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EFFECT OF PLANT PRODUCTS ON INCIDENCE OF TUKRA ON MULBERRY

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ABSTRACT

Tukra is one of the major problem in mulberry growing areas and it is caused by pink mealy bug *Maconellicoccus hirsutus* which affect both the quality and yield of mulberry leaf. A preliminary attempt has been made to control tukra in mulberry using plant extracts of natural pesticide origin. The seed kernel and leaf extracts of *Azadirachta indica, Pongamia pinnata, Madhuca longifolia* and only leaf extracts of *Lantana camara, Adathoda vasica* were directly used as a foliar spray in the control of tukra in M-5 mulberry variety. Total of four sprays were given with an interval of 7 days. The experimental data on effect of medicinal plant extracts on tukra incidence after seven days of spray revealed non significant results. However, after second spray leaf area of 13.12 and 4.34 per cent free from tukra observed for Neem seed kernel extract @ 4% and *Lantana* leaf extract @ 10% and they are found more and less effective in reducing tukra incidence respectively. After third spray the maximum per cent area free from incidence recorded from Neem seed kernel extract @ 4% (24.04%) and least was recorded from *Lantana* leaf extract @ 10% (5.90%). After fourth spray per cent protection over pre treatment count was recorded maximum as 92.10 per cent with Neem seed kernel extract @ 4 per cent spray followed by *Pongamia* seed kernel extract @ 2 per cent (86.64%) and least reduction was observed with *Lantana* leaf extract @8% (29.91%) respectively. The finding revealed that, the seed kernel extracts exerted better experimental results than their corresponding leaf extracts.

INTRODUCTION

Mulberry is the indispensable food for mulberry silkworm and is known for its luxuriant growth. About 300 insect and non-insect species of pests are known to inflict the damage to mulberry in different parts of the world. Among the pests, sucking pests are considered as major pests causing considerable damage to mulberry in all the growing stages of crop particularly in the apical portion (Reddy and Narayanaswamy, 2003). However, the pink mealy bug *Maconellicoccus hirsutus* Green (Pseudococcidae: Homoptera) is considered as an important cosmopolitan sucking pest and regular in occurrence. During infestation they prefer tender portion of the plant because of succulence. It sucks the sap simultaneously releasing toxins which results in short internodes, curling, wrinkling and crumpling of apical leaves virtually stopping the growth of the plant by suppression of stem elongation affecting the yield of leaves.

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Further the affected region swells and turns into deep green color. Therefore, the symptoms of mealy bug infestation in mulberry collectively called as tukra (Misra, 1919). Besides, reduction in leaf area, yellowing of leaves, premature leaf fall occurs due to impaired function of the petiole due to mealy bug infestation. The tukra affected mulberry plantations recorded three to six tonnes of leaf yield/ha/ year (Kumar *et al*., 1992). Palanidurai (1996) reported that substantial reduction in number of leaves / plant by 13.6 per cent. Further Satyaprasad *et al.* (2000) reported that, mealy bug incidence caused an estimated loss in leaf yield of 4500 Kg/ha/yr amounting to 34.24 per cent (Manjunath *et al*., 2003), thus depriving the farmer from brushing about 450 dfls/ha/yr, leading to decline in cocoon production by 150 Kg/ha/yr (10-15 per cent). The field observations on the pest and the rate of spread of the disease and the extent to which the plants are susceptible in the field were assessed based on fortnightly observations. The study revealed that, the infestation is capable of spreading very rapidly to the tune of initial infestation of 7.70 per cent in the total population of plants arose in 45 days and reached to the extent of 87.40 per cent. In an affected plant, all the growing tips of the branches were

