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Bio-Efficacy of some green pesticides under laboratory condition against *Suidasia nesbitti* Sasa (Acari. Suidasiidae) infesting milky white mushroom, *Calocybe indica* Purkayastha & Chandra

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Abstract
Laboratory bio-efficacy study of some green pesticides, Citrus leaf extract and Custard apple leaf extract both at 2% and 5% concentrations, Neem oil + water both as 2ml in 25 ml water and 4 ml in 25 ml water and green chili paste 5mg + 50 ml water and 12 mg + 50 ml water against milky white mushroom, *Calocybe indica* revealed that the mean mortality was highest (76.15%) in case of green chili paste i.e. 12mg + 50ml water followed by the same green pesticides with concentration of 5mg in 50 ml water, registering mortality of 68.69%. Citrus leaf extract at 2% concentration was the poorest among all recording mortality of 35.85%. The mortality achieved in Custard apple at both the concentrations is also reasonably good.

Keywords: Bio-efficacy, Green pesticides, *Suidasia nesbitti*, *Calocybe indica*, Milky white mushroom

Introduction
The mushroom unit of R K Mission, Narendrapur is cultivating milky white mushroom, *Calocybe indica* and during May to August, 2019 it was found very heavily infested with *Suidasia nesbitti*. The population was so high that it completely damaged the mushroom cultivation. Since no synthetic chemical pesticide is advisable to apply on mushroom being an edible product, the choice had gone for some green pesticides for control of this mite infestation. In view of that, this laboratory experiment was set up to study bio-efficacy of some green pesticides like Citrus and Custard apple leaf extracts both at 2% and 5% concentrations. Neem oil + water both with 2ml in 25ml water and 4 ml in 25 ml water and green chili paste as 5mg in 50 ml water and 12 mg in 50 ml water, including a water sprayed control treatment against *Suidasia nesbitti* was carried out under laboratory condition and the present paper is based upon the results of that study.

Material & Methods
The mushroom samples infested with *Suidasia nesbitti* were collected from mushroom unit of R K Mission, Narendrapur and the bio-efficacy study was done on those mites. Leaf extracts of custrud apple (*Anona squamosa*) and citrus (*Citrus limonium*) were prepared following technique of Gupta (2007) [1] and Wang (2009) [3]. In case of green chili paste, it was made by procuring measured quantity of green chili and pasting the same in a mortar. After the paste was made, 5mg was taken and was mixed with 50ml of water to make one concentration and likewise, another concentration was made with 12mg of paste with 50 ml of water. In case of neem oil, the commercially available neem oil having azadirachtin content of 4-5% was used. Ten specimens of the test mite, *Suidasia nesbitti* taken from laboratory culture were put into a small tube (5cm x 2.5cm) and the mouth of the tube was closed with a fine cloth fitted tightly with rubber band. In such manner, a total of 25 tubes (3 tubes to serve as 3 replications for each treatment x 8 treatments + 1 tube having water spray on test mites to serve as control). The spraying was done with the help of a glass atomizer. The observations towards mortality were recorded from 24 hours and continued till 144 hours. The percentage mortality was calculated basing on the formula as given below.
Percentage mortality= Number of dead mites/ total number of mites x 100 (McDonald *et al.*, 1970) [2]. The data was subjected to necessary statistical analysis.

Results & Discussion

Table 1: Percentage mortality of different treatments due to spraying of green pesticides on *Suidasia nesbitti* infesting *Calocybe indica* under laboratory condition.

Treatments	Initial population	24 hours	48 hours	72 hours	96 hours	120 hours	144 hours	Mean mortality
T_1 Citrus leaf extract 2%	10.66	19.44	24.60	26.67	37.22	41.67	65.53	35.85
T_2 Citrus leaf extract 5%	10.00	20.45	26.11	45.39	66.67	79.60	92.51	55.12
T_3 Custard Apple leaf extract 2%	10.66	21.67	25.00	43.22	55.55	69.35	91.13	50.98
T_4 Custard Apple leaf extract 5%	12.67	31.11	47.22	59.78	73.19	89.93	100.00	66.87
T_5 Neem oil 2ml/25ml water	11.00	11.67	25.86	38.09	49.82	63.19	79.13	44.63
T_6 Neem oil 4ml/25ml water	11.67	18.23	38.84	49.97	63.23	79.87	93.10	57.22
T_7 Chili paste 5mg/50ml water	10.67	28.89	42.38	67.77	82.13	91.00	100.00	68.69
T_8 Chili paste 12mg/50ml water	11.00	42.37	54.60	78.87	87.52	93.55	100.00	76.15
T_9 Control	13.00	0	0	0	0	0	0	0
CD at 5% level		6.31	5.17	7.19	6.35	7.12	5.33	

