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**Allwin Loveson**
Agricultural College and Research Institute, Killikulam, TNAU, Tamil Nadu, India

**Srividhya S**
Horticultural College and Research Institute, Paiyur, TNAU, Tamil Nadu, India

**Jamuna E**
ICAR-Krishi Vigyan Kendra, Tindivanam, TNAU, Tamil Nadu, India

**Thilagam P**
Horticultural College and Research Institute, Paiyur, TNAU, Tamil Nadu, India

**Deivamani M**
ICAR-Krishi Vigyan Kendra, Paparappatty, TNAU, Tamil Nadu, India

**Corresponding Author:**
**Srividhya S**
Horticultural College and Research Institute, Paiyur, TNAU, Tamil Nadu, India

# Efficacy of plant based products and entomopathogenic microbials efficacy against blossom midge, *Contarinia maculipennis* felt on orchids of Perunchilambu, Tamil Nadu, India

**Allwin Loveson, Srividhya S, Jamuna E, Thilagam P and Deivamani M**

**Abstract**
The Orchid midge infestation may be due to importation of orchids from Thailand. Now, *C. maculipennis* has become a serious threat to orchid producers in Indian subcontinent. It is a polyphagous pest, causes severe damage by infesting the blossoms of dendrobium plants in orchid farms. The ovipositional injury by adults and feeding of larvae on flower buds leads to decaying of flower buds which cause considerable damage and inflicting severe yield loss to the growers. Experiments on the efficacy of botanicals and entomopathogenic microbials were evaluated against blossom midge, *C. maculipennis* on orchids under the shade net conditions in two different locations (Rynco orchid farm, Thuckalay, Kanyakumari. and Horticultural Research Station, Pechiparai). Botanicals were tested for their efficacy against blossom midge showed similar results. Among the botanical oils, lemongrass oil recorded highest ovipositional deterrent effect (92.88%).Pungam oil @ 5ml/l showed the lowest ovipositional deterrence of 23.52 per cent and 18.72 per cent at 24 and 48 hours after treatment, respectively. Among the entomopathogenic microbials evaluated as soil drench on pupation and adult emergence of *C. maculipennis, M. anisopliae* @ 5 g/l had the minimum per cent pupation of 27.20 and the highest per cent reduction in pupation over untreated control of 72.15 with the per cent adult emergence of 38.81.*Paecilomyceslilacinus*@ 5 g/l showed the maximum per cent pupation of 77.60 and the per cent reduction in pupation over untreated control of 20.48 with the per cent adult emergence of 89.69.

**Keywords:** *Contarinia maculipennis,* Orchid midges, Botanicals, Entomo pathogenic microbials

## Introduction
Orchids are the colourful flowers widely used as cut flowers and decorative flowers. Orchids are valued for cut flower production due to their long lasting vase life and higherrate in the international market (Gupta, 2017) [3]. Among the orchids, *Dendrobium* spp. are the most popular tropical orchids widely used as cut flowers in the world (Sugapriya *et al.*, 2012) and occupies nearly 90 per cent of the area under orchid cultivation due to the advancement in management practices (Sujatha A, 2009) [12].

Orchids are infested by different insect pests as that of other flowering and ornamental plants. The orchid production is mainly hampered by the blossom midge, *C. maculipennis*. It is a polyphagous pest, and which causes severe damage by infesting the blossoms of dendrobium plants in orchid orchards. The ovipositional injury by adults and feeding of larvae on flower buds leads to decaying of flower buds which cause considerable damage and inflicting severe yield loss to the farmers of India (Gagné, 1989) [2].

*C.maculipennis*has been recorded as an important insect pest infesting the flower buds of *Jasminum sambac* Linn in Andhra Pradesh (Thirumala Rao *et al.*, 1954) [13] and *J. auriculatum* Vahl in Tamil Nadu (David, 1958) [1] for the first time. Further, it is primarily a pest of hibiscus and dendrobium orchids, tomato, jasmine, plumeria, egg plant, pepper, bitter melon and many vegetables and ornamentals (Kawate and Sewake, 2014) [9]. (Jensen, 1950) [8] reported that the eggs are laid by *C. maculipennis* inside the flower buds. The eggs are usually hatched within one to two days after egg laying.

