International Journal of Entomology Research
www.entomologyjournals.com
ISSN: 2455-4758
Received: 24-12-2021, Accepted: 08-01-2022, Published: 24-01-2022
Volume 7, Issue 1, 2022, Page No. 97-100

Anti–insect properties of various oil formulations against major sap feeders in chilli

S Balamurugan[1], S Arivudainambi[2]
[1] Department of Entomology, Faculty of Agriculture, Annamalai University, Annamalai nagar, Tamil Nadu, India
[2] Professor and Head, Department of Entomology, Faculty of Agriculture, Annamalai University, Annamalai Nagar, Tamil Nadu, India

Abstract
Chilli is one of the important vegetable and spice crop in all over the world. Most of the sap feeders in chilli are persistent and cause more crop loss than borers and leaf feeders. Aphids known to cause 20-30% yield loss but depending upon the degree of attack, the yield reduction may go up to 63% in chilli. Yellow mite nymphs and adults desap in large numbers from the undersurface of leaves and turn rough and brittle called murda disease. Multimode of action is the speciality of phyto-insecticides. The bioassay studies were investigated the anti – insect properties of various oil formulations against aphids and mites under in-vitro conditions. The botanicals Soap flake formulation of Neem oil, Soap flake formulation of Pungam oil, Mahua oil were tested against aphids and mites with three various concentrations of 1%, 3% and 5%. The observations were made on the mortality of aphids and mites at 6h, 24h and 48h respectively. Two different types of bioassay *viz.*, onplant and poison food bioassay were conducted. Results revealed that the Mahua oil 5% showed with high mortality in both type of bioassays.

Keywords: Chilli, soap flakes of neem oil, soap flakes of pungam oil, mahua oil, aphids and mites

Introduction
Chilli is one of the important vegetable and spice crop in all over the world. India is contributing for about 38% in world chilli production (Geetha and Selvarani, 2017) [4]. Most of the sap feeders in chilli are persistent and cause more crop loss than borers and leaf feeders (Ikisan, 2021). Aphids known to cause 20-30% yield loss but depending upon the degree of attack, the yield reduction may go up to 63% in chilli. Infested plants turn pale with sticky appearance. It transmits cucumber mosaic virus on peppers (Kannan *et al.*, 2016) [6]. Yellow mite damage is usually severe in summer, which coincides with flowering season. Nymphs and adults desap in large numbers from the undersurface of leaves and make petioles of the lower leaves extremely elongated with narrow lamina and it turns rough and brittle called murda disease. Nowadays aphids and mites developments in chilli are more and farmers repeatedly going for many spray of chemical pesticides. Most of the synthetic chemicals are persistent, highly toxic, resurgence inducing and harmful to natural enemies, pollinators and birds. (Cork *et al.*, 2003).There is a great demand at the global level for phyto-insecticides, which is considered as a viable alternative to synthetic chemicals. Multimode of action is the speciality of phyto-insecticides (Dua *et al.*, 2009) [2]. The bioassay studies were investigated the anti – insect properties of various oil formulations against aphids and mites under in-vitro conditions.

Materials and methods
The studies entitled as "Anti – insect properties of variuos oil formulations against major sap feeders" was carried out on 2021 in Phyto-Insecticides Research Laboratory Department of Entomology, Annamalai University, Chidambaram, Tamil Nadu, India.

Culturing of test insects, fifteen days old seedlings of chilli pepper (Var. Co-1) raised in the nursery were planted in poly cups, of 200 ml capacity containing the mixture of red soil, sand and compost at the ratio of 1:2:1 @ one seedling per cup and watered daily. After one week, the plants raised in poly cups were kept in nylon mesh netted insect cages (45 × 45 × 45 cm) and infested with aphids that collected from chilli field in and around Annamalainagar. Fresh seedlings were introduced into the nylon mesh netted insect cages whenever the old seedlings started withering. The aphids migrated to new seedlings on their own and established within a day. Then the old withered seedlings removed from the cage. Thus a continuous culture of aphids was maintained under 27±2ºC temperature and 70±5%RH with a 12:12 (L:D) photoperiod in the screen house and used in laboratory bioassays. The procedure described above was followed for mites culturing also.

