Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2020; 9(3): 1453-1456
Received: 15-03-2020
Accepted: 20-04-2020

H Sharanabasav
1. Department of Plant Pathology, University of Agricultural Sciences, Raichur, Karnataka, India
2. Rice Pathology Laboratory, All India Coordinated Rice improvement Programme, Agricultural Research Station. Gangavathi, University of Agricultural Sciences, Raichur, Karnataka, India

D Pramesh
Rice Pathology Laboratory, All India Coordinated Rice improvement Programme, Agricultural Research Station. Gangavathi, University of Agricultural Sciences, Raichur, Karnataka, India

E Chidanandappa
Rice Pathology Laboratory, All India Coordinated Rice improvement Programme, Agricultural Research Station. Gangavathi, University of Agricultural Sciences, Raichur, Karnataka, India

A Saddamhusen
Rice Pathology Laboratory, All India Coordinated Rice improvement Programme, Agricultural Research Station. Gangavathi, University of Agricultural Sciences, Raichur, Karnataka, India

Amoghvarsha Chittaragi
Rice Pathology Laboratory, All India Coordinated Rice improvement Programme, Agricultural Research Station. Gangavathi, University of Agricultural Sciences, Raichur, Karnataka, India

A Raghunandana
Rice Pathology Laboratory, All India Coordinated Rice improvement Programme, Agricultural Research Station. Gangavathi, University of Agricultural Sciences, Raichur, Karnataka, India

MK Prasanna Kumar
Department of Plant Pathology, University of Agricultural Sciences, Bangalore, Karnataka, India

BT Raghavendra
Department of Plant Pathology, University of Agricultural Sciences, Raichur, Karnataka, India

R Harischandra Naik
Pesticides Residue and Food Quality Analysis Laboratory, University of Agricultural Sciences, Raichur, Karnataka, India

SB Mallesh
Department of Plant Pathology, University of Agricultural Sciences, Raichur, Karnataka, India

K Mahantashivayogayya
All India Coordinated Rice improvement Programme, Agricultural Research Station. Gangavathi, University of Agricultural Sciences, Raichur, Karnataka, India

Sujay Huruli
All India Coordinated Rice improvement Programme, Agricultural Research Station. Gangavathi, University of Agricultural Sciences, Raichur, Karnataka, India

BGM Reddy
All India Coordinated Rice improvement Programme, Agricultural Research Station. Gangavathi, University of Agricultural Sciences, Raichur, Karnataka, India

SB Gowdar
Department of Plant Pathology, University of Agricultural Sciences, Raichur, Karnataka, India

Corresponding Author:
D Pramesh
Rice Pathology Laboratory, All India Coordinated Rice improvement Programme, Agricultural Research Station. Gangavathi, University of Agricultural Sciences, Raichur, Karnataka, India

Field evaluation of fungicides against false smut disease of rice

H Sharanabasav, D Pramesh, E Chidanandappa, A Saddamhusen, Amoghvarsha Chittaragi, A Raghunandana, MK Prasanna Kumar, BT Raghavendra, R Harischandra Naik, SB Mallesh, K Mahantashivayogayya, Sujay Huruli, BGM Reddy and SB Gowdar

DOI: https://doi.org/10.22271/phyto.2020.v9.i3x.11515

Abstract
False smut disease of rice caused by *Ustilaginoidea virens* is an emerging biotic stress of rice. A field experiment to evaluate bioefficacy of solo and combination fungicides against false smut disease of rice was conducted in two consecutive *Kharif* seasons (2017 and 2018). Experiment was laid out in a randomized block design with eleven fungicide treatments of three replications each. Disease was measured and expressed in percent disease severity following previously described method. The data obtained in 2017 and 2018 was analyzed after pooling. Among different fungicides tested, trifloxystrobin (25%) + tebuconozole (50%) 75 WG at 0.4 g/ litre was found highly effective in controlling the false smut disease with least per cent disease severity (35.87) followed by azoxystrobin (18.2%) + difenconozole (11.4%) SC at 1ml/litre (39.90). The fungicide identified can be used for effective management of false smut disease under field condition.

Keywords: False smut, *Ustilaginoidea virens*, fungicides, management

Introduction
Rice (*Oryzae sativa*) is one of the leading food crops in the world and the most important staple food in Asia. Paddy cultivation is affected by many biotic constraints such as diseases and pests. More than forty diseases infect rice crop among them, false smut is one of the major emerging disease in recent time [1, 2]. False smut disease is caused by an ascomycetous fungus hence the name "False smut or Pseudo smut". The disease occurrence can be correlate with high rainfall (6.66 to 6.67 mm), high relative humidity (90%), low temperature (25-30·c), high nitrogen application and moderate sunshine hours (6.20-6.29 hrs). Such congenial environment is suitable for germination of overwinter survival structures such as sclerotia [3] and superfluous dormant spores *i.e* chlamydospores [4]. Sclerotia produces ascospores which are primary source of infection to rice plants, whereas air borne chlamydospores serves as secondary source of inoculum [5]. Disease transforms individual grain into initially yellow, green and later into velvety coloured "Pseudomorphs or Smut balls". False smut not only reduces the grain yield but also affects quality by producing enormous amount of mycotoxins, like ustiloxin and Ustilaginoidins including ergot alkaloids (more than 100 mg per kilogram false smut balls) which inhibit cell division in humans, animals and plants by inhibiting microtubules formation and thus affect the health of human and livestock [6, 7].
Since disease is assuming epidemic status in all rice growing ecosystems, it draws the attention towards the holistic approach of disease management. Very few rice cultivars have moderate level of resistance and majority of the commercially cultivated varieties do not show any resistance to false smut [8, 9]. Therefore presently, the best alternative to manage the disease is through the use of fungicides. The various studies have been reported on the evaluation of bio-efficacy of different chemicals from different parts of the world. Many solo fungicides such as mancozeb, carbendazim, copper oxychloride, hexaconozole, validamycin, difenoconazole, propiconazole, tