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Status of stem brown canker of apple in Himachal Pradesh

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Abstract

Botryosphaeria dothidea causes stem brown canker is among the most important apple canker diseases, causing widespread losses in apple production. Enormous occurrences of stem brown 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 brown canker was maximum (41.05%) at Narkanda in Shimla district followed by Nohradhar of Sirmaur district (38.32%), whereas disease was totally absent in some places namely, Kumarsain, Maraog, Matiyana, Karsog and Nihri. percent disease index of stem brown canker was maximum at Narkanda (21.91%) followed by Rajgarh (16.60%) in Sirmaur district, while minimum percent disease index (0.00%) was recorded from Karsog, Kumarsain, Matiyana, Maraog and Nihri. The percent disease index of stem brown canker ranged from 0.00 to 21.91 per cent disease index during 2017 and 2018 crop seasons.

Keywords: Stem brown, 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. 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 (NHB, 2018) ^[10] and it is 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 metric tonnes of apples, with an average productivity rate of 3.96 metric tonnes per hectare (NHB, 2018) ^[10]. 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) ^[13] reported that these diseases lead to 30-40% reduction in total yield. Root rot in the 1960s (Agarwala, 1961) ^[1] which killed 10-15% of apple trees each year. From the late 1980s onwards, apple scab epiphytotic (Gupta, 1978) ^[3]. Similarly in a single year 1983, Gupta and Sharma (1995) ^[4] 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) ^[11], 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) ^[1]. 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) ^[11] 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 brown 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 brown 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.

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 brown canker was recorded with the scale devised by Verma (1991) [14] 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) [7]:

$$\text{Per cent Diseases Index (\%)} = \frac{\text{Sum of all numerical ratings}}{\text{Number of twigs/branches/trunks observed} \times \text{Maximum rating}} \times 100$$

Results and Discussion

To assess the magnitude of stem brown canker at different locations of apple plantation i.e., Kullu, Shimla, Kinnaur, Sirmaur and Mandi district of Himachal Pradesh, located at different altitudes ranging between 900-2500 m above mean sea level (A.M.S.L). The data on prevalence of disease were recorded as incidence and percent disease index in the apple orchards comprising trees in different age groups. The perusal of data presented in Table 1 indicated that the disease was widespread in Kullu, Shimla, Kinnaur, Sirmaur and Mandi districts of Himachal Pradesh and was more prevalent and occurring frequently in almost all apple growing areas surveyed.

Table 1: Prevalence of stem brown canker (*Botryosphaeria dothidea*) 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	22.94	28.15	25.55	11.53	14.51	13.02
Batahar	14.07	25.87	19.97	3.47	10.23	6.85
Chowai	28.46	22.91	25.69	14.06	6.35	10.21
Dalighat	30.32	21.34	25.83	16.61	7.61	12.11
Gushaini	25.68	26.47	26.08	11.47	15.25	13.36
Javan	11.73	19.51	15.62	2.81	6.96	4.89
Kakhnal	18.68	12.76	15.72	3.01	2.14	2.58
Kamand	14.15	20.03	17.09	5.27	5.33	5.30
Karjan	14.72	22.45	18.59	4.12	10.76	7.44
Trambli	30.82	16.09	23.46	19.65	5.23	12.44
Naggar	25.61	21.78	23.70	16.87	12.82	14.85
Raison	26.84	12.26	19.55	7.08	3.08	5.08
Seobagh	23.09	25.61	24.35	11.36	8.75	10.06
Thati Bir	23.98	26.43	25.21	9.18	9.73	9.46
Thaila	24.02	15.44	19.73	7.47	4.60	6.04
Mean	22.34	21.14	21.74	9.60	8.22	8.91
Shimla						
Bamta	25.47	31.43	28.45	10.43	15.05	12.74
Bhutti	15.24	20.48	17.86	5.87	6.42	6.15
Chirgaon	22.19	20.07	21.13	12.73	11.22	11.98
Deha	19.42	17.33	18.38	5.47	2.97	4.22
Dhangvi	18.36	15.78	17.07	3.10	1.87	2.49
Ghoond	28.61	34.22	31.42	10.84	11.11	10.98
Jubbal	22.45	26.39	24.42	8.41	9.02	8.72
Kotkhai	10.17	22.38	16.28	3.53	14.89	9.21
Kumarsain	0.00	0.00	0.00	0.00	0.00	0.00
Maraog	0.00	0.00	0.00	0.00	0.00	0.00
Matiyana	0.00	0.00	0.00	0.00	0.00	0.00
Narkanda	39.18	42.92	41.05	21.74	22.07	21.91
Rohru	9.54	28.17	18.86	3.05	11.39	7.22
Sarahan	2.04	5.65	3.85	1.42	2.33	1.88
Shathla	15.91	32.57	24.24	6.76	22.83	14.80
Thanedhar	19.84	25.69	22.77	7.32	13.40	10.36
Theog	8.23	11.94	10.09	2.14	5.76	3.95
Mean	15.10	19.71	17.40	6.05	8.84	7.45
Kinnaur						
Nichar	15.07	16.78	15.93	4.40	5.69	5.05
Bhavanagar	14.45	18.34	16.40	0.54	3.06	1.80
Chagaon	22.53	15.43	18.98	6.95	5.11	6.03
Katgaon	13.42	17.28	15.35	0.23	9.36	4.80

