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# EVALUATION OF DIFFERENT BOTANICAL POWDERS AGAINST RICE MOTH, *CORCYRA CEPHALONICA* IN STORED GROUNDNUT KERNELS

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**ABSTRACT**

The present experiment was conducted to evaluate the efficacy of different botanical powders against rice moth (*Corcyra cephalonica*) in stored groundnut kernels. Among various botanical powders, neem leaf powder at 1.25 per cent was proved to be the most effective against rice moth as it recorded maximum oviposition deterrence (90.30%), highest reduction in adult emergence (92.77%), lowest longevity of male (2.53 days) as well as female (2.60 days) moth, lowest fecundity (40.13 eggs/female) as well as egg viability (38.50%), minimum weight loss (8.90%) and had no adverse effect on the germination of groundnut kernels after 3 months of storage followed by karanj leaf powder at 1.25 per cent.
***Keywords*** **:** Rice moth, *Corcyra cephalonica*, groundnut, botanical powders.

## Introduction

Groundnut or peanut (*Arachis hypogaea* L.) is the sixth most important oilseed crop in the world. Groundnut belongs to family legume and it's native to South America. It is known as the King of oilseeds and wonder nut. This crop is a vital source of income and nutrition in tropical regions, particularly in semi-arid areas. Groundnut kernel as a whole is highly nutritious as it is rich in edible oil and proteins (Dick, 1987). Groundnuts are stored as unshelled pods and kernels for different uses. After harvest, both forms are at risk of infestation by various insect pest. However, groundnut kernels are more susceptible to to insect damage than pods in storage.

More than 100 insect species infest stored groundnut, some of which are of economic importance. Storage insect pests of groundnuts are groundnut bruchid, red flour beetle, rice moth and pod sucking bug (Rao *et al*., 2010). Stored insect-pests are serious problem throughout the world, because they reduce the quality and quantity of grain. Their damage to stored grains and grain products ranges from 25-40 percent in the tropical zone (Shaaya *et al*., 1997). Apart from bruchid, the other pest that causes serious damage to storage groundnut kernels is rice moth, *Corcyra cephalonica.* Rice moth, commonly known as the "flour moth" or "rice meal moth," is a member of the Lepidoptera order and family Pyralidae. Rice moth is a major pest of rice but is also reported to feed on wheat, maize, sorghum, groundnut, cotton seeds, coffee, spices, cocoa beans and millet (Kumar and Kumar, 2001). The larvae of *C. cephalonica* are proficient of damaging intact kernels and feed both on the surface and within seeds. They spin a tough silken fiber, webbing together kernels, frass and cast larval skins (Dick, 1987).

Chemical method has a number of problems, including health risks to users and consumers of stored grains. It causes residual toxicity, environmental pollution and pesticide resistance to insect pests (Menge *et al*., 2018). Increasing awareness of the hazards caused due to the use of chemical pesticides and several reported cases of food poisoning has created renewed interest in the use of botanical powders as grain protectants (Jhala *et al*., 2018). Hence, keeping these facts in view, the present experiment was carried out to evaluate the botanical

powders and plant oils against *C. cephalonica* in stored groundnut under laboratory conditions.

## Materials and Methods

A laboratory experiment was conducted to evaluate botanical powders and plant oils against *C. cephalonica* on stored groundnut based on oviposition deterrence (%), reduction in adult emergence (%), Adult longevity (days), fecundity and egg viability (%), weight loss (%) and germination (%) at laboratory of Department of Entomology, C. P. College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar (Gujarat).

### Method of recording observations

All the botanical powders were collected from local and nearby area of Sardarkrushinagar. The botanicals were dried under shade. After complete drying, each botanical was crushed to make powder and was used for further experimentation. Ten botanical powders (Table 1) were applied to 500 g previously sterilized groundnut kernels by mixing at 1.25% (w/w). An untreated and sterilized bulk of 500 g groundnut kernels was kept as control treatment. All the 11 (each of 500 g) were stored in an air tight plastic jar at room temperature and were utilized for further experiment.

**Table 1:** List of various botanicals used during experiment

| Sr. No. | Name of botanical | Concentration (%) |
|---|---|---|
| **Different botanical powders (w/w)** | | |
| 1 | Neem leaf powder | 1.25 |
| 2 | Karanj leaf powder | 1.25 |
| 3 | Garlic clove powder | 1.25 |
| 4 | Turmeric rhizome powder | 1.25 |
| 5 | Lemongrass leaf powder | 1.25 |
| 6 | Eucalyptus leaf powder | 1.25 |
| 7 | Lantana leaf powder | 1.25 |
| 8 | Ginger rhizome powder | 1.25 |
| 9 | Naffatiya leaf powder | 1.25 |
| 10 | Mint leaf powder | 1.25 |