affected. Heavy rains are, however found to wash away the pest and thus give a relief to the plants, which recover completely from the attack (Sriharan *et al*., 1979). Low incidence of tukra during winter crops was noticed due to the poor egg laying ability and hatchability of the mealy bug. While the same was high during summer causing a steep rise in tukra attack. Further, heavy rains during monsoon period wash away the mealy bug and thus drastically lowered the incidence in winter months (Shree and Boraiah, 1988). Rao *et al*. (1993) assess the incidence of tukra in the districts of Malda, Musidabad and Birbhum of West Bengal during four sericultural seasons (commercial). The season and district wise data on the incidence of tukra were evaluated. The highest incidence of tukra was recorded during April-June (Jaistha) and July- September (Bhaduri) where high temperature and humidity were prevalent throughout the districts and significantly low during winter crops *i.e.* October to December (Agrahayani) and January – March (Falgooni). Among the three districts surveyed, significantly higher incidence of tukra was observed in Malda in all the seasons with peak incidence in April to June (58.42%) followed by Birbhum (56.36%) and Murshidabad (35.12%) in July to September growth period. Generally insecticides are not advisable for mulberry ecosystem, because of the residual toxicity and also it directly influences the silkworm rearing. Recently non-chemical avenues like botanicals acted as an efficient alternative for the pesticides in mulberry garden (Sathyaseelan and Bhaskaran, 2010**)** . Hence the efficacy of native botanicals were tested on tukra incidence in mulberry under field conditions.

MATERIALS AND METHODS

This experiment was laid out during post rainy season of 2011-2012 in Randomized Block Design with three replications. Well established M5 variety mulberry garden were selected at UAS, GKVK, Bangalore. All the agronomic practices were followed as per the package of practices for higher yields except the plant protection schedule.

Culturing of pink mealy bug

The pure culture was released on well matured pumpkin which was cleaned using water and treated with 0.1% Bavistin 50 WP. The wounds present on pumpkins were plugged using wax. The culture was maintained throughout the research period without contamination. Chacko *et al.* (1978) and Singh (1978). Inoculation studies were carried out on unaffected plants by transferring 25 crawlers to the growing tips with an interval of 30 days. The symptom developed due to mealy bug was assessed by colonisation and infestation by the coccids after 15 days of release in the infested (Sriharan *et al.,* 1979). Total of four sprays were given with an interval of 7 days.

Preparation of plant extracts and spraying

Plant extract was prepared by homogenizing 10 g of plant material (leaf) in 100 ml of distilled water using pestle and mortar. The homogenate was filtered through three layered muslin cloth. The resulting clear solution is used as foliar spray (8% and 10 %) on M_5 mulberry plants with an interval of 7 days. Further the seed kernel extracts @ 2 and 4% (4 g of seed kernel powder in 100 ml of distilled water) along with one per cent soap solution also sprayed on each plant. The leaf and seed kernel extracts were sprayed (using hand sprayer) for 28 days on mulberry sapling as drenching spray of extracts both on ventral and dorsal surface of leaves. The control batch (sprayed with water) was also maintained within the net. All the mulberry plants were treated (5 ml) with botanical at a time. Care was taken to wash the hand sprayer with water thoroughly well before using another botanical to avoid contamination. In each plant (both sprayed and unsprayed) the total number of infested and healthy leaves was recorded to calculate the per cent tukra incidence by the formulae of Mc Kinney (1923) in the following 5 different grades.

I-Grade 1-10 % -leaf area affected by tukra
II-Grade 11-25 % -leaf area affected by tukra
III-Grade 26-50 % -leaf area affected by tukra
IV-Grade 51-75% -leaf area affected by tukra
V-Grade 76-100% -leaf area affected by tukra

Percent tukra incidence

$$\text{Tukra incidence (\%)} = \frac{\text{Sum of numerical values}}{\text{Total no. of leaves} \times \text{Maximum grading}} \times 100$$

Per cent protection over pretreatment count from incidence

$$= \frac{\text{Incidence in the pretreatment count} - \text{incidence after spray}}{\text{Incidence in the pretreatment count}} \times 100$$

