brinjal. The insecticide Thiamethoxam 25 WG registered highest reduction of hopper (80.99%) with mean hopper population of 1.07 numbers/leaf/plant and found superior over all the treatments tested. Azadirachtin 0.03% EC ranked second effective treatment next to Thiamethoxam with 69.54% reduction and the poor reduction in population (37.48%) was obtained in Panchakavya 3%. Ten days after treatment the efficacy got decreased and the mean population was appeared to be increasing trend. Chandrasekaranand Veeravel, 1998 also mentioned that the population of thrips (*Scirtothrips dorsalis* Hood) were reduced in the neem based formulation *viz*., Achook 1.5% treated plot. The results were in tune with Sharma and Lal (2002)

Table 1: The efficacy of aqueous plant extracts against the leaf hopper in brinjal

Sl. No.	Treatment	Leaf hoppers (number/ 3 leaves)*						
		Pre-treatment population	3 DAT	7 DAT	10 DAT	14 DAT	Mean	% reduction over control
T1	3G extract @ 3%	4.55	2.68 (1.78)^{bc}	2.32 (1.67)^{b}	2.08 (1.60)^{bcd}	2.86 (1.83)^{bc}	2.48	56.05
T2	NSKE @ 5%	4.86	2.11 (1.61)^{b}	2.04 (1.59)^{ab}	2.00 (1.58)^{bc}	2.10 (1.61)^{ab}	2.06	63.48
T3	*Citrullus* extract @ 3%	5.16	3.32 (1.95)^{bc}	3.13 (1.90)^{bc}	3.05 (1.88)^{cde}	3.48 (2.02)^{bc}	3.36	40.49
T4	Azadirachtin 0.03% EC (5 ml/L)	4.13	2.02 (1.58)^{b}	1.82 (1.52)^{ab}	1.80 (1.51)^{b}	2.31 (1.67)^{abc}	1.72	69.54
T5	Panchakavya @3%	5.11	3.54 (2.00)^{bc}	3.43 (1.98)^{bc}	3.18 (1.91)^{e}	3.99 (2.11)^{c}	3.53	37.48
T6	3G extract @ 5%	5.49	2.17 (1.63)^{ab}	2.10 (1.61)^{ab}	2.07 (1.60)^{bcd}	2.11 (1.61)^{ab}	2.16	61.75
T7	*Citrullus* extract @ 5%	4.81	3.02 (1.87)^{bc}	2.86 (1.83)^{b}	2.71 (1.79)^{bcde}	2.90 (2.01)^{bc}	2.87	49.20
T8	Panchakavya @ 5 %	5.14	3.02 (1.87)^{bc}	3.01 (1.87)^{bc}	3.10 (1.89)^{de}	3.43 (2.11)^{c}	3.24	42.66
T9	Thiamethoxam 25 WG (0.4 g/L)	5.83	0.83 (1.15)^{a}	0.72 (1.10)^{a}	0.97 (1.21)^{a}	1.78 (1.50)^{a}	1.07	80.99
T10	Control	5.06	4.99 (2.34)^{c}	5.26 (2.4)^{c}	6.05 (2.55)^{f}	6.32 (2.611)^{d}	5.65	
	SEd **	NS	0.23	0.26	0.15	0.22		
	CD (p = 0.05)	NS	0.49	0.55	0.31	0.46		

** Mean of population of whitefly per three leaves; ** Significant at 0.01%; NS - Non-significant; Figures in the parentheses are square root transformed values i.e.√x+0.5.*

recorded that Thiamethoxam 25 % WG reduced the population of leaf hopper by 94.06 % one day after first spray which was remarkable than the rest of pesticides treated. Iqbal *et al*. (2017) was also registered that the *Citrullus*extract exerted 56.18 % and 57.11 % mortality of jassids on 7 DAT in bhendi.

