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Prevalence of Rose Powdery Mildew in Different Districts of Himachal Pradesh, India

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Abstract

The present investigation was done in the month of March to June and August to November to survey the powdery mildew infection on commercial greenhouses, nurseries and garden grown roses. Powdery mildew manifests as white to grayish patches of powdery growth on the surfaces of plant organs. Powdery mildew of rose was presented all rose growing areas of districts Bilaspur, Kangra, Mandi, Sirmour, Shimla and Solan during the years 2015 and 2016 in moderate to severe. Rose powdery mildew cause decreased the quality and quantity of the rose stem production as well as loose flowers yield. The average range of disease incidence and per cent disease index varied between 48.50 to 66.75 and 22.22 to 36.02, respectively. The present study examined the prevalence of powdery mildew disease in roses grown in orchards and commercial stands between March, June, August and November, Powdery mildew on roses is characterized by the growth of white-gray powdery spots or patches on the back of the plant parts This study found that in 2015 and 2016 in rose growing areas of Bilaspur, Kangra , Mandi, Sirmoor, Shimla and Solan districts were all prevalent with powdery mildew , with infestation levels ranging from moderate to severe. The disease has a severe impact on the rose tree, reducing the number and quality of rose trees and reducing the production of soft flowers. humanize text % disease index and disease level ranged from 22.22 to 36.02 to 48.50 to 66.75, respectively. These high rates indicate that powdery mildew is a major constraint in rose growing in these areas, and that effective management strategies are needed to minimize its impact.

Keywords: Powdery mildew, disease index, disease incidence, rose

INTRODUCTION

The genus *Rosa* comprises more than hundred botanical (wild) species, of which only about ten contributed to the development of cultivated roses: *R. chinensis*, *R. foetida*, *R. gallica*, *R. gigantean*, *R. moschata*, *R. multiflora*, *R. phoenicea*, *R. rugosa*, *R. wichurana* and *R. rubra* [7]. Powdery mildew, downy mildew, black spot, grey mould, leaf spot, and rust are some of the most detrimental foliar diseases that cause significant losses to roses [18].

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Powdery mildew fungi are obligate pathogens and are regarded as one of the most noticeable groups of plant diseases.

They are identified by the presence of white to grayish, powdery spots or patches on the surfaces of plant organs. The fungus typically appears on the upper side of leaves but also affects the underside, as well as other plant parts, including young shoots and stems, buds, flowers, and young fruits across various plant species [4,11,9]. Powdery mildew fungi rarely kill their hosts but instead extract nutrients, reduce photosynthesis, increase respiration and transpiration, hinder plant growth,

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and lower yield by 20 to 40 percent, depending on the favorable conditions for their growth and proliferation [1]. Losses specifically in roses have been reported to range between 20 to 25 percent [15].

In India the occurrence of rose powdery mildew for the first time has been reported from Kashmir, Ranikhet and Dehradun [5], Shimla by Coventry, Nagpur by Pandit and Mumbai [5] and from Rajasthan [24]. The occurrence of rose powdery mildew caused by the *Podosphaera pannosa* has been reported worldwide from USA [19,30,21] United Kingdom [12, 25–27], China [16], Netherland [10], British Columbia [22] and Italy [23] and many other countries. Under optimum conditions, the disease is equally destructive in greenhouses, the home gardens and in the fields [29]. Powdery mildew of roses was first described by Theophrastus in 300 BC [11] and remains a major disease of the crop today. Powdery mildew of rose is caused by the obligate biotroph *Podosphaera pannosa* (Wallr.: Fr.) de Bary, an ascomycete, which had long been known as *Sphaerotheca pannosa var. rosae* (Wallr.: Fr.) [2,3].

The pathogen *Podosphaera pannosa* (Wallr.) de Bary belongs to true fungi phylum: Ascomycota, order: Erysiphales, class: Filamentous ascomycetes and infects roses (*Rosa* spp.) and other members of *Rosaceae* family including stone fruit (*Prunus* spp.). A new distribution map of pathogen has revealed its worldwide distribution in European, African, North American, Central, South American and Asia countries. In India, the presence of the pathogen has been reported in Assam, Delhi, Gujarat, Himachal Pradesh, Jammu and Kashmir, Karnataka, Maharashtra, Meghalaya, Rajasthan, Uttar Pradesh, and West Bengal [6].