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The larval development has completed within five to seven days and then pupates in the soil. Adults normally emerged 14 days after pupation. In Hawaii islands, *C. maculipennis* took 24 – 28 days to complete one generation.

Though *C. maculipennis* has been recorded as a major pest in many parts of the world, it is known to infest the Dendrobium plants very recently in Tamil Nadu, India (Jayasheelan *et al*., 2018) [7]. The infestation may be due to importation of orchids from Thailand. Now, *C. maculipennis* has become a serious threat to orchid farmers in Indian subcontinent.Since, *C. maculipennis* assumed a major pest status on orchid plants; it is essential to formulate an eco-friendly pest management strategy on orchids gains importance.

## Materials and Methods

### Culturing of *C. maculipennis*

The infested Dendrobium buds were collected from the farm and placed inside the glass bottle (100 mm height with 50 mm dia.) filled with moist soil up to 3 cm for pupation. The adults were collected regularly, utilized for further culture maintenance and experiments.

### Experimental trial location

Efficacy of different bio-rationals against orchid blossom midge, *C. maculipennis* was carried out in two different locations under shade net conditions during February 2018 – April 2018.

### Efficacy of botanicals as ovipositional deterrent against adults of blossom midge, *C. maculipennis* on orchids

Experiments on the efficacy of botanicals against blossom midge, *C. maculipennis* on orchids was carried out under the shade net conditions at Rynco orchid farm, Thuckalay, Kanyakumari. Shade net experiments were conducted to evaluate the efficacy of botanical oils on oviposition of *C. maculipennis*. The Dendrobium plants sprayed with different oils were placed at equidistance inside the insect proof chamber (3×2×2.5m). Ten pairs of newly emerged male and female *C. maculipennis* were released into the insect proof chamber. The treated plants of five replicates were placed randomly on tray benches inside the insect proof chamber. After the introduction of the adults into insect proof chamber, plants were removed and apical flower buds were dissected and examined under the microscope. The observations were recorded at 24 and 48 hours after treatment. All the eggs and larvae found were counted and expressed as per cent reduction over untreated control.

| S. No. | Treatments | Dosage |
|---|---|---|
| $T_1$ | Illupai oil | 5 ml/l |
| $T_2$ | Jatropha oil | 5 ml/l |
| $T_3$ | Lemongrass oil | 5 ml/l |
| $T_4$ | Neem oil | 5 ml/l |
| $T_5$ | Palmarosa oil | 5 ml/l |
| $T_6$ | Pungam oil | 5 ml/l |
| $T_7$ | Untreated check | - |

### Efficacy of entomopathogenic microbials as soil drench on the pupae of blossom midge, *C. maculipennis* on orchids

Different entomopathogenic microbials were evaluated against the pupae of *C. maculipennis* as soil drench under shade net conditions. The soil around the orchid plants was drenched with microbial solutions to find out the effect on pupation of *C. maculipennis*. In each replication, twenty five final instar larvae about to pupate were released on the treated soil surface. The experiment was carried out with five replications. Observations on per cent pupation and adult emergence were recorded and expressed as per cent reduction over untreated control.

| S. No. | Treatments | Dosage |
|---|---|---|
| $T_1$ | *Bacillus thuringiensis var. kurstaki*0.5%WP | 5 g/l |
| $T_2$ | *Beauveria bassiana*1x10$^8$cfu/g | 5 g/l |
| $T_3$ | *Metarhizium anisopliae*1x10$^8$cfu/g | 5 g/l |
| $T_4$ | *Paecilomyces fumosoroseus*1x10$^8$cfu/g | 5 g/l |
| $T_5$ | *Paecilomyces lilacinus*1x10$^8$cfu/g | 5 g/l |
| $T_6$ | *Lecanicillium lecanii* 1x10$^8$cfu/g | 5 g/l |
| $T_7$ | Untreated control | - |

### Statistical Analysis

The experimental data were analyzed using SPSS statistical package (SPSS version 16.0). The shade net experiments were conducted using completely Randomized Block Design and the percentage values obtained were converted using arc sine transformation. The per cent reduction over untreated control was calculated using the following formula given by Henderson and Tilton (1955) [5].