The following three botanicals were selected for the study based on the discussion with organic farmers group at Sirkazhi. Soap flake formulation of Neem oil (*Azadirachta indica)*, Soap flake formulation of Pungam oil (*Pungamia glabra*), Mahua oil (*Madhuca longifolia*). Soap flake formulations of Neem and Pungam oils were obtained from Centre for Indian knowledge system (CIKS) at Sirkazhi. Oil of Mahua bought from the essential oil shop at Chennai. Soap flakes of neem and pungam oils were crushed into small bits, weighed and dissolved in water to obtain 1, 3, 5% concentrations. Mahua oil was measured using graduated measuring cylinder and mixed with required quantity of water and wetting agent (0.1 ml of Ultravet per 100 ml water) to get desired concentrations.

Bio-efficacy test of On plant bioassay fifteen days old, chilli pepper seedlings (var. Co 1) raised in the poly cups were used for the bioassay. Plants raised in the cups thinned out

and one seedling at the centre was retained per cup. Paper disc was placed under each plant. Then twenty numbers of second stage nymphs of respective insects were identified with the help of hand lens and released onto the leaves using camel hairbrush (No.1) and then wrapped with mylar film. After 1h, the plants were sprayed with desired concentration of the respective botanical. Approximately 1 ml of the spray solution was directed per plant using atomizer. After treatment, the open end of the mylar cage was secured with gada cloth. Observations were made on the mortality of test insects at 6, 24 and 48h after treatment. Hand lens of 10X used to count the dead insects that fell on the paper disc kept under seedling. The percent mortality was worked out. Bio-efficacy test of poison food bioassay the procedure described above was followed but the test insects released after spraying the respective concentration of respective botanical. Statistical analysis of data recorded in the experiments subjected to analysis of variance (ANOVA) under randomized block design by adopting the procedures described by Gomez and Gomez (1984). Necessary data transformation made before analysis and the computer based IRRISAT package used for the calculation.

Result and Discussion

At On plant application of 6h, the percent mortality of aphids recorded in T_9 – mahua oil @ 5% was 24.00 and T_3-neem oil soap flakes @ 5% showed 22.67% mortality of aphids. At 24h, the percent mortality of aphids in T_9 – mahua oil @ 5% and T_8 – mahua oil @ 3% were 68.00 and 66.67% respectively. T_8 and T_9 are statistically on par. At 48h, T_9 – mahua oil @ 5% showed 80.00% mortality and T_6 – pungam oil soap flakes @ 5% showed 76.00% mortality. In control, 4% mortality was observed. The percent mortality over control after 48h was 79.17 in T_9-mahua oil @ 5%. T_6 – pungam oil soap flakes @ 5% showed 75.00% mortality over control (Table 1). At poison food bioassay of 6h, T_9 – mahua oil @ 5% showed 24.00%. T_6 – pungam oil soap flakes @ 5% showed 22.67% mortality. The percent mortality of aphids after 24h of exposure in T_9 – mahua oil @ 5% and T_6 – pungam oil soap flakes @ 5% were 57.33. T_6 and T_9 are statistically on par. This was followed by T_3 – neem oil soap flakes @ 5% that showed 42.67% mortality of aphids. T_9 – mahua oil @ 5% showed 74.67% mortality of aphids after 48h of exposure. T_6 – pungam oil soap flakes @ 5% showed 65.33% mortality. In control, 8.00% mortality observed. The percent mortality over control after 48h in T_9 – mahua oil @ 5% was 72. 47. T_6 – pungam oil soap flakes @ 5% showed 62.32% mortality (Table 2). The result revealed that mahua oil @ 5% had greater effect under on plant application assay against aphids which recorded around 80% mortality over control. Both the doses (3 & 5%) of mahua oil performed better. The same trend was exhibited in poison food bioassay. *Pongamia glabra* oil was reported to possess a negative influence on the offspring of *M. persicae* (Stepanycheva *et al*., 2014) [10] and this supports our findings. Extracts of various plants were shown effective by the authors *viz*., Chandrashekharaih and Sannaveerappanavar (2013), Yankova *et al.* (2014) [10], Sohail *et al*. (2012), Milenkovic *et al.* (2013), Razmjou *et al*. (2016) [8] and Ebadollahi *et al.* (2017) [3] against aphids in earlier studies and this supports our idea.

