



Prevalence of Stem Black Canker of Apple In Himachal Pradesh

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ABSTRACT

Coniothecium chomatosporum causes stem black canker is among the most important apple canker diseases, causing widespread losses in apple production. Occurrences of stem black canker were observed in the Kinnaur, Kullu, Mandi, Sirmaur, and Shimla districts of Himachal Pradesh, at elevations ranging from 1000 to 2500 meter above mean sea level (a.m.s.l.) during the regular canker development season, from May to December in 2017 and 2018. The incidence of stem black canker was maximum (38.32%) at Nihri followed by Janjheli (30.93%) of Mandi district, whereas disease was totally absent in some places namely, Narkanda, Rohru and Sarahan. Percent disease index of stem black canker was maximum in Nohradhar (14.22%) followed by Karsog (13.23%) in Mandi district, while minimum percent disease index (0.00%) was at Narkanda and Rohru. The mean overall percent disease index of stem black canker ranged from 0.00 to 14.22 per cent during 2017 and 2018 crop seasons.

Key Words: Stem Black, Canker, Apple, Himachal Pradesh, Disease Incidence, Percent Disease Index

INTRODUCTION

The apple (*Malus x domestica* Borkh.) was first cultivated in Himachal Pradesh in the late 1900s (Singh *et al*, 2022a). Commercial apple production provided prosperity to its producers and a financial windfall to the state, earning it the moniker Apple state of India. Apple farming is carried out on 1,12,630 hectares (Singh *et al*, 2022b) and the main source of income for farmer families, as well as for others employed in the industry as workers, transporters, middlemen, retailers, and so on. In 2017-18, Himachal Pradesh produced 4, 46,570 MT of apples, with an average productivity rate of 3.96 MT/ha (NHB, 2018). However, in comparison to other parts of the world, this state's apple production per unit area is poor.

The occurrence of numerous diseases, as well as other factors such as bad quality material, insufficient technology, improper inputs, insufficient cooling units, changing climate, and so on, have all been major roadblocks to achieving the necessary output. Fungus, bacteria, viruses, and other microbes produce a variety of diseases that cause both immediate and long-term damage. Thakur (2008) reported that these diseases lead to 30-40% reduction in total yield. Root rot in the 1960s (Agarwala, 1961) which killed 10-15% of apple

trees each year. From the late 1980s onwards, apple scab epiphytotic (Gupta, 1978). Similarly, Gupta and Sharma (1995) reported losses of Rs. 1.5 crores with this disease and Marssonina blotch, which generated misery via early defoliation in the late 1990s (Sharma and Sharma, 2012), has been a source of concern for the state's apple growers.

In the 1970s, the state had a simultaneous outbreak of cankers (Agarwala and Gupta, 1971). Cankers wounds increase surface area from season to season and are localized lesions on a stem or branch that cause the sloughing away of plant. Thirteen different cankers were reported from Himachal Pradesh by Sharma and Sharma (2012) but there is yet no status update on the severity of individual pathogen associated with canker disease with different apple growing areas. The distribution patterns of stem black canker have been studied in numerous apple growing districts in Himachal Pradesh. Such information could be useful in determining the true state of the disease and its economic consequences. Furthermore, the distribution trends of stem black canker revealed in this survey would advise apple growers about canker resistant varieties to be transplanted in different elevations and geographic areas across the state.

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MATERIALS AND METHODS

The survey was carried out in five apple-growing districts of Himachal Pradesh, namely Kinnaur, Kullu, Mandi, Shimla and Sirmaur, at different altitudes ranging between 1000-2500 m above mean sea level (a.m.s.l). The survey was carried out during the normal canker development period, from July to December in 2017-18. The disease incidence was recorded by using the formula as follows:

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

The data regarding the percent disease index of stem black canker was recorded with the scale devised by Verma (1991) as follows:

0 = No lesion formation

1 = Lesion size of 0.1-5 cm²

2 = Lesion size of 5.1- 10 cm²

3 = Lesion size of 10.1-30 cm²

4 = Lesion size of more than 30 cm²

Percent disease index was calculated as per Mc Kinney (1923):

