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# Prevalence and Management of Pestalotia Leaf Spot (*Pestalotia* sp.) of Strawberry

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**Abstract**

Pestalotia leaf spot was prevalent in all the locations at Solan and Sirmour districts of Himachal Pradesh during 2017−18 cropping season. The disease incidence of Pestalotia leaf spot ranged from 6.53 to 22.87% and severity ranged from 4.44−17.77% respectively. In Solan district, highest incidence (22.21) and severity (16.66%) were recorded at Nauni followed by Mandholghat with incidence of 20.25% and disease severity of 13.33% respectively. Whereas, in Sirmour district, highest incidence (22.87%) and severity (17.77%) of Pestalotia leaf spot was recorded at Dhaulakuan and lowest incidence (6.53%) and severity (4.44%) was recorded at Baghthan. Overall data revealed that the incidence and severity of the leaf spot was higher in Solan district than Sirmour district. Among different fungicides evaluated under *in vitro* conditions, carbendazim was found most effective with 98.49% of mycelial inhibition followed by mancozeb (96.60%) and copper oxy chloride (94.60%). Under field conditions, minimum disease incidence (4.72%) and disease index (1.84%) were recorded in treatment with sprays of Bavistin. Sprays with Diathane M-45 were found next in efficacy with disease incidence of 5.14% and disease index of 2.48%.

***Keywords:*** Disease, incidence, pestalotia leaf spot, severity, symptom

## 1. Introduction

Strawberry (*Fragaria×ananassa* Duch.) is an important fruit of the family Rosaceae. Strawberry fruits are attractive with pleasant aroma, good flavour and also rich source of vitamin-C (39–86 mg 100 $g^{-1}$ fruit) and many minerals. The fruits are also rich in ascorbic acid, secondary metabolites and simple sugars as reported by Kafkas et al. (2007). On the other hand, strawberry fruits are richest source of bioactive phytochemicals with potential antioxidant activities, mainly ellagic acid and flavonoids which can lower the risk of cardiovascular diseases and tumorogenesis (Wang et al., 1996, Heinonen et al., 1998). It is cultivated in Himachal Pradesh, Jammu and Kashmir, Maharashtra, West Bengal, Nilgiri Hills, Haryana, Punjab and some parts of Delhi. With the introduction of low chilling and day neutral cultivars, strawberry cultivation is gaining more popularity in the plains of Punjab and Northern States due to high yield in the crop and remunerative returns. In Himachal Pradesh, it is cultivated over an area of 50 ha with a production of 50 MT (Anonymous, 2018). In Himachal Pradesh, strawberry is grown in certain pockets of Solan, Sirmour, Kullu, Shimla and Kangra districts. Strawberry is infected by number of diseases caused by fungi, bacteria, viruses and other pathogens. Amongst fungal diseases, leaf spots caused by different species of Pestalotia (*Pestalotia laurocerasi* and *Pestalotia longisetula*) are important diseases which cause huge losses in the crop. The symptoms of Pestalotia leaf spot starts from the beginning of the rainy season in the form of grey or dirty-white spots, measuring upto 15 mm in diameter. These spots increase in size, coalesce, often involving most of the leaf surface. The fungus fructifies on the surface of the affected leaves, forming concentric rings of minute, dot like, black structures. Later on shot-holes are usually formed in the centre of the spots and very often the entire central portion of the spot disintegrates and falls. Pestalotia leaf spots have been reported from many parts of the world. Incidence of *Pestalotia longisetula* was reported from diseased strawberry in China (Zhu et al., 1994). Camili et al. (2002) also reported *Pestalotia longisetula* causing strawberry rot from Brazil. Further, *Pestalotia* spp. has been reported as the causal agent of strawberry leaf spots disease in India (Bose, 1970). Pestalotia rot of strawberry fruits caused by *Pestalotia longisetula* was reported by Shitole et al. (2000) in India. Therefore, the present investigations were carried out to study the incidence and severity of Pestalotia leaf spot.

