

DISEASE ASSESSMENT KEY FOR POWDERY MILDEW OF MANGO

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ABSTRACT

In the present investigation, experiment was conducted to develop an assessment key for evaluating the powdery mildew 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 varieties like Dashehari (31.26%), Amrapali (31.42%) and was minimum in local variety Gaurjit (23.57%) in both the years. The maximum PDI was found in cultivars Amrapali (1.42%) and Rasgulla (1.41%), while minimum PDI was observed in cultivar Chausa (1.14%), Gorakhpurlangra (1.15%), Ramkela (1.15%) and (Gaurjit 1.15%) in both the years. The study indicated that during both the years of study the commercially grown cultivars like Amrapali and Dashehari were found to be more susceptible, and the local cultivar Gaurjit was least susceptible indicating the role of local cultivars in incorporating powdery mildew resistance in future mango breeding programme.

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). It is unique species with respect to diversity, also a most favorite fruit of Indian sub-continent (Sial, 2002). It occupy an area of 2.51lakh ha having annual production of 18.4lakh 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). 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 powdery mildew of mango caused by *Oidium mangiferae* Bert. 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). It was first reported in the eastern Transvaal region of South Africa in 1937 (Wager, 1937; Doidge *et al.*, 1953; Gorter, 1988a).

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).

Very little work has been done on phytopathometry under Uttarakhand region. Therefore, the present study was planned to develop a disease assessment key for powdery mildew with the objective of evaluating the disease incidence and per cent disease index (PDI) for developing the resistant cultivars in breeding programmes

MATERIALS AND METHODS

The field experiment was conducted at Horticulture Research Centre (HRC), Pattarchatta G.B.Pant University of Agriculture & Technology, Pantnagar whereas glass house experiment was carried out in Department of Plant Pathology Pantnagar, Uttarakhand. The experiment was conducted at HRC on 10-15 years old trees of 20 cultivars during 2013 and 2014 with three replications. At the time of flowering 3 uniform looking plants from each replication were selected for generating data.

Evaluation of disease parameters for assessment of powdery mildew disease

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 5 grades disease rating scale on the basis of area of mango inflorescence affected by powdery mildew from the given disease rating on powdery mildew by Akhtar and Alam, (2002); Raheel *et al.*, (2008); Galli *et al.*, (2007) and Thind *et al.*, (2005):

Rating Scale	Area of Inflorescence Covered (%)
0	Inflorescence free from infection
1	1-10% Inflorescence covered by powdery mildew
2	11-25% Inflorescence covered by powdery mildew
3	26-50% Inflorescence covered by powdery mildew
4	51-75% Inflorescence covered by powdery mildew
5	>75% Inflorescence covered by powdery mildew

Pictorial diagram of powdery mildew 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 0-5 showing 0 - > 75% disease severity on each panicle of mango tree as given in (Figure1).

Study of Symptoms

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

Pathogenicity test

One year old grafted plants of mango cultivars were maintained in the poly house for this purpose. Three plants from each of cultivar were inoculated with the natural inoculums of *O. mangiferae* collected from Das he hari. The inoculation was done by tapping the conidia laden leaves over the test plants. The number of days taken for symptom development and per cent infection after 2nd and 4th weeks were recorded. One plant each of these cultivars was not inoculated and maintained as control according to the method suggested by Ash and Lanoiselet (2001).

Disease evaluation parameters

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

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

The percent disease intensity (PDI) was calculated using the formula developed by McKinney (1923) 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 powdery mildew

The characteristic symptom (Figure2) of the disease is the white superficial powdery fungal growth on the young tissues of all parts of the inflorescence, leaves, stalks of panicles, flowers and young fruits. The affected flowers and fruits drop prematurely reducing the fruit yield considerably or might even prevent the fruit set. Rains or mists accompanied by cooler nights during flowering are congenial for the disease development. The fungus parasitizes young tissues of all parts of the inflorescence, leaves and fruits. 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 (Wagle, 1928; Singh, 1960; Gupta, 1976; Lonsdale and Kotze, 1993a, 1993b; Joubert *et al.*, 1993; Prakash *et al.*, 1997; Akhtar and Alam, 2002; Singh, 2000; Junqueira *et al.*, 2001; Nelson, 2008; Syed *et al.*, 2014).