$$\text{Per cent reduction over untreated control (\%)} = \left[1 - \frac{Ta \times Cb}{Tb \times Ca}\right] \times 100$$

Where, *Ta* = Number of midges after treatment
*Tb* = Number of midges before treatment
*Ca* = Number of midges in untreated control after treatment
*Cb* = Number of midges in untreated control before treatment

## Results and Discussion

### Efficacy of botanicals as ovipositional deterrent against adults of *C. maculipennis* on orchids

#### Location-I

The results of experiment conducted at Rynco orchids, Perunchilambu under shade net condition revealed that among the six botanical oils evaluated as foliar spray against the adults of *C. maculipennis*, lemongrass oil @ 5 ml/l had highest ovipositional deterrence of 92.88 per cent and 59.89 per cent at 24 and 48 hours after treatment, respectively and followed by palmarosa oil @ 5 ml/l had ovipositional deterrence of 78.53 per cent and 45.71 per cent at 24 and 48 hours after treatment, respectively. Pungam oil @ 5ml/l showed the lowest ovipositional deterrence of 23.52 per cent and 18.72 per cent at 24 and 48 hours after treatment, respectively (Table 1).

#### Location-II

Similar trend was also noticed in the results of experiment conducted at Horticultural Research Station, Pechiparai under shade net condition. The data revealed that among the six botanical oils evaluated as foliar spray against the adults of *C. maculipennis*, lemongrass oil @ 5 ml/l had the highest ovipositional deterrence of 90.17 per cent and 57.37 per cent at 24 and 48 hours after treatment, respectively and followed by palmarosa oil @ 5 ml/l had the ovipositional deterrence of 79.72 per cent and 41.05 per cent at 24 and 48 hours after treatment, respectively. Pungam oil @ 5ml/l showed the lowest ovipositional deterrence of 26.27 per cent and 14.61 per cent at 24 and 48 hours after treatment, respectively (Table 1).

### Efficacy of some entomopathogenic microbials as soil drench on pupation and adult emergence of *C. maculipennis*on orchids

**Location-I:** The results of the experiment conducted at Rynco Orchids, Perunchilambu under shade net conditions revealed that among the six entomopathogenic microbials evaluated as soil drench against the pupation and adult emergence of *C. maculipennis*, *M. anisopliae* @ 5 g/l had the minimum per cent pupation of 27.20 and the highest per cent reduction in pupation over untreated control of 72.15 with the per cent adult emergence of 38.81 and followed by *B. bassiana* @ 5 g/l had the per cent pupation of 35.20 and the per cent reduction in pupation over untreated control of 63.94 with the per cent adult emergence of 47.78. *Paecilomyces lilacinus* @ 5 g/l showed the maximum per cent pupation of 72.00 and the per cent reduction in pupation over untreated control of 26.11 with the per cent adult emergence of 93.50 (Table 2).

**Location II:** The similar results were also noticed at Horticultural Research Station, Pechiparai under shade net conditions which revealed that among the six entomopathogenic microbials evaluated as soil drench against the pupation and adult emergence of *C. maculipennis*, *M. anisopliae* @ 5 g/l recorded the minimum per cent pupation of 28.80 and the highest per cent reduction in pupation over untreated control of 70.48 with the per cent adult emergence of 58.33 and followed by *B. bassiana* @ 5 g/l had the per cent pupation of 34.40 and the per cent reduction in pupation over untreated control of 64.71 with the per cent adult emergence of 62.79. *Paecilomyces lilacinus* @ 5 g/l showed the maximum per cent pupation of 77.60 and the per cent reduction in pupation over untreated control of 20.48 with the per cent adult emergence of 89.69 (Table 2).

