Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

**E-ISSN:** 2278-4136
**P-ISSN:** 2349-8234
JPP 2019; 8(4): 3081-3084
Received: 29-05-2019
Accepted: 30-06-2019

**Suresh D Ekabote**
Professor and Head, Department of Horticulture Crop Protection, College of Horticulture, Hiriyur, University of Agricultural and Horticultural Sciences, Shivamogga, Karnataka, India

**Pruthviraj**
Senior Research Fellow, Department of Horticulture Crop Protection, College of Horticulture, Hiriyur, University of Agricultural and Horticultural Sciences, Shivamogga, Karnataka, India

**Ravindra H**
Associate Director of Research, University of Agricultural and Horticultural Sciences, Shivamogga, Karnataka, India

**Narayanaswamy P**
Registrar, University of Agricultural and Horticultural Sciences, Shivamogga, Karnataka, India

**Correspondence**
**Suresh D Ekabote**
Professor and Head, Department of Horticulture Crop Protection, College of Horticulture, Hiriyur, University of Agricultural and Horticultural Sciences, Shivamogga, Karnataka, India

# Studies on bio-efficacy and phytotoxicity of Mandipropamid 23.4% w/w SC (Revus 25 SC) on cucumber against downy mildew disease

**Suresh D Ekabote, Pruthviraj, Ravindra H and Narayanaswamy P**

**Abstract**
Cucumber (*Cucumis sativus*) is a widely cultivated plant in the gourd family, Cucurbitaceae. It is a creeping vine that bears cucumiform fruits that are used as vegetables. Downy mildew caused by *Pseudoperonospora cubensis* (Berk. and Curt.) Rostow has become a serious problem for successful cultivation of cucumber. Therefore, a field experiment was carried out on the effect of Mandipropamid 23.4% w/w SC (Revus 25 SC) against downy mildew during 2017-18 and 2018-19, at College of Horticulture, Hiriyur. Experimental results revealed that all the treatments significantly reduced the downy mildew disease severity over untreated control. Amongst all the treatments in both season significantly least disease severity of downy mildew (5.97 and 3.66%) was recorded with foliar application of Mandipropamid 23.4% w/w SC (Revus 25 SC) at 1ml/lt with highest yield of 16.27 and 16.92 t/ha respectively followed by Mandipropamid 23.4% w/w SC (Revus 25 SC) at 0.8ml/lt.

**Keywords:** Cucumber, downy mildew and Mandipropamid

## Introduction
The cucumber (*Cucumis sativus* L.) is cultivated on large scale in open field. Several diseases have been reported to attack cucumber crop in field as well as in green house. It is a monoecious creeper is a nutritious and delicious vegetable of tropical part of the world (Bailey, 1969) [1]. It belongs to family cucurbitaceae and having chromosome number 2n= 14. It contributes in vegetable production due to the number of vegetables are prominent members of this family. Cucumber exhibits a fascinating range of floral morphology, including staminate, pistillate and hermaphrodite flowers occurring in various arrangements and expressed various types of flowers. Downy mildew of cucumber (*Pseudoperenospora cubensis*) causes serious losses under favourable environmental conditions. Downy mildew on cucumber appears as characteristic small, slightly chlorotic to bright yellow areas on the upper surface of leaves which, later turn necrotic and brown. Lesions are angular in shape bounded by leaf veins. Sporangiophores appear on lower leaf surface producing brown or colourless zoosporangia through the stomata and cause necrosis of larger leaf areas and finally the death of entire leaf (Miriam *et al*., 2004) [6]. Elizabeth *et al*., 2011 [4] while studying the symptom expression on various cucurbits *viz.*, cucumber (*Cucumis sativus*), muskmelon (*Cucumis melo*), ridge gourd (*Luffa acutangula*) and spongegourd (*Luffa aegyptiaca*) initially observed development of pale green areas, separated by islands of darker green, progressively these spots turn yellow and become well-defined angular in shape often restricted by veins on upper surface with purplish downy growth on lower side, subsequently resulting in death of entire leaf. Bains (1991) categorized symptom expression depicted by leaves of various cucurbitaceous crops in response to downy mildew diseases caused by *Pseudoperonospora cubensis* into four groups with respect to lesion colour, shape, size, coalescing, necrosis and extent of sporulation. The four categories are as follows: Category-I: Isolated faded green to faint yellow lesions with no sporulation and no necrosis; Category-II: Conspicuous visible spots of restricted size, with water soaked corky lesions on the underside; Category-III: Conspicuous lesions due to their colour, i.e. yellow to tan yellow, enlarged spots, frequently coalescing and becoming necrotic. Category-IV: Necrotic lesions without any sporulation. Singh and Thind (2001) [8], Hausbeck *et al.*, 2014 [5], studied downy mildew disease on various cucurbitaceous crops and found symptoms confined only to leaves with yellow water soaked irregular areas on upper surface. On further advancement, these lesions were covered on lower side by violet greyish to brownish growth of sporangiophores and sporangia. Subsequently, these areas enlarged, coalesced and became necrotic. Therefore, keeping in view of economic losses caused by diseases, the present study was aimed at bottleneck for the management of downy mildew diseases.

