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## Disease assessment key for bacterial black spot of mango

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**Abstract**

In the present investigation, experiment was conducted to develop an assessment key for evaluating the bacterial black spot incidence and per cent disease index on each twenty different mango cultivars. The study was conducted in randomized block design with three replications during cropping season 2013 and 2014. The incidence of disease was more in the commercially successful variety like Langra (6.80%) and was minimum in local variety Gulabkhas (3.56%) in both the years. The maximum PDI was found in cultivar Langra (1.14%), while minimum PDI was observed in cultivar Gulabkhas (0.76%) in both the years. The study indicated that during both the years of study the commercially grown cultivars like Langra was found to be more susceptible, and the local cultivar Gulabkhas was least susceptible indicating the role of local cultivars in incorporating bacterial black spot resistance in future mango breeding programme.

**Keywords:** Mango, assessment key, *Mangifera indica* L., Bacterial black spot, disease management

**Introduction**

Mango (*Mangifera indica* L.) is one the world's most important and esteemed fruits and described by some as the "king of all fruits" (Basha *et al.*, 2010) [3]. It is unique species with respect to diversity, also a most favorite fruit of Indian sub-continent (Sial, 2002) [8]. It occupy an area of 2.51 lakh ha having annual production of 18.4 lakh ton giving productivity 7.3 ton/ha in India and contributes 20.7 per cent production share of major fruit crops in India. (National Horticultural Board, 2014) [6]. Because of diverse production conditions and the vast area grown, mango suffers from a number of diseases, some of them taking heavy toll on the crop and limiting production and productivity. Among them bacterial black spot of mango caused by *Xanthomonas campestris* pv. *Mangiferae indica*. is one of the major plant pathological constraints in growing healthy mango orchards affecting almost all the parts of the plant namely, trunk, branch, twig, leaf, petiole, flower and fruit (Adhikary *et al.*, 2013) [1]. Accurate and precise assessments of plant diseases are important in any study relating the disease severity to disease losses and further management tactics. Phytopathometry is an important tool for disease assessment and helpful in developing resistant cultivars. Crop losses can be prevented by measuring the intensity of disease and thus they are part of any disease survey and surveillance programme. The disease assessment technology is not only useful for research but it is also essential for extension pathologists, administrators, environmental protection agencies, industries and the farmers to decide priorities and promotional activities in accordance with the disease assessment programme (Horsfall and Cowling, 1978) [4]. Very little work has been done on Phytopathometry under Uttarakhand region. Therefore, the present study was planned to develop a disease assessment key for bacterial black spot with the objective of evaluating the disease incidence and per cent disease index (PDI) for developing the resistant cultivars in breeding programmes.

**Materials and Method**

An experiment was conducted to observe the progress of Bacterial black spot from a source point of infection in the field for two years, i.e. 2013 and 2014 at Horticulture Research Center (HRC). Observation were recorded starting from its appearance (April) of the disease from the infection focus to observe its progression. Three uniform 15 years old trees in each of twenty cultivars growing under uniform cultural practices were randomly selected. In both years, 30 current year leaves were labeled at the first week of April before symptoms were detected.

**Evaluation of disease parameters for assessment of bacterial black spot**

Disease severity assessments were made regularly at 7 days intervals starting from first appearance of disease. The assessment carried out using the self designed 0 to 4 grades disease

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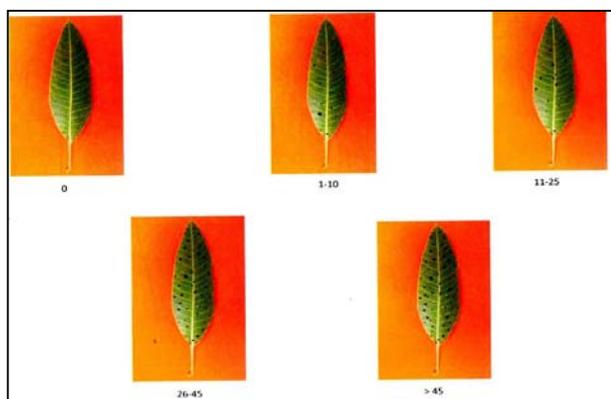
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rating scale on the basis of area of mango leaf affected by bacterial black spot from the given disease rating on bacterial black spot Akhtar and Alam (2000)<sup>[2]</sup>; Pitkethley (2006)<sup>[7]</sup>. Thirumalesh *et al.*, (2011)<sup>[9]</sup>.

Rating Scale	Area of Inflorescence Covered (%)
0	No lesions
1	1-10 small and dispersed spots
2	11-25 small and dispersed spots
3	26-45 small and dispersed spots
4	>45 dispersed black spots

**Pictorial diagram of bacterial black spot symptoms on mango tree**

The disease symptoms were observed from sides of the tree according to the direction indicator i.e. east, west, north and south. On the basis of the symptoms and infected area of a particular inflorescence/ panicle was allocated scale from 0-4 showing 0 - > 45% disease severity on each leaf of mango tree as given in (Fig.1).



**Fig 1:** Pictorial assessment keys for estimating disease severity of bacterial black spot of mango

**Study of Symptoms**

The infected leaves and fruits were collected separately in polythene bags and carried in laboratory and symptoms were studied with the help of microscope.