### Oviposition deterrence

For this purpose, three samples of treated groundnut kernel each of 50 g (one sample for one repetition) were drawn from each bulk of treatment. Five pairs of newly emerged adults of rice moth were introduced in each container. The control was maintained separately for each repetition. After 3 days, number of eggs laid in treated seeds (Ts) and control seeds (Cs) was recorded and the oviposition deterrence (%) was calculated by formula given by Singh and Jakhmola (2011).

$$POD = \frac{Cs - Ts}{Cs} \times 100$$

### Reduction in adult emergence

ental set was kept undisturbed till the emergence of F1 adults from the treated and untreated kernels. Based on the number of F1 adults emerged from the control kernels (Ac) and treated kernels ($A_t$), reduction in adult emergence (%) was calculated by the formula given by Singh and Jakhmola (2011).

$$PRA = \frac{Ac - At}{AC} \times 100$$

Where,
Ac = Number of F1 adults emerged from the control
At = Number of F1 adults emerged from the treatment
PRA = Per cent reduction in adult emergence

### Longevity of adult emerged

Total number of male and female moths that emerged from each treatment was also recorded along with their longevity.

### Fecundity and egg viability

For recording fecundity, ten freshly emerged adults from the larvae reared on treated seeds were kept in separate jars for egg laying. The total numbers of eggs laid by each female was counted daily till the death of female. For egg viability, random samples of 50 eggs were taken from each treatment and placed in Petri plates. The hatched or unhatched eggs were counted with the help of stereomicroscope.

### Weight loss

For recording weight loss (%) of kernels, initial weight as well as final weight at 3 months after storage was recorded and calculated using formula given by Mahdi and Rahman (2008).

$$\text{Weight loss}(\%) = \frac{\text{Initial weight} - \text{Final weight}}{\text{Initial weight}} \times 100$$

### Germination

The per cent seed germination was calculated by taking 100 seeds from each container. The seeds were sandwiched in paper towel. The paper towel was then kept in seed germinator chamber at 25 ± 10. (Kedar, 2005).

$$\text{Germination percentage}(\%) = \frac{\text{No. of germination seed}}{\text{Total No. of seed}} \times 100$$

### Statistical analysis

All experiments were carried out by employing a completely randomized design (CRD). Transformation of data either angular/square root was done to

percentage and absolute values, respectively. Significant differences (P-value < 0.05) among treatments were determined using Duncan's New Multiple Range Test.

## Results and Discussion

Efficacy of ten botanical powders were evaluated against *C. cephalonica* in stored groundnut kernels based on oviposition deterrence (%), reduction in adult emergence (%), adult longevity (days), fecundity and egg viability (%), weight loss (%) and germination (%). The results obtained are described here under and presented in Tables 2.