Pathogenicity

The leaves of mango plant (Dashehari cultivar) grown in 20 cm earthen pots under glass house condition were inoculated by spraying conidial suspensions. The plants were maintained in a chamber under aseptic condition. The whitish mass appeared on the leaves 5-6 days after inoculation. In control no such powdery mass were observed on leaves. The conidia of *O. mangiferae* are barrel shaped and produced singly visible in (Fig. 3). Same morphology of *O. mangiferae* has been described by (Uppal *et al.*, 1941; Palti *et al.*, 1974; Gorter 1988a, 1988b; Akhtar *et al.*, 1999; Singh, 2000; Syed *et al.*, 2014).

Mango powdery mildew incidence and per cent disease index on twenty mango cultivars

Table 1: Mean mango powdery mildew 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	24.99	31.38	28.19	1.18	1.26	1.22
2	Dashehari	29.12	33.41	31.26	1.22	1.48	1.35
3	Amrapali	30.01	32.82	31.42	1.37	1.48	1.42
4	Neelum	26.12	29.43	27.77	1.26	1.33	1.30
5	Hathijhool	25.75	29.10	27.43	1.26	1.33	1.30
6	Rasgulla	28.27	33.12	30.70	1.33	1.48	1.41
7	Redtotapari	24.32	29.17	26.74	1.18	1.26	1.22
8	Langra	27.52	29.46	28.49	1.33	1.41	1.37
9	Nashpati	26.78	28.37	27.57	1.33	1.41	1.37
10	Ramkela	20.87	23.49	22.18	1.11	1.18	1.15
11	Gaurjit	22.55	24.59	23.57	1.11	1.18	1.15
12	Golazafrani	27.01	29.63	28.32	1.33	1.41	1.37
13	Gulabkhas	25.40	30.55	27.98	1.18	1.26	1.22
14	Gorakhpurlangra	23.72	26.74	25.23	1.11	1.18	1.15
15	Kalahafus	25.51	27.28	26.39	1.26	1.33	1.30
16	Karela	23.94	26.99	25.47	1.11	1.26	1.18
17	Tamancha	26.19	29.40	27.80	1.33	1.33	1.33
18	Barahmasi	27.74	30.41	29.08	1.33	1.41	1.37
19	Husnara	24.66	27.42	26.04	1.11	1.26	1.18
20	Chausa	22.37	25.20	23.78	1.11	1.18	1.14

