

RESEARCH ARTICLE

Reaction of sunflower hybrids to powdery mildew caused by *Erysiphe cichoracearum* DC.

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ABSTRACT

Five sunflower hybrids KBSH -1, KBSH -41, KBSH -42, KBSH -44 and KBSH -53 were assessed under glasshouse conditions for resistance to a field population of powdery mildew fungus *Erysiphe cichoracearum* DC. Hybrid KBSH 53 recorded least powdery mildew severity of 4.2 per cent as compared with other hybrids and was resistant to powdery mildew. The highest disease severity (61 %) was recorded in hybrid KBSH-44 which was highly susceptible to powdery mildew.

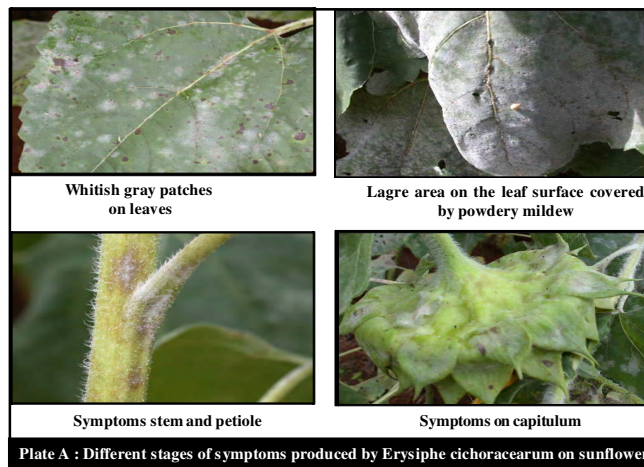
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INTRODUCTION

Erysiphe cichoracearum DC. is a widely distributed pathogen of cultivated annual sunflower (*Helianthus annuus* L.). Infection of sunflower by *E. cichoracearum* causes early senescence during the flowering stage and upto 15 per cent stunting and 81 per cent reduction in yield in the greenhouse. Powdery mildew may also cause economically significant reduction in sunflower production in tropical areas. Cultivars of sunflower are known to differ in their reaction to the powdery mildew fungus (Zimmer and Hoes, 1978). The only known source of resistance lies in wild *Helianthus* species (Jan and Chandler, 1985). The annual species of *Helianthus debelis* sub.sp. *sylvestris*, *H. praecox* sub.sp. *praecox* and *H. bolanderi* and the perennial species, *H. californicus*, *H. ciliaris*, *H. decapetalus*, *H. lacinatus* and *H. rigidus* were reported to be tolerant to powdery mildew under green house and natural conditions (Saliman *et al.*, 1982).

Powdery mildew affects most of the commercial varieties under present cultivation and it has been reported from different parts of the world. The powdery mildew of sunflower was first reported from US in 1928 (Anonymous, 1928). In India, the disease was first reported from Bombay province

(Patel *et al.*, 1949), later from Rajasthan (Prasada *et al.*, 1968), West Bengal (Goswami and Dasgupta, 1981) and Punjab (Bains *et al.*, 1996) causing considerable reduction in yield. The disease manifests as minute discoloured speck on leaves from which powdery mass radiates in all directions. All the aerial parts of the host are covered with white powdery mass containing mycelia and conidia of the fungus (Plate A).



Powdery mildew was rarely observed in Karnataka before 2006. Severe foliar (80%) infections by powdery mildew was observed during 2006 at Challakere, Chitradurga district in Karnataka (Anonymous, 2007). Since then the disease is being regularly seen in different parts of Karnataka in moderate to severe form. The loss due to powdery mildew is proportionate to the disease severity and varies considerably depending on the stage of the plant growth at which disease occurs. High inoculum in the field coinciding with favourable environmental conditions leads to early infections causing severe loss. In this paper the reaction of sunflower hybrids to infection by *Erysiphe cichoracearum* is discussed in the light of earlier reports.

MATERIALS AND METHODS

The present investigation was undertaken during 2010 at Zonal Agricultural Research Station, University of Agricultural Sciences, GKVK, Bengaluru. Reaction of sunflower genotypes viz., KBSH -1, KBSH -41, KBSH -42, KBSH -44 and KBSH -53 to *E.cichoracearum* causing powdery mildew was carried out to know their resistance or susceptibility.

