Original Research Article

Monitoring of Virulence of gall midge (*Orseoliaoryzae* Wood-Mason) population at Warangal, Telangana

ABSTRACT

A study was conducted for two years during 2022 and 2023at Regional Agricultural Research Station, Warangal, Telangana, India to know the virulence of gall midge on rice varieties with known gall midge resistant genes.During both the years i.e., 2022 and 2023, the virulence of gall midge was low in Aganni followed by Akshayadhan, W1263 and Purple. The gall midge virulence was very low and similar in Aganni and Akshayadhan which reveals the efficacy of Gm4 and Gm8 gall midge resistance genes against gall midge biotype 4M. Since Purple variety does not have any gall midge resistant gene, gall midge virulence was highest on Purple variety. The study revealed that, gall midge genes viz., Gm4 & Gm8 are holding good for resistance against gall midge biotype 4M.

Key Words: Rice gall midge, virulence, monitoring

INTRODUCTION

Rice (*Oryzasativa* L.) is the most important food crop of India and the world. Rice is the very important back bone of energy for the millions of the people all over the world. Major Rice growing countries include India, China, Bangladesh, Thailand, Myanmar, Philippines, Japan, Pakistan, USA, Indonesia, Korea and Vietnam. India and China produce 50% of rice in the world [1]. Rice is the most important crop in the world and grown in 117 countries, being a staple food of 2.7 billion people in Asia alone [2]. After the green revolution in India, there has been a constant increase in the number of insect pests, and a concomitant shift in their pest status, diversity and spread [3]. The cultivation of resistant varieties in an intensive way over a long period was associated with development of new biotypes. Suspected biotype occurrence in two places like Warangal in Andhra Pradesh and Cuttack in Odisha was observed during 1955 [4]. Four biotypes of gall midge exist in India [5] and recently one more biotype from Kerala state capable of damaging the newly identified donors has been reported [6]. Yield loss projections for damage due to 1% gall midge induced silver shoot damage was 3.5% loss [7]. This study was conducted for two years during 2022 and 2023 to know the virulence of gall midge on rice varieties with known gall midge resistant genes.

MATERIALS AND METHODS

The experiment was conducted at Regional Agricultural Research Station, Warangal in two years i.e., Kharif 2022 and Kharif 2023.

List 1 : Experimental design

	Kharif 2022	Kharif 2023
Lay out	Observational	Observational
Entries	Aganni (*Gm8*), Akshayadhan PYL (*Gm4* + *Gm8* genes), W1263 (*Gm1*), Purple (Susceptible check)	Aganni (*Gm8*), Akshayadhan PYL (*Gm4* + *Gm8* genes), W1263 (*Gm1*), Purple (Susceptible check)
Replications	250	250
Plot size	Pot experiment	Pot experiment
Seedlings/hill	5	5
Date of Sowing the sprouted seed	23-09-2022	22-09-2023
Date of planting	Direct sowing was done	Direct sowing was done
Date of release	08-10-2022	15-10-2023 & 16-10-2023
Date of observation	31-10-2022 to 17-11-2022	10-11-2023 25-11-2023

The nurseries of the four differentials with different genes for gall midge resistance viz., Aganni (*Gm8*),Akshayadhan PYL (*Gm4* + *Gm8* genes), W1263 (*Gm1*),Purple (Susceptible check) were raised in plastic trays 2 weeks prior to anticipated peak population of gall midge. One week old seedlings of four differenticals were transplanted to 250 small plastic pots of about 10 cm diameter and 8-10 cm height holding 500 gm soil. Each pot was planted with all the four differentials (4 hills) and each hill was with 5 seedlings. Each hill in the pot represented one variety (differential). Each variety was planted at predetermined equidistance spots in clockwise order of Purple, W1263, Akshayadhan PYL and Aganni. The pots were kept in the polyhouse.

Exposure of plants to electric light source during night times was avoided. Each pot was covered with a clear plastic bag to fit the pot at the upper rim. A rubber band was used to tie the plastic cover to the pot. Infestation of pots with gall midge was done when the plants were 2 weeks old/ three leaf stage.Female insects were collected during the night time between 7.00 PM to 9.00 PM from the light points in the surroundings, farm etc. 7.00 PM to 9.00 PM was the peak time for gall midge infestation and for collection of gall midge insects. Collected female insects were released into the pot by making a small slit in the cover. Proper care was taken to release only one female to each pot and closed the plastic cover of the pot to prevent the escape of the insect.The release of female gall midge insects into the plastic pots wascompleted in one or two days. An aspirator was used to collect the gall midge insects by gently sucking the insects into the tube and then released them through the slit into the bag by gently blowing out. Maintained the infested pots covered with plastic bag in the polyhouse till taking the observations on gall midge incidence.Watered the plants and provided extra humidity for egg hatching and maggot establishment. Plants were taken care for about 3 weeks until galls developed.

Data collected:

When differentials in all the pots show galls, observations on number of gall midge damaged plants for each of the differentials was recorded for each pot. Data on number of galls in the differentials were also recorded.

