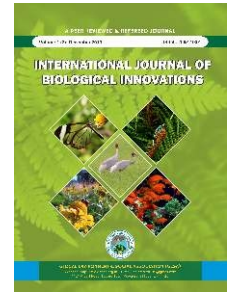




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Research Article

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Evaluation of Bio efficacy of *Azadirachta indica* and *Mentha piperita* extract against *Papilio demoleus* L. on Citrus crop

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Abstract: Lemon butterfly (*Papilio demoleus*) is a serious pest of citrus crop. Present experiment was carried out in the laboratory under controlled conditions with three replications. Five concentrations of neem and mint extract were taken with solvent as petroleum ether, methanol, chloroform, and distilled water. The chloroform extract and methanol extract of *Azadirachta indica* and *Mentha piperita* were found to be effective with reduced larval survival up to 46.35% and 52.24%, respectively. With 20% neem extract concentration, survival percentage was found to be 47.8% and 46.3% in chloroform solvent after 24 and 72 hours of exposure, respectively. Methanol extract also revealed statistically at par results. In control experiment, survival percentage was ranged from 97–100% in all solvent extracts. Similarly, with mint extract, survival percentage was found to be minimum with chloroform solvent (52.13%) followed by methanol solvent (58.08) after 24 hours. Similar trend was recorded after 48 and 72 hours of exposure.

Keywords: *Azadirachta*, Bio efficacy, Citrus, *Mentha*, *Papilio*.

INTRODUCTION

India is on fifth position in production of citrus fruit in the World. It produces 7464000 MT citrus fruit every year. These fruits are well known and have high demand because of rich substance of vitamin C and reviving juice. Various sorts of citrus fruits like lime/lemon, Sweet/orange, musambi, Malta and kinnow are grown in India in enormous scale. Maharashtra, Andhra Pradesh, Punjab, Karnataka, Uttarakhand, Assam, Gujarat and Bihar are major citrus fruits producing states in India. Climate change will provide new ways for invasive species to encroach on new territory (Prakash and Srivastava, 2019) and sometimes helps to maintain the widespread biodiversity and ecological balance (Ashok, 2017 and 2018). Production of citrus fruit is profoundly influenced by the serious invasion of various kinds of insect pests; however, lemon butterfly (*Papilio demoleus*) is the most dangerous pest in citrus plantations exceptionally in nurseries (Arya, 2019). Its caterpillars feed

on young leaves, defoliate the small plants and young twigs of grown up trees. The caterpillar feed voraciously on leaf lamina. The caterpillar has five instars in their larval period. One cycle of *Papilio demoleus* takes commonly 25-28 days and in ideal condition 5-8 cycles have been recorded in one year. I, II and III instar stages are dark brown in colour and has white marking on 8th and 9th segment, which seems a white patch of uric acid stored in a Bird's droppings. It causes them to escape from predation (Arya, 2018). The insecticides offer a very good control of the insect pests, but these are directly or indirectly harmful to mankind. So, it has become necessary to evolve control measures, which may be selective in action and relatively harmless to nontarget organisms and human beings (Ansari *et al.*, 2003). Hence the present examination was pointed towards the locally accessible plants on the impact of ovipositional behaviour, larval survival, and its impact on citrus plants (Arya and Dubey, 2013).

MATERIALS AND METHODS

100g leaves of neem (*Azadirachta indica*) and mint (*Mentha piperita*) were taken for extraction in a Soxhlet extractor using petroleum ether, methanol, chloroform, and distilled water. The crude extracts were obtained and stored in refrigerator. The crude extract was tested against 3rd instar larvae of *P. demoleus*. The experiment was carried out under controlled conditions in Completely Randomized Design (C.R.D) with three replications at $28 \pm 2^\circ\text{C}$ temperature and 55 to 60% relative humidity (RH) in the laboratory. Bio efficacy of extracts was tested on larvae after 24, 48 and 72 hours of exposure in all solvents with treatment concentration of 2, 4, 8, 10 and 20 percent. Acetone and untreated jar were also kept for check and control treatment.

RESULTS AND DISCUSSION

Studies on bio efficacy of neem (*Azadirachta indica*) and mint (*Mentha piperita*) extracts have been tested against 3rd instar larvae of *P. demoleus*. It is obvious from the table-1 that neem extract, after exposure to 24 hours survival percentage of larva was found to be 47.89% with 20% chloroform solvent, followed by 51.98% and 61.42% in methanol and petroleum ether solvent, respectively. Chloroform solvent revealed highly significant difference with methanol, petroleum and distilled water solvent. Survival was found maximum in distilled water solvent *i.e.* 63.45% with 20% concentration treatment and 67.38% with 10% concentration.

It was found 90 per cent with acetone extract and in control treatment. Difference among concentrations and solvents was found highly significant. Arya and Dubey (2017) also studied the application, importance, and effect of neem oil on guava insects and found similar results. Data of larval survival revealed that 20% concentration of chloroform extract for 48- and 72-hours exposure was found to be effective and gave 46.35% survival of larvae. While other tested concentrations of extract did not reveal significant reductions in survival of larvae after 48 and 72 hours of exposure, respectively (Mann *et al.*, 2001). Critical difference revealed all the concentration has significant difference at 5% level of significance. Extract of petroleum ether, methanol and chloroform exhibited statistically at par results in 4% concentration of treatment (Mann *et al.*, 2001; Mumtaj *et al.*, 2006).