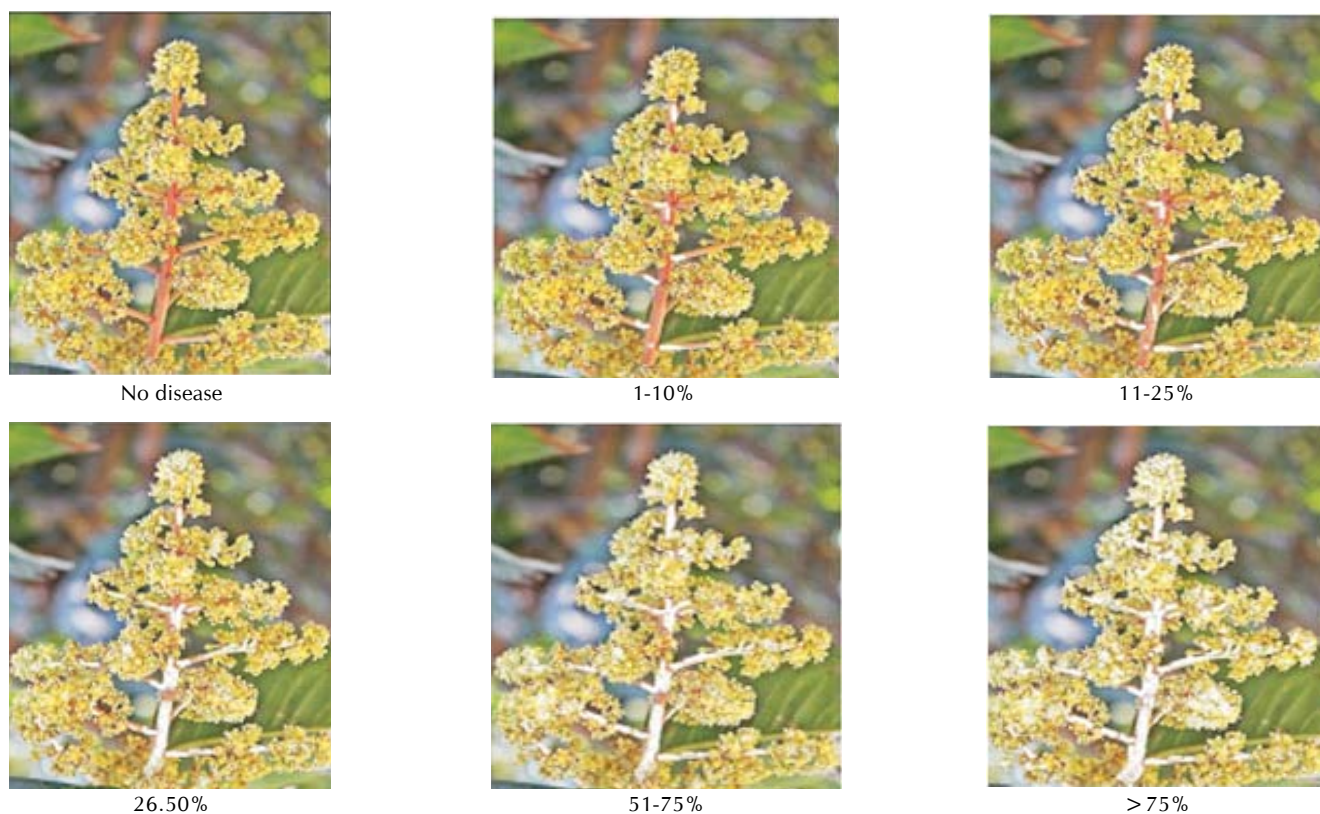


Figure 1: Assessment key for powdery mildew according to scale (0-5)

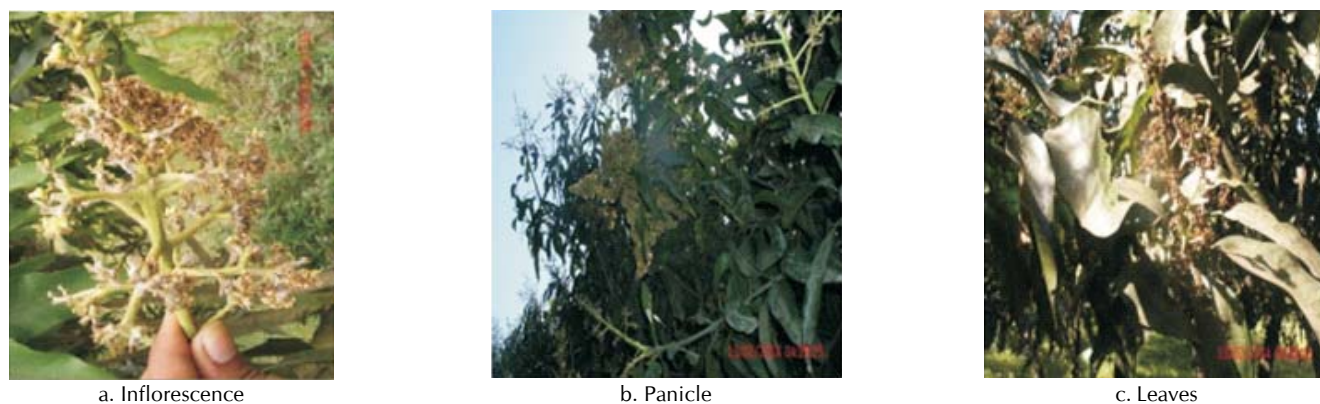
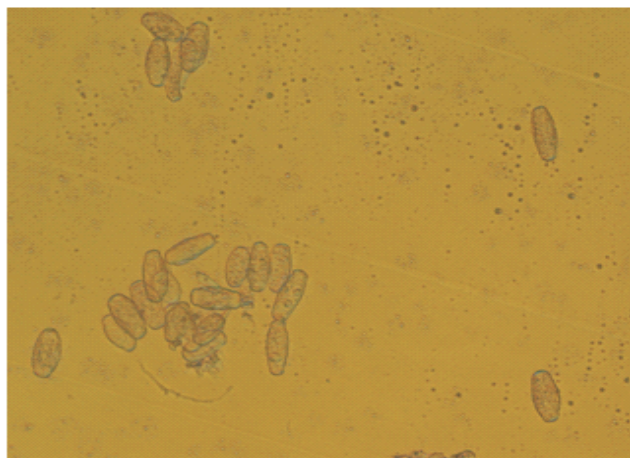