At on plant application of 6h, T_9 – mahua oil @ 5% showed 21.33% mortality of mites and followed by T_6 – pungam oil soap flakes @ 5showed 20.00% mortality. At 24h exposure, T_9 – mahua oil @ 5% showed 41.33% mortality and T_6 – pungam oil soap flakes @ 5% showed 40.00% mortality. T_6 and T_9 are statistically on par At 48h, T_9 – mahua oil @ 5% showed 72.00% mortality. This was followed by T_6-pungam oil soap flakes @ 5%, which showed 62.67% mortality The percent mortality over control after 48h in T_9 - mahua oil @ 5% was 71.23 (Table 3). At poison food bioassay data observed after 6h, T_9 – mahua oil @ 5% and T_6 – pungam oil soap flakes @ 5% showed 22.67% mortality of mites. This was followed by T_3 - neem oil soap flakes @ 5%, which showed 21.33% mortality. T_3, T_6 andT_9 are statistically on par. At 24h, T_9 – mahua oil @ 5% and T_6 – pungam oil soap flakes @ 5% showed 48.00% mortality of mites. After 48h of exposure, T_9 – mahua oil @ 5% caused 62.67% mortality of mites. This was followed by T_3 – neem oil soap flakes @ 5% showed 58.67% mortality. The percent mortality over control after 48h of exposure T_9 – mahua oil @ 5% recorded 61.12% mortality (Table 4). High dose of mahua oil found to be superior and was followed by pongam oil soap flakes at higher dose. Though the research findings published by Dimetry *et al*. (2012), Rahman *et al*. (2016) and Devi *et al.* (2017) clearly shown the higher efficacy of neem products against mites, our results failed to have affirmation with their findings.

Conclusion

Based on the overall efficacy, mahua oil @ 5% concentration showed better effect on both the type of bioassays. The present findings showed that mahua oil @ 5% can be developed as commercial formulations for the management of aphids and mites.

Table 1: Insecticidal efficacy of plant oils against aphids (On plant application)

Treatment No.	Treatment	*Cumulative Per cent mortality after			Percent mortality over control
		6h	24h	48h	
1	Neem oil soap flakes 1%	9.33 (17.71)^{b}	33.33 (35.23)^{f}	48.00 (43.85)^{e}	45.83
2	Neem oil soap flakes 3%	12.00 (20.09)^{b}	41.33 (40.01)^{de}	50.67 (45.39)^{de}	48.62
3	Neem oil soap flakes 5%	22.67 (28.41)^{a}	58.67 (50.02)^{bc}	69.33 (56.39)^{bc}	68.05
4	Pungam oil soap flakes 1%	8.00 (16.08)^{b}	38.67 (38.45)^{ef}	46.67 (43.08)^{e}	44.45
5	Pungam oil soap flakes 3%	12.00 (20.09)^{b}	45.33 (42.32)^{d}	60.00 (50.78)^{cd}	58.33
6	Pungam oil soap flakes 5%	21.33 (27.49)^{a}	64.00 (53.15)^{ab}	76.00 (60.72)^{ab}	75.00
7	Mahua oil 1%	5.33 (13.17)^{c}	54.67 (47.69)^{c}	56.00 (48.46)^{de}	54.17
8	Mahua oil 3%	9.33 (17.71)^{b}	66.67 (54.75)^{a}	72.00 (58.09)^{ab}	70.83
9	Mahua oil 5%	24.00 (29.34)^{a}	68.00 (55.58)^{a}	80.00 (63.51)^{a}	79.17
10	Control	0.00 (0.57)^{d}	0.00 (0.57)^{g}	4.00 (9.51)^{f}	-
	Sed	2.12	1.81	2.99	-
	CD (0.05%)	4.46	3.80	6.28	-

*Mean of three replications Values in parentheses are arc sine transformed In the column, means followed by a common alphabet are not significantly different at 5% level by DMRT

Table 2: Insecticidal efficacy of plant oils against aphids (Poison food bioassay)