The use of higher concentration of mint extracts proved to be more effective on larval survival as compared to lower concentrations (Table.2). The various tested extract did not exhibit any significant variation in reduction of larval survival. Similar results were found after 24, 48 and 72 hours of exposure. Among all the solvents chloroform extract was found more effective in each plant extracts *i.e.* neem and mint. Present findings showed close conformity with the findings of Rahman *et al.* (2005) and Arya (2018).

Table 1: Survival of *Papilio demoleus* larvae on different leaves extracts of *Azadirachta indica*.

Survival of larvae (%)												
Treatment	After 24 hrs. exposure				After 48 hrs. exposure				After 72 hrs. exposure			
Conc. of extract (%)	Petroleum ether extract	Methanol extract	Chloro-form extract	Distilled water extract	Petroleum ether extract	Methanol extract	Chloro-form extract	Distilled water extract	Petroleum ether extract	Methanol extract	Chloro-form extract	Distilled water extract
2	98 -83.35	100 -90	92 -73.65	100 -90	85 -67.39	95.6 -80.22	93.03 -74.9	94 -75.9	85 -67.41	93 -74.09	88 -69.85	95 -79.4
4	92 -73.65	92 -73.65	93 -74.89	97 -81.84	85.84 -67.32	85 -67.39	94 -75.9	91 -72.59	85 -67.41	85 -67.41	84 -66.49	90 -71.62
8	85 -67.41	82 -65.03	83 -68.27	92 -73.65	83 -68.26	82 -64.96	75 -60.02	83 -65.71	82 -64.91	73 -58.72	80 -63.44	81 -64.16
10	82 -65.03	81 -64.17	72 -58.18	85 -67.38	73 -58.73	80 -63.64	65 -53.76	75 -60.03	75 -60.03	73 -58.72	65 -53.77	75 -60.03
20	77 -61.42	62.6 -51.98	55 -47.89	80 -63.45	73 -58.72	55 -47.88	52.3 -46.35	75 -60.03	74.2 -59.28	52.4 -48.35	52.4 -46.35	76 -64.03
Acet-one as check	100 -90	97 -81.84	97 -81.84	100 -90	100 -90	97 -84.18	97 -84.18	100 -90	100 -90	97 -84.18	97 -84.18	97 -84.18
control	100 -90	97 -81.84	100 -90	100 -90	100 -90	98 -83.44	100 -90	100 -90	100 -90	100 -90	100 -90	100 -90

Factor	SE	CD (5%)	SE	CD (5%)	SE	CD (5%)
Sol. (A)	1.1 -1.06	3.09 -2.94	1.2 -1.13	3.35 -3.16	1.03 -1.16	2.95 -3.62
Conc. (B)	1.46 -1.37	4.1 -3.88	1.57 -1.48	4.48 -4.21	1.35 -1.53	3.86 -4.35
AB	2.98 -2.82	8.29 -7.92	3.25 -3	7.93 -7.43	2.8 -3.1	7.86 -8.73

Note: Data in parentheses represents angular transformation

Table 2: Survival of *Papilio demoleus* larvae on different leaves extracts of *Mentha piperita*.

Survival of larvae (%)												
Treatment	After 24 hrs. exposure				After 48 hrs. exposure				After 72 hrs. exposure			
Conc. of extract (%)	Petroleum ether extract	Methanol extract	Chloroform extract	Distilled water extract	Petroleum ether extract	Methanol extract	Chloroform extract	Distilled water extract	Petroleum ether extract	Methanol extract	Chloroform extract	Distilled water extract
2	92 -73.6	100 -90	95 -78.65	98 -83.35	95 -79.54	100 90	97 81.84	95 -77.9	100 -90	90 -71.72	88 -69.85	92 -73.65
4	94 -78.54	85 -67.4	90 -73.86	93 -78.86	91 -72.59	92 -73.86	94 -75.96	91 -72.59	92 -73.66	86 -68.41	92 -73.66	90 -71.62
8	82 -64.96	85 -67.4	82 -64.96	91 -72.59	84 -66.44	82 -64.96	85 -67.23	86 -69.32	84 -66.44	81 -64.17	80 -63.51	85 -67.24
10	82 -65.03	72 -58.05	75 -60	85 -67.23	82 -64.96	73 -59.98	73 -59.98	84 -66.44	78 -63.46	72 -58.08	72 -58.08	85 -67.24
20	76 -62	70 -58.08	63 -52.13	82 -64.96	71 -56.08	64 -53.13	71 -57.42	81 -62.96	72 -58.08	71 -57.42	63 -52.24	80 -62.37
Acet-one as check	100 -90	100 -90	100 -90	100 -90	100 -90	100 -90	100 -90	100 -90	100 -90	100 -90	100 -90	100 -90
control	100 -90	100 -90	100 -90	100 -90	100 -90	100 -90	100 -90	100 -90	100 -90	100 -90	100 -90	100 -90

Factor	SE	CD (5%)	SE	CD (5%)	SE	CD (5%)
Sol. (A)	0.69 -0.91	1.95 -2.62	0.53 -0.69	1.46 -1.86	13.96 -0.66	39.38 -1.58
Conc. (B)	0.9 -1.22	2.58 -3.41	0.69 -0.87	1.94 -2.48	18.34 -0.74	52.94 -2.1
AB	1.9 -2.51	5.11 -6.84	1.37 -1.74	3.88 -4.93	36.68 -1.47	103.89 -4.26

Note: Data in parentheses represents angular transformation

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