Maintenance of inoculum :

The inoculum of *E .cichoracearum* used in this study for artificial inoculations was obtained from naturally infected plants in the field at Zonal Agricultural Research Station , GKVK, Bengaluru. Conidia from clear, separate and isolated colonies were picked up through the bristles of a brush and dusted onto KBSH 44 plants raised in glasshouse which is highly susceptible to powdery mildew. Isolated colonies developing on these plants were further transferred to large number of KBSH 44 plants and a pure culture originating from a single, well developed, isolated colony was established. The culture, thereafter, was maintained in the glass house to avoid contamination and to provide a constant source of fresh conidia. The culture was transferred to new plants by dusting the conidia on the leaf surface using camel hair brush as and when required.

Screening of hybrids:

The hybrids to be screened under *in vitro* conditions were raised in earthen pots when the seedlings were 30 days old. These plants were randomly placed among the plants on which culture was maintained and were inoculated at or after the three to five leaf stage by dusting conidia onto the leaves of plants three to four times. Disease severity was recorded six weeks after the last inoculation was done. The powdery mildew severity was recorded by recording the per cent leaf area covered by the disease, through visual observation using a rating scale of 0-9 scale (Mayee and Datar, 1986) on five marked plants of each hybrid. The epiphytotic was recorded

by selecting three leaves per plant on five plants from each hybrid on a random basis. The genotypes were further grouped based on reaction type as given by Khare and Lakpale (1997).

Reaction	Leaf area covered
Immune (I)	No symptom of powdery mildew on leaves.
Highly resistance (HR)	Small scattered powdery mildew specks covering 1 % or less leaf area.
Resistance (R)	Small powdery lesions covering 1-10 % of leaf area.
Moderately resistant/ Moderately susceptible (MR/MS)	Powdery lesions enlarged covering 11-25% of leaf area.
Susceptible (S)	Powdery lesions coalesce to form big patches covering 26-50% of leaf area.
Highly susceptible (HS)	Big powdery patches covering: 51% or more of leaf area and defoliation occur

RESULTS AND DISCUSSION

The culture was sent to The Herbarium Cryptogame Indiae Orientalis (HCIO), Division of Plant Pathology, Indian Agricultural Research Institute, New Delhi, India and was identified as the oidium state of *E. cichoracearum* with the accession /identification number HCIO 50056.

Reactions of hybrids in the glass house experiments is presented on Table 1. Hybrid KBSH 53 recorded least powdery mildew severity of 4.2 per cent compared with other hybrids and was recorded as resistant to powdery mildew.

Table 1 : Screening of sunflower hybrids against powdery mildew of sunflower

Hybrid	Disease severity (%)	
	Greenhouse	Reaction
KBSH 1	43	Susceptible
KBSH 41	45	Susceptible
KBSH 42	47	Susceptible
KBSH 44	61	Highly susceptible
KBSH 53	4.2	Resistant

The highest disease severity (61 %) was recorded in hybrid KBSH-44 which was recorded as highly susceptible to powdery mildew. Whereas, other hybrids namely, KBSH-1, KBSH- 41 and KBSH-42 showed disease severity ranging from 43 to 47 per cent and were found susceptible to powdery mildew. While, KBSH 53 was recorded as resistant and KBSH 44 as highly susceptible genotypes .

Several workers had previously reported about the resistance sources against powdery mildew of sunflower.

Jan and Chandler (1988) reported that PM1 derived from the *H. debelis* parental group was resistant to *E. cichoracearum* in USA. It contained the partially dominant powdery mildew resistance gene(s) of *H. debelis* at a frequency of about 50 per cent. A recessive genetic male-sterility gene from P 21 was also present upto 50 per cent. It was believed to be the first sunflower genotype highly resistant to *E. cichoracearum*. Eva (2002) opined that the response of sunflower plants to infection by *E. cichoracearum* f.sp. *helianthi* varied with genotype, phenological stage at which infection began, affected organ and climatic conditions. He also observed that resistance to infection was high before flowering and low during flowering up to physiological ripening. The yields of the hybrids were significantly affected by the disease incidence and climatic conditions. Hybrids such as Splendor, Select and Performer recorded higher yields than the control, whereas Rapid and Super with lower yields. The use of glasshouse tests to identify resistance to the powdery mildew pathogen in different lines will result in a significant savings in time, labour and field space.

The different reactions of the five hybrids to *E. cichoracearum* suggests that the response to infection by *E. cichoracearum* may be characteristic of the hybrid. The screening of the hybrids has resulted in the identification of KBSH 53 as resistant to powdery mildew.

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