



OCCURRENCE OF MAJOR FOLIAR DISEASES OF MULBERRY UNDER TEMPERATE CLIMATIC CONDITIONS OF KASHMIR, INDIA

Irfan Illahi, Vishal Mittal, Ramegowda, G. K., Anil Dhar and Khan, M. A.

Central Sericulture Research and Training Institute, Central Silk Board, Pampore-192 121, Jammu and Kashmir, India

ABSTRACT

Leaf spot and powdery mildew are the major foliar diseases of mulberry in Kashmir valley. Efforts were made to map the prevalence of these two mulberry diseases in Kashmir valley along with seasonality and severity on five mulberry varieties from July to October, during three years 2006, 2007 and 2008. Fortnightly surveys were conducted at various locations spread across Kashmir valley. Survey revealed that the powdery mildew was prevalent throughout the valley. Its incidence started during August with disease incidence (DI) and percent disease index (PDI) of 3.47 and 1.04, respectively to reach peak in the month of October with DI and PDI of 5.71 and 2.15, respectively. The powdery mildew incidence was least (5.4%) on Chinese white at Baramulla and was maximum (41.57%) on Goshorami at Pampore. Irrespective of the mulberry varieties the incidence ranged from 18.47 percent (Baramulla) to 29.35 percent (Pampore). Irrespective of locations, it ranged from 9.71 (KNG) to 35.39 percent (Tr-10). Leaf spot prevalence was noticed throughout the valley with incidence and severity levels ranging between 9.12 and 2.66 percent (Mirgund) to 18.58 and 5.14 percent (Pampore), respectively. The incidence started in the month of August. Pampore followed by Manasbal occupied the top slots with respect to incidence and severity of leaf spot while, Mirgund recorded least incidence and severity. The incidence level ranged from 7.38 percent on Rokokuyaso at Srinagar to 40.38 percent on Tr-10 at Quazigund. Irrespective of the varieties, the leaf spot incidence ranged from 16.21 percent (Srinagar) to 23.41 percent (Quazigund).

KEYWORDS: Kashmir, mulberry, powdery mildew, leaf spot.

INTRODUCTION

Kashmir has its own identity in the global map for its quality Bivoltine silk since ancient days. Despite congenial climatic conditions the silk production in the State of Jammu and Kashmir has drastically declined from 76 tonnes in 1980 to 18 tonnes in 1991 (Anonymous, 1992). Till the recent past the silk production in Kashmir was on declining trend at the rate of one percent per annum compared to the levels fifty years ago. The present production of silk cocoons is 8.32, lakh Kg compared to 16.00 lakh Kg during 1960. The decline is mainly due to reduction in number of sericultural farmers influenced by the diseases and insect pests of mulberry as well as silkworm (Nika, 2010). Silkworm diseases and mulberry insect pests and diseases are the major biotic factors responsible for the decrease in silk production in general and in specific to J&K state. Mulberry (*Morus* spp.) the sole food plant of silkworm, *Bombyx mori* L. is a perennial crop with diverse genetic base. The intensive cultivation of high yielding varieties under a wide range of agro climatic conditions has made mulberry vulnerable to various plant pathogens (Philip *et al.*, 1994; Teotia and Sen, 1994 and Sukumar and Padma, 1999). It is essential that mulberry leaf should be disease free to increase the productivity and quality of cocoons. Weather situations favour diseases outbreaks leading to 15 to 20% mulberry crop losses and also affect the silk cocoon production too. Among mulberry diseases, leaf spot and powdery mildew are the major foliar diseases of mulberry in Kashmir valley which are the impediments in the production of quality leaf/feed (Khan *et al.*, 2004). In this background efforts were made to map the prevalence of these two foliar mulberry

diseases in Kashmir valley along with seasonality and severity during 2006, 2007 and 2008.

MATERIALS AND METHODS

Fortnightly surveys were conducted by deploying fixed plot technique from fifteen randomly selected and tagged trees at various locations spread across Kashmir valley. Study was carried out during July to October period each year. The disease infection/ incidence was measured by counting the total number of leaves and diseased leaves on a branch from three branches per tree and the percentage is worked out (%DI). The infection/ incidence (DI) was recorded from fifteen plants in each mulberry varieties commonly cultivated in the Kashmir valley *viz.*, Goshorami, Chinese white, Kairyonezawmigaeshi (KNG), Tr-10 and Rokokuyaso. Intensity was quantified by grading the diseased leaves on 0-5 scale and Percent Disease Index (PDI) was calculated following standard protocol (FAO, 1967).

