

EVALUATION OF F₁ GENERATION OF RESISTANT AND SUSCEPTIBLE BRINJAL CULTIVARS AGAINST FOUR POPULATION OF ROOT-KNOT NEMATODES*

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'Gulla', a resistant brinjal cultivar was crossed with six susceptible cultivars and the F₁ generations were evaluated for their reaction to four populations of the root-knot nematode under green-house conditions. F₁ generations of 'Gulla x West Coast Round' were found to be tolerant where as, those of 'Gulla x Erengere' and 'Gulla x Arka Kusumakar' were highly susceptible to all the four nematode populations.

Keywords : F₁ generations; tolerant; highly susceptible; root-knot nematodes; brinjal.

Introduction

Root-knot nematode (*Meloidogyne* spp.) is one of the major pathogens of brinjal (*Solanum melongena* L.) which can cause economic yield losses (Sitaramaiah *et al.*, 1971). Several attempts have been made to combat this nematode among which plant resistance is regarded as a feasible method as it is an effective, economical and environmentally safe means. Brinjal inspite of being widely grown, lack resistance to several common species of root-knot nematode and attempts to hybridize have been unsuccessful (Fassuliotis, 1976). Present investigations were carried out as an

attempt to transfer the resistance factor from a resistant cultivar 'Gulla', which is popularly being grown in some parts of Karnataka, into six cultivars ('Pusa Purple Long', 'Pusa Purple Round', 'Erengere', 'West Coast Round', 'Arka Sheel' and 'Arka Kusumakar') that are popularly being grown throughout Karnataka and are highly susceptible to *M. javanica*, race-1, race-2 and race-3 of *M. incognita*. F₁-generation of the crosses were evaluated for their reaction to these four populations of root-knot nematode under green-house conditions.

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Material and Methods

In screening studies, 'Gulla' a local cultivar was found to be highly resistant to race-1 and race-2 of *M. incognita* but slightly susceptible to race-3 and *M. javanica* (Ravichandra, 1987). Hence this cultivar was selected for the present study along with other six popularly grown brinjal cultivars in Karnataka which are highly susceptible to all the four populations of the nematode. Seedlings were raised separately in six inch pots containing 1000 g sterilized soil. A bud on susceptible cultivar was selected one evening prior to its opening and the petals were opened from the top with forceps. All the stamens were removed and the flower was bagged. The anther from 'Gulla' were selected in the morning and the emasculated flower was pollinated, bagged, labelled and allowed for fruit setting. The seeds were collected from F₁-generations, dried and stored properly. Seedlings were raised from F₁-seeds and 10 days later, 10 ml of the larval suspension containing about 1000 larvae was inoculated into the four holes made in the soil around the plants. The holes were then closed by gently pressing the soil. Fortyfive days later, plants were carefully depotted, root systems were washed free of soil and observations were recorded on numbers of galls and egg-masses per root system, number of eggs per egg-mass and nematode

population per 5 g soil. Root system was scored for egg-mass index using the scale as suggested by Hadisoeganda and Sasser (1982). Observations were also recorded on some host growth parameters as an additional information.

Results

With respect to race-1 of *M. incognita* results were significant with 'Gulla x Erengere' (67.20) which recorded maximum number of galls compared to other F₁-generations (Table 1). 'Gulla x Arka Kusumakar' (22.20) and 'Gulla x West Coast Round' (20.00) though were on par with each other, differed significantly from 'Gulla x Arka Sheel' (42.60), 'Gulla x Pusa Purple Long' (9.60) which again differed significantly with one another. With respect to the number of egg-masses, 'Gulla x Erengere' recorded the maximum number (62.20) and was significantly different from the rest of the F₁-generations. 'Gulla x Arka Kusumakar' and 'Gulla x West Coast Round' (15.60 x 16.00 respectively) were on par with each other and differed significantly from 'Gulla x Arka Kusumakar' (38.80). However, 'Gulla x Pusa Purple Round' (4.60) and 'Gulla x Pusa Purple Long' (4.80) were on par with each other and differed significantly from other F₁-generations.

Maximum number of eggs per egg-mass was recorded by 'Gulla x

Table 1. Reaction of F₁-generations of some brinjal cultivars popularly grown in Karnataka to *M. incognita* (race-1).

| Cross | Dry Shoot weight (g) | Dry Root weight (g) | No. of galls/ root system | No. of egg-masses/ root system | No. of eggs/ egg-masses | No. of nematodes/ 5 g soil | Egg-mass index |
|---------------------------|----------------------|---------------------|---------------------------|--------------------------------|-------------------------|----------------------------|----------------|
| Gulla x Pusa Purple Long | 16.88 | 7.96 | 9.60 | 4.80 | 134.20 | 22.00 | 2.40 |
| Gulla x Pusa Purple Round | 17.88 | 15.38 | 7.20 | 4.60 | 124.80 | 19.60 | 2.00 |
| Gulla x Erengere | 5.60 | 6.23 | 67.20 | 62.20 | 219.60 | 37.60 | 4.00 |
| Gulla x West Coast Round | 17.00 | 9.22 | 20.00 | 16.00 | 156.00 | 20.20 | 3.00 |
| Gulla x Arka Sheel | 6.73 | 8.23 | 42.60 | 38.80 | 178.40 | 39.80 | 4.00 |
| Gulla x Arka Kusumakar | 9.89 | 9.49 | 22.20 | 15.60 | 121.00 | 19.60 | 3.00 |
| Mean | 12.33 | 9.41 | 28.13 | 23.66 | 155.66 | 26.46 | 3.06 |
| CD 0.05 | 6.41 | 4.74 | 47.32 | 15.77 | 73.61 | 4.47 | 1.16 |

Arka Sheel' (178.40), 'Gulla x West Coast Round' (156.00) and 'Gulla x Pusa Purple Long' (134.20), which significantly differed among themselves and also with other F_1 -generations. However, 'Gulla x Arka Kusumakar' (121.00) and 'Gulla x Pusa Purple Round' (124.80) were on par with each other.

Though maximum egg-mass index was recorded by 'Gulla x Erengere' and 'Gulla x Arka Sheel' (4.00 each), they were on par with 'Gulla x West Coast Round' and 'Gulla x Arka Kusumakar' (3.00 each). However, they differed significantly from 'Gulla x Pusa Purple Long' and 'Gulla x Pusa Purple Round' (2.40 and 2.00) which were again on par with each other.

With regard to race-2, 'Gulla x Arka Sheel' recorded maximum number of galls (65.60) followed by 'Gulla x Erengere' (62.00) and were on par with each other (Table 2). However, the rest of the cultivars differed significantly among themselves and also with the others. 'Gulla x Arka Kusumakar' recorded 27.80 followed by 'Gulla x West Coast Round' (20.80), 'Gulla x Pusa Purple Long' (17.60) and 'Gulla x Pusa Purple Round' (8.20). 'Gulla x Erengere' recorded maximum number of egg-masses (58.00) which was significantly different from the rest of the F_1 -generations whereas, 'Gulla x Arka Sheel' (28.80) and 'Gulla x Arka Kusumakar' (21.40) were on par

with each other. 'Gulla x West Coast Round' (17.80), 'Gulla x Pusa Purple Long' (11.60) and 'Gulla x Pusa Purple Round' (5.80) differed significantly among themselves and also with the rest of the F_1 -generations.

Statistically significant results were obtained with 'Gulla x Arka Sheel' which recorded maximum number of eggs per egg-mass (196.80) followed by 'Gulla x Erengere' (185.00), 'Gulla x Arka Kusumakar' (134.60), 'Gulla x West Coast Round' (132.20), 'Gulla x Pusa Purple Long' (126.60) and 'Gulla x Pusa Purple Round' (92.00). All the F_1 -generations differed significantly from one another with the exception of 'Gulla x Arka Kusumakar' and 'Gulla x West Coast Round' which were on par with each other.

'Gulla x Arka Sheel' and 'Gulla x Erengere' recorded maximum egg-mass index (4.00) each and significantly differed from 'Gulla x Pusa Purple Round' (2.00) whereas, 'Gulla x Pusa Purple Long' (3.00), 'Gulla x West Coast Round' (3.00) and 'Gulla x Arka Kusumakar' (3.20) were on par among themselves.

