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# Repellent and antifeedant efficacy of four *Ocimum* species extracts against BPH, *Nlilaparvata lugens* (Stal.)

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**ABSTRACT :** Brown plant hopper *Nilaparvata lugens* (Stal.) (Delphacedae, Homoptera), is one of the most serious pest of rice. Plant extracts obtained from the aerial parts of plants may have the potential to be an alternative to synthetic pesticides, since they have been demonstrated to possess a wide range of bioactivities against BPH. The aim of the current study was to investigate the effect of Methanol extracts from four different *Ocimum* spp. namely: *Ocimum sanctum, Ocimum basilicum, Ocimum americanum* and *Ocimum gratissimum* (Lamiaceae). The extracts used at 1.0% concentration for evaluation of repellency in cage study and feeding deterrence test. Results indicated that *O. gratissimum* recorded highest average repellency (89.17%) to females as compared to control (53.65% check) and the repellent action of water extract against female reduced after every 15 minutes. However, the trend in response continued to be same till 120 minutes with *O. gratissimum* as the best treatment. average probing marks by BPH varied from 18.26 to 38.15%. *O. gratissimum* extracts received the significantly lowest percentage of probing marks (18.26%) compared to control (80.16%). Higher probing percentage was noticed in *O. americanum* (38.15%).

**Key Words:** Rice (*Oryza sativa* L.), brown plant hopper (BPH) *Nilaparvata lugens* (Stal.), repellent and antifeedant efficacy, *O. sanctum, O. basilicum, O. americanum, O. gratissimum.*

Rice (*Oryza sativa* L.) (2n = 24) belonging to the family Graminae is the staple food crop for one third world's population and occupies almost one fifth of the total land area covered under cereals. It is grown under diverse cultural conditions and over wide geographical range. More than 90% of the world's production was consumed in Asia, which constitutes more than half of the global population. Approximately 11% of the world's arable land is planted annually with rice , production of 748.0 million tons next to it ranks wheat. In India, area under rice is estimated to be 44.9 million ha with a production of 272 million tons (Anonymous, 2015). India ranks 1st in area (44.95 million ha) and 2nd in production (272 .61 million tonnes), after China (2nd advance estimate, 2015-16, Department of Agriculture, Cooperation and Farmer's Welfare, Ministry of Agriculture, GOI), Rice, being the staple food for more than 70 per cent of the population and the source of livelihood for 120-150 million rural households, is the backbone of the Indian agriculture. India ranks 1st in area (44.95 million ha) and 2nd in production (272.61 million tonnes), after China (2nd advance estimate, 2015-16, Department of Agriculture, Co operation and Farmer's Welfare, Ministry of Agriculture, GOI).

Brown plant hopper [*Nilaparvata lugens* (Stal)] is one of the most menacing insect pests of rice (*Oryza sativa* L.) among various leafhoppers and plant hopper species. The Brown plant hopper was a minor pest in most tropical countries of Asia earlier. Following the introduction of insecticides and modern semi-dwarf rice varieties, *N. lugens* became most devastating insect pest of rice in Asia and large scale damage by this pest has been reported from India, Indonesia, Philippines, Sri Lanka and Bangladesh. Brown plant hopper *N. lugens* is mainly a pest of irrigated rice but it can also become abundant in rain fed environment and upland rice. At low infestation of this insect, plant height, crop vigour, tiller production reduces, whereas heavy infestation turns plants yellow, which dry up rapidly. At early infestation round yellow patches appear, which soon turn brownish due to drying up of the plants. Since this insect generally remain confined to plant stems and leaf sheaths, its presence goes undetected. The dry brown spots in the lush-green paddy field known as hopper burn are often the first visible symptoms, which spread very fast if not controlled. Under severe infestation, circular patches of hopper burn are evident in the field. Severely affected plants do not bear any grains. The most commonly practical method of controlling brown plant hopper is through application of insecticides.