RESULTS

Powdery mildew: Survey revealed that the powdery mildew was prevalent throughout the valley. Its incidence started during August with DI and PDI of 3.47 and 1.04, respectively and reached more severe in the month of October with DI and PDI of 5.71 and 2.15, respectively (Table 1). In the beginning the incidence ranged from 2.66 percent (Nunar) to 4.41 percent (Y. K. Pora) and the severity was proportional to the incidence level. Powdery mildew progressed gradually with the advancement of season and reached peak during the month of October with the infection levels ranging from 4.97 (Nunar) to 6.81

Major foliar diseases of mulberry under temperate climatic conditions of Kashmir

percent (Y. K. Pora) (Table 1.). Both disease incidence levels and severity of powdery mildew were highest at Y. K. Pora among the five locations spread across Kashmir valley. But, at the Pampore location the severity was least even though the incidence level was moderate among the locations. The powdery mildew incidence was least (5.4%) on Chinese white at Baramulla and maximum

(41.57%) on Goshorami at Pampore (Table 2). Irrespective of the varieties the incidence ranged from 18.47 percent (Baramulla) to 29.35 percent (Pampore). There existed no difference in the incidence levels across locations. Irrespective of locations, it ranged from 9.71 (KNG) to 35.39 percent (Tr-10).

TABLE- 1. Distribution and seasonality of mulberry powdery mildew in Kashmir region

Location	August		September		October		Mean	
	DI	PDI	DI	PDI	DI	PDI	PI	PDI
Pampore	3.25	0.79	4.20	1.28	5.66	1.97	4.37	1.35
Manasbal	3.96	1.17	4.95	1.87	6.08	2.45	5.00	1.83
Mirgund	3.11	1.00	3.74	1.46	5.03	1.94	3.96	1.47
Y. K. Pora	4.41	1.32	5.23	1.86	6.81	2.46	5.48	1.88
Nunar (G. Bal)	2.66	0.92	3.60	1.31	4.97	1.95	3.74	1.39
Mean	3.47	1.04	4.34	1.55	5.71	2.15	4.51	1.58

TABLE- 2. Severity and varietal reaction of mulberry powdery mildew in Kashmir region.

Location	Goshorami	Chinese White	KNG	Tr-10	Rokokuyaso	Location Avg.
Baramulla	26.65 (28.97)	5.40 (13.37)	11.37 (18.99)	32.33 (31.50)	16.59 (22.01)	18.47
Pampore	41.57 (40.17)	25.50 (25.35)	6.28 (14.37)	40.67 (38.61)	32.73 (32.33)	29.35
Quazigund	16.62 (26.25)	21.15 (26.19)	14.08 (21.45)	35.53 (34.96)	40.87 (41.45)	25.65
Srinagar	32.65 (32.68)	38.80 (36.01)	7.10 (15.41)	33.02 (32.20)	21.83 (25.18)	26.68
Variety Avg.	29.37	22.71	9.91	35.38	28.00	
SEm ±	6.42	8.03	1.96	2.96	6.94	
F test	NS	NS	NS	NS	NS	

Figures in parenthesis are angular transformed values

TABLE- 3. Distribution and seasonality of mulberry leaf spot in Kashmir region.

Location	M O N T H					
	AUGUST		SEPTEMBER		OCTOBER	
	DI	PDI	DI	PDI	DI	PDI
Pampore	12.35	3.03	19.45	5.08	23.95	7.31
Manasbal	12.56	2.82	14.78	3.62	17.44	5.20
Mirgund	7.13	1.71	9.13	2.54	11.10	3.73
Y. K. Pora	9.31	1.98	11.02	3.05	13.45	3.91
Nunar (G.Bal)	7.84	2.26	9.92	3.17	12.18	4.09
Mean	9.83	2.36	12.82	3.49	15.62	4.84

TABLE- 4. Severity and varietal reaction of mulberry leaf spot in Kashmir region

Location	Goshorami	Chinese White	KNG	Tr-10	Rokokuyaso	Location Avg.
Baramulla	8.62 (16.83)	35.34 (34.90)	29.61 (29.23)	12.92 (20.97)	10.93 (18.44)	19.48
Pampore	10.63 (17.60)	10.74 (18.73)	32.11 (32.85)	14.75 (21.58)	14.47 (18.09)	16.54
Quazigund	10.94 (19.00)	35.58 (35.59)	16.50 (23.82)	40.38 (38.57)	13.66 (21.59)	23.41
Srinagar	19.42 (25.55)	15.27 (22.78)	16.70 (23.45)	22.26 (27.80)	7.38 (15.73)	16.20
Variety Avg.	12.40	24.23	23.73	22.57	11.61	
SEm ±	(2.92)	(7.14)	(9.71)	(4.43)	(5.85)	
F test	NS	NS	NS	NS	NS	

Figures in parenthesis are angular transformed values

Leaf spot: Leaf spot prevalence was noticed throughout the valley with incidence and severity levels ranging between 9.12 and 2.66 percent (Mirgund) to 18.58 and 5.14 percent (Pampore), respectively (Table 3). The incidence started in the month of August and the incidence level as well as severity increased gradually from the levels in August (3.47 and 1.04 percent, respectively) with the advancement of season to 15.71 and 2.15 percent, respectively in October. Pampore followed by Manasbal occupied the top slots with respect to incidence and severity of leaf spot while, Mirgund recorded least incidence and severity. The incidence level ranged from 7.38 percent on Rokokuyaso at Srinagar to 40.38 percent on Tr-10 at Quazigund (Table 4). Irrespective of the varieties, the leaf spot incidence ranged from 16.21 percent (Srinagar) to 23.41 percent (Quazigund). In the similar manner irrespective of locations the leaf spot incidence was least in Rokokuyaso (11.61%) followed by Gshoerami (12.40%) and maximum on Chinese white (24.23%).