24 Hours
At lower concentration in this interval, the mortality was highest in case of T_7 (28.89%) which was superior to all other treatments. And this was followed by T_3 and T_1 where the percentage mortality was 21.67 and 19.44, respectively. T_5 was the poorest among all where the mortality was 11.67%.
At higher concentration the percentage mortality was highest in T_8 where it was 42.37 followed by T_4 where it was 31.11% followed by T_2 (20.45%) equal to T_6 (18.23%).
No mortality was recorded in case of control.

48 Hours
At lower concentration the mortality was highest as usual at T_7 (42.38%) which was superior to T_1, T_3 and T_5, respectively and the percentage mortality was 24.60, 25.00 and 25.86 respectively.
At higher concentration T_8 continued its best performance recording mortality of 54.60% which was significantly superior to all other treatments. This was followed by T_4 (47.22%) and was better than T_6 (38.84%) as well as T_2 (26.11%).
No mortality was recorded in case of control.

72 Hours
At lower concentration T_7 continued its superiority recording mortality of 67.77% and that was better than T_3 (43.22%) equal to T_5 (38.09%) while T_1 was the poorest where the percentage mortality was 26.67.
At higher concentration, the trend was more or less similar where T_8 was the best among all (78.87%) mortality followed by T_4 (59.78%), T_6 (49.97%) and equal to T_2 (45.39%).
No mortality was recorded in case of control.

96 Hours
At lower concentration, in this interval T_7 maintained its superiority where the mortality was 82.13%, better than T_3 (55.55%), better than T_5 (49.82%) and T_1 was the poorest where the percentage mortality was 37.22.
At higher concentration, the percentage mortality can be arranged in the following descending order- T_8 (87.52) >T_4 (73.19) >T_2 (66.67) =T_6 (63.23) No mortality was recorded in case of control.

120 Hours
At lower concentration, the percentage mortality achieved at different treatments can be arranged in the following descending order- T_7 (91.00%) > T_3 (69.35%) = T_5 (63.19%) > T_1 (41.67%).
Likewise, at higher concentration, the percentage mortality could be arranged at following descending order – T_8 (93.55%) = T_4 (89.93%)>T_6 (79.87%) = T_2 (79.60%).
As usual, no mortality was recorded in case of control.

144 Hours
At lower concentration, T_7 recorded highest mortality of 100% >T_3 (91.13%)>T_5 (79.13%)>T_1 (65.53%).
At higher concentration the percentage mortality can be arranged at following descending order – T_8 (100%) = T_4 (100%)> T_6 (93.10%) = T_2 (92.51%). As usual no mortality was recorded in case of control.

Mean Mortality: Mean mortality can be arranged at following descending order. At lower concentration- T_7 (68.69%)> T_3 (50.98%) = T_5 (44.63%)> T_1 (35.85%). At higher concentration the percentage mortality can be arranged at the following descending order. T_8 (76.15%) > T_4 (66.87%) > T_6 (57.22%) > T_2 (55.12%).

Conclusion
From the above laboratory experiment the following can be concluded –

1. All the green pesticides had proved acaricidal effects on mushroom mite, *Suidasia nesbitti* but their degree of efficacy varied.
2. The percentage mortality progressively increased with the increase of intervals.
3. Green chili paste + water at both the concentrations recorded the highest mortality whereas the *Citrus* at both the concentrations were relatively inferior. The other treatments also proved to be quite effective.
4. No mortality was recorded in control treatment.
5. This laboratory study needs to be confirmed by conducting field trial.

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