MATERIALS AND METHODS

Survey of different rose growing areas of six districts viz. Solan, Shimla, Sirmour, Mandi, Bilaspur and Kangra of Himachal Pradesh were conducted to record the disease severity/incidence of powdery mildew. In each field of the districts visited, ten plants were selected randomly to record the severity and incidence, during the years 2015 and 2016 from the end of March to the end of June and mid August to November 2nd week. During the course of periodic surveys, the infected aerial plant parts mainly leaves showing characteristic symptoms were collected in paper/ polythene bags and brought to the laboratory for study and preserved in refrigerator at 4-6 °C for further use. The per cent disease index (PDI) was calculated by using the formula given [20] as follows:

$$\text{Disease index (\%)} = \frac{\text{Sum of all the disease ratings}}{\text{Total number of samples observed x Maximum disease grade}} \times 100$$

Whereas, the per cent disease incidence was determined by the following formula:

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

The data on disease severity was recorded by following a disease rating based on 0-6 scale developed for the estimation of rose powdery mildew [28] with slight modifications as 0=No symptom of powdery mildew, 1=Small scattered specks covering <1% leaf area, 2=Small scattered specks covering 2-5% leaf area, 3=Small powdery lesions covering about 6-20% of leaf area,4= Powdery lesions enlarging covering 21-40% of leaf area, 5=Powdery lesion coalesces to form big patches covering 41-80% of leaf area, 6 = Powdery patches covering the entire leaf and stem (>80%).

RESULTS AND DISCUSSION

To record the occurrence and severity of the powdery mildew disease, regular surveys of the different rose growing areas of six districts viz. Solan, Shimla, Sirmour, Mandi, Bilaspur and Kangra of Himachal Pradesh were conducted for two consecutive seasons of the years i.e. 2015 and 2016. The data on disease incidence and severity are presented in Table 1 which revealed that the disease was prevalent and wide spread in moderate to severe form in all the districts surveyed during the years of present study.

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It is evident from the data that the disease incidence of powdery mildew varies between 40.00 to 78.00 and 38.00 to 76.00 per cent during the year 2015 and 2016, respectively. During 2015, minimum disease incidence of 40.00 per cent was recorded in Gagal of district Kangra and highest (78.00%) was recorded in location Ganiza in district Solan whereas, during 2016 same location i.e. Gagal (Kangra) and Macher of district Sirmour registered minimum disease incidence of 38.00 per cent. Maximum disease incidence (77.00%) was again recorded in Ganiza location of Solan. However the highest cumulative disease incidence prevailed in district Solan with 66.75 per cent followed by the Shimla (66.20%), Mandi (61.89%) and lowest (48.50%) mean disease incidence was recorded in district Kangra.

The per cent disease index (PDI) ranged from 16.68 to 45.67 per cent and 14.33 to 41.00 per cent during the years 2015 and 2016, respectively. The lowest per cent disease index of 16.68 and 14.33 per cent were recorded in Narag of district Sirmour during two consecutive years whereas, the highest per cent disease index of 45.67 and 41.00 per cent were recorded in Ganiza of district Solan. District wise distribution of the disease revealed that the lowest (48.50%) mean disease incidence was recorded in district Kangra followed by Bilaspur (54.14%) while highest disease incidence of 66.75 per cent was registered in Solan (66.20%). The overall highest mean per cent disease index of 36.02 per cent was recorded in district Shimla followed by Solan (31.65%) and minimum PDI (22.22%) was recorded in district Kangra. These results were in consonance with the findings of [17] and [13] which indicated 43.00 per cent of average disease severity of powdery mildew of rose and 67.39 per cent severity on Isfehan 9 accession, respectively. Similar, results were observed [8], they reported 71.25, 46.91 and 42.51 per cent disease incidence and disease index of 25.72, 13.63 and 18.57 per cent from Srinagar, Anantnag and Pulwama districts of Jammu and Kashmir.

The occurrence of rose powdery mildew in India for the first time has been reported from Kashmir, Ranikhet and Dehradun by E.J. Butler, Shimla by Coventry, Nagpur by Pandit and Mumbai by K R Kartikar [5] and from Rajasthan by Pathak (1967). The pathogen (*Podosphaera pannosa*) is widely distributed worldwide in France, Germany, Egypt, Ethiopia, South Africa, China, Iran, SARael, Japan and India according to the reports [6]. Powdery mildew rarely kills its hosts but instead consumes their nutrients, reduces photosynthesis, increases respiration and transpiration, impairs growth, and decreases yield by 20-40 percent [9, 14]. Losses specifically due to powdery mildew in roses have been reported to range between 30 to 35 percent [15].

