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SHORT NOTE

Identification of sources of resistance to powdery and downy mildew diseases in Cucumber [*Cucumis sativus* (L.)]

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Cucumber (*Cucumis sativus* var. *sativus* L.) is a delicious vegetable relished most as salad. Diseases are a limiting factor for profitable cucumber production in India. The most widespread and serious pathogens of cucurbits are; powdery mildew incited by races 1 and 2 of *Sphaerotheca fuliginea* (Schlecht Fr) and downy mildew incited by race 3 of *Pseudopernospora cubensis* (Berk and Curt). Yield loss to powdery and downy mildew diseases was estimated to be 50-70 % (Sitterly, 1972). Though there are many simple cultural practices employed such as crop rotation and fall plowing (Sumner *et al;* 1981) and also the use of commercially available fungicides (Awad *et al*; 2011, Lebeda and Urban; 2006) . The most cost effective way of combating diseases is the production of cucumber hybrids with multiple disease resistance. Due to the unfavorable the climatic conditions, resistant varieties are becoming susceptible and also not consistent. A few commercial cucumber varieties or hybrids resistant to Powdery and Downey mildew diseases are currently available in India. Objective for this study was to screen available cucumber germplasm accessions for combined resistance to powdery and downy mildew diseases under natural field conditions during Rabi summer using a commercial cultivar Swarna Agathi as reference cultivar.

The experiments were conducted at Indian Institute of Horticultural Research, Hessaraghatta, Bangalore, Karnataka, India, during Rabi summer 2010-2011. The experimental materials consisted of 42 accessions of *Cucumis* spp including the wild type *Cucumis hardiwickii, Cucumis sativus* var *sativus* and SM 12735 (Bitter in taste). This study also included a commercial cultivar Swarna Agathi which was used as susceptible check. We used a randomized block design with three replications for each of the germplasm and screened the lines using a field adapted method, diseases inoculation methodologies and scoring Percent Diseases Index (PDI) of a disease assessment scale for evaluating the resistance against powdery mildew (Nick Fanourakis,1990) and downy mildew in cucumber developed by Swamy *et al*, 1980 and Pitchaimuthu *et al,* 2007. The PDI was calculated using the formula,

$$PDI = \frac{\text{Sum of numerical Values}}{\text{Number of leaves graded X Maximum ratings}} \times 100$$

After calculating the PDI, the germplasm in the population was categorized into four groups namely resistant (0-25), moderately resistant (26-40), susceptible (41-60) and highly susceptible(>60).

In open field screening, wild species *Cucumis hardiwickii*-14 and 15*, Cucumis sativus* var *sativus* and SM 12735 exhibited a high level of resistance to powdery and downy mildew diseases with 0-25 % PDI under natural conditions. Five accessions namely (IIHR-27, IIHR-35, IIHR-303, IIHR-64 and 82) had < 40 % PDI exhibited moderately resistance to PM and DM diseases and rest of the accessions showed > 60 % PDI depicting highly susceptible to both the diseases. This preliminary work must be repeated by screening all lines under artificial conditions in the glasshouse in order to confirm the results.

Normally any disease outcome is by a three-way interaction of the pathogen, the plant and the environment which is thereby known as the disease triangle. Hence it can be stated that resistance to a particular disease can be due to the above mentioned factors. In case of the pathogen- the strain, the duration of infection and the time of infection can contribute to a certain extant in the out come but as commonly understood environment plays a critical role as it has been demonstrated that both downey and powdery mildew are favored by the commonly warm and humid weather conditions. Hence variation in disease severity during a growing season is dependent on the prevailing temperatures and relative

Table 1. Screening of cucumber germplasm for powdery and downy mildew diseases under natural field condition Rabi summer 2010-11

Accession	Powdery Mildew PDI	Downy Mildew PDI
IIHR-1	41.0	59.0
IIHR-2	33.5	85.0
IIHR-3	36.0	56.00
IIHR-5	48.0	74.00
IIHR-6	66.1	82.00
IIHR-7	58.0	49.00
IIHR-8	74.0	81.00
IIHR-10	56.0	65.00
IIHR-11	62.0	45.10
IIHR-12	29.0	30.00
IIHR-15	58.0	52.25
IIHR-16	40.2	40.00
IIHR-17	45.0	52.00
IIHR-18	44.4	63.00
IIHR-20	85.2	95.00
IIHR-23	68..0	56.00
IIHR-24	75.0	68.00
IIHR-25	63.0	75.00
IIHR-26	28.5	24.00
IIHR-27	31.5	39.00
IIHR-29	85.0	50.00
IIHR-30	65.0	70.00
IIHR-31	74.0	80.00
IIHR-32	55.0	54.00
IIHR-34	65.0	70.00
IIHR-35	25.0	35.00
IIHR-36	34.0	31.00
IIHR-37	54.0	45.25
IIHR-38	63.0	56.00
IIHR-39	47.0	56.00
IIHR-50	62.0	65.00
IIHR-64	29.5	34.00
IIHR-66	85.0	65.00
IIHR-67	75.0	72.00
IIHR-81	60.0	74.00
IIHR-82	25.0	18.00
IIHR-303	35.0	38.65
Cucumis hardiwickii-14	0.0	10.0
Cucumis hardiwickii-15	0.0	15.0
SM-12735	0.0	5.0
Cucumis sativus var *sativus*	0.0	10.0
Swarna Agethi (Check)	65	89.0
CD 5 %	29.966	21.455
CV (%)	28.258	22.421

humidity conditions. Furthermore intraspecific genetic variation in the capacity of plants to combat microbial attack is confined mainly to disease resistance (R) loci which encode either a single gene or a complex of genes in giving resistance to a particular disease hence it is very important to take up studies that include the identification followed by expression study of genes for resistance to biotic stresses such as powdery and downy mildew, which will help in developing completely resistant varieties.

In general it is probably fair to say that resistance will not fully guarantee total crop protection, but choosing resistant varieties should rather be considered as a part of overall integrated pest management strategy, in particular they can be especially useful where the threat from specific pests and diseases are very high. Hence the most resistant lines identified in this field study may be useful sources of resistance and will be useful in breeding powdery and downy mildew disease resistant cucumber cultivars.

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