Kalpa	14.22	25.13	19.68	2.71	7.64	5.18
Sangla	16.57	15.79	16.18	1.16	4.15	2.66
Pangi	17.71	24.25	20.98	6.54	14.79	10.67
Kilba	15.46	16.84	16.15	6.23	7.81	7.02
Purbani	18.17	12.04	15.11	1.36	2.94	2.15
Pooh	15.06	15.72	15.39	4.03	3.23	3.63
Thangi	20.45	18.37	19.41	7.31	5.58	6.45
Moorang	22.43	23.08	22.76	7.98	11.63	9.81
Lippa	14.55	20.72	17.64	3.16	5.56	4.36
Chango	17.42	12.25	14.84	3.54	2.65	3.10
Sharbo	9.47	19.53	14.50	0.08	7.42	3.75
Mean	16.47	18.10	17.28	3.75	6.44	5.09
Sirmaur						
Hariphurdhar	29.56	32.29	30.93	11.35	11.48	11.42
Rajgarh	21.64	39.67	30.66	15.02	18.17	16.60
Charna	31.81	16.60	24.21	10.20	1.88	6.04
Sarahan	24.40	21.24	22.82	4.51	11.74	8.13
Nohradhar	34.55	42.09	38.32	13.28	15.97	14.63
Shillai	20.61	12.84	16.73	8.81	4.02	6.42
Sangrah	14.74	22.72	18.73	1.78	4.91	3.35
Mean	25.33	26.78	26.05	9.28	9.74	9.51
Mandi						
Janjehli	18.25	19.54	18.90	10.59	7.45	9.02
Karsog	0.00	0.00	0.00	0.00	0.00	0.00
Keolidhar	18.59	24.48	21.54	11.49	9.06	10.28
Kigas	19.97	33.72	26.85	12.97	16.88	14.93
Nihri	0.00	0.00	0.00	0.00	0.00	0.00
Thunag	21.95	17.95	19.95	8.08	5.96	7.02
Mean	13.13	15.95	14.54	7.19	6.56	6.87

The incidence of stem brown canker was maximum (41.05%) at Narkanda in Shimla district followed by Nohradhar of Sirmaur district (38.32%), whereas disease was totally absent in some places namely, Kumarsain, Maraog, Matiyana, Karsog and Nihri. Per cent disease index of stem brown canker was maximum at Narkanda (21.91%) followed by Rajgarh (16.60%) in Sirmaur district, while minimum per cent disease index (0.00%) was recorded from Karsog, Kumarsain, Matiyana, Maraog and Nihri. The per cent disease index of stem brown canker ranged from 0.00 to 21.91 per cent disease index during 2017 and 2018 crop seasons.

The perusal of data presented in above table, further showed that the mean incidence of stem brown canker was maximum (26.05%) in Sirmaur district followed by Kullu (21.74%), whereas it was minimum in Mandi (14.54%) district. Mean Per cent disease index of stem brown canker was maximum in Sirmaur (9.51%) followed by Kullu (8.91%) district, while minimum Per cent disease index was in Kinnaur (5.09%) district.

First documentation of stem brown canker was from Kumaon hills (Singh, 1942) [12], after that from Kashmir (Malik, 1967) [5] and Himachal Pradesh (Agarwala and Gupta, 1971) [1]. This canker disease is known to infect a wide variety of hosts, i.e., birch, sweet gum, blueberry, gooseberry, blackberry, currant, grape, rose, stone fruit, pear, willow, quince, *Rhododendron*, mountain ash, avocado and chestnut (Marinelli *et al.*, 2012; Mondello *et al.*, 2018; Moral *et al.*, 2019) [6, 8, 9].

Conclusion

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

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