Among the six botanical oils evaluated as foliar spray against adults of *C. maculipennis*, lemongrass oil shown the highest ovipositional deterrent action which might be due to the less preference of dipterans to oviposit their eggs over the lemongrass oil sprayed substratum and the persistence of repellent compounds *viz.*, geraniol and citronellol over the buds for a longer period followed by palmarosa oil in 24 hours. The results of the effect of palmarosa oil are in line with the findings of Isabel (1996) [6] and Vanitha (2001) [14]. Pungam oil showed the lowest ovipositional deterrence effect. Among the entomopathogenic microbials evaluated as soil drench on pupation and adult emergence of *C. maculipennis*, *M. anisopliae* $1x10^8$cfu/g shown the highest per cent reduction in pupation and adult emergence which is in accordance with Hemalatha (2009) [4] and Merlin Kamala (2017) [10].

**Table 1:** Efficacy of botanicals as ovipositional deterrent against adults of *C. maculipennis*-Location I &II

| S. No. | Treatment | Location I | | | | Location II | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Number of eggs laid/plant* | | % reduction over untreated control | | Number of eggs laid/plant* | | % reduction over untreated control | |
| | | 24 h | 48 h | 24 h | 48 h | 24 h | 48 h | 24 h | 48 h |
| $T_1$ | Illupai oil @ 5 ml/l | 9.40 | 17.80 | 58.78 (50.06)$^c$ | 37.47 (37.75)$^c$ | 9.20 | 16.60 | 56.19 (48.56)$^c$ | 35.60 (36.63)$^c$ |
| $T_2$ | Jatropha oil @ 5 ml/l | 14.2 | 20.20 | 37.60 (37.82)$^d$ | 29.51 (32.91)$^d$ | 16.20 | 19.80 | 28.86 (32.49)$^d$ | 23.07 (28.71)$^d$ |
| $T_3$ | Lemongrass oil @ 5 ml/l | 1.60 | 11.40 | 92.88 (74.53)$^a$ | 59.89 (50.70)$^a$ | 2.20 | 11.00 | 90.17 (71.73)$^a$ | 57.37 (49.24)$^a$ |
| $T_4$ | Neem oil @ 5 ml/l | 9.40 | 16.60 | 58.83 (50.08)$^c$ | 41.55 (40.14)$^{bc}$ | 9.80 | 15.80 | 57.02 (49.04)$^c$ | 38.73 (38.49)$^{bc}$ |
| $T_5$ | Palmarosa oil @ 5 ml/l | 4.80 | 15.40 | 78.73 (62.54)$^b$ | 45.71 (42.54)$^b$ | 4.60 | 15.20 | 79.72 (63.24)$^b$ | 41.05 (39.84)$^b$ |
| $T_6$ | Pungam oil @ 5 ml/l | 17.40 | 23.20 | 23.52 (29.01)$^e$ | 18.72 (25.64)$^e$ | 16.80 | 22.00 | 26.27 (30.83)$^d$ | 14.61 (22.48)$^e$ |
| $T_7$ | Untreated control | 22.80 | 28.60 | 0.00 | 0.00 | 22.80 | 25.80 | 0.00 | 0.00 |
| | SED | | | 1.79 | 1.91 | | | 1.29 | 0.96 |
| | CD (P=0.05) | | | 3.67 | 3.92 | | | 2.64 | 1.97 |

*Mean of five replications, Figures in parentheses are arc-sin transformed values.
In a column, means followed by common letters are not significantly different by LSD (P=0.05)

**Table 2:** Efficacy of entomopathogenic microbials as soil drench on pupation and adult emergence of *C. maculipennis*-Location I