RESULTS AND DISCUSSION

The experimental data on effect of medicinal plant extracts on tukra incidence after seven days of spray revealed non significant results. However there is considerable leaf area free from mealy bug infestation was reported after second spray. However after second spray leaf area of 13.12 and 4.34 per cent free from tukra observed for NSKE @ 4% and LLE @ 10% and they are found more and less effective in reducing tukra incidence respectively. The per cent protection over pre count of tukra incidence was reported maximum from MLE @ 10% (37.80%), followed by PLE @ 8% (36.85%), ALE @ 10% (35.58%), NSKE @ 4% (33.83%), PSKE @ 4% (32.83%) which were found on par with MSKE @ 2% (32.84%), MSKE @ 4% (31.92%), PSKE @ 2% (31.21%), ALE @ 8% (30.85%), PLE @ 10% (30.22%), NSKE @ 2% (28.55%), LLE @ 10% (27.39%), MLE @ 8% (26.68%), NLE @ 8% (25.25%), NLE @ 10% (24.01%), LLE @ 8% (22.24%) and no reduction in tukra incidence was recorded in control (0.00%) and found non significant (Table -2). After third spray the maximium per cent area free from incidence recorded from NSKE @ 4% (24.04%), PSKE @ 2% (20.22%), PSKE @ 4% (20.00%), NSKE @ 2% (19.42%), NLE @ 8% (18.94%), NLE @ 10% (18.67%), ALE @ 8% (16.87%), PLE @ 10% (16.16%), MSKE @ 4% (15.91%), MSKE @ 2% (14.84%), ALE @ 10% (14.38%), PLE @ 8% (13.20%), MLE @ 10% (9.52%), MLE @ 8% (7.99%), LLE @ 8% (7.28%) and LLE @ 10% (5.90%), respectively after third spray and found significant. The per cent protection over pre count of

Table 1. Treatments Details

Tr. No	Treatments
T1: NSKE @ 4%	Neem (*Azadirachta indica*) seed kernel extract @4% + Soap powder @1%
T2: NSKE @ 2%	Neem (*Azadirachta indica*) seed kernel extract @2% + Soap powder @1%
T3: NLE @ 10%	Neem (*Azadirachta indica*) leaf extract @ 10%
T4: NLE @ 8%	Neem (*Azadirachta indica*) leaf extract @8%
T5: PSKE @ 4%	Honge *(Pongamia pinnata)* seed kernel extract @ 4% + Soap powder @1%
T6: PSKE @ 2%	Honge *(Pongamia pinnata)* seed kernel extract @2%+ Soap powder @1%
T7: PLE @ 10%	Honge (*Pongamia pinnata*) leaf extract @ 10%
T8: PLE @ 8%	Honge (*Pongamia pinnata*) leaf extract@ 8%
T9: MSKE @ 4%	Mahua (*Madhuca longifolia*) seed kernal extract @4% + Soap powder @1%
T10: MSKE @ 2%	Mahua (*Madhuca longifolia*) seed kernal extract@2% + Soap powder @1%
T11: MLE @ 10%	Mahua (*Madhuca longifolia*) leaf extract @10%
T12: MLE @ 8%	Mahua (*Madhuca longifolia*) leaf extract@8%
T13: LLE @ 10%	*Lantana (Lantana camara)* leaf extract@ 10%
T14: LLE @ 8%	*Lantana (Lantana camara)* leaf extract @8%
T15: ALE @ 10%	Adusoge (*Adathoda vasica)* leaf extract @10%
T16: ALE @ 8%	Adusoge (*Adathoda vasica)* leaf extract @ 8%
T17	Control

Table 2. Effect of plant extracts on tukra incidence due to *M. hirsutus,* 7 and 14 days after spray