(B) Whitefly

The whitefly population indicated in Table 2 ranged from 5.20 to 6.33 numbers/leaf in pre-treatment observations taken one day before spray. After the spray was given, the mean population reduction was observed significantly in all treatments varied between 0.90 and 5.13 numbers/leaf excluding control plot. The effectiveness of spray was brought down within all the treatments ten days after the spray was given. The insecticide Thiamethoxam 25 WG was found to be superior in population reduction of 81.16 % than rest of the treatments which was followed by Azadirachtin 0.03% EC with 75.84% reduction compared to other aqueous extracts. Chandrasekaran *et al*. (2003) revealed that the Neemazal-F 5% WSC @ 1 ml/L was reduced the sucking pests ranged around 70 - 80 % in bhendi. Kumar *et al*. (2017) documented the minimum population of whitefly (0.33 numbers/leaf) in plot treated with Thiamethoxam 25 WG @ 100g/ha. In aqueous extracts, Neem Seed Kernel Extract (NSKE) 5 percent registered the highest reduction around 64.48 percent, followed by Ginger, Garlic, and Green Chilli extract (3G) 5 percent, which had a reduction rate of 57.86 percent, which was on par with NSKE 5 percent. *Citrullus* 5% extract exhibited moderate whitefly reduction of 46.87%. With 18.10 % reduction, Panchakavya 3 percent achieved the least substantial reduction. The present findings were supported by Bisen *et al.* (2020), that the module composed of Azadirachtin 300 ppm, NSKE 5%, thiamethoxam 25%WG were effectively managed the whitefly population (1.54 and 1.65 numbers/leaf on 3DAT) in okra and it was followed by imidacloprid 17.8 SL @ 100 ml/ha. Mandal *et al.* (2010) also reported that the NSKE 5% could effectively reduce the whitefly numbers in brinjal by 56.25 % over control plots.

(C) Mealy bug

The effectiveness of various treatments tested were presented in Table 3. The standard insecticide check Thiamethoxam 25 WG exerted maximum efficacy among all the treatments by reducing 71.16% population of mealy bug. It was in tune with El-Fakharany (2020), that the Thiamethoxam was effectively control the mealy bug in brinjal plants by 86.69 and 87.75% respectively in two subsequent years. Next to insecticide, Azadirachtin 0.03 EC recorded 46.70 % reduction of mealy bug (Fig. 1). Amdist the aqueous plant extracts, the plots received

Table 2: The efficacy of aqueous plant extracts against whitefly in brinjal

Sl. No.	Treatment	Whitefly (number/ 3 leaves)*						
		Pre -treatment population	3 DAT	7 DAT	10 DAT	14 DAT	Mean	% reduction over control
T1	3G extract @ 3%	5.6	3.31 (1.95)^{d}	3.24 (1.93)^{cde}	3.15 (1.91)^{de}	4.12 (2.14)^{e}	3.45	43.52
T2	NSKE @ 5%	6.06	2.21 (1.64)^{c}	1.77 (1.50)^{b}	1.59 (1.44)^{bc}	3.12 (1.93)^{c}	2.20	64.48
T3	*Citrullus* extract @ 3%	5.20	4.41 (2.21)^{cd}	4.33 (2.19)^{de}	4.20 (2.16)^{ef}	4.61 (2.26)^{f}	4.38	28.27
T4	Azadirachtin 0.03 % EC (5 ml/L)	5.73	1.22 (1.31)^{b}	1.13 (1.27)^{b}	1.06 (1.24)^{b}	2.50 (1.87)^{b}	1.47	75.84
T5	Panchakavya @3%	6.53	5.13 (2.37)^{e}	4.87 (2.31)^{e}	4.66 (2.27)^{f}	5.38 (2.40)^{g}	5.01	18.10
T6	3G extract @ 5%	5.40	2.45 (1.71)^{cd}	2.31 (1.67)^{bc}	2.30 (1.67)^{c}	3.25 (1.90)^{cd}	2.57	57.86
T7	*Citrullus* extract @ 5%	5.86	3.42 (1.97)^{d}	3.13 (1.90)^{c}	3.04 (1.88)^{d}	3.41 (2.26)^{d}	3.25	46.87
T8	Panchakavya @ 5 %	5.13	4.71 (2.28)^{de}	4.13 (2.15)^{d}	4.50 (2.23)^{e}	4.37 (2.20)^{ef}	4.42	27.62
T9	Thiamethoxam 25 WG (0.4 g/L)	6.13	0.90 (1.18)^{a}	0.86 (1.16)^{a}	0.80 (1.14)^{a}	2.05 (1.59)^{a}	1.15	81.16
T10	Control	6.33	5.98 (2.54)^{f}	6.47 (2.64)^{f}	5.73 (2.49)^{g}	6.29 (2.60)^{h}	6.11	
	SEd **	NS	0.16	0.35	0.26	0.24		
	CD (p = 0.05)	NS	0.53	0.74	0.55	0.50		

** Mean of population of whitefly per three leaves; ** Significant at 0.01%; NS - Non-significant;*
Figures in the parentheses are square root transformed values i.e.√x+0.5.