## Materials and Methods

Experiment were performed at Deportment of Entomology, Indian Institute of Rice Research, Hyderabad. The plant materials were used for experiment conduct-

**Table-1 :** Repellency of water extracts from different *Ocimum* spp. to BPH, *N. lugens.*

| S. No. | Treatments | Per cent repellency | | | | | Average |
|---|---|---|---|---|---|---|---|
| | | 15min | 30min | 60min | 90min | 120min | |
| 1. | ***O.sanctum*** | 88.87c (62.69) | 80.12c (53.22) | 83.45c (56.54) | 76.45bc (49.84) | 65.85b* (41.17) | 78.95 (52.12)*** |
| 2. | ***O.basilicum*** | 92.41b (67.51) | 88.45b (62.17) | 86.25b (59.57) | 79.56b (52.69) | 65.65ab (41.02) | 82.46 (55.53) |
| 3. | ***O.americanum*** | 87.85c (61.44) | 81.75c (54.81) | 76.47d (49.86) | 73.27c (47.09) | 62.48b (38.65) | 76.36 (49.77) |
| 4. | ***O.gratissimum*** | 98.75a (80.90) | 92.46a (67.58) | 88.25a (61.92) | 83.65a (56.75) | 82.75a (55.82) | 89.17 (63.06) |
| 5. | **Control** | 62.22d (38.30) | 58.29d (35.34) | 55.88e (33.35) | 48.45d (28.67) | 45.63e (26.73) | 53.65 (32.40) |
| | **SEm** | 9.43 | 7.28 | 6.34 | 5.36 | 10.20 | 10.09 |
| | **CD(0.05%)** | 1.76 | 1.92 | 1.37 | 1.75 | 5. 02 | 3.19 |

*Mean followed by same letter are not significantly diff

**Figures are average means of five replication.

***figure in the parenthesis are arc sine tranformed values

ing were different *Ocimum* spp. viz., Holy basil, *Ocimum sanctum,* Sweet basil *Ocimum basilicum,* Wild basil *Ocimum americanum,* Clove basil *Ocimum gratissimum*. Water extracts and methanol extracts at 1.0% concentration used for repellency test (cage study), antifeedency test (Probing mark test) respectively. For evaluation of cage study 1.0% water extracts prepared by dissolving 2.5gm of different *Ocimum* spp. fine leaf powder in 100ml of distilled water and plant materials soaked for overnight. Next day mixed the dissolved contents thoroughly and filtered with muslin cloth then with filter paper then made it to 1.0% solution by add distilled water. The test was carried out according to methodology suggested by Naito (1964). Repellency data was taken at 15,30,60,90,120 minutes after released. For this purpose, seeds of TN1 variety were germinated separately in Petri dishes. Germinated seed were sown into wooden trays containing well puddled soil and grown for 15 days. Seedlings were removed from trays and washed the mud adhering to roots thoroughly with water.

Required plant materials for antifeedant test of different *Ocimum* spp. with methanol were extracted by using Soxhlet apparatus. 15 days old TN1 rice seedlings were treated with concentration 1.0 % methanol extracts of different *Ocimum* spp. by dipping method (Park *et al*., 2002). After treatment rice seedlings transferred individually into test tubes (dimensions 15×3 cm) containing a few drops of water. One or two days old female BPH was released individually into each test tube and allowed to make punctures on the seedlings for one night (12 hrs). Test tubes were plugged with sterilized non-absorbent cotton swab. The seedlings were dipped in another tube containing 1.0 percent erythrosine dye aqueous solution for staining purpose. Prob-

**Table-2 :** Effect of methanol extracts on probing behavior of BPH, *N. lugens*

| Sl. | Treatments | No of probing marks |
|---|---|---|
| 1. | *O.sanctum* | 32.12cd* (18.91) |
| 2. | *O.basilicum* | 27.35**dc (16.04)*** |
| 3. | *O.americanum* | 38.15c (22.54) |
| 4. | *O.gratissimum* | 18.26e (10.69) |
| 5. | Methanol | 64.28b (40.21) |
| 6. | Triton X-100 | 70.42ab (44.75) |
| 7. | Control | 80.16a (53.26) |
| | SEM | 4.74 |
| | CD(0.05%) | 2.63 |

