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Short Communication

First-hand Report of False Smut in Coastal Rice Ecosystem at Naira, Andhra Pradesh

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Among the diseases of rice, false smut is one of the major emerging diseases that reduce the quality and yield of rice (Bag *et al.*, 2021). The disease is caused by *Ustilaginoidea virens* (teleomorph - *Villosiclava virens*) which is a flower-infecting fungus. False smut has become an important disease as it appears in many rice-growing areas of the world in mild to alarming proportions. The disease is greatly influenced by prevailing weather conditions and has been occurring in many rice-growing regions of the world. Yield loss due to false smut varied from 0.5-75%, depending on the genotypes and weather conditions (Upadhyay and Singh, 2013; Baite *et al.*, 2020). The disease is harmful to both humans and animals due to poisonous mycotoxins produced by the fungus (Sun *et al.*, 2017; Wang *et al.*, 2019). As false smut is increasingly encountered in many rice-growing regions, it was important to carry out a survey to find out the status of false smut in the coastal rice ecosystem. Therefore, a study was carried out at Naira, Andhra Pradesh to monitor the incidence of false smut in rice.

A roving survey was conducted in the research farm of Regional Coastal Rice Research Station (RCRRS), ICAR-National Rice Research Institute (NRRI), Naira, Srikakulam, Andhra Pradesh (geographical coordinates 18° 22' 52.6" N latitude and 83° 56' 53.4" E longitude), to monitor the incidence of false smut rice fields during 2021 *kharif* season. False smut disease was characterized by the appearance of yellowish/black smut balls on the infected grain. The total number of grains, chaffy grains and smut balls per panicle was counted by taking three random panicles from the infected tillers. The disease incidence was assessed by counting the number of infected tillers from the total tillers and expressed in percentage using the standard method followed by Singh and Dube (1978).

$$\text{Disease incidence (\%)} = \frac{\text{Number of infected tillers}}{\text{Total number of tillers}} \times 100$$

The mean number of smut balls and percent disease incidence were tested for the normality based on the Shapiro-Wilk test of significance (df = 2, $p<0.05$) and the mean data was subjected to Tukey's power of ladder transformation before statistical analysis. The mean number of smut balls and percent disease index followed a normal distribution after data transformation which was confirmed using the Shapiro-Wilk test significance. The mean of ranks for smut ball number and percent disease incidence were compared between the three rice varieties, namely, CR Dhan 307 (Maudamani), MTU 1061 and MTU 1210 using Tukey's HSD post hoc test in R-Studio 2022.07.1 (R Core Team, 2022). Based on smut ball number, the disease was scored using the scale of 0 (Highly resistant), 1 (Resistant), 3 (Moderately resistant), 5 (Moderately susceptible), 7 (Susceptible) and 9 (Highly susceptible) as per Huang *et al.* (2019).

The survey data revealed that some of the rice genotypes, namely, Swarna, Pradhan Dhan, Luna Suvarna and CSR 36 had no false smut infection. The other three varieties *viz.*, CR Dhan 307 (Maudamani), MTU 1061 (Indra) and MTU 1210 (Sujata) were infected with false smut as revealed by the presence of typical smut balls on the panicles (Fig.1). Significant variations in the number of smut balls panicle^{-1} and disease incidence were recorded among these three varieties (Table 1). The significantly highest number of smut balls panicle^{-1} was recorded in MTU 1061 (39.66), followed by MTU 1210 (11.66) and CR Dhan 307 (10.33). Similarly, in the variety MTU 1061, the highest disease incidence of 21.02% was recorded which was significantly higher than that observed in MTU 1210 (7.77) and CR Dhan 307 (6.68).

The chaffiness of rice grain varied between 34-47% in the infected panicles of the three varieties and that

can significantly reduce the yield of rice. The variety, MTU 1061 also registered the highest number of grains panicle^{-1} as compared to the other two rice varieties (Table 1).

Based on the number of smut balls, all three genotypes MTU 1061, MTU 1210 and CR Dhan 307 were categorized as susceptible genotypes as they exhibited a disease score of 7 (Huang *et al.*, 2019). During the 2021 *kharif* season, false smut was observed only in a few genotypes/varieties. In contrast, 15 rice genotypes were found infected with false smut in 2016 at Cuttack, Odisha. In our present study, the occurrence of 10-39 smut balls was much higher than the previously reported numbers of 0.53-6.47 smut balls panicle^{-1} (Baite *et al.*, 2017). Our observed disease incidence (7-21%) corroborates with the findings by Atia (2004) with 4-45% disease incidence during the 2001 growing season in Egypt and 6-18% and 10-25% disease incidence in 2010 and 2011, respectively as described from the temperate ecosystem of Kashmir by Sanghera *et al.* (2012). However, the observed disease incidence was lower than those described by Singh and Pophaly (2010) who reported values of 16.8-40.7% bearing 5-12 smut balls in 2007. Similarly, Baite *et al.*(2020) reported disease incidence from 6-33% in 17 rice genotypes infected with false smut during the 2017 growing season in the farmers' fields in Cuttack, Odisha. The observed chaffiness of 34-47% in the infected panicles followed a similar pattern as reported by Atia (2004) who observed 25-42% chaffiness in rice panicles infected with false smut.

There was significant variation in smut balls number and disease incidence among the rice varieties cultivated in the coastal ecology. A high disease incidence and higher number of chaffy grains in infected plants

Fig. 1. *Rice panicle infected with false smut*

Table 1. *False smut incidence at Naira, Andhra Pradesh in kharif season of 2021*

Variety	No. of grains panicle^{-1}	Chaffiness (%)	No. of smut balls panicle^{-1}	Disease incidence (%)
CR Dhan 307 (Maudamani)	154.66^{b}	33.94^{c}	10.33^{b}	6.68^{b}
MTU 1061 (Indra)	188.66^{a}	44.08^{b}	39.66^{a}	21.02^{a}
MTU 1210 (Sujata)	150.00^{c}	47.42^{a}	11.66^{b}	7.77^{b}
CV(%)	0.11	0.42	0.85	1.49

Different letters signify that the means are significantly different

suggested that the disease is gradually becoming a major biotic stress of rice that can reduce yield at an alarming rate. The following genotypes, namely, CR Dhan 307, MTU 1061 and MTU 1210 were found infected with false smut with a disease incidence of 7-21%. The highest disease incidence was observed in the variety MTU 1061. Our study reports the occurrence of false smut at Naira, Andhra Pradesh which established that false smut is an emerging rice disease. To overcome the losses due to the disease and to optimize yields, resistant varieties should be used for cultivation. For long-term management of the disease, emphasis should be given to developing false smut-resistant varieties in the near future.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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