**Disease evaluation parameters**

The infection was identified on basis of symptoms present in the leaves. Thereafter, disease incidence was calculated as the number of infested plants showing symptoms out of total numbers of mango plants observed.

$$\text{Disease incidence} = \frac{\text{No. of diseased plants}}{\text{Total no. of Plant examined}} \times 100$$

The percent disease intensity (PDI) was calculated using the formula developed by McKinney (1923)<sup>[23]</sup> is given below:

$$\text{PDI}(\%) = \frac{\text{Sum of all the disease ratings}}{\text{No. of Plant observed} \times \text{Maximum disease grade}} \times 100$$

**Results and Discussion**

**Disease symptom of bacterial black spot**

The characteristic symptom (Figure 2) of the disease on leaves it produce angular, water-soaked spots of 1-3mm in diameter, which are delimited by the veins. On fruit, lesions developed as water soaked halos around lenticles or wound and soon become raised and then blacken and crack open with gummy infection. The characteristic symptoms observed due to the disease were compared in the light of available

literature and these were found to be similar to those documented by Akhtar and Alam (2000)<sup>[2]</sup>; Pitkethley (2006)<sup>[7]</sup>; Thirumalesh *et al.*, (2011)<sup>[9]</sup>.



a. Symptoms on leaf



b. Symptoms on leaf



c. Symptoms on fruit

**Fig 2:** Disease symptoms of bacterial black spot of mango as visible on (a, b) leaves and on fruit (c)

**Mango bacterial black spot incidence and per cent disease index on twenty mango cultivars**

The bacterial black spot disease of mango is widespread throughout most of the mango growing areas and the incidence varied from cultivar to cultivar. The perusal data from Table No. 1, revealed that in general disease incidence was more in the year 2014 as compared to the year 2013. A sudden rise in the temperature in the end of February and late winter rains might have created the more congenial conditions for the bacterial black spot development in the year 2014. It was also observed that during the year 2013, disease

incidence was found maximum in cultivar Langra and minimum in cultivar Chausa. However in the year 2014, maximum disease incidence was found in cultivar Langra and minimum in cultivar Gulabkhas. Akhtar and Alam (2000)<sup>[2]</sup>; Pitkethley (2006)<sup>[7]</sup>; Thirumalesh *et al.*, (2011)<sup>[9]</sup> have also reported that sudden high temperature and high humidity increases the bacterial black spot incidence. The pooled analysis revealed that maximum disease incidence was found in cultivar Langra and minimum in cultivar Chausa. It is clear from the result that the bacterial black spot incidence was more in the commercially successful variety like Langra in both the years and was minimum in local variety Gulabkhas. The low incidence of bacterial black spot in cultivar Gulabkhas in both the years clearly demonstrated the importance of local germplasm as a source of resistance for

this disease in the development of improved mango varieties. In the year 2013, maximum PDI was found in cultivars Langra and minimum in cultivars Neelum, Kalahafus and Chausa. While in the year 2014, maximum PDI was observed in cultivar like Langra and minimum in cultivar Gulabkhas. However in the pooled analysis maximum PDI was found in cultivar Langra, while minimum PDI was observed in cultivar Gulabkhas. It is evident from the study that susceptible cultivars against the disease are Langra and resistant cultivar is Gulabkhas. This again indicated that the local cultivars though are less yielder but possesses better resistance against bacterial black spot and can be used in the mango breeding programmes (Akhtar and Alam (2000)<sup>[2]</sup>; Pitkethley (2006)<sup>[7]</sup> and Thirumalesh *et al.*, (2011)<sup>[9]</sup>.

**Table 1:** Bacterial black spot incidence and per cent disease index on twenty mango cultivars

S. No	Cultivar	Disease incidence (%)			Per cent disease index (%)		
		2013	2014	Mean	2013	2014	Mean
1	Pantsinduri	4.83	4.74	4.79	0.95	0.85	0.90
2	Dashehari	4.96	4.81	4.89	0.95	0.85	0.90
3	Amrapali	4.30	4.66	4.48	0.85	0.76	0.81
4	Neelum	3.61	3.91	3.76	0.76	0.76	0.76
5	Hathijhool	3.97	4.20	4.09	0.95	0.85	0.90
6	Rasgulla	3.96	4.03	4.00	0.85	0.76	0.81
7	Redtotapari	4.61	4.69	4.65	0.95	0.85	0.90
8	Langra	6.68	6.91	6.80	1.14	1.14	1.14
9	Nashpati	5.01	5.43	5.22	0.95	0.95	0.95
10	Ramkela	4.23	3.73	3.98	0.85	0.85	0.85
11	Gaurjit	6.00	5.88	5.94	0.95	0.95	0.95
12	Golazafrani	6.48	6.19	6.34	1.14	1.04	1.09
13	Gulabkhas	3.84	3.31	3.58	0.85	0.76	0.81
14	Gorakhpurlangra	6.21	6.01	6.11	1.04	0.95	1.00
15	Kalahafus	3.52	3.64	3.58	0.76	0.76	0.76
16	Karela	4.09	4.57	4.33	0.85	0.85	0.85
17	Tamancha	3.80	3.85	3.83	0.76	0.76	0.76
18	Barahmasi	4.33	4.39	4.36	0.85	0.85	0.85
19	Husnara	6.42	6.51	6.47	1.14	1.14	1.14
20	Chausa	3.50	3.61	3.56	0.76	0.76	0.76
	CD at 5%	1.61	1.14				

## Conclusion

From this experiment we conclude that cultivar Langra was found to be more susceptible, However the local cultivar Gulabkhas was found to be least susceptible which indicated the role of local cultivar like Gulabkhas in incorporating bacterial black spot resistance in the development of improved mango cultivars/ varieties in future.

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