Treatment no.	Treatment	*Cumulative Per cent mortality after			Percent mortality over control
		6h	24h	48h	
1	Neem oil soap flakes 1%	6.67 (14.80)^{bc}	29.33 (32.78)^{e}	49.33 (44.62)^{e}	44.92
2	Neem oil soap flakes 3%	10.67 (18.99)^{b}	36.00 (36.85)^{cd}	57.33 (49.23)^{cd}	53.62
3	Neem oil soap flakes 5%	20.00 (26.49)^{a}	42.67 (40.76)^{b}	61.33 (51.56)^{bc}	57.97
4	Pungam oil soap flakes 1%	9.33 (17.71)^{b}	33.33 (35.23)^{d}	40.00 (39.22)^{f}	34.78
5	Pungam oil soap flakes 3%	18.67 (25.57)^{a}	41.33 (40.01)^{bc}	49.33 (44.62)^{e}	44.92
6	Pungam oil soap flakes 5%	22.67 (28.41)^{a}	57.33 (49.22)^{a}	65.33 (53.96)^{b}	62.32
7	Mahua oil 1%	6.67 (14.80)^{bc}	37.33 (37.64)^{bc}	50.67 (45.38)^{de}	46.38
8	Mahua oil 3%	20.00 (26.49)^{a}	41.33 (40.01)^{bc}	56.00 (48.46)^{cde}	52.17
9	Mahua oil 5%	24.00 (29.28)^{a}	57.33 (49.22)^{a}	74.67 (59.89)^{a}	72.47
10	Control	0.00 (0.57)^{d}	0.00 (0.57)^{f}	8.00 (16.43)^{g}	-
	SEd	2.14	1.52	1.97	-
	CD (0.05%)	4.50	3.20	4.14	-

*Mean of three replications Values in parentheses are arc sine transformed In the column, means followed by a common alphabet are not significantly different at 5% level by DMRT

Table 3: Insecticidal efficacy of plant oils against mites (On plant application)

Treatment No.	Treatment	*Cumulative Per cent mortality after			Percent mortality over control
		6h	24h	48h	
1	Neem oil soap flakes 1%	5.33 (13.17)^{d}	25.33 (30.21)^{cd}	40.00 (39.22)^{e}	38.35
2	Neem oil soap flakes 3%	10.67 (18.99)^{c}	34.67 (36.06)^{b}	46.67 (43.09)^{de}	45.21
3	Neem oil soap flakes 5%	17.33 (24.58)^{ab}	38.67 (38.45)^{ab}	56.00 (48.46)^{bc}	54.79
4	Pungam oil soap flakes 1%	5.33 (13.17)^{d}	22.67 (28.41)^{d}	48.00 (43.85)^{d}	46.57
5	Pungam oil soap flakes 3%	10.67 (18.99)^{c}	34.67 (36.06)^{b}	57.33 (49.22)^{bc}	56.16
6	Pungam oil soap flakes 5%	20.00 (26.49)^{a}	40.00 (39.22)^{a}	62.67 (52.34)^{b}	61.65
7	Mahua oil 1%	6.67 (14.80)^{d}	29.33 (32.78)^{c}	50.67 (45.39)^{cd}	49.32
8	Mahua oil 3%	14.67 (22.48)^{bc}	37.33 (37.66)^{ab}	61.33 (51.56)^{b}	60.27
9	Mahua oil 5%	21.33 (27.49)^{a}	41.33 (40.01)^{a}	72.00 (58.09)^{a}	71.23
10	Control	0.00 (0.57)^{e}	0.00 (0.57)^{e}	2.67 (7.88)^{f}	-
	Sed	1.91	1.25	2.07	-
	CD(0.05%)	4.01	2.63	4.35	-

*Mean of three replications Values in parentheses are arc sine transformed In the column, means followed by a common alphabet are not significantly different at 5% level by DMRT

Table 4: Insecticidal efficacy of plant oils against mites (Poison food bioassay)