Per cent Diseases Index (%)	=	Sum of all numerical ratings	× 100
		Number of twigs/branches/trunks observed × Maximum rating	

RESULTS AND DISCUSSION

To assess the magnitude of stem black canker in apple at different locations i.e., Kullu, Shimla, Kinnaur, Sirmaur and Mandi districts of Himachal Pradesh, located at different altitudes ranging between 900-2500 m above mean sea level (a.m.s.l), a survey was carried out during normal canker development period i.e., July-September during 2017 and 2018 crop seasons. The data on prevalence of disease was recorded as incidence and percent disease index in the apple orchards comprising of trees in different age groups between 15-30 years and have been presented in Table 1.

The incidence of stem black canker was widespread in Kullu, Shimla, Kinnaur, Sirmaur and Mandi districts

of Himachal Pradesh which was more prevalent and occurring frequently in almost all apple growing areas surveyed. The incidence of stem black canker was maximum (38.32%) at Nihri followed by Janjheli (30.93%) of Mandi district, whereas disease was totally absent in some places namely, Narkanda, Rohru and Sarahan. Percent disease index of stem black canker was maximum in Nohradhar (14.22%) followed by Karsog (13.23%) in Mandi district, while minimum percent disease index (0.00%) was at Narkanda and Rohru. The mean overall percent disease index of stem black canker ranged from 0.00 to 14.22 per cent during 2017 and 2018 crop seasons.

The perusal of data (Table 1) indicated that the mean incidence of stem black canker was maximum (27.28%) in Mandi district followed by Sirmaur (17.78%), whereas its incidence was minimum in Kinnaur (11.63%) district. Similarly, mean percent disease index of stem black canker was maximum in Mandi (9.27%) followed by Sirmaur (7.29%), while minimum percent disease index was recorded in Kinnaur (4.40%) district.

In different parts of the world, stem black canker of apple was reported from many countries like Argentina, Australia, Ceylon, South Africa, New Zealand, Denmark, England, India (Dey and Singh, 1939; Singh, 1942) and it infects many other fruit trees like pear (Argentina: Fernandez Valiela *et al*, 1954; Australia: Osborn and Samuel, 1922). In India, stem black canker was first observed in Kumaon hills with disease incidence nearly up to 60 per cent (Dey and Singh, 1939) but considered of minor importance in Himachal Pradesh (Agarwala and Gupta, 1971).

CONCLUSION

It can be concluded from the study that stem black canker problem was more severe in Mandi and Sirmaur districts of Himachal Pradesh whereas moderate in Shimla and Kullu district. Disease incidence was low in Kinnaur district. However, pathogen has a very wide range and widely spread in all the apple growing areas of Himachal Pradesh.

ACKNOWLEDGEMENT

Authors thank the Department of Plant Pathology, College of Horticulture, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal

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Table1. Prevalence of stem black canker (*Coniothecium chomatosporum*) in different apple growing areas of Himachal Pradesh.

