

Varietal Reaction of Cucumber (*Cucumis sativus* L.) Germplasm for Management of Fusarium Wilt of Cucumber (FWC)

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Abstract Twelve cucumber varieties/lines (Cuc-30, Cuc-05, Local, Rocky, Hcu-163A, Hashim, Guard HC1, Qasim, Durga, Shaheen, Happy and Green cucumber) were cultivated to find out their genetic potential against Fusarium wilt disease of cucumber in research area of the Department of Plant Pathology University of Agriculture Faisalabad under randomized complete block design (RCBD). None of them was immune and resistant against fusarium wilt of cucumber. Among twelve varieties nine varieties (Green cucumber, Hashim, Rocky, Cu-05, Happy, Durga, Guard HC-1, Cu-30 and Qasim) exhibited moderately susceptible response with 38.0%, 37.78%, 36.0%, 34.0%, 31.12%, 28.0%, 26.0%, 26.0% and 44.45% disease incidence respectively. Shaheen (20.0%) and Hcu-163A (22.50%) expressed moderately resistant response while only one variety (Local) gave highly susceptible reaction with a disease incidence of 55.0%.

Keywords Fusarium Wilt, Cucumber Varieties, Screening, Fusarium Wilt Disease

1. Introduction

Cucumber (*Cucumis sativus* L.) is an important economical vegetable of cucurbitaceae family [1]. Cucumber is 4th most important cultivated vegetable after cabbage, onion and tomatoes in the world [2].

It is a main vine crop of Pakistan despite of low cultivation. Its cultivation is increasing gradually due to its medicinal and other valuable aspects. An area of 1200 hectares with a production of 7300 tons was cultivated [3]. Per capita consumption of processed cucumber is 2.2 kg and of fresh cucumber 3.1 kg is estimated in United States [3].

A number of biotic and abiotic factors are responsible for its low production. Among biotic factors diseases are the most prominent. Fusarium wilt disease reduces 10-50% yield significantly in dry and irrigated areas of Pakistan [4]. Wilt pathogen is soil borne and survives in soil for many years and is not controlled by simple methods such as crop rotation [5].

Due to environmental and health concerns nonchemical practices are encouraged over the large use of pesticides and chemicals [6]. It is a fact that presently available genome has a little level of resistance against fusarium wilt disease but, sowing of resistant varieties is cost reducing and environmentally friendly practice. An excellent and reliable way to manage this disease is the finding of resistant genetic potential of germplasm by its own self. This shows cost reduction, efficiency and a friendly behavior to environment so cultivation of resistant genome or cultivar is highly appreciable way to manage the disease over other tools [7]. To suppress the fusarium wilt disease incidence we have no reliable, cost effective, efficient and applicable way till now. However some useful, less expensive and eco-friendly practices are there which are recommended to suppress the pathogen attack one of them is, the use of resistant varieties [8,9]. That is why the present study was conducted to find out the resistant germplasm against Fusarium wilt disease of cucumber.

2. Materials and Method

A disease screening nursery was established to identify source of resistance against fusarium wilt disease of cucumber in the research area of Department of Plant Pathology, University of Agriculture, Faisalabad in first week of March, 2013. Twelve cucumber varieties/lines namely Cuc-05, Hcu-163A, Hashim, Cuc-30, Guard HC1,

Qasim, Rocky, Local, Shaheen, Happy, Durga and Green cucumber were collected from vegetable section of Ayub Agriculture Research Institute (AARI) Faisalabad, and were sown under field conditions with 1 m B×B and 30 cm P×P distance. All the recommended horticultural practices were followed to maintain the crop in good condition. For inoculation, natural inoculum in the form of diseased leaves and seed tubers was collected from vegetable nursery of institute of Horticultural Sciences, University of Agriculture, Faisalabad. These were artificially inoculated by fungus after getting its pure culture in laboratory for pathogenicity test and confirmation of pathogen. On appearance of symptoms, the disease incidence was recorded by using following formula.

$$\text{Disease Incidence \%} = \frac{\text{No. of infected plants} \times 100}{\text{Total no. of inspected plants}}$$

(Rahman *et al.*, 2011)[10]

Disease rating was taken on weekly basis to find out the percentage of disease incidences among these cultivars by following the scale of [11].

