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# DEVELOPMENT OF MALE STERILITY BASED POWDERY MILDEW RESISTANT HIGH YIELDING F1 HYBRID IN CHILLI (*CAPSICUM ANNUUM* L.)

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## ABSTRACT

Powdery mildew disease in chilli pepper caused by *Leveillula taurica* has been affecting chilli pepper grown not only in greenhouse but also in open field condition. The use of fungicides to control powdery mildew in chilli has been ineffective and genetic resistance is the best alternative. Resistance sources identified in *Capsicum annuum* L. are rare and unsatisfactory. The purpose of this study was to identify the powdery mildew resistance genotypes/hybrids in chili. The hybrid UARChH42 recorded significantly highest mean dry fruit yield in station trials and multilocation as well as farm trials. Hybrid UARChH42 and UARChH43 showed highly resistant and resistant reaction to powdery mildew respectively.

***Key words :*** *Male sterility, powdery mildew, high yielding hybrid, chilli.*

Chilli (*Capsicum annuum* L.) is one of the most important commercial crops, grown in almost all parts of the world as well as in India. India is the largest consumer and exporter of chilli in the world with a production of 3292 MT from an area of 238 thousand ha and productivity 10 MT per ha during 2016 (1). The required goals of increasing productivity in the quickest possible time can be achieved only through heterosis breeding which is feasible in chili crop. Exploitation of natural out crossing could render commercial hybrid seed production technology economically viable through use of male sterile lines. Among the various factors responsible for low yield of chilli, pests and diseases are of prime importance which affects the quality and production. Powdery mildew of chili incited by *Leveillula taurica* is one of the most serious diseases of chili. Chili production in India is responsible of heavy yield loss ranging from 14 to 30 per cent (2). Chilli suffers from many foliar diseases like cercospora leaf spot, powdery mildew, anthracnose, murda complex and many other diseases. Among them powdery mildew caused by *Leveillula taurica* is one of the major constraint in chilli production causing yield loss of 42.82 per cent due to severe defoliation and reduction in size and number of fruits per plant (3). The use of systemic fungicides for control is not effective. Besides this, its indiscriminate use causes pathogen resistant strains development (4). Perfect solution to keep disease away from the crop is to develop resistant variety/hybrid. Among the limited commercial hybrids available in chili none is resistant to powdery mildew. Heredity studies of *Capsicum annuum* showed that resistance to powdery mildew is dominant and polygenic (5). Hence, it may be possible to develop high yielding hybrids resistant to powdery mildew. Keeping in a view the present study was conducted for commercial exploitation of powdery mildew resistant hybrid in chili.

## MATERIALS AND METHODS

Two geno-cytoplasmic male sterile lines GCMS lines of chili and 10 fertility restorer were used for development of hybrids and screening for resistance to powdery mildew. 20 hybrids were produced during 2010-11 using line x tester design. Station trials were conducted to evaluate 20 hybrids and their 22 parents using Completely Randomized Block Design with three replications during 2011-12 to 2013-14. The promising hybrids were identified and tested in multilocation trials during 2014-15 and 2015-16 at University of Agricultural Sciences, Raichur, Karnataka, India. The most promising hybrids like., UARChH42 and UARChH43 were identified and recommended for release by conducting farm trials during 2016-17. Among the available genotypes/hybrids the two sterile lines viz., JNA1 and ACA1, two restorer lines *viz.,* BVC42 and B. Dabbi, two promising hybrids like, UARChH42 and UARChH43 and two private hybrids *viz.,* Indame5 and Sitara were selected and screened in natural epiphytotic conditions for powdery mildew resistance during 2018-19. The experiment was carried out in natural epiphytic condition using earlier hot spots for powdery mildew disease. The epidemic of powdery mildew occurred naturally. Seedlings were transplanted with plant to plant and row to row spacing of 60 cm x 60 cm. Powdery mildew reaction evaluation was done at fruit maturity. A scale of scores was used in accordance with the leaf area affected, proposed by (6), of which: 1-resistant, no symptoms; 2-moderately resistant, with 10 per cent of the leaf area affected; 3-moderately susceptible, with 11-20 per cent of the leaf area affected; 4-susceptible, with 21-50 per cent of the leaf area affected and 5-highly susceptible with 51 per cent or more of the leaf area affected. Hybrid Indame5 and variety B. Dabbi were used as susceptible checks. The populations evaluation was

**Table-1 :** Performance of High yielding hybrids and reaction to powdery mildew resistance in chili.

| Hybrid/ Genotypes | Station trials | | | | Multilocation Trials | | | | | Disease reaction | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RA 11-12 | RA 12-13 | RA 13-14 | Mean Yield Kg/ha | RA 14-15 | RA 15-16 | HMT 14-15 | Bgudi 14-15 | HG15-16 | Mean Yield (kg/ha) | Hybrids/ Genotypes | Reaction | %leaf area infected |
| $F_1$ UARChH-42 | 4008* | 6033* | 4661* | 4900 | 3029* | 6467* | 4393* | 1823* | 3577* | 4248 | $F_1$ UARChH42 | Highly resistant | Upto 1 |
| $F_1$ UARChH-43 | 3397* | 5240 | 4026 | 4224 | 2875* | 5896* | 3292* | 1474* | 3530* | 3716 | $F_1$ UARChH43 | Resistant | 1-10 |
| $F_1$ Indame5 | — | — | — | — | 908 | 3851 | 1273 | 975 | 2200 | 1841 | $F_1$ Indam5 | Highly susceptible | >50 |
| BVC1 | 2949 | 5137 | — | 4043 | 1757 | 2700 | 2051 | — | 2837 | 2905 | BVC42 | Resistant | 1-10 |
| B. Dabbi(c) | — | 3468 | 2747 | 3107 | 1030 | 2750 | 441 | 615 | - | 1841 | B.Dabbi | Highly susceptible | >50 |
| $F_1$ Sitara | 2251 | 5420 | 4138 | 3936 | 1854 | 4329 | 708 | 1337 | 2743 | 2272 | JNB1 | Highly resistant | Upto 1 |
| CV | 9.18 | 4.98 | 5.11 | | 14.16 | 13.2 | 7.24 | 6.9 | 4.72 | | JNA1 | Highly resistant | Upto 1 |
| CD 5% | 222 | 309 | 204 | | 451 | 1075 | 241 | 121 | 207 | | | | |

made when referential check plants achieved maximum score 5.