Treatments	Pre treatment count	7 DAS	14 DAS	Area free from incidence	% Protection over pre treatment count
NSKE @ 4%	38.30	38.30	25.18	13.12	33.83
NSKE @ 2%	34.24	34.24	24.87	9.36	28.55
NLE @ 10%	37.62	37.62	30.93	6.68	24.01
NLE @ 8%	34.90	34.90	26.96	7.94	25.25
PSKE @ 4%	34.43	34.43	24.30	10.13	32.83
PSKE @ 2%	35.12	35.12	24.45	10.67	31.21
PLE @ 10%	31.60	31.6	22.99	8.60	30.22
PLE @ 8%	28.32	28.32	21.40	6.91	36.85
MSKE @4%	32.02	32.02	24.59	7.43	31.92
MSKE @2%	32.86	32.86	23.45	9.41	32.84
MLE @10%	29.29	29.29	21.37	7.92	37.80
MLE @ 8%	32.83	32.83	26.97	5.85	26.68
LLE @ 10%	26.16	26.16	21.82	4.34	27.39
LLE @ 8%	27.89	27.89	22.98	4.90	22.24
ALE @10%	26.34	26.34	17.49	8.85	35.58
ALE @ 8%	31.94	31.94	23.79	8.14	30.85
Control	31.59	31.59	31.50	0.00	0.00
F –test	NS	NS	NS	NS	NS
S.Em±	2.94	2.94	2.97	1.57	5.66
CD at 5%	-	-	-	-	-

DAS –Days after spray: NS- Non significant

Table 3. Effect of plant extracts on tukra incidence due to *M. hirsutus,* 21 days after spray

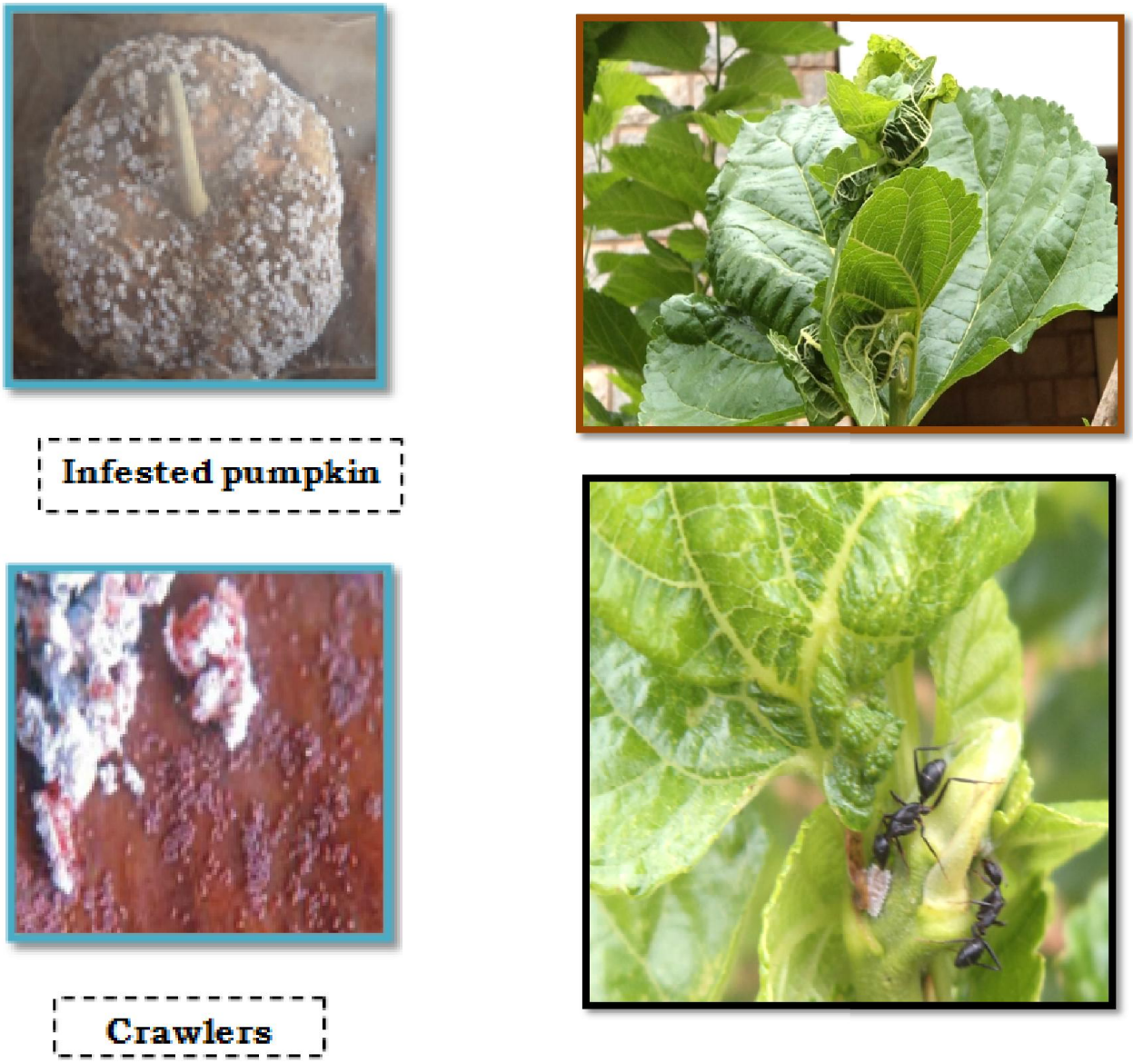
Treatments	Pre treatment count	21 DAS	Area free from incidence	% Protection over pre treatment count
NSKE @ 4%	38.30	14.26	24.04	56.22
NSKE @ 2%	34.24	14.82	19.42	45.93
NLE @ 10%	37.62	18.95	18.67	47.64
NLE @ 8%	34.90	15.96	18.94	51.18
PSKE @ 4%	34.43	14.44	20.00	55.72
PSKE @ 2%	35.12	14.90	20.22	54.08
PLE @ 10%	31.60	15.45	16.16	49.84
PLE @ 8%	28.32	15.12	13.20	49.15
MSKE @ 4%	32.02	16.12	15.91	48.74
MSKE @ 2%	32.86	18.02	14.84	53.26
MLE @ 10%	29.29	19.77	9.52	44.33
MLE @ 8%	32.83	24.83	7.99	39.51
LLE @ 10%	26.16	20.26	5.90	40.80
LLE @ 8%	27.89	20.61	7.28	35.59
ALE @ 10%	26.34	11.97	14.38	52.53
ALE @ 8%	31.94	15.07	16.87	48.43
Control	31.59	36.40	-	-
F- test	NS	*	*	NS
S.Em±	2.94	1.89	1.94	8.84
CD at 5%	-	5.44	5.60	-