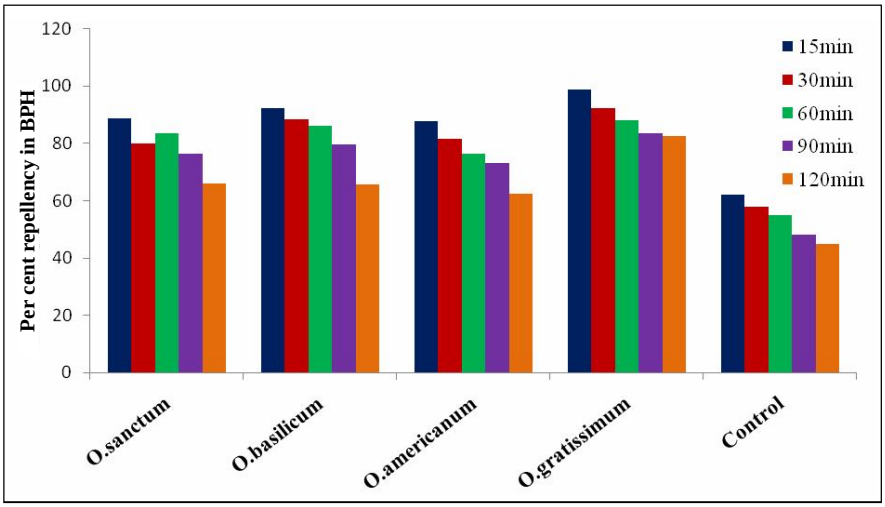


**Fig.-1 :** Repellency of water extracts from different *Ocimum* spp to BPH, *N. lugens*.

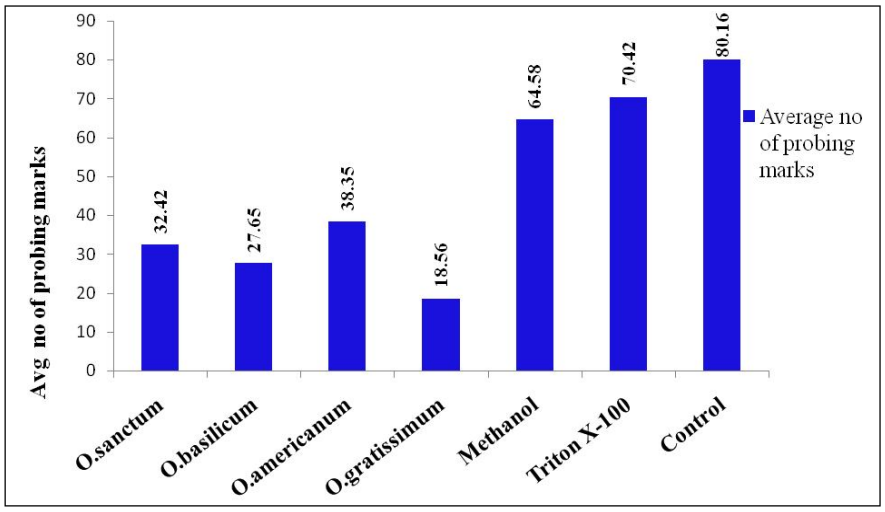


**Fig.-2 :** Effect of methanol extracts on probing behavior of BPH, *N.lugens.*

ing marks were counted visually under electron microscope after 3hrs of staining. The whole experiment designed with 7 treatments and 5 replications.

## Results and Discussion

### Repellent activity of water extracts of different *Ocimum* spp. to female BPH

Cage studies on effect of 1% water extracts of *Ocimum* spp on olfactory response of BPH are shown in Table-1 and data indicated that *O. gratissimum* recorded highest average repellency (89.17%) to females as compared to other treatments (76.36-82.46%) and control (53.65% check). The repellent action of water extract against female reduced after every 15 minutes (Fig.-1) However, the trend in response continued to be same till 120 minutes with *O. gratissimum* as the best treatment.

In present study *Ocimum* spp water extracts were reported to be repellent to female BPH. Though not same plants, water extracts of other plants- *Azadirachta indica*, *Annona reticulata* and *Tinospora rumphi* showed the repellent effects against *Nilaparvata lugens* (Telan *et al.*, 1994).

The results of present study are in related with the findings of Bhimrao (2005) who tested different plant derivatives, against brown plant hopper. Neem oil @ 2% had the highest repellent action to *Nilaparvata lugens* repelling 90% of the population from the treated area. Telan *et al.* (1994) they have reported that extracts of *Azadirachta indica*, *Annona reticulata*, and

*Tinospora rumphi* showed the repellent effects against *Nilaparvata lugens.*

**Antifeedant test (Probing mark test)**

The effect of methanol extracts on probing behavior of BPH, *N. lugens* was given in Table-2. Data indicated that the average probing marks by BPH varied from 18.56 to 38.15%. *O. gratissimum* extracts received the significantly lowest percentage of probing marks (18.26%) compared to control (80.16%) (Fig.-2). Higher probing percentage was noticed in *O. americanum* (38.35%). In other treatments probing percentage observed were 27.65, 32.42, 38.35, 64.58 and 70.42 per cent in *O. basilicum*, *O. sanctum*, solvent methanol and Triton X-100.

The average probing marks by BPH, *N. lugens* varied from 14.80 to 35.40 in numbers per seedlings in seed oil treated plants when compared to control (14.80). Neem oil received the highest average probing marks per seedling (35.40) indicating antifeedant action, while mahua oil received lowest number of (19.80) probing marks.

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