## RESULTS AND DISCUSSION

The GCMS based hybrid UARChH42 registered significantly highest mean dry fruit yield (4900 kg/ha) followed hybrid UARChH43 (4224 kg/ha) over non GCMS based hybrid Sitara (3936 kg/ha) in station trials (Table-1). Multilocation trials were conducted over three locations during 2014-15 and 2015-16 and found that hybrid UARChH42 recorded significantly highest mean dry fruit yield of 4248kg/ha followed by UARChH43 (3716 kg/ha) over standard non GCMS based check hybrid Sitara (2272 kg/ha). The high yielding hybrids were tested by conducting 6 large scale demonstrations and 17 farm trials in farmer's field and found that the hybrid UARChH42 registered highest average dry fruit yield of 3495 kg/ha over check hybrid Sitara (3025 kg/ha) which was 15.53 per cent superior. None of the male sterile lines, restorer lines and hybrids screened for powdery mildew disease was found to be Immune (I) in reaction in natural epiphytotic conditions (Table-1). The findings are concurrent with (7, 8). However, one sterile line JNA1, one maintainer line JNB1 and one hybrid UARChH42 were found to be highly resistant. While, one restorer line BVC42 and one hybrid UARChH43 found to be resistant reaction to powdery mildew indicating inheritance of resistance to powdery mildew is dominant as one of the parent involved in the cross was resistant to powdery mildew. Similar results also registered by (9). However, (10) showed susceptible reaction to powdery mildew for all the F1 hybrids evaluated, indicating recessive inheritance. Resistant and susceptible phenotypes are clearly distinct (Figure-2). Figure-2 showed that the private non CGMS based hybrid viz., Indame5 showed highly susceptible reaction at the maturity. However, hybrid UARChH42 showed no symptoms of powdery mildew and helps to stay green to enhance the yielding ability.

## CONCLUSIONS

The hybrid UARChH42 recorded significantly highest mean dry fruit yield in station trials and multilocation as well as farm trials indicating the stable performance of the hybrid over the year and the location. Hybrid UARChH42 and UARChH43 showed highly resistant and resistant reaction to powdery mildew respectively because of the high resistance of the male sterile line used to produce hybrid UARChH42 and the resistant male parent used to produce both hybrids. These results indicate that inheritance of resistance to powdery mildew is dominant. Both the resistant hybrids developed are useful to the farming community to boost the chili yield in commercial level.

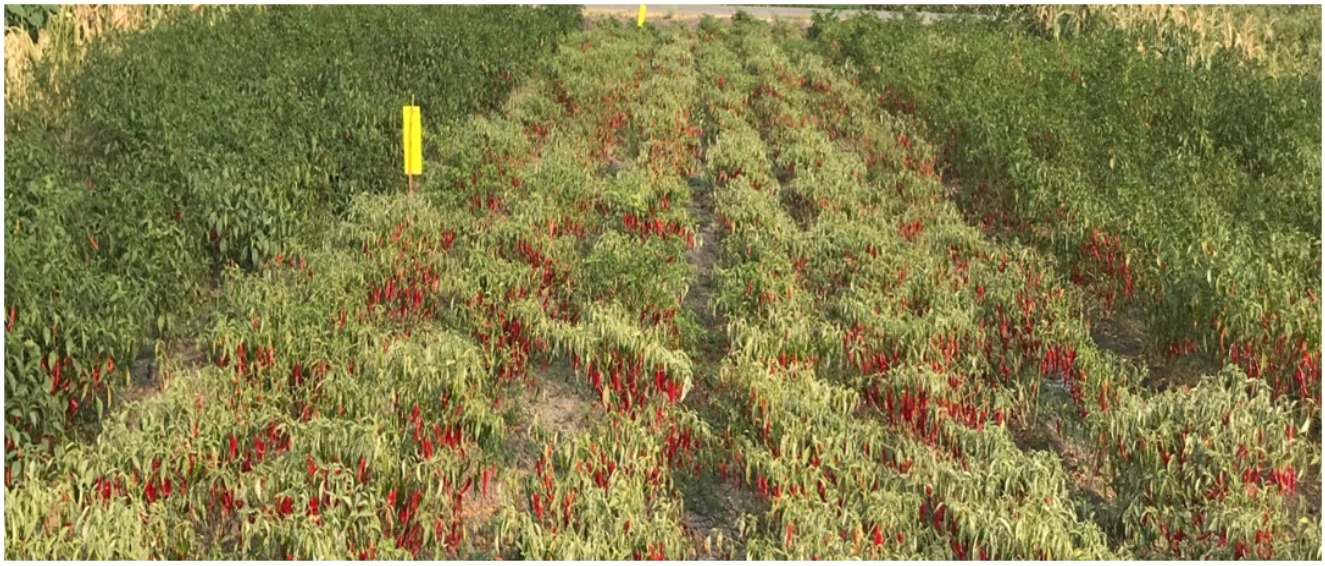

**Fig.-1 :** Reaction to powdery mildew resistance in chili.
A. UARChH42: Highly resistance, B. UARChH43: Resistance, C. Indam5: Highly susceptible

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