Scale	Disease incidence	Infection Level
0	0 %	Immune
1	0 – 10 %	Resistant
2	11 – 25 %	Moderately Resistant
3	26 – 45 %	Moderately Susceptible
4	46 – 70 %	Susceptible
5	71 – 100%	Highly Susceptible

Modified Scale [11]

3. Results

Table 1. Response of Twelve cucumber germplasm against Fusarium wilt disease

Cultivar/s varieties	Disease incidence (%age)	Rating	Response
Shaheen	20 k	2	MR
Hcu-163A	22 j	2	MR
Cuc-30	26 i	3	MS
Guard HC1	26 i	3	MS
Durga	28 h	3	MS
Happy	31.12 g	3	MS
Cuc-05	34 f	3	MS
Rocky	36 e	3	MS
Hashim	37.78 d	3	MS
Green cucumber	38 c	3	MS
Qasim	44 b	3	MS
Local	55 a	4	HS
LSD		0.074	

Mean values in a column having similar letters do not differ significantly as determined by LSD test ($P \leq 0.05$).

MR= Moderately Resistant MS = Moderately Susceptible

HS = Highly Susceptible

Fusarium wilt of cucumber appeared in field during the second week of May, 2013 and became maximum in the subsequent weeks till the death of plants. In subsequent weeks of May and June an increase in disease incidence was observed. Leaves and other vegetative parts of cucumber were susceptible to infection by *Fusarium oxysporum f.sp. cucumerinum*. Symptoms were visible in the form of yellowing of leaves, stunted growth and weakened stem or rotting of vascular tissues. Finally plants were died along fruits. All the cultivated cultivars were almost susceptible to wilt incidence. The maximum disease incidence was noted on Local and was minimum to Shaheen. None of them was immune and resistant against Fusarium wilt of cucumber. Among twelve, nine varieties (Green cucumber, Hashim, Rocky, Cu-05, Happy, Durga, Guard HC-1, Cu-30 and Qasim) exhibited moderately susceptible response with disease incidence of 38.0%, 37.78%, 36.0%, 34.0%, 31.12%, 28.0%, 26.0%, 26.0% and 44% respectively. Shaheen (20%) and Hcu-163A (22%) expressed moderately resistant response while only one variety Local gave highly susceptible reaction with a disease incidence 55% (Table.1).

4. Discussion

Present study is an effective tool to manage Fusarium wilt disease caused by pathogen (*F. oxysporum f.sp. cucumerinum*) of cucumber crop. The plant pathogens produce enzymes and toxin (mode of action) that rupture and degrade the plant cell wall components [12,13]. For this purpose the research trial was conducted to screen twelve cucumber varieties/lines, two of them Shaheen and HCu-163A were moderately resistant cultivars and can be recommended to growers, especially in those areas where the disease is very severe. Moreover, such cultivars can be grown as a source of resistance to develop other wilt resistant varieties, nine varieties were moderately susceptible and one variety was highly susceptible against the disease. On the basis of symptoms data regarding disease incidence showed severe disease symptoms on the Local variety which was categorized into highly susceptible according to scale. Nine cultivars came into the moderately susceptible as the attack was not so severe as Local. Two cultivars expressed minimum disease incidence and categorized as moderately resistant. These results are in agreement with those of Dong and Chen, 1993 [14], Punja and Parker, 2000 [15] and Morsy *et al.*, 2009 [16] reported during their experiment on screening of cucumber cultivars against Fusarium wilt that development of resistant variety is one of the cheapest, safest and durable methods for the control of Fusarium wilt diseases. From Samaria zones numerous descendants experiments were carried to examine the mechanism of resistance, 248 germplasms of many cultivars were sown to assess their own genetic potential to wilt disease attack from them only one susceptible cultivar (Shimson) and numerous cucumber lines or cultivars were assessed. One lonely line WIS-248 was at risk by backcross of parentages. Weizman

Institute told that Science can manage efficiently the pathogen *F. oxysporum*. This line had given significant behavior of resistance to dominant gene planned to *F. oxysporum* f.sp. *cucumerinum* [17].

In Sichuan, China 62 cucumber varieties were screened out against fusarium wilt disease to find out the level of resistance. One of them was highly resistant against this disease. Varieties which show white to whitish yellow color showed resistant behavior from green colored cultivars [14].

Screening of 25 cucumber varieties was done against Fusarium wilt disease. Cultivars gave response from highly susceptible to moderately resistant. Serami, Flamingo and Mustang which were known as English cultivars were highly susceptible to wilt pathogen [15].

Four cucumber cultivars Americans IBB, Denmark Beta-Alpha, Americana Beta-Alpha, and Beta-Alpha (Hybrid Japanese) were grown to check them for pathogenicity. All the cultivars were attacked by *F. oxysporum* pathogen [16].

5. Conclusions

As minimum disease incidence of Fusarium wilt disease was recorded on variety Shaheen (20%). It was scored as moderately resistant (MR) against Fusarium wilt. This variety, because of its good performance against Fusarium wilt disease is recommended for sowing, especially in areas of Fusarium wilt incidence. However, in case the Local variety it is highly susceptible for Fusarium wilt disease incidence, its resistance must be complemented with chemical treatment and by systemic acquired resistance as it does not have resistance against Fusarium wilt disease.

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