With respect to race-3, however, results were statistically significant with all the F_1 -generations with respect to number of galls (Table 3). Maximum number of galls however, was recorded by 'Gulla x Erengere' (80.00) followed by 'Gulla x West

Table 2 : Reaction of F₁-generations of some brinjal cultivars popularly grown in Karnataka to *M. incognita* (race-2).

| Cross | Dry Shoot weight (g) | Dry Root weight (g) | No. of galls/ root system | No. of egg-mass/ root system | No. of eggs/ egg-mass | No. of nema-todes/ 5 g soil | Egg-mass index |
|---------------------------|----------------------|---------------------|---------------------------|------------------------------|-----------------------|-----------------------------|----------------|
| Gulla x Pusa Purple Long | 9.22 | 6.80 | 17.60 | 11.60 | 126.60 | 15.40 | 3.00 |
| Gulla x Pusa Purple Round | 23.84 | 14.23 | 8.20 | 5.80 | 92.00 | 20.80 | 2.00 |
| Gulla x Erengere | 6.02 | 8.02 | 62.00 | 58.00 | 185.00 | 38.40 | 2.00 |
| Gulla x West Coast Round | 14.78 | 11.04 | 20.80 | 17.80 | 132.20 | 21.40 | 3.00 |
| Gulla x Arka Sheel | 15.54 | 12.90 | 65.60 | 28.80 | 196.80 | 51.20 | 2.00 |
| Gulla x Arka Kusumakar | 16.95 | 15.53 | 27.80 | 21.40 | 134.60 | 20.80 | 3.20 |
| Mean | 14.39 | 11.42 | 33.66 | 23.90 | 144.54 | 28.00 | 3.20 |
| CD 0.05 | 3.52 | 2.08 | 25.44 | 4.68 | 81.78 | 31.75 | 0.34 |

Table 3 : Reaction of F₁-generations of some brinjal cultivars popularly grown in Karnataka to *M. incognita* (race-3)

| Cross | Dry Shoot weight (g) | Dry Root weight (g) | No. of galls/ root system | No. of egg-mass/ root system | No. of eggs/ egg-mass | No. of nema-todes/ 5 g soil | Egg-mass index |
|---------------------------|----------------------|---------------------|---------------------------|------------------------------|-----------------------|-----------------------------|----------------|
| Gulla x Pusa Purple Long | 16.48 | 9.59 | 13.40 | 9.00 | 129.00 | 22.60 | 2.80 |
| Gulla x Pusa Purple Round | 19.60 | 13.70 | 7.40 | 5.60 | 128.60 | 10.80 | 2.00 |
| Gulla x Erengere | 7.88 | 7.62 | 80.00 | 72.20 | 189.60 | 44.60 | 4.00 |
| Gulla x West Coast Round | 8.65 | 9.09 | 62.20 | 59.20 | 237.40 | 46.40 | 4.00 |
| Gulla x Arka Sheel | 15.41 | 14.72 | 19.20 | 14.00 | 98.20 | 21.60 | 3.00 |
| Gulla x Arka Kusumakar | 17.18 | 15.63 | 9.40 | 7.40 | 109.40 | 20.40 | 2.20 |
| Mean | 14.20 | 11.72 | 31.93 | 27.90 | 148.70 | 27.73 | 3.00 |
| C D 0.05 | 12.22 | 8.60 | 53.48 | 7.81 | 65.41 | 17.65 | 1.16 |

Coast Round' (62.00), 'Gulla x Arka Sheel' (19.20) 'Gulla x Pusa Purple Long' (13.40), 'Gulla x Arka Kusumakar' (9.40) and 'Gulla x Pusa Purple round' (7.40). Gulla x Erengere' recorded the maximum number of egg-masses (72.20) which was significantly different from the rest of the cultivars. 'Gulla x Pusa Purple Round' (5.60), 'Gulla x Arka Kusumakar' (7.40) and 'Gulla x Pusa Purple Long' (9.00) were on par among themselves.

Maximum number of eggs per egg-mass was observed with 'Gulla x West Coast Round' (237.40) which was significantly different from the rest of the F_1 -generations. 'Gulla x Erengere' (189.00) also differed significantly from others whereas, 'Gulla x Pusa purple Long' (129.00) and 'Gulla x Pusa Purple Round' (128.60) were on par with each other. However, 'Gulla x Arka Sheel' (98.20) was significantly different from others.

Maximum egg-mass index was recorded by 'Gulla x Erengere' and 'Gulla x West Coast Round' (4.00 each) which were on par with 'Gulla x Arka Sheel' (3.00), 'Gulla x Pusa Purple Long' (2.80), 'Gulla x Arka Kusumakar' (2.20) and 'Gulla x Pusa Purple Round' (2.00).