| S. No. | Treatment | Total number of larvae* | Total number of dead larvae* | Total number of larvae pupated* | Per cent pupation | Per cent reduction in pupation over untreated control | Number of adults emerged | Per cent adult emergence |
|---|---|---|---|---|---|---|---|---|
| $T_1$ | *Bacillus thuringiensis var. kurstaki* @ 5 g/l | 25.00 | 13.00 | 12.00 | 48.00 | 50.83 (45.48)$^c$ | 10.80 | 90.21 |
| $T_2$ | *Beauveriabassiana* @ 5 g/l | 25.00 | 16.20 | 8.80 | 35.20 | 63.94 (53.11)$^b$ | 4.20 | 47.78 |
| $T_3$ | *Metarhiziumanisopliae* @ 5 g/l | 25.00 | 18.20 | 6.80 | 27.20 | 72.15 (58.17)$^a$ | 2.60 | 38.81 |
| $T_4$ | *Paecilomycesfumosoroseus*@ 5 g/l | 25.00 | 8.80 | 16.20 | 64.80 | 33.52 (35.34)$^d$ | 14.20 | 87.87 |
| $T_5$ | *Paecilomyceslilacinus* @ 5 gm/l | 25.00 | 7.00 | 18.00 | 72.00 | 26.11 (30.61)$^e$ | 16.80 | 93.50 |
| $T_6$ | *Lecanicilliumlecanii* @ 5 g/l | 25.00 | 13.80 | 11.20 | 44.80 | 54.00 (47.30)$^c$ | 8.80 | 79.09 |
| $T_7$ | Untreated control | 25.00 | 0.60 | 24.40 | 97.60 | 0.00 | 23.40 | 95.86 |
| | SED | | | | | 1.49 | | |
| | CD (P=0.05) | | | | | 3.06 | | |

*Mean of five replications, Figures in parentheses are arc-sin transformed values.
In a column, means followed by common letters are not significantly different by LSD (P=0.05)

## Conclusion

Among the botanical oils, lemongrass oil recorded highest ovipositional deterrent effect (92.88%). Among the entomopathogenic microbials, *M. anisopliae* $1x10^8$cfu/g shown the highest per cent reduction in pupation and adult emergence.

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## References

1. David S. Insects and mites affecting jasmine in the Madras state. Madras Agric J. 1958;45(4):146-150.
2. Gagné RJ. The plant-feeding gall midges of North America. Comstock Pub Associates, 1989.
3. Gupta H. Studies on the effect of micronutrient on the growth of orchid (Dendrobium nobile) cv. Sonia white under shade net house. M.Sc. Thesis, Indira Gandhi Krishi Vishwavidhyalaya, Raipur, 2017.

4. Hemalatha G. Biorational management of key pests of Jasmine (*Jasminum sambac*). M.Sc. Thesis, College of Horticulture, Vellanikkara, 2009.
5. Henderson CF, Tilton EW. Tests with acaricides against the brown wheat mite. J Econ Entomol. 1955;48(2):157-61.
6. Isabel JN. Studies on the management of major pests of Jasmine (*Jasminum sambac* Ait.) Gundumalli with special reference to Nausino egeometralis Guenee (Pyralidae: Lepidoptera). M.Sc. Thesis, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India, 1996.
7. Jayasheelan M, Allwin L, Elanchezhyan K, Preetha G. New record of orchid blossom midge Contarinia maculipennis Felt in Tamil Nadu. Paper presented at the International Conference on Biocontrol and Sustainable Insect Pest Management, Killikulam, 2018.
8. Jensen D. Notes on the life history and ecology of blossom midge, *Contarinia lycopersici* Felt (Diptera: Cecidomyiidae). Proc Hawaiian Entomol Soc. 1950;14(1).
9. Kawate M, Sewake K. Pest management strategic plan for potted orchid production in Hawaii. University of Hawaii at Manoa, 2014.
10. Merlin Kamala I. Studies on diversity, bioecology and integrated management of major pests of jasmine (*Jasminum sambac* L.). Ph.D. Thesis, Tamil Nadu Agricultural University, Madurai, 2017.
11. Sugapriya S, Mathad J, Patil A, Hegde R, Lingaraju S, Biradar M. Evaluation of Dendrobium orchids for growth and yield grown under greenhouse. Karnataka J Agric Sci. 2012;25(1).
12. Sujatha AN. Influence of nutrition on yield, quality and profitability of orchid cv. Dendrobium Sonia 17. Paper presented at the International Conference on Horticultural for Livelihood Security and Economic Growth, Bangalore, 2009.
13. Thirumala Rao V, Perraju A, Ranga Rao PV. The jasmine fly. Andhra Agric J. 1954;1:313-315.
14. Vanitha J. Management of major pests of jasmine (*Jasminum* spp.) with special reference to botanicals and biological control. M.Sc. Thesis, Tamil Nadu Agricultural University, 2001.