## Material and methods

A field experiment on bio efficacy of Mandipropamid 23.4% w/w SC (Revus 25 SC) against downy mildew of cucumber were conducted at College of Horticulture, Hiriyur during 2017-18 and 2018-19. The experiments consisted of seven treatments *viz.*, untreated check, Mandipropamid 23.4% w/w SC (Revus 25 SC) at 0.6, 0.8 and 1ml/lt. Cymoxanil 8% + Mancozeb 64% WP (3 g/lt), Azoxystrobin 23% SC (1ml/lt) and Mancozeb 75% WP (4 g/lt)and was laid-out in Randomized Block Design with three replication. A susceptible variety was used for the present investigations. The variety was grown as per packages of practices for higher yields. Treatments were imposed at the beginning of the disease appearance. Spray schedule was repeated at fifteen days intervals. The observations of downy mildew were recorded using a 0-5 scale. The Per cent disease index (PDI) was computed by selecting five plants at random and recording severity as per 0–5 scale (Verma and Saharan, 1994) [9] where 0 - no disease; 1, 1–10%; 2, 11–25%; 3, 26–50%; 4, 51–75%; 5, 76–100% at before and after each spray. Average of all spray has been given in this and the data was statistically analyzed after suitable transformations. The recorded grade values were converted into Percent Disease Index (PDI) by using following formula proposed by Wheeler (1969) [10].

The per cent disease severity was calculated by the formula:

$$\text{Percent disease severity} = \frac{\text{Number of leaves infected}}{\text{Total number of leaves observed}} \times 100$$

The observation on fruit yield expressed in terms of t/ha was also recorded.

For Phytotoxicity studies

| Sl. No | Treatment | g. a.i/lit of water | Formulation (g or ml/lit of water) |
|---|---|---|---|
| 1 | Untreated check | -- | --- |
| 4 | Mandipropamid 23.4% w/w SC | 0.25 | 1 |
| 5 | Mandipropamid 23.4% w/w SC | 0.50 | 2 |

## Results and discussion

A field experiment was conducted at College of Horticulture, Hiriyur as explained in 'material methods' to find out the effect of chemical for management of downy mildew of cucumber during the *kharif* 2017-18 and 2018-19. Totally three sprays were given at fifteen days intervals starting from initiation of disease. The Observations were recorded at fifteen days after spray (DAS) by using a 0-5 scale and converted into per cent disease index (PDI) using the formula given by Wheeler (1969) [10], and calculated yield was statistically analyzed, data were presented in Table 1, 2 and 3.

### Per cent disease index

Downy mildew during first year experiments (2017-18) the effect of test fungicides Mandipropamid 23.4% w/w SC (Revus 25 SC) comparing with other fungicides on downy mildew of cucumber revealed that the disease severity before the treatment imposition was non-significant, and all the treatments remained on par or almost uniform with each other. The first season experiment on effect of test fungicide Mandipropamid 23.4% w/w SC (Revus 25 SC) and other comparing fungicide on downy mildew of cucumber revealed that the treatments differed significantly over the study period (Table 1). Downy mildew severity was significantly low in Mandipropamid 23.4% w/w SC treated plots. At the terminal stage of disease record 6.33 and 5.97 disease severity was measured when treated with Mandipropamid 23.4% w/w SC at the rate of 0.8ml/lt and 1ml/lt respectively, which indicated 85.39 and 86.22 reduction in downy mildew, respectively compared to control (43.33% disease severity) and significantly superior over other fungicides tried. The downy mildew severity in Cymoxanil 8% + Mancozeb 64% WP at 3g/lt and Mancozeb 75% WP at 4g/lt were 13.67 and 18.67 and inferior to various doses of Mandipropamid 23.4% w/w SC. Azoxystrobin 23% SC at 1ml/lt was superior over the Mandipropamid 23.4% w/w SC at 0.6ml/lt but inferior over the Mandipropamid 23.4% w/w SC at 0.8 and 1ml/lt (Table 1).

The 2nd season experiment exhibited that at terminal stage of disease record downy mildew severity were 4.80 and 3.66% in Mandipropamid 23.4% w/w SC treated plots applied through foliar application @ 0.8ml/lt and 1ml/lt, respectively and these treatments were significantly comparable with the other treatments (Table 2). The per cent disease reduction by those treatments compared to untreated check were 87.01% and 90.09% respectively. The next best treatment was Azoxystrobin 23 SC applied @ 1ml/lt and Cymoxanil 8% + Mancozeb 3g/lt but both the molecules are inferior to two (0.8 and 1ml/lt) doses of Mandipropamid 23.4% w/w SC.