Table 1. Disease incidence and disease index of powdery mildew of rose at different locations of Himachal Pradesh (years 2015 and 2016.

District	Locality	Disease Incidence (%)		Mean	Disease index (%)		Mean
		2015	*2016*		*2015*	*2016*	
Bilaspur	Morshingi	58.00	56.00	57.00	28.45	24.00	26.23
	Talyana	50.00	51.00	50.50	21.00	18.45	19.73
	Kashol	48.00	52.00	50.00	18.00	16.78	17.39
	Kotipura*	56.00	52.00	54.00	27.43	24.00	25.72
	Deoth	62.00	58.00	60.00	32.00	29.00	30.50
	Chila	55.00	50.00	52.50	25.00	24.87	24.94
	Nehsarli	52.00	50.00	51.00	25.78	22.00	23.89
	Rajpura	60.00	56.00	58.00	30.00	28.67	29.34
	Mean	55.13	53.14	54.14	25.96	23.47	24.65
Kangra	Bhattu*	46.00	42.00	44.00	20.00	16.00	18.00
	Gagal*	40.00	38.00	39.00	18.00	16.00	17.00
	Mator*	50.00	48.00	49.00	26.00	25.56	25.78

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	Rajpura*	48.00	46.00	47.00	22.00	18.00	20.00
	Thara	52.00	56.00	54.00	26.00	24.47	25.24
	Chobu	58.00	60.00	59.00	30.00	28.00	29.00
	Kandwari	46.00	49.00	47.50	18.00	23.00	20.50
	Mean	48.57	48.43	48.50	22.86	21.58	22.22
Mandi	Soyra	52.00	50.00	51.00	25.78	22.65	24.22
	Kathlag	58.00	60.00	59.00	28.67	24.00	26.34
	Sehal	64.00	62.00	63.00	31.00	29.00	30.00
	Rajgarh*	68.00	65.00	66.50	34.00	32.00	33.00
	Hatgarh*	72.00	70.00	71.00	40.00	38.78	39.39
	Pali	63.00	65.00	64.00	30.75	27.33	29.04
	Behal	70.00	68.00	69.00	38.00	34.00	36.00
	Chhamadu Bagh*	56.00	54.00	55.00	26.75	20.00	23.38
	Roopa	60.00	57.00	58.50	29.78	22.00	25.89
	Mean	62.56	61.22	61.89	31.64	27.75	29.70
Shimla	IIWBR, Flowerdale	70.00	68.00	69.00	42.76	39.78	41.27
	Bhagda	65.00	60.00	62.50	34.00	31.56	32.78
	Mundaghat	70.00	74.00	72.00	42.00	40.00	41.00
	Kotti	68.00	66.00	67.00	30.56	29.75	30.16
	Dungadwas	62.00	59.00	60.50	33.00	36.75	34.88
	Mean	67.00	65.40	66.20	36.46	35.57	36.02
Sirmour	Chakhal*	68.00	70.00	69.00	36.00	38.75	37.38
	Macher	50.00	38.00	44.00	20.78	15.76	18.27
	Gahloot	62.00	57.00	59.50	29.00	23.78	26.39
	Maryog*	58.00	63.00	60.50	28.67	30.65	29.66
	Narag	45.00	50.00	47.50	16.68	14.33	15.51
	Daro Deoria	54.00	48.00	51.00	22.76	19.54	21.15
	Rajgarh	48.00	60.00	54.00	26.76	24.64	25.70
	Mean	55.00	55.14	55.07	25.81	23.92	24.87
Solan	Ganiza*	78.00	76.00	77.00	45.67	41.00	43.34
	Kandaghat*	63.00	66.00	64.50	33.33	30.27	31.80
	Salogda*	72.00	70.00	71.00	38.78	35.00	36.89
	Mahog Bagh*	60.00	58.00	59.00	27.67	25.00	26.34
	Nauni*	74.00	71.00	72.50	42.00	39.67	40.84
	Ram Shahar*	66.00	65.00	65.50	30.45	26.76	28.61
	Kailar*	70.00	66.00	68.00	28.0	24.00	26.00
	Danghil*	56.00	54.00	55.00	20.00	18.75	19.38
	Mean	67.38	65.75	66.75	33.24	30.06	31.65

**Commercial greenhouses and nurseries*

CONCLUSION

Rose Powdery Mildew is a major problem of all rose growing regions of the Himachal Pradesh. its infection occurred very aggressively in the rose which are grown under poly house conditions. This disease can be prevented by growing the resistant varieties to powdery mildew and maintaining the proper air circulation inside the polyhouse.

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