DAS- Days after spray
*significant at 5% NS- Non significant

Table 4. Effect of plant extracts on tukra incidence due to *M. hirsutus* 28 days after spray

Treatments	Pre treatment count	28 DAS	Area free from incidence	% Protection over pre treatment count
NSKE @ 4%	38.30	2.97	35.33	92.10
NSKE @ 2%	34.24	4.73	29.51	86.07
NLE @ 10%	37.62	9.55	28.06	74.59
NLE @ 8%	34.90	10.76	24.14	69.23
PSKE @ 4%	34.43	5.33	29.10	84.46
PSKE @ 2%	35.12	4.65	30.46	86.64
PLE @ 10%	31.60	10.58	21.02	66.50
PLE @ 8%	28.32	12.03	16.29	57.40
MSKE @ 4%	32.02	12.38	19.64	61.30
MSKE @ 2%	32.86	15.67	17.20	52.34
MLE @ 10%	29.29	16.55	12.74	43.36
MLE @ 8%	32.83	20.88	11.95	36.45
LLE @ 10%	26.16	16.65	9.51	36.20
LLE @ 8%	27.89	19.51	8.38	29.91
ALE @ 10%	26.34	7.20	19.14	72.60
ALE @ 8%	31.94	10.89	21.05	65.73
Control	31.59	41.27	9.68	-
F- test	NS	*	*	*
S.Em±	2.94	1.37	1.94	0.51
CD at 5%	-	3.95	5.59	1.47

DAS- Days after spray, NS- Non significant, * Significant at 5%.