## 2. Materials and Methods

### *2.1. Disease survey*

Periodic survey of different strawberry growing areas was done in Solan and Sirmour districts of Himachal Pradesh for recording the incidence and severity of Pestalotia leaf

spot in the farmers' field during the months of August and September in 2017−18 cropping season. Data was recorded from three fields from each location and ten plants were randomly selected in a field. Disease incidence and severity were recorded and samples were also collected for laboratory use. Disease incidence was recorded by counting the number of infected plants in a field and disease severity was recorded on 0−7 scale. The per cent disease incidence (PDI) was calculated as below.

$$\text{Disease incidence (\%)} = \frac{\text{Total number of infected plants}}{\text{Total number of plants observed}} \times 100$$

Disease index was also calculated from five plants randomly selected per replication on a 0−7 scale (Gauhl et al., 1995). During the course of the survey, representative Pestalotia leaf spot samples with symptoms of the disease cited in the literature were collected for isolation of the pathogen.

2.2. *In vitro efficacy of fungicides against Pestalotia leaf spot*

Chemical fungicides have been used and reported effective for the management of Pestalotia leaf spot caused by *Pestalotia longisetula*. Hence, three fungicides viz., Bavistin, Diathane M-45 and Blitox most frequently cited in the literature were tested *in vitro* by poisoned food technique (Falck, 1907) to study their inhibitory effect on the radial growth of the test pathogen. These fungicides were tested at five concentrations viz., 50, 100, 250, 500 and 1000 ppm.

A double strength potato dextrose agar (PDA) medium was prepared by doubling the number of constituents used in the PDA except water. PDA was sterilized for 20 min at 1.05kg $cm^{-2}$ pressure in autoclave. Out of this sterilized melted PDA, 50 ml was taken in 250 ml conical flask. Then, 50 ml of double strength fungicidal solution was prepared in sterilized water of each fungicide to be evaluated and was added separately in double strength medium in different conical flasks. The poisoned mixed media was shaken well and poured separately in Petri plates and allowed to solidify. A small culture bit of 5 mm size of *P. longisetula* cut with a sterilized cork borer was picked up with the help of a sterilized inoculation needle and was placed in the center of each Petri plate under aseptic conditions in a laminar air flow. Petri plates with blank water and without fungicide in medium served as control. Each concentration of fungicide was replicated thrice and inoculated Petri plates were incubated at 25±1ºC for a period of 10-12 days after which diametric growth of mycelium was measured and per cent inhibition was calculated as under:

$$I = \frac{C-T}{C} \times 100$$

Where,

I=Per cent mycelial inhibition.

C=Diametric mycelial growth in control (mm)

T=Diametric mycelial growth in treatment (mm)

*2.3. Field evaluation of fungicides*

Disease management studies were carried out at the experimental farm of Department of Plant Pathology at Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh. The experiment was conducted in Randomized Block Design in (1×1) $m^2$ plot size. Distance from plant to plant and row to row was (45×45) cm. Plants of Chandler variety were used in the field experiment. Bavistin (0.05%), Dithane M-45 (0.25%) and Blitox (0.3%) were also evaluated under field conditions for comparison. Sprays of different treatments were given starting with the appearance of the disease and the control plants were sprayed with water only. Ten sprays of each treatment were given by a foot sprayer starting from first week of July at 10 days interval during 2018.

## 3. Results and Discussion

*3.1. Disease prevalence*

Data pertaining to the incidence and severity of Pestalotia leaf spot disease of strawberry at different locations is presented in Table 1. The disease was prevalent at all the locations in

Table 1: Prevalence of Pestalotia leaf spot of strawberry in Solan and Sirmour districts of Himachal Pradesh

| District | Village | Disease incidence (%) | Disease severity (%) | Variety under cultivation |
|---|---|---|---|---|
| Solan | Nauni | 22.21 | 16.66 | Winter Down, Camarosa, Chandler. |
| | Piplughat | 15.99 | 10.00 | Camarosa, Chandler. |
| | Kandaghat | 16.33 | 12.22 | Winter Down, Chandler. |
| | Mandholghat | 20.25 | 13.33 | Winter Down, Camarosa |
| | Basantpur | 18.29 | 12.22 | Chandler, Winter Down, Camarosa. |
| Sirmour | Narag | 20.91 | 14.44 | Camarosa, Winter Down. |
| | Thanadhar | 10.45 | 6.66 | Winter Down, Camarosa. |
| | Dhaulakuan | 22.87 | 17.77 | Camarosa, Winter Down, Sweet Charlies. |
| | Baghtan | 6.53 | 4.44 | Camarosa, Chandler. |
| | Sarahan | 15.03 | 13.33 | Camarosa, Winter Down. |