Treatment No.	Treatment	*Cumulative Per cent mortality after			Percent mortality over control
		6h	24h	48h	
1	Neem oil soap flakes 1%	6.67 (14.80)^{c}	28.00 (31.91)^{d}	38.67 (38.45)^{ef}	36.12
2	Neem oil soap flakes 3%	12.00 (20.09)^{b}	37.33 (37.66)^{bc}	49.33 (44.62)^{bcd}	47.22
3	Neem oil soap flakes 5%	21.33 (27.49)^{a}	42.67 (40.78)^{ab}	58.67 (49.99)^{ab}	56.95
4	Pungam oil soap flakes 1%	5.33 (13.17)^{c}	30.67 (33.62)^{cd}	37.33 (37.66)^{f}	34.72
5	Pungam oil soap flakes 3%	12.00 (20.09)^{b}	37.33 (37.66)^{bc}	44.00 (41.55)^{def}	41.67
6	Pungam oil soap flakes 5%	22.67 (28.41)^{a}	48.00 (43.85)^{a}	57.33 (49.23)^{abc}	55.55
7	Mahua oil 1%	5.33 (13.17)^{c}	33.33 (35.26)^{cd}	42.67 (40.78)^{def}	40.28
8	Mahua oil 3%	16.00 (23.47)^{ab}	41.33 (40.01)^{ab}	48.00 (43.85)^{cde}	45.83
9	Mahua oil 5%	22.67 (28.41)^{a}	48.00 (43.85)^{a}	62.67 (52.34)^{a}	61.12
10	Control	0.00 (0.57)^{d}	1.33 (4.23)^{e}	4.00 (9.51)^{g}	-
	SEd	2.36	2.16	2.77	-
	CD (0.05%)	4.95	4.54	5.82	-

*Mean of three replications Values in parentheses are arc sine transformed In the column, means followed by a common alphabet are not significantly different at 5% level by DMRT

References

1. Devi M, Niranjana RF, Umapathy G. Seasonal incidence of different *Aceria* sp. correlated with weather parameters. J. Entomol. Zoo. studies,2017:5(3):39-43.
2. Dua VK, Pandey AC, Raghavendhra K, Gupta A, Sharma T, Dash AP. Larvicidal activity of neem oil (*Azadirachta indica*) formulation against mosquitoes. Malarial Journal,2009:8:124-124.
3. Ebadollahi A, Davari M, Razmjou J, Naseri B. Separate and Combined Effects of *Mentha piperata* and *Mentha pulegium* Essential Oils and a Pathogenic Fungus *Lecanicillium muscarium* Against *Aphis gossypii* (Hemiptera: Aphididae). J. econ. entomol.,2017:110(3):1025-1030.
4. Geetha R, Selvarani K. Study of chilli production and Export from India. International journal of advance and innovative ideas in education,2017:3(2):205-210.
5. Ikisan. Insect management, 2021. http: //www.ikisan.com /ka - chilli – insect –

management.html. (Retrived on June 15, 2021).
6. Kannan R, Kathirvelu C, Veeravel R. Crop pest management. Manibharathi achagam, Chidambaram, Tamilnadu, India, 2016, 54.
7. Rahman A, Islam KS, Jahan M, Islam N. Efficacy of three botanicals and a microbial derivatives acaricide (Abamectin) on the control of jute yellow mite, *Polyphagotarsonemus latus* (Bank). J. Bangladesh Agri.Univ.,2016:14(1):1-6.
8. Razmjou J, Davari M, Ebadollahi A. Effect of Two Plant Essential Oils and the Entomopathogenic Fungus, *Lecanicillium muscarium* on the Cotton Aphid, *Aphis gossypii* Glover. Egyptian J. Bio. Pest Cont.,2016:26(4):1-2.
9. Stepanycheva EA, Petrova MO, Chermenskaya TD, Pavela R. Prospects for the Use of *Pongamia pinnata* Oil-Based Products against the Green Peach Aphid *Myzus persicae* (Sulzer) (Hemiptera: Aphididae). *Psyche*, 2014, 1-5.
10. Yankova V, Markova D, Velichkov G, Velkov N. Plant oils for control of cotton aphid (*Aphis gossypii* Glov.) in greenhouse cucumbers. Turkish J. Agri. Natural Sci.,2014:7(7):1565-1568.