With *M. javanica*, maximum number of galls was recorded by 'Gulla x Erengere' (76.60) which differed significantly from others (Table 4).

'Gulla x Arka Kusumakar' recorded 42.40 galls followed by 'Gulla x Arka Sheel' (17.60), 'Gulla x Pusa Purple Long' (13.20), 'Gulla x Pusa Purple Round' (9.60) and 'Gulla x West Coast Round' (8.60) and they significantly differed from one another. 'Gulla x Erengere' recorded maximum number of egg-masses (70.60) which differed significantly from the rest of F_1 -generations followed by 'Gulla x Arka Kusumakar' (30.20) and 'Gulla x Arka Sheel' (13.00). However, 'Gulla x Pusa Purple Round' (8.20), 'Gulla x Pusa Purple Long' (8.0) and 'Gulla x West Coast Round' (6.60) were on par among themselves.

The results were statistically significant with respect to the number of eggs per egg-mass. Minimum number was recorded by 'Gulla x West Coast Round' (89.00). However, maximum number was observed with 'Gulla x Arka Kusumakar' (213.20) followed by 'Gulla x Erengere' (182.80), 'Gulla x Pusa Purple Long' (162.40), 'Gulla x Pusa Purple Round' (122.80) and 'Gulla x Arka Sheel' (105.40).

With respect to the egg-mass index 'Gulla x Erengere' recorded maximum (4.00) and was on par with 'Gulla x Arka Kusumakar' (4.00) whereas they differed significantly with 'Gulla x Arka Sheel' and 'Gulla x Pusa Purple Long' (2.80 each). 'Gulla x Pusa Purple Round' recorded minimum index (2.00) which

Table 4 : Reaction of F₁-generations of some brinjal cultivars popularly grown in Karnataka to *M. javanica*

| Cross | Dry Shoot weight (g) | Dry Root weight (g) | No. of galls/ root system | No. of egg-masses/ root system | No. of Eggs/ egg-mass | No. of nematodes/ 5 g soil | Egg-mass index |
|---------------------------|----------------------|---------------------|---------------------------|--------------------------------|-----------------------|----------------------------|----------------|
| Gulla x Pusa Purple Long | 13.06 | 9.74 | 13.20 | 8.00 | 162.40 | 17.00 | 2.80 |
| Gulla x Pusa Purple Round | 24.46 | 12.14 | 9.60 | 8.20 | 122.80 | 20.60 | 2.00 |
| Gulla x Erengere | 7.61 | 6.73 | 76.60 | 70.60 | 182.80 | 45.80 | 4.00 |
| Gulla x West Coast Round | 18.47 | 11.92 | 8.60 | 6.60 | 89.00 | 16.80 | 2.20 |
| Gulla x Arka Sheel | 9.04 | 7.24 | 17.60 | 13.00 | 105.40 | 14.40 | 2.80 |
| Gulla x Arka Kusumakar | 7.69 | 9.28 | 42.40 | 30.20 | 213.20 | 39.60 | 4.00 |
| Mean | 13.38 | 9.50 | 28.00 | 22.76 | 145.93 | 25.70 | 2.96 |
| CD 0.05 | 4.76 | 5.66 | 37.65 | 60.17 | 88.86 | 12.26 | NS |

was on par with 'Gulla x West Coast Round' (2.20).

Discussion

Though six F_1 -generations behaved differently with four nematode populations, in general, generations of 'Gulla x West Coast Round' showed some promising results as they recorded minimum nematode parameters compared to others. F_1 -generations of 'Gulla x Erengere' and 'Gulla x Arka Kusumakar' were found to be highly susceptible to all the nematode populations. With respect to intra specific/intervarietal crosses of cultivated types no information is available in brinjal. However, various attempts have been made to cross wild *S. sisymbriifolium* with *S. melongena* in order to transfer resistance to *M. incognita* from wild species to cultivated species (Fassuliotis and Dukes, 1972; Fassuliotis, 1973). Gleddie *et al.* (1985) concluded somatic hybridization to be a potential method of transferring nematode resistance into egg-plant. They

compared somatic hybrids between *S. melongena* and *S. sisymbriifolium* with their parents for resistance to *M. incognita* and found that several hybrids (lines 7, 12, 14, 15 and 16) had similar resistance to that of *S. sisymbriifolium* in that no reproduction occurred, although a few galls occurred in some instances.

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