Table 3: The efficacy of aqueous plant extracts against the mealy bugin brinjal

Sl. No.	Treatment	Mealy bug (number/ 3 leaves)*						
		Pre -treatment population	3 DAT	7 DAT	10 DAT	14 DAT	Mean	% reduction over control
T1	3G extract @ 3%	24.43	21.24 (4.66)^{d}	19.11 (4.42)^{bc}	17.00 (4.18)^{bc}	17.29 (4.21)^{e}	18.66	34.01
T2	NSKE @ 5%	25.92	18.23 (4.32)^{b}	16.19 (4.08)^{b}	14.18 (3.83)^{b}	15.06 (3.94)^{c}	15.91	43.72
T3	*Citrullus* extract @ 3%	24.84	21.67 (4.70)^{de}	19.14 (4.43)^{c}	18.03 (4.30)^{bc}	17.86 (4.28)^{ef}	19.17	32.19
T4	Azadirachtin 0.03% EC (5 ml/L)	23.66	17.12 (4.19)^{b}	15.48 (3.99)^{b}	14.94 (3.92)^{b}	15.75 (3.64)^{b}	15.07	46.70
T5	Panchakavya @3%	23.75	22.09 (4.75)e	21.09 (4.64)^{c}	20.15 (4.54)^{d}	20.07 (4.53)^{f}	21.57	23.71
T6	3G extract @ 5%	25.6	20.13 (4.75)^{b}	19.84 (4.61)^{bc}	19.78 (4.50)^{cd}	13.59 (2.02)^{d}	16.58	41.35
T7	*Citrullus* extract @ 5%	24.12	21.25 (4.54)^{c}	18.17 (4.32)^{c}	16.61 (4.13)^{d}	13.86 (3.78)^{de}	17.19	39.20
T8	Panchakavya @ 5 %	26.37	22.18 (4.76)^{cd}	20.79 (4.61)^{bc}	19.11 (4.42)^{cd}	19.10 (4.42)^{e}	20.29	28.23
T9	Thiamethoxam 25 WG (0.4 g/L)	22.18	10.12 (3.55)^{a}	8.79 (3.04)^{a}	7.19 (2.77)^{a}	6.52 (2.64)^{a}	8.15	71.16
T10	Control	27.13	26.74 (5.21)^{f}	30.23 (5.31)^{d}	27.03 (5.24)^{e}	29.12 (5.44)^{g}	28.28	
	SEd **	NS	0.37	0.27	0.27	0.28		
	CD (p = 0.05)	NS	0.78	0.58	0.57	0.59		

** Mean of population of mealy bug per three leaves; ** Significant at 0.01%; NS - Non-significant; Figures in the parentheses are square root transformed values i.e.√x+0.5.*