### Yield

The treatments, Mandipropamid 23.4% w/w SC (Revus 25 SC) @ 0.8 and 1ml/lt gave fruit yield *i.e.,* 15.83 t/ha and 16.27 t/ha respectively in the year 2017-18, which were significantly higher than the other molecules tested. The untreated check resulted in 10.17 t/ha. Azoxystrobin 23 SC exhibited fruit yield of 14.50 t/ha and Cymoxanil 8% + Mancozeb 64% WP gave the fruit yield of 12.67 t/ha which were significantly inferior to Mandipropamid 23.4% w/w SC (Revus 25 SC) @ 0.8 and 1ml/lt (Table 2). The treatments, Mandipropamid 23.4% w/w SC (Revus 25 SC) @ 0.8 and 1ml/lt gave fruit yield *i.e.,* 16.32 and 16.92 respectively which were significantly higher than the other molecules tested in the year 2018-19. The untreated check resulted in 11.54 t/ha. Azoxystrobin 23 SC exhibited fruit yield of 15.84 t/ha and Cymoxanil 8% + Mancozeb 64% WP gave the fruit yield of 14.89 t/ha which were significantly inferior to Mandipropamid 23.4% w/w SC (Revus 25 SC) at rate of 0.8 and 1ml/lt (Table 3).

Results of the present study showed that all fungicide treatments significantly controlled downy mildew infection on cucmber as compared to untreated control. Among the different fungicides Mandipropamid 23.4% w/w SC (Revus 25 SC) at all concentration recorded least disease severity. The results obtained concur with the results obtained by many workers Cohen *et al*. (2007) [3] and Lal *et al*. (2018) [7] found that carboxylic acid amide (CAA) fungicide mandipropamid was effective in managing late blight of with no phytotoxic effect on the crop even on increasing the recommended dose. Bhat *et al*. (2018) [2] who found that Mandipropamid was found effective in managing downy mildew of cucumber.

**Phytotoxicity**

There were no phytotoxicity symptoms like Epinasty, hyponasty, vein clearing, yellowing, necrosis, leaf margin burning, rosseting and wilting were observed in different concentrations of Mandipropamid 23.4% w/w SC (Revus 25 SC) (Table 4).

**Conclusion**

Based on the two-year experimentation it has been found that, Mandipropamid 23.4% w/w SC (Revus 25 SC) at 1ml/lit is most effective in management of downy mildew of cucumber, which was on par with the same fungicides at 0.8 ml/lit.

**Acknowledgement**: The senior author is grateful to M/s Syngenta, India Ltd, Pune for providing financial assistance to conduct the study.

**Table 1:** Bio efficacy of Mandipropamid 23.4% w/w SC against downy mildew of cucumber during, 2017-18

| Sl. No | Treatment | Dosage G or ml/lt | Disease severity (%) | | | % Disease reduction |
|---|---|---|---|---|---|---|
| | | | 1 DBA | 15 days 1st spray | 15 days 2nd spray | |
| 1 | Untreated check | -- | 1.62 | 22.66 | 43.33 | -- |
| 2 | Mandipropamid 23.4% w/w SC | 0.6 | 0.94 | 6.33 | 10.33 | 76.15 |
| 3 | Mandipropamid 23.4% w/w SC | 0.8 | 0.26 | 1.96 | 6.33 | 85.39 |
| 4 | Mandipropamid 23.4% w/w SC | 1 | 0.70 | 1.88 | 5.97 | 86.22 |
| 5 | Cymoxanil 8% + Mancozeb 64% WP | 3 | 0.10 | 2.16 | 13.67 | 68.45 |
| 6 | Azoxystrobin 23% SC | 1 | 0.62 | 3.66 | 8.67 | 79.99 |
| 7 | Mancozeb 75% WP | 4 | 0.46 | 6.33 | 18.67 | 56.91 |
| | SEm± | | NS | 0.60 | 0.64 | |
| | CD (0.05%) | | NS | 1.86 | 1.97 | |
| | CV | | NS | 16.43 | 17.28 | |