Solan and Sirmour districts of Himachal Pradesh. The incidence of leaf spot ranged from 6.53−22.87% and severity ranged from 4.44−17.77%. In Solan district, highest incidence and severity was recorded at Nauni (22.21 and 16.66%) followed by Mandholghat (20.25 and 13.33%). Further, lowest incidence and severity was recorded at Piplughat (15.99 and 10.00%). In Sirmour district, highest incidence (22.87%) and severity (17.77%) of Pestalotia leaf spot was recorded at Dhaulakuan and lowest incidence (6.53%) and severity (4.44%) was recorded at Baghthan. Overall data revealed that the incidence and severity of the leaf spot was higher in Solan district than Sirmour district. Pestalotiopsis leaf spot is a major problem of strawberry cultivation in Indo-Gangetic plains and more than 50% leaf area get damaged due to this disease. This pathogen also causes serious losses on the foliage and yield in other crops. Horikawa (1986) reported that grey leaf blight of tea (*Camellia sinensis*) caused by *Pestalotia theae* resulted upto 10-20% crop losses in Japan. *Pestalotia palmarum* caused foliar damage upto 90% in coconut (Karunakaran et al., 1993). Shu and Jian (1994) reported that grey leaf blight of coconut (*Pestalotiopsis palmarum*) caused yield losses to the time of 2.24 million nuts in a growing area of 23 tha in China. Das and Benchamin (2000) reported that grey blight of som (*Machilus bombycina*) plant caused by *Pestalotiopsis disseminata* resulted upto 48−59% losses in leaf production. Karthikeyan et al. (2002) reported 10.0 to 23.6% reduction in nut yield of coconut in Tamil Nadu. Joshi et al. (2009) reported that *Pestalotiopsis* sp. is most important fungal pathogen causing grey blight or spot in tea plant and due to this disease, total tea crop loss is estimated to be 17% in southern India. Lazarotto et al. (2012) reported that *Pestalotiopsis* sp. is major fungal pathogen causing leaf spots in pecan nut tree and resulted losses in nut production. Bhardwaj et al. (1998) also reported occurrence of leaf spots in strawberry caused by *Pestalotia* spp. in Himachal Pradesh.

### *3.2. In vitro efficacy of fungicides against Pestalotia leaf spot*

The data on diametric growth of fungus were recorded and presented in Table 2. It is evident from the data that all the fungicides were effective in inhibiting the mycelial growth of the pathogen in comparison to control. Maximum average mycelial growth inhibition of 98.49% was recorded in the Petri-plates poisoned with Bavistin followed by Dithane M-45 (96.60%) and Blitox (94.60%). All the three fungicides resulted in 100% mycelial inhibition of test fungus at 250, 500 and 1000 ppm concentration. However, Bavistin resulted in 92.49 and 100% mycelial inhibition even at 50 and 100 ppm concentration respectively.

Table 2: *In vitro* evaluation of fungicides against Pestalotia leaf spot pathogen (*Pestalotia longisetula*)

| Treatment | Per cent inhibition in mycelial growth at different concentration (ppm) | | | | | |
|---|---|---|---|---|---|---|
| | 50 | 100 | 250 | 500 | 1000 | Mean |
| Bavistin | 92.49(74.07)* | 100(90.15)* | 100(90.15)* | 100(90.15)* | 100(90.15)* | 98.49(86.32)* |
| Diathane M-45 | 89.58(71.14)* | 93.46(75.17)* | 100(90.15)* | 100(90.15)* | 100(90.15)* | 96.60(82.89)* |
| Blitox | 83.35(65.90)* | 89.65(71.22)* | 100(90.15)* | 100(90.15)* | 100(90.15)* | 94.60(81.05)* |
| Mean | 88.47(70.37)* | 94.37(78.59)* | 100(90.15)* | 100(90.15)* | 100(90.15)* | |