**Table 2 :** Evaluation of botanical powders on against rice moth, *C. cephalonica* in stored groundnut seeds

| Tr. No | Treatments | Conc. (%) (w/w) | Oviposition deterrence (%) | Reduction of adult emergence (%) | Longevity (Days) | | Fecundity (Eggs/ female) | Egg viability (%) | Weight loss (%) | Germination (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Male | Female | | | | |
| 1 | Neem leaf powder | 1.25 | 74.08$^{a}$* (92.30) | 74.94$^{a}$* (92.77) | 1.74$^{a}$** (2.53) | 1.76$^{a}$** (2.60) | 6.37$^{a}$** (40.13) | 38.33$^{a}$* (38.50) | 17.23$^{a}$* (8.90) | 73.74* (92.00) |
| 2 | Karanj leaf powder | 1.25 | 67.47$^{b}$ (84.93) | 71.65$^{a}$ (89.62) | 1.84$^{ab}$ (2.90) | 1.98$^{ab}$ (3.48) | 7.02$^{ab}$ (49.05) | 43.99$^{ab}$ (48.25) | 21.44$^{b}$ (13.45) | 73.40 (91.75) |
| 3 | Garlic clove powder | 1.25 | 58.76$^{c}$ (73.00) | 58.81$^{b}$ (73.05) | 2.06$^{bc}$ (3.78) | 2.16$^{b}$ (4.18) | 7.23$^{bc}$ (51.80) | 49.90$^{bc}$ (58.50) | 24.18$^{bc}$ (16.85) | 72.60 (90.25) |
| 4 | Turmeric rhizome powder | 1.25 | 50.34$^{de}$ (59.23) | 51.47$^{cd}$ (61.20) | 2.49$^{d}$ (5.73) | 2.89$^{d}$ (7.90) | 7.89$^{c}$ (61.80) | 62.65$^{ef}$ (78.50) | 27.24$^{cde}$ (21.05) | 70.11 (88.00) |
| 5 | Lemongras leaf powder | 1.25 | 42.67$^{f}$ (45.95) | 44.14$^{e}$ (48.51) | 2.96$^{f}$ (8.30) | 3.35$^{e}$ (10.73) | 9.34$^{d}$ (86.88) | 70.94$^{g}$ (89.25) | 30.16$^{e}$ (25.25) | 68.21 (86.00) |
| 6 | Eucalyptus leaf powder | 1.25 | 55.84$^{cd}$ (67.95) | 53.63$^{bc}$ (64.72) | 2.12$^{c}$ (4.00) | 2.49$^{c}$ (5.75) | 7.46$^{bc}$ (55.33) | 53.34$^{cd}$ (64.25) | 24.65$^{c}$ (17.40) | 71.72 (90.00) |
| 7 | Lantana leaf powder | 1.25 | 44.50$^{f}$ (49.13) | 47.24$^{de}$ (53.88) | 2.92$^{ef}$ (8.15) | 3.20$^{de}$ (9.73) | 9.31$^{d}$ (86.25) | 69.94$^{g}$ (87.50) | 28.36$^{de}$ (22.60) | 70.68 (89.00) |
| 8 | Ginger rhizome powder | 1.25 | 51.18$^{de}$ (60.66) | 52.09$^{cd}$ (62.22) | 2.42$^{d}$ (5.38) | 2.87$^{d}$ (7.83) | 7.56$^{bc}$ (56.93) | 57.70$^{de}$ (71.25) | 26.43$^{cd}$ (19.95) | 71.70 (89.75) |
| 9 | Naffatiya leaf powder | 1.25 | 44.24$^{f}$ (48.67) | 48.32$^{cde}$ (55.74) | 2.67$^{de}$ (6.63) | 3.08$^{de}$ (9.05) | 9.13$^{d}$ (82.88) | 66.97$^{fg}$ (84.25) | 29.67$^{de}$ (24.50) | 68.03 (86.00) |
| 10 | Mint leaf powder | 1.25 | 47.22$^{ef}$ (53.85) | 51.02$^{cd}$ (60.37) | 2.55$^{d}$ (6.03) | 2.98$^{d}$ (8.45) | 7.87$^{c}$ (61.55) | 67.28$^{fg}$ (84.75) | 28.01$^{de}$ (22.05) | 71.55 (89.75) |
| 11 | Untreated control | - | 4.05$^{g}$ (0.05) | 4.05$^{f}$ (0.05) | 3.78$^{g}$ (13.83) | 4.00$^{f}$ (15.53) | 11.92$^{e}$ (142.23) | 77.56$^{h}$ (95.25) | 33.29$^{f}$ (30.65) | 73.09 (91.00) |
| S.Em. ± | | | 1.93 | 1.84 | 0.09 | 0.11 | 0.25 | 2.09 | 1.03 | 2.13 |
| C. D. at 5% | | | 5.56 | 5.30 | 0.26 | 0.31 | 0.72 | 6.00 | 2.97 | NS |
| C.V. % | | | 7.93 | 7.32 | 7.04 | 7.52 | 6.01 | 6.97 | 7.82 | 5.46 |

Figures in parentheses are retransformed values of *arc sin transformation and ** $\sqrt{x+0.5}$ transformation. Treatment mean(s) with letter(s) in common are non-significant by DNMRT at 5% level of significance

### Oviposition deterrence

On the basis of oviposition deterrence of *C. cephalonica*, significantly the maximum per cent oviposition deterrence (92.30%) was observed in neem leaf powder at 1.25 per cent. Least effective treatment was lemongrass leaf powder at 1.25 per cent with least oviposition deterrence (45.95%) and it was at par with naffatiya leaf powder, lantana leaf powder and mint leaf powder at 1.25 per cent which recorded oviposition deterrence ranged from 48.67 to 53.85 per cent. More or less similar trend was also observed by Meena and Bhargava (2005) observed that maximum reduction in oviposition of rice moth was observed when sorghum seeds were treated with karanj kernel powder @ 2.5 g/100 g (92.16%). Based on oviposition deterrence, Dulera *et al.* (2015) reported that karanj kernel powder @ 2.5 g (98.68 %) and neem leaf powder @ 5.0 g per 100 g groundnut seeds (98.53 %) were found to be most effective against *C. cephalonica.* Ramanaji *et al.* (2020) observed that neem seed kernel powder @ 2.5 g/100 g seeds was found to be most effective in protecting stored groundnuts against rice moth as it recorded highest oviposition deterrence of 92.16 per cent.