RESULTS AND DISCUSSION

During *Kharif*2022, the virulence pattern of the gall midge populations was monitored through progeny testing of a single gall midge female. The trial was conducted on three differentials, W1263 (*Gm1*), Akshayadhan PYL (*Gm4 + Gm8*), Aganni (*Gm8*) along with Purple variety. 250 pots (each with 5 seedlings each of 4 differentials per pot) were infested with single gall midge female and were tested for virulence pattern/ silver shoot incidence after 30 days. 176 females (70.4%) were virulent. The virulence pattern on three differentials, W1263 (*Gm1*), Akshayadhan PYL (*Gm4 + Gm8*), Aganni (*Gm8*) along with Purple variety revealed 1.36% virulence on Aganni, 2.31% on Akshayadhan PYL, 24.68% on W1263 and 31.31% on purple.

During *Kharif*2023, the virulence pattern of the gall midge populations was monitored through progeny testing of a single gall midge female. The trial was conducted on three differentials, W1263 (*Gm1*), Akshayadhan PYL (*Gm4 + Gm8*), Aganni (*Gm8*) along with Purple variety. 250 pots (each with 5 seedlings each of 4 differentials per pot) were infested with single gall midge female and were tested for virulence pattern/ silver shoot incidence after 30 days. 184 females (73.6%) were virulent. The virulence pattern on three differentials, W1263 (*Gm1*), Akshayadhan PYL (*Gm4 + Gm8*), Aganni (*Gm8*) along with Purple variety revealed 1.27% virulence on Aganni, 1.49% on Akshayadhan PYL, 36.86% on W1263 and 43.63% on purple.

Table 1: Virulence in gall midge populations in Rice at RARS, Warangal during *Kharif*, 2022

No. of females tested	No. of virulent females	Variety	Per cent virulence	
			Pot wise	Plant wise
250	176	Aganni	4.80	1.36
		Akshayadhan	5.60	2.31
		W1263	56.80	24.68
		Purple	62.00	31.31

Table 2: Virulence in gall midge populations in Rice at RARS, Warangal during *Kharif*, 2023

No. of females tested	No. of virulent females	Variety	Per cent virulence	
			Pot wise	Plant wise

250	184	Aganni	5.20	1.27
		Akshayadhan	4.80	1.49
		W1263	58.80	36.86
		Purple	65.20	43.63

Table 3: Per cent virulence of gall midge during 2022 and 2023

Variety	Per cent virulence			
	Pot wise		Plant wise	
	2022	2023	2022	2023
Aganni	4.80	5.20	1.36	1.27
Akshayadhan	5.60	4.80	2.31	1.49
W1263	56.80	58.80	24.68	36.86
Purple	62.00	65.20	31.31	43.63

During both the years 2022 and 2023, the virulence of gall midge was low in Aganni followed by Akshayadhan, W1263 and Purple. The virulence was very low and similar in Aganni and Akshayadhan which reveals the efficacy of Gm4 and Gm8 gall midge resistance genes against gall midge biotype 4M. Since Purple variety does not have any gall midge resistant gene, gall midge virulence was highest on Purple variety.

Aganni was most promising against gall midge in our study, similarly Singh [8] screened 137-rice genotypes in Manipur and the entries R320-300, R321-108, RP2436-79-22-2, WGL18011-15, WGL 20471-97, WGL 26358, BPT 3624, W1263, Aganni, T1477 and Banglei were found to be resistant against rice gall midge. Resistance against rice gall midge biotypes, GMB4 atRagoluand GMB4M at Warangal was confirmed by only three genes*viz.*, *gm3*, *Gm4*and *Gm8* [9]. Prasad and Prasad [10] reported that 6 entries remained free from the attack of gall midge. These entries were: ARC6605, MR 1523, RP 2068-18-5, Jhitpiti, INRC3021 and Aganni in the agro climatic conditions of Ranchi region of Jharkhand state.Seni and Naik, [11]screened different rice entries in field condition at OUAT regional Research Station, Chiplima, Sambalpur during Kharif, 2016 and observed that the entries W 1263, INRC 3021, SuduHondarawala, PTB 26, RP 4686-48-1-937, RMSG-11, WGL 1147, WGL 1127, WGL 1121, WGL 1131, WGL 1141, JGL 27058 were found resistant to gall midge.Where as, in our study more virulence (gall midge incidence) was recorded in W1263 by gall midge biotype 4M in Warangal. The study revealed that, gall midge genes viz., Gm4 & Gm8 are holding good for resistance against gall

midge biotype 4M. Hence, the promising rice cultures with Gm4 & Gm8 may be identified and utilized as donors in breeding programmes for developing resistant rice varieties.

CONCLUSION

During both the years i.e., 2022 and 2023, the virulence of gall midge was low in Aganni followed by Akshayadhan, W1263 and Purple. The gall midge virulence was very low and similar in Aganni and Akshayadhan which reveals the efficacy of Gm4 and Gm8 gall midge resistance genes against gall midge biotype 4M. Since Purple variety does not have any gall midge resistant gene, gall midge virulence was highest on Purple variety. The study revealed that, gall midge genes viz., Gm4 & Gm8 are holding good for resistance against gall midge biotype 4M. Hence, the promising rice cultures with Gm4 & Gm8 may be identified and utilized as donors in breeding programmes for developing resistant rice varieties.

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