* DBA- day before application

**Table 2:** Bio efficacy of Mandipropamid 23.4% w/w SC against downy mildew of cucumber during, 2018-19

| Sl. No | Treatment | Dosage G or ml/lt | Disease severity (%) | | | % Disease reduction |
|---|---|---|---|---|---|---|
| | | | 1 DBA | 15 days 1st spray | 15 days 2nd spray | |
| 1 | Untreated check | -- | 0.96 | 15.80 | 36.96 | --- |
| 2 | Mandipropamid 23.4% w/w SC | 0.6 | 0.80 | 5.66 | 9.33 | 74.75 |
| 3 | Mandipropamid 23.4% w/w SC | 0.8 | 0.40 | 1.44 | 4.80 | 87.01 |
| 4 | Mandipropamid 23.4% w/w SC | 1 | 0.66 | 1.32 | 3.66 | 90.09 |
| 5 | Cymoxanil 8% + Mancozeb 64% WP | 3 | 0.48 | 4.88 | 14.33 | 61.22 |
| 6 | Azoxystrobin 23% SC | 1 | 0.24 | 1.56 | 6.33 | 82.87 |
| 7 | Mancozeb 75% WP | 4 | 0.80 | 6.33 | 16.66 | 54.92 |
| | SEm± | | NS | 0.56 | 0.43 | |
| | CD (0.05%) | | NS | 1.73 | 1.34 | |
| | CV | | NS | 18.46 | 5.74 | |

* DBA- day before application

**Table 3:** Effect of Mandipropamid 23.4% w/w SC on yield of cucumber during 2017-18 and 2018-19

| Sl. No | Treatment | Dosage G or ml/lit of water | Fruit yield (t/ha) | |
|---|---|---|---|---|
| | | | 2017-2018 | 2018-19 |
| 1 | Untreated check | -- | 10.17 | 11.54 |
| 2 | Mandipropamid 23.4% w/w SC | 0.6 | 12.83 | 13.46 |
| 3 | Mandipropamid 23.4% w/w SC | 0.8 | 15.83 | 16.32 |
| 4 | Mandipropamid 23.4% w/w SC | 1 | 16.27 | 16.92 |
| 5 | Cymoxanil 8% + Mancozeb 64% WP | 3 | 12.67 | 14.89 |
| 6 | Azoxystrobin 23% SC | 1 | 14.50 | 15.84 |
| 7 | Mancozeb 75% WP | 4 | 11.17 | 12.76 |
| | SEm± | | 0.43 | 0.43 |
| | CD (0.05%) | | 1.34 | 1.34 |
| | CV | | 5.68 | 5.68 |

**Table 4:** Impact of Mandipropamid 23.4% w/w SC on cucumber during 2017-18 and 2018-19

| Treatments | Dose (ml/lt) | Score values on | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 DAA | | | | | | 3 DAA | | | | | | 5 DAA | | | | | | 7 DAA | | | | | | 10 DAA | | | | | |
| | | A | B | C | D | E | F | A | B | C | D | E | F | A | B | C | D | E | F | A | B | C | D | E | F | A | B | C | D | E | F |
| Mandipropamid 23.4% w/w SC | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mandipropamid 23.4% w/w SC | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Untreated check | -- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

A: Leaf injury on tips and leaf surface; B: Wilting; C: Leaf vein clearing; D: Necrosis; E: Epinasty; F: Hyponasty; DAA: Days after Application

**References**


1. Bailey LH. Manual of cultivated plants. Macmillan Company, New York, 1969, 116.
2. Bhat JA, Rizwan R, Waseem AD, Bhat RA. Efficacy of Different Fungicides for the Management of Downy Mildew of Cucumber Grown Under Low Plastic Tunnel International Journal of Pure and Applied Bioscience. 2018; 6(2):884-890
3. Cohena Y, Rubina E, Hadada T, Gotlieba D, Sierotzkib, H, Gisib U. Sensitivity of Phytophthora infestans to mandipropamid and the effect of enforced selection pressure in the field. Plant Pathology. 2007; 56:836-842.
4. Elizabeth AS, Leah LG, Lina MQ, Marina V, Mary KH, Brad D. The cucurbit downy mildew pathogen *P. cubensis*. Molecular Plant Pathology. 2011; 12:217-26.
5. Hausbeck MK, Morrice J, Linderman S. Monitoring and managing cucurbit downy mildew. Michigan State University Extension, 2014.
6. Miriam L, Ulrike S, Dehne HW, Oerke EC. Effects of downy mildew development on transpiration of cucumber leaves visualized by digital infra red thermography. Phytopathology. 2004; 12:183.
7. Lal M, Sanjeev S, Saurabh Y, Santosh K. Management of Late Blight of Potato http://dx.doi.org/10.5772/intechopen.72472.
8. Singh PP, Thind TS. Diseases of cucurbits and their management. In: Diseases of Forests and vegetables and their management. 1st Edition (ED. T. S. Thind). Kalyani Publishers, New Delhi (India), 2001, 209-305.
9. Verma PR, Saharan GS. Monograph on *Alternaria* diseases of crucifers. Saskatoon Research Station, Technical Bulletin 1994-6E, Agric Agri Food Canada, Saskatoon, Canada, 1994, 162.
10. Wheeler BEJ. An introduction to plant disease. John Wiley and Sons Ltd. London, 301, 1969.