**Reduction in adult emergence**

On the basis of reduction in rice moth adult emergence, kernels treated with neem leaf powder at 1.25 per cent recorded highest (92.77%) reduction in adult emergence and Summary and Conclusion 64 it was at par with karanj leaf powder at 1.25 per cent (89.62%). While, treatment lemongrass leaf powder was at 1.25 per cent (48.51%) least effective and it was at par with lantana leaf powder at 1.25 per cent (53.88%). Dulera *et al*. (2015) recorded that karanj leaf powder @ 2.5 and neem leaf powder 5.0 g/100 g groundnut seeds were found to be the most effective against *C. cephalonica* (84.97 and 83.37%, respectively) based on reduction in adult emergence. Further, Menge *et al*. (2018) observed that turmeric rhizome powder @ 6 g and neem seed kernels powder @ 6 g/100 g kernels were found effective against *C. cephalonica* and recorded adult emergence per cent of 34.84 and 56.79 per cent, respectively. Similar trend was also observed by Jhala *et al*. (2018) and Ramanaji *et al*. (2020) who recorded that the neem seed kernel powder was most effective in reducing rice moth adult emergence followed by neem leaf powder in stored rice grains and groundnut seeds.

**Longevity**

Among various botanical powders, neem leaf powder and karanj leaf powder at 1.25 per cent were most effective in reducing the longevity of both male (2.53 and 2.90 days, respectively) and female (2.60 and 3.48, respectively). Dulera *et al*. (2015) reported that karanj kernel powder and neem leaf powder @ 2.5 g/100 g groundnut kernels were most effective in reducing the longevity of male (4.11 and 4.00 days, respectively) and female (4.67 and 4.56, respectively) rice moths. In addition, Ramanaji *et al*. (2020) reported that the neem seed kernel powder and neem leaf powder @ 2.5 g/100 g kernels were found most effective in reducing the longevity of male (2.85 and 3.46 days, respectively) and female (2.89 and 3.54 days, respectively) *C. cephalonica* in stored groundnut.

**Fecundity**

Among various treatments, neem leaf powder at 1.25 per cent was most effective in reducing the fecundity of *C. cephalonica* by recording lowest (40.13 eggs/female) number of eggs per female and it was at par with karanj leaf powder at 1.25 per cent (49.05 eggs/female), whereas it was higher (82.88 to 86.88 eggs/female) in lemongrass leaf powder, naffatiya leaf powder and lantana leaf powder at 1.25 per cent. Similarly, Dulera *et al*. (2015) reported that neem leaf powder (5.88 eggs/female) @ 2.5 g/100 g groundnut seeds was most effective in reducing the fecundity of *C. cephalonica*. In addition to that, Ramanaji *et al*. (2020) also observed that the neem seed kernel powder @ 2.5 g/100 g of kernels was most effective in reducing the fecundity of *C. cephalonica* to 42.80 eggs/female as compared to untreated control (215.59 eggs/female).

**Egg viability**

Minimum egg viability (38.50%) was observed in neem leaf powder at 1.25 per cent and it was at par with karanj leaf powder at 1.25 per cent (48.25%), whereas treatment lemongrass at 1.25 per cent was least effective which recorded highest egg viability 89.25 per cent. Dulera *et al*. (2015) reported that maximum reduction of egg viability was observed with karanj leaf powder and neem seed kernel powder @ 5.0 g/ 100 g groundnut seed were found the most effective against *C. cephalonica* recorded as 60.00 and 52.67 eggs, respectively. In addition, Ramanaji *et al*. (2020) noted that the minimum egg viability (43.96%) was observed in groundnut kernels treated with neem seed kernel powder which was followed by neem leaf powder (48.62%), eucalyptus leaf powder (53.96%) and garlic bulb powder (60.62%).

**Weight loss**

The minimum percentage of weight loss was observed in groundnut kernels treated with neem leaf powder at 1.25 per cent (8.90%) and it was significantly superior over rest of the treatments. However, treatment with lemongrass at 1.25 per cent registered the highest (25.25%) weight loss and it was at par with nafatiya leaf powder, lantana leaf powder and mint leaf powder at 1.25 per cent (24.50 to 22.05%). According to Patel (2000), neem leaf powder and eucalyptus leaf powder were most promising protectants based on rice weight loss due to *C. cephalonica* which is in agreement with the present findings.

**Germination**

The germination of groundnut kernels treated with various botanical powders ranged from 86.00 to 92.00 per cent and there was no significant difference among the treatments which indicated uniform germination of kernels after 3 months of storage. Hence, it is evident that none of the botanical powders had adverse effect on the germination of groundnut kernels. The results obtained were in close association with Dulera *et al*. (2015) and Ramanaji *et al*. (2020) who observed non-significant germination of groundnut kernels treated with various botanical powders after 120days.

## Conclusion

It can be concluded that among various botanical powders, neem leaf powder and karanj leaf powder at 1.25 per cent were most effective protectant against rice moth in groundnut.

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