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Evaluate of the cucumber cultivars for the identification of resistance sources to downy mildew diseases in muskmelon (*Cucumis sativus* (L.)

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Abstract
Among the fifty accessions Alpur-1 (11.10%) and Alpur green (18.52%) exhibited a high level of resistance (0-25% PDI) to downy mildew diseases, six accessions namely, Sirangi (25.92%), IC321342 (30.86%), Sharabathenara (33.33%), IC321343 (37.04%), Trisha-2 (39.51%), Alpur orange (39.51%) exhibited moderately resistance (26-40 % PDI) fallowed by twenty five accessions showed 40 - 60 % PDI it patens to susceptible and rest of the seventeen accessions showed >61 % PDI with highly susceptible to Downy mildew in cucurbits.

Keywords: Accessions, downy mildew and percent diseases index

Introduction
Muskmelon is a delicious vegetable relished most as salad. Diseases are a limiting factor for profitable melons production in India. The most widespread and serious pathogens of melons are powdery mildew 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) [4]. Though there are many simple cultural practices employed such as crop rotation and fall ploughing (Sumner *et al*, 1981) [5] and also the use of commercially available fungicides (Awad *et al*, 2011, Lebeda and Urban; 2006) [5]. The most cost effective way of combating diseases is the production of muskmelon hybrids with multiple disease resistance. Due to the unfavourable the climatic conditions, resistant varieties are becoming susceptible and also not consistent. A few commercial muskmelon varieties or hybrids resistant to Powdery and Downey mildew diseases are currently available in India.

Materials and methods
The experiments were conducted at Horticultural Research Station, Anantharajupeta, Andhra Pradesh, India, during Rabi summer 2016-17 & 2017-18. The experimental materials consisted of fifty accessions of muskmelon spp. This study also included a commercial cultivar IC321376 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 downy mildew in muskmelon developed by Swamy *et al*, 1980 [3] and Pitchaimuthu *et al*, 2007 [2].
Objective for this study was to screen available muskmelon germplasm accessions for combined resistance to downy mildew diseases under natural field conditions during Rabi. The PDI was calculated using the formula,

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

After calculating the PDI, the germplasm in the population was categorized into four groups namely resistant (0-25), moderately resistant (25-40), susceptible (40-60) and highly susceptible (>61).

Results and discussion
In open field screening (Table 1 & Graph 1) Alpur-1 (11.10 %) and Alpur green (18.52%) exhibited a high level of resistance to downy mildew diseases with 0-25 % Percent Disease Incidence under natural conditions. six accessions namely,

Sirangi (25.92), IC321342 (30.86), Sharabathenara (33.33), IC321343 (37.04), Trisha-2 (39.51), and Alpur orange (39.51) 26-40 % PDI exhibited moderately resistance to Downy mildew diseases, twenty five four accessions namely, Papasa (42.17), Muskan (46.91), IC321366 (46.91), Bobby (46.91), IC321378 (48.15), Papayee-III (48.15), Patash (49.33), IC321323 (50.62), IC321312 (51.85), IC321326 (53.09), Papayee - I (53.09), IC321327 (54.31), IC321333 (54.32), IC321329-1 (54.32), KSP-1060 (54.32), IC321371 (54.32), IC321380 (55.55), IC321374-2 (75.31), IC321328 (56.79), IC321372 (56.79), Sharabath (58.02), IC321368 (58.02), IC315330 (59.26), IC321327-1 (59.26), and Allanagaram (60.49) showed 40- 60 % PDI susceptible to DM of the diseases and rest of seventeen accessions namely, NCSL (61.73), suvarna (62.96), amul-2 (62.96), IC315330 (65.43), papayee –II (65.43), IC321344 (67.83), IC315330-4 (67.90), IC315330-3 (67.90), IC321325 (69.13), IC315330-2 (70.37), arkajith (70.37), IC321323 (70.38), NMMH-24 (71.60), IC321374-1 (75.31), IC321374-2 (75.31), IC321328-1(75.31) and IC321376 (78.93) had showed >61 % PDI highly susceptible to DM.