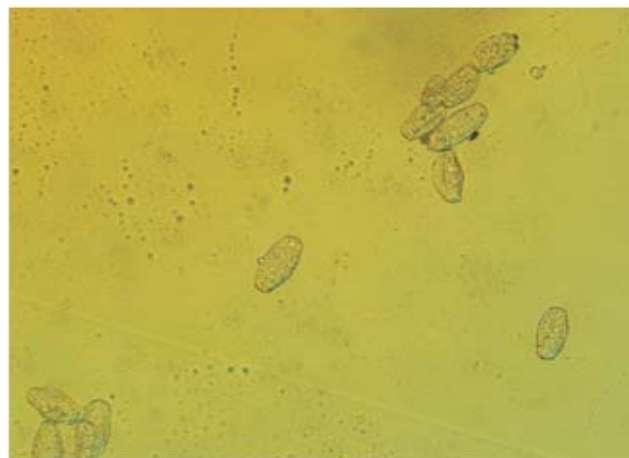
Figure 2: Disease symptoms of mango powdery mildew as visible on (a) Inflorescence (b) Panicles (c) Leaves

The powdery mildew 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 the 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 powdery mildew development in the year 2014. It was also observed that during the year 2013, disease incidence was found maximum in cultivars Amrapali, Dashehari and Rasgulla and minimum in cultivars Gaurjit. However in the year 2014, maximum disease incidence was found in cultivars Das hehari, Rasgulla, Amrapali and Pansinduri and minimum in

cultivars Ramkela and Gaurjit. Wager, 1937; Gupta, 1979; Gupta, 1989; Joubert *et al.*, 1993; Singh, 2000; Sinha, 2004; Nelson, 2008; Syed *et al.*, 2014; Sharma *et al.*, 2014; Nasir *et al.*, 2014; Muhammad-Sarwar, 2015 have also reported that sudden high temperature and high humidity at the time of flowering increases the powdery mildew incidence. The pooled analysis revealed that maximum disease incidence was found in cultivars Dashehari, Amrapali and Rasgulla, minimum in cultivars Gaurjit. It is clear from the result that the powdery mildew incidence was more in the commercially successful varieties like Dashehari, Amrapali in both the years and was minimum in local variety Gaurjit. The low incidence of powdery mildew in cultivar Gaurjit in both the years clearly



Spores at 20X



Spores at 40X

Figure 3: Spores of powdery mildew (a) 20X (b) 40X

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 Amrapali, Tamancha and Barahmasi and minimum in cultivars Karela, Gaurjit, Ramkela, Gorakhpurlangra, Chausa and Husnara. While in the year 2014, maximum PDI was observed in cultivars Dashehari, Amrapali and Rasgulla, and minimum in cultivars Gorakhpurlangra, Gaurjit, Ramkela and Chausa. However in the pooled analysis maximum PDI was found in cultivars Amrapali and Rasgulla, while minimum PDI was observed in cultivar Chausa, Gorakhpurlangra, Ramkela and Gaurjit. It is evident from the study that susceptible cultivars against the disease are Das he hari, Amrapali and Rasgulla and resistant cultivar is Gaurjit. This again indicated that the local cultivars though are less yielder but possesses better resistance against powdery mildew and can be used in the mango breeding programmes (Nishijima, 1993; Reuveni and Reuveni, 1995; Om-Prakash and Misra, 1999; Singh, 2000; Sinha 2004; Galli *et al.*, 2008; Raina, 2010; Syed *et al.*, 2014; Sharma *et al.*, 2014; Nasir *et al.*, 2014; Azmy, 2014; Muhammad-Sarwar, 2015) have also reported the differential powdery mildew incidence on different cultivars of mango.

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