*Figure in parentheses are arc sine transformed values

Effectiveness of Bavistin, Diathane M45 and Blitox against *Pestalotia* spp. has been reported by different researchers. Das and Mahanta (1985) reported that Bavistin (at 100, 200, 300, 400, and 500 ppm concentration) and Diathane M-45 (at 500 ppm) completely inhibited the growth of *Pestalotia palmarum* causing grey leaf blight of coconut under *in vitro* condition. Khatoon et al. (2017) reported Bavistin to be most effective in inhibiting the radial growth (100%) of *Pestalotiopsis palmarum* causing leaf spot of cashew (*Anacardium occidentale*) under *in vitro* condition. Tanziman et al. (2017) reported that Bavistin (1000 ppm) resulted in 100% inhibition of growth of *Pestalotiopsis* spp under *in vitro* conditions.

### *3.2. Field evaluation of fungicides*

Three fungicides tested under *in vitro* conditions were also evaluated under field conditions (Bavistin, 0.05%, Diathane M-45, 0.25% and Blitox 0.3%). The data on per cent disease

Table 3: Efficacy of fungicides against Pestalotia leaf spots under field condition

| Treatment | Concentration (%) | Disease incidence (%) | Disease index (%) | Yield (q $ha^{-1}$) | Plant height (cm) | No. of runner $plant^{-1}$ |
|---|---|---|---|---|---|---|
| Bavistin | 0.05 | 4.72 (12.49) | 1.84 (10.37) | 136.52 | 31.72 | 32 |
| Diathane M-45 | 0.25 | 5.14 (12.95 | 2.48 (8.43) | 135.14 | 32.42 | 31.6 |
| Blitox | 0.3 | 8.92 (17.35) | 4.62 (8.79) | 133.26 | 33.72 | 30.6 |
| Control | | 64.32 (53.33) | 35.76 (12.34) | 53.68 | 19.96 | 13.8 |

Figure in parentheses are arc sine transformed values

incidence, disease severity, yield (q $ha^{-1}$), plant height (cm) and number of runners $plant^{-1}$ were recorded and presented in Table 3. All the treatments significantly reduced the incidence and severity of the leaf spots. Among all the treatments, minimum disease incidence (4.72) and disease index (1.84) were recorded in treatment with sprays of Bavistin. Sprays with Diathane M-45 were found next in efficacy with disease incidence of 5.14% and disease index of 2.48%. Karthikeyan et al. (2002) reported the effectiveness of carbendazim (2.0%) against leaf blight disease caused by *Pestalotia* spp. in coconut. Kyada (2006) reported the effectiveness of carbendazim+mancozeb (0.1%) with 69.30% reduction of grey leaf blight caused by *Pestalotia guipinii* in mango under field conditions. Das and Jha (2008) reported carbendazim (0.20%) reduced the disease severity of grey blight (*Pestalotiopsis disseminata*) in som (*Persea bombycina*) plant. Tippeshi et al. (2010) reported the effectiveness of Diathane M-45 and Bavistin against *Pestalotiopsis* spp. in jatropa. Barman et al. (2015) reported the effectiveness of Bavistin against *Pestalotiopsis theae* in tea (*Cammelia sinensis*).

## 4. Conclusion

In Solan district, highest incidence and severity was recorded at Nauni (22.21 and 16.66%) and lowest incidence and severity at Piplughat (15.99 and 10%). In Sirmour district, highest incidence (22.8%) and severity (17.7%) of Pestalotia leaf spot was recorded at Dhaulakuan and lowest incidence (6.5%) and severity (4.4%) was recorded at Baghthan. The overall data indicate that the incidence and severity of the leaf spot was higher in Solan district than Sirmour district.

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