Tukra symptoms noticed on mulberry under field conditions due to *M. hirsutus*

tukra incidence was maximum in NSKE @ 4% (56.22%) followed by PSKE @ 4% (55.72%), PSKE @ 2% (54.08%), MSKE @ 2% (53.26%), ALE @ 10% (52.53%), NLE @ 8% (51.18%), PLE @ 10% (49.84%), PLE @ 8% (49.15%), MSKE @ 4% (48.74%), ALE @ 8% (48.43%), NLE @ 10% (47.64%), NSKE @ 2% (45.93%), MLE @ 10% (44.33%), LLE @ 10% (40.80%), MLE @ 8% (39.51%) and LLE @ 8% (35.59%) and found significant (Table -3). After fourth spray the NSKE @ 4% reduced the tukra incidence from 38.3 to 2.97 per cent and per cent leaf area free from incidence was 35.33. NSKE @ 2% reduced the tukra incidence from 34.24 to 4.73 per cent and percentage of area free from incidence was 29.51. NLE @ 10% reduced the incidence from 37.62 to 9.55 per cent and percentage of area free from incidence was 28.06. NLE @ 8% reduced the tukra incidence from 34.9 to 10.76 per cent and percentage of area free from incidence is 24.14. PSKE @ 4% reduced the tukra incidence from 34.43 to 5.33 per cent and percentage of area free from incidence was 29.10. PSKE @ 2% reduced the tukra incidence from 35.12 to 4.65 per cent and percentage of area free from incidence was 30.46. PLE @ 10% reduced the incidence from 31.60 to 10.58 per cent and percentage of area free from incidence was 21.02. PLE @ 8% reduced the tukra incidence from 28.32 to 12.03 per cent and percentage of area free from incidence was 16.29. MSKE @ 4% reduced the tukra incidence from 32.02 to 12.38 per cent and percentage of area free from incidence was 19.64. MSKE @ 2% reduced the tukra incidence from 32.86 to 15.67 per cent and percentage of area free from incidence was 17.20.

MLE @ 10% reduced the incidence from 29.29 to 16.55 per cent and percentage of area free from incidence was 12.74. MLE @ 8% reduced the tukra incidence from 32.83 to 20.88 per centand percentage of area free from incidence was 11.95. LLE @ 10% reduced the incidence from 26.16 to 16.65 per cent and percentage of area free from incidence was 9.51. LLE @ 8% reduced the tukra incidence from 27.89 to 19.51 per cent and percentage of area free from incidence was 8.38. ALE @ 10% reduced the incidence from 26.34 to 7.20 per cent and percentage of area free from incidence is 19.14. ALE @ 8% reduced the tukra incidence from 31.94 to 10.89 per cent and percentage of area free from incidence is 21.05. In the check their may be increase in incidence from 31.59 to 41.27 per cent and percentage increase in area from incidence 9.68. Further the per cent protection over pre count of tukra incidence was reported maximum in NSKE @ 4% (92.10%) followed by PSKE @ 2% (86.64%), NSKE @ 2% (86.07 %), PSKE @ 4% (84.46%), NLE @ 10% (74.59%), ALE @ 10% (72.60%), NLE @ 8% (69.23%), PLE @ 10% (66.50%), ALE @ 8% (65.73%), MSKE @ 4% (61.30%), PLE @ 8% (57.40%), MSKE @ 2% (52.34%), MLE @ 10% (43.36%), MLE @ 8% (36.45%), LLE @ 10% (36.20%), and LLE @ 8% (29.91%) and found significant (Table-4).

Raman Suresh Babu *et al.* (1994) also revealed the use of aqueous plant extracts on *Maconellicoccus hirsutus* prepared from *Azadirachta indica, Rhizophora apiculata, Adathoda vasica, Parthenium hysterophorus, Lantana camera* and *Prosophis juliflora* directly used as a foliar spray on six mulberry varieties *viz.,* M_5, S_{13}, MR_2, Kosen, BC2-59 and Tr_4 revealed prevention of spread of *Maconellicoccus hirsutus*. However application of *Azadirhachta indica and Adathoda vasica* sprayed directly on mulberry have controlled the tukra and did not affect nutritional status of mulberry and silkworm rearing parameters. Further, the maximum decrease in incidence was observed with aqueous extracts of *A.indica* (82.37, 24.27, 32.69 and 100%) followed by *Adathoda vasica* (51.45, 51.98, 77.09 and 52.22 %) and *Prosopis juliflora* (42.43, 58.24, 20.45 and 16.21 %) respectively in MR-2, BC-2-59, Tr-4 and Kosen mulberry varieties respectively. The deviation of the tukra incidence obtained from the present study might be due to the difference in concentration, environmental factors and differ in mulberry variety as reported. This decrease in incidence may be due to the presence of biochemical constituents in the botanicals with property of repellency, antifeedent, insecticidal, Sterilant effect, Oviposition deterrent effect, Insect growth regulatory effect, toxic effect etc., and also their availability during the infestation of mealy bug. However, the presence of Azadirachtin and other tetranortriterpenoids were responsible for the repellency of NSKE.