District /Location	Disease incidence (DI) (%)		Mean DI (%)	Percent Disease Index (PDI) (%)		Mean PDI (%)
	2017	2018		2017	2018	
Kullu						
Amarbag	12.65	17.86	15.26	1.88	5.56	3.72
Batahar	3.78	15.58	9.68	0.18	4.28	2.23
Chowai	18.17	12.62	15.40	8.03	1.02	4.53
Dalighat	20.03	11.05	15.54	11.58	2.28	6.93
Gushaini	15.39	16.18	15.79	2.80	9.28	6.04
Javan	5.36	13.14	9.25	0.52	5.37	2.95
Kakhnal	12.31	6.39	9.35	0.72	0.45	0.59
Kamand	10.78	13.66	12.22	2.98	3.74	3.36
Karjan	8.35	16.08	12.22	1.83	9.17	5.50
Trambli	20.53	5.80	13.17	9.42	3.64	6.53
Naggar	15.32	11.49	13.41	8.64	5.23	6.94
Raison	16.55	1.97	9.26	4.79	1.49	3.14
Seobagh	12.80	15.32	14.06	7.07	10.16	8.62
Thati Bir	13.69	16.14	14.92	3.89	6.33	5.11
Thaila	13.73	5.15	9.44	5.18	3.01	4.10
Mean	13.30	11.90	12.60	4.63	4.73	4.68
Shimla						
Bamta	18.69	24.65	21.67	5.57	12.10	8.84
Bhutti	8.46	13.70	11.08	1.01	2.54	1.78
Chirgaon	15.41	13.29	14.35	7.60	5.45	6.53
Deha	12.64	10.55	11.60	4.52	2.02	3.27
Dhangvi	11.58	9.00	10.29	2.15	0.92	1.54
Ghoond	21.83	27.44	24.64	9.89	10.16	10.03
Jubbal	15.67	19.61	17.64	7.46	8.07	7.77
Kotkhai	23.39	15.60	19.50	11.58	3.94	7.76
Kumarsain	22.76	21.39	22.08	9.03	8.44	8.74
Maraog	2.04	5.65	3.85	0.76	2.35	1.56
Matiyana	15.91	32.57	24.24	6.78	11.85	9.32
Narkanda	0.00	0.00	0.00	0.00	0.00	0.00
Rohru	0.00	0.00	0.00	0.00	0.00	0.00
Sarahan	0.00	0.00	0.00	0.00	0.00	0.00
Shathla	15.91	32.57	24.24	4.81	10.88	7.85
Thanedhar	19.84	25.69	22.77	9.37	11.70	10.54
Theog	8.23	11.94	10.09	0.19	3.81	2.00

Mean	12.49	15.51	14.00	4.75	5.54	5.15
Kinnaur						
Nichar	9.42	11.13	10.28	1.96	3.60	2.78
Bhavanagar	8.80	12.69	10.75	1.93	4.88	3.41
Chagaon	16.88	9.78	13.33	6.34	3.93	5.14
Katgaon	7.77	11.63	9.70	0.62	8.18	4.40
Kalpa	8.57	19.48	14.03	2.10	6.46	4.28
Sangla	10.92	10.14	10.53	3.55	2.97	3.26
Pangi	12.06	18.60	15.33	6.93	11.61	9.27
Kilba	9.81	11.19	10.50	5.62	6.63	6.13
Purbani	12.52	6.39	9.46	2.75	1.76	2.26
Pooh	9.41	10.07	9.74	3.42	2.05	2.74
Thangi	14.80	12.72	13.76	6.70	4.40	5.55
Moorang	16.78	17.43	17.11	7.37	8.45	7.91
Lippa	8.90	15.07	11.99	2.55	4.38	3.47
Chango	11.77	6.60	9.19	2.93	1.47	2.20
Sharbo	3.82	13.88	8.85	0.07	6.24	3.16
Mean	10.82	12.45	11.63	3.66	5.13	4.40
Sirmaur						
Hariphurdhar	19.19	21.92	20.56	9.44	11.57	10.51
Rajgarh	11.27	29.30	20.29	5.11	13.26	9.19
Charna	21.44	16.23	18.84	10.29	6.97	8.63
Sarahan	14.03	10.87	12.45	4.60	1.54	3.07
Nohradhar	24.18	31.72	27.95	13.37	15.06	14.22
Shillai	10.24	12.47	11.36	0.90	3.11	2.01
Sangrah	14.67	11.35	13.01	2.87	4.00	3.44
Mean	16.43	19.12	17.78	6.65	7.93	7.29
Mandi						
Janjehli	29.56	32.29	30.93	8.21	11.34	9.78
Karsog	21.64	39.67	30.66	11.88	14.58	13.23
Keolidhar	31.81	16.60	24.21	11.06	2.74	6.90
Kigas	24.40	21.24	22.82	8.37	8.60	8.49
Nihri	34.55	42.09	38.32	10.14	15.76	12.95
Thunag	20.61	12.84	16.73	6.67	1.88	4.28
Mean	27.10	27.46	27.28	9.39	9.15	9.27

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Pradesh, India, for providing the resources and for all of their help and guidance throughout the investigation.

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Received on 4/8/2022

Accepted on 10/1/2022