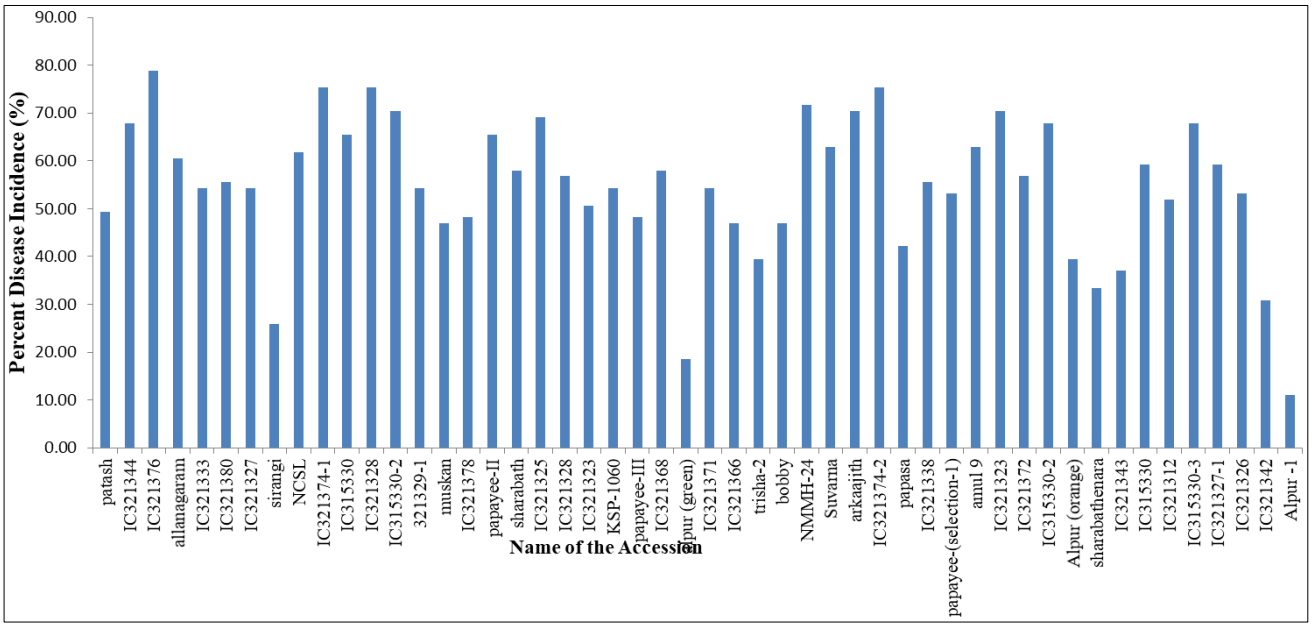
Normally any disease outcome is by a three-way interaction of the pathogen, the plant and the environment which is thereby known as the disease triangle. Hence it can be stated that resistance to a particular disease can be due to the above mentioned factors. In case of the pathogen- the strain, the duration of infection and the time of infection can contribute to a certain extant in the outcome but as commonly understood environment plays a critical role as it has been demonstrated the downy mildew are favoured 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 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 downy mildew, which will help in developing completely resistant varieties.

Table 1: Screening of muskmelon Accession for the evaluation of resistant source to downy mildew disease in musk melon under natural field condition.

S. no	Name of the Accession	Percent Disease Index (%)
1	Patash	49.33 (44.61)*
2	IC321344	67.83 (55.43)
3	IC321376	78.93 (62.72)
4	Allanagaram	60.49 (51.08)
5	IC321333	54.32 (47.52)
6	IC321380	55.55 (48.19)
7	IC321327	54.31 (47.46)
8	Sirangi	25.92 (30.49)
9	NCSL	61.73 (51.78)
10	IC321374-1	75.31 (60.23)
11	IC315330	65.43 (54.01)
12	IC321328-1	75.31(60.44)
13	IC315330-2	70.37 (57.11)
14	IC321329-1	54.32 (47.47)
15	Muskan	46.91 (42.95)
16	IC321378	48.15 (43.92)
17	Papayee-II	65.43 (54.05)
18	Sharabath	58.02 (49.61)
19	IC321325	69.13 (56.23)
20	IC321328	56.79 (48.98)
21	IC321323	50.62 (45.73)
22	KSP-1060	54.32 (47.51)
23	Papayee-III	48.15 (43.92)
24	IC321368	58.02 (49.63)
25	Alpur (green)	18.52 (25.40)
26	IC321371	54.32 (47.51)
27	IC321366	46.91 (43.20)
28	Trisha-2	39.51 (38.90)
29	Bobby	46.91 (43.15)
30	NMMH-24	71.60 (57.85)
31	Suvarna	62.96 (52.72)
32	Arkaajith	70.37 (57.11)
33	IC321374-2	75.31 (60.23)
34	Papasa	42.17 (40.38)
35	IC321338	55.55 (48.22)
36	Papayee-(selection-1)	53.09 (46.81)
37	Amul 9	62.96 (52.53)
38	IC321323	70.38 (57.10)
39	IC321372	56.79 (48.90)
40	IC315330-4	67.90 (55.52)
41	Alpur (orange)	39.51 (38.65)
42	Sharabathenara	33.33 (35.12)

43	IC321343	37.04 (37.23)
44	IC315330	59.26 (50.40)
45	IC321312	51.85 (46.10)
46	IC315330-3	67.90 (55.56)
47	IC321327-1	59.26 (50.40)
48	IC321326	53.09 (46.86)
49	IC321342	30.86 (33.61)
50	Alpur -1	11.10(19.28)
	C.D	10.17
	S.E (m)	3.61
	S.E (d)	5.11
	C.V	13.11

(* figures in parenthesis are angular values)



Graph 1: Screening of the accessions to evaluate the resistant source against the downy mildew disease in musk melon

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