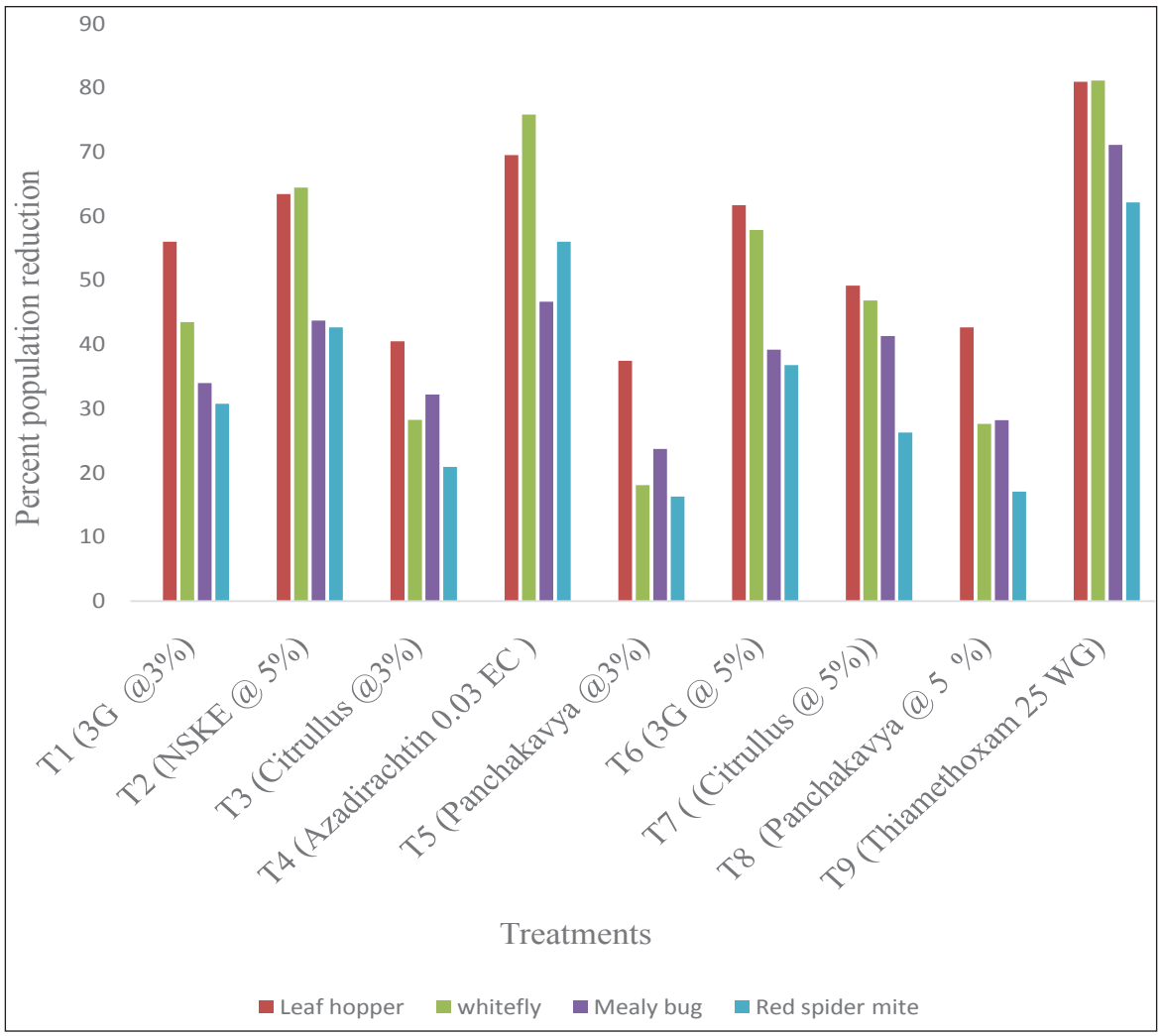

Fig. 1: Effect of different treatments on the population reduction of leaf hopper, whitefly, mealy bug and red spider mite

Table 4: The efficacy of aqueous plant extracts against red spider mite in brinjal

Sl. No.	Treatment	Number of spiders / cm²/leaf						
		Pre treatment population	3 DAT	7 DAT	10 DAT	14 DAT	Mean	% reduction over control
T1	3G extract @ 3%	18.11	16.56 (4.13)^{e}	12.51 (3.60)^{cd}	10.20 (3.27)^{d}	11.03 (3.39)^{cd}	16.71	30.75
T2	NSKE @ 5%	18.41	14.06 (3.81)^{bc}	8.56 (3.00)^{c}	8.17 (2.94)^{b}	13.76 (3.77)^{bc}	13.83	42.68
T3	*Citrullus* extract @ 3%	18.90	18.82 (4.39)^{f}	13.16 (369)^{cd}	12.01 (3.53)^{cd}	12.17 (3.55)^{cde}	19.09	20.90
T4	Azadirachtin 0.03 % EC (5 ml/L)	16.64	11.23 (3.42)^{b}	9.96 (3.23)^{b}	8.85 (3.05)^{b}	8.84 (3.05)^{b}	10.61	56.03
T5	Panchakavya @3%	20.17	20.14 (4.54)^{g}	14.43 (3.86)^{e}	14.31 (3.84)^{cd}	17.09 (4.19)^{e}	20.20	16.32
T6	3G extract @ 5%	18.42	15.21 (3.96)^{c}	9.50 (3.16)^{bc}	8.94 (3.07)^{b}	12.79 (3.64)^{c}	15.26	36.78
T7	*Citrullus* extract @ 5%	19.32	13.87 (3.79)^{cd}	12.07 (3.54)^{d}	10.57 (3.32)^{c}	17.86 (4.28)^{d}	17.79	26.27
T8	Panchakavya @ 5 %	19.93	14.68 (3.89)^{d}	13.65 (3.76)^{de}	13.50 (3.74)^{d}	15.12 (3.05)^{d}	20.01	17.08
T9	Thiamethoxam 25 WG (0.4 g/L)	19.56	6.73 (2.68)^{a}	5.12 (2.37)^{a}	3.12 (2.77)^{a}	5.92 (2.53)^{a}	9.13	62.15
T10	Control	20.25	21.54 (4.69)^{h}	23.53 (4.90)^{f}	27.13 (4.86)^{e}	24.36 (4.98)^{f}	24.14	
	SEd **	NS	0.37	0.18	0.44	0.32		
	CD (p = 0.05)	NS	0.77	0.37	0.92	0.67		

** Mean of population of red spider mite per cm² per three leaves; ** Significant at 0.01%;*
NS - Non-significant; Figures in the parentheses are square root transformed values i.e. √x+0.5.

NSKE 5% showed significant least population of mealy bug (15.91 numbers/leaf) with 43.72% and it was followed by 3G extract 5% (16.58 numbers/leaf) and *Citrullus* extract 5% (17.19 numbers/leaf) showing 41.35 % and 39.20 % reduction respectively. Bharati and Muthukrishnan, 2017 stated that NSKE 5% recorded 78.2 % population reduction of mealy bug after three days and found to be the effective treatment next to fish oil resin soap and neem oil in cotton. Khanzada and Khanzada, 2018 were also supported the present findings who reported that the Neem seed kernel extract 5% was significantly reduced population of mealy bug by 70% followed by Garlic extract (64 %) over the unsprayed plot. Panchakavya 3% was not so effective treatment (21.57 numbers/leaf) in suppressing mealy bug population but found superior over untreated plot.

(D) Red spider mite

It was found that reduction in mite population was significantly noticed in all the treatments compared to untreated plot and remained between 16.32% to 62.15%. Azadirachtin 0.03 EC recorded 56.03 % pest reduction and found to be effective next to Thiamethoxam 25 WG which registered 62.15% (9.13 numbers/cm^2) reduction of mite population. Shejulpatil (2019) confirmed that the mite population was lowered by the application of Azadirachtin 10000 ppm @ 2 ml/L + Thiamethoxam 25 WG @ 0.2 g/L (2.16 mites/leaf) and Thiamethoxam25 WG @ 0.4 g/L (2.59 mites/leaf) .The present finding are in correlation with Varghese and Mathew (2013) who reported that spraying of Thiamethoxam 40 g a.i.ha^{-1} and Imidacloprid 20g a.i.ha^{-1} recorded minimum mite population on chilli. Among the different aqueous plant extracts treated, NSKE 5% showed 42.68% reduction of mite population. It was followed by 3G extract 5% (15.26 numbers/cm^2) and *Citrullus* extract 5% (17.19 numbers/cm^2) exhibiting 36.78% and 26.27% population deduction of mites respectively. According to Naga *et al*., (2017) the botanicals, NSKE imparted 49.01 % mortality on mites followede by Azadirachtin 0.03EC (46.23%), Calotropis extract (35.34%) and least was found in Datura extract (34.61%).The plot treated with Panchakavya 3% was identified as inferior (20.20 numbers/cm^2) in suppressing the incidence of mite by reducing 16.32% of population but superior over control plot recorded 24.14 numbers/cm^2. Similarly, Naga *et al*. (2017) stated that the Dicofol 18.5 EC (0.04%), Thiamethoxam 25 WG (0.01%) were moderately effective treatments by reducing population of 60.53% and 58.85%, respectively, 15 days after application of pesticides in okra.

CONCLUSION

The toxic principle present in plant extracts could help to fall down the pest population and benefits the non-target insects available in an ecosystem. Plants extracts would be avail easily and cost effective

when compared to commercial formulations. The aqueous neem seed kernel extract 5% and 3G extract 5% have exhibited improved reduction of sucking pest damage in brinjal ecosystem. Hence these aqueous extracts found to be a good alternatives in the place of inorganic compounds and suited to incorporate IPM modules. Moreover, neem seed kernel extract and 3G extract are well suited to the farmers,those who are all following the organic cultivation of brinjal.

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