REFERENCES

CHACKO, M.J., BHAT, P.K., ANANDA RAO, L.V., DEEPAK SINGH, M.B., RAMANARAYAN, E.P. AND SREEDHARAN, K., 1978, The use of the lady bird beetle, *Cryptolaemus montrouzieri* for the control of coffee mealy bugs. *J. Coffee Res.,* 8: 14-19.

KUMAR, P., KISHORE, R., NOAMANI, M. K.R. AND SENGUPTA, K., 1992, Effect of feeding tukra affected mulberry leaves on silkworm rearing performance. *Indian J. Seric.,* 31 (1): 27-29.

MANJUNATH, D., SATHYA PRASAD, K. AND SIDDE GOWDA, D. K., 2003, Ecological approaches for the management of mealy bug, *M. hirsutus* attacking mulberry. *National Conference on Tropical Sericulture for Global Competitveness.* Central Sericultural Research and Training Institute, Mysore, p 41.

Mc KINNEY, H.H., 1923, Influence of soil temperature and moisture on infection of wheat seedling by *Helminthosporium sativum*. *J. Agric. Res.,* 26:195-210.

MISRA, C.S., 1919, Tukra disease of mulberry. *Proc. 3rd Ent. Mtg*., Pusa, pp.610-618.

PALANIDURAI, S., 1996, Ecology and management of pink mealybug, *Maconellicoccus hirsutus* (Green) in mulberry. *M.Sc.(Seri) Thesis*, Tamil Nadu Agricultural University, Coimbatore, pp.74.

RAMAN SURESH BABU, DAVI DORCUS AND MUNISAMI VIVEKANADAN, 1994, Changes in morpho-physiology, water relations and nutrients in tukra diseased leaves of a few mulberry varieties.*J. Seric.Sci. Japan,* 63 :183-188.

RAO, G.R., RAGHAVAIAH, G. AND NAGALINGAM, B., 1993, Effect of botanicals on certain behavioural responses and on the growth inhibition of *Spodoptera litura* F. *In Botanical Pesticides in Integrated Pest Management.* Indian Society for Tobacco Science, Rajamundry, pp. 175- 182.

REDDY, D. N. R. AND NARAYANASWAMY, K. C., 2003, *Pests of Mulberry*. Zen Publishers, Bangalore, P. 75.

SATYA PRASAD, K., SUJATHA, C.R., MANJUNATH, D. AND DATTA, R.K., 2000, Screening of popular mulberry varieties for tukra infestation, *National Conference on Stratagies on Sericulture Research and Development,* Central Sericultural Research and Training Institute, Mysore.

SATYASEELAN, V. AND BHASKARAN, V., 2010, Efficacy of some native botanicals extracts on the repellency property against the pink mealy bug, *Maconellicoccus hirsutus* (Green) in mulberry crop. *Recent Research in Science and Technology,* 2(10):35-38.

SHREE, M.P. AND BORAIAH, G.,1988, Incidence of tukra disease and bacterial blight on mulberry plants in germplasm bank. *Curr. Sci.,* 57 : 1224-1228.

SINGH, S.P., 1978, Propagation of a coccinellid beetle for the biological control of citrus and coffee mealy bugs. *Scientific Conf.* CPA, Dec. 1978, pp. 2.

SRIHARAN, T.P., SAMSON, M.V. AND KRISHNASWAMI, S., 1979, Studies on the tukra disease (*Maconellicoccus hirsutus*) of mulberry. *Indian J. Seri.,* 18: 78-80.

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