FIGURE-1. A leaf with powdery mildews



FIGURE-2. Severely infected twig



FIGURE- 3. A leaf with characteristic spots



FIGURE-4. Severely infected twig

DISCUSSION

In Kashmir valley the peak period of powdery mildew incidence has been observed from August to November (Munshi, *et al.*, 1994). None of the mulberry cultivars grown in the Kashmir has been observed to be completely free from the diseases, although there are differences in the degree of tolerance / susceptibility (Munshi, *et al.*, 1999). In the present study the severity of the diseases was fairly lower. Also, KNG recorded lower disease intensity reconfirming its tolerance/resistance to powdery mildew. While, the severity of powdery mildew was highest on Gshoerami.

Survey conducted by Kausar (2003) during 1999, revealed that the leaf spot disease was prevalent in all the five districts of Kashmir Valley with maximum incidence (66.47%) and intensity (50.03%) in district Anantnag. The minimum disease incidence (17.17%) and intensity (7.91%) was observed in district Srinagar with a mean incidence of 41% and intensity of 24% for the Kashmir Valley. Of the 34 mulberry genotypes none were immune to disease. Varieties like Obawase, KNG, Brantul and Senmestsu were categorized as resistant to the disease

whereas, Botetul, Takawase and Serpentina were found highly susceptible. However, most of the commercial varieties such as Gshoerami, Kokuso-20, 21 and 27 Kanva-2, Limoncina etc were found moderately susceptible. In the present study, Gshoerami and Rokokuyaso registered relatively lower leaf spot severity than the other three.

CONCLUSION

Study clearly projected that there are no varieties available with acceptable levels of tolerance to both the diseases. In the light of the studies documented by earlier workers, the mulberry diseases intensity in the current study is fairly low which is quite natural as it is influenced by a number of factors including weather and cultural operations. Efforts are being made to identify and quantify those weather factors which are going to favour the mulberry diseases under temperate conditions of Kashmir, India. Therefore it is necessary to keep a watch on these predisposing factors. This will also help us in quantifying role these factors on the mulberry diseases besides enabling us to forecast the disease incidence and get

prepared with the counteracting measures to suppress the diseases and their ill effects on sericulture industry in Kashmir.

ACKNOWLEDGEMENT

Thanks are due to the Officers / officials of Department of sericulture, J & K for their co operation during the survey, also authors are thankful to Mrs. Imtiyaza Akhter, Technical Assistant, Entomology and Pathology, CSR &TI, Pampore for her assistance during the study.

REFERENCES

Anonymous, (1992) *Development Report- 1991-92*. Government of Jammu and Kashmir, Srinagar.

FAO (1967) Crop losses due to diseases and pests. Food and Agriculture Organization, Rome,.

Kausar, T. (2003) Studies on the leaf spot disease of mulberry (*Morus* spp.). *Ph. D. Thesis*, Kashmir University.

Khan, M.A.; Dhar, A.; Zeya, S.B. and Trag, A.R. (2004) *Pests and diseases of mulberry and their management*. Bishen Singh Mahendra Pal Singh 23-A, New Connaught Place, Dehradun-248 001(INDIA).

Munshi, N.A.; Tanki, T.N.; Zargar, M.A.;Trag, A.R. and Grover, R.K. (1994) Field evaluation of fungicides against powdery mildew of mulberry in Kashmir. *Sericologia.*, **34**: 707-711.

Munshi, N.A.; Tanki, T.N.;Sahaf, K.A.; Zargar, M.A.;Mir, G.M. and Mir, N.A. (1999) Reaction of mulberry varieties to *Phyllactinia corylea* in Kashmir. *SKUAST Journal of Research*. **1**: (2): 198-203.

Nika, F. A., 2010, Sericulture is a vital sector of Kashmir's economy. 7th February 2010. <http://www.kashmir Forum.org>.

Philip, T.; Gupta, V. P.; Govindaiah; Bajpai, A. K. and Datta, R. K. (1994) Diseases of Mulberry in India- Research priorities and Management Strategies. *International Journal of Tropical Plant Diseases*, **12**:1-21.

Sukumar, J and Padma, S. D. (1999) Diseases of Mulberry in India- Research Progress and Priorities. *In Advances in Mulberry Sericulture* (Eds. M. C. Devaiah, K. C. Narayanswamy and V. G. Maribashetty), CVG Publications, Bangalore, pp. 152-186.

Teotia, R. S. and Sen, S. K. (1994) Mulberry Diseases in India and their Control- A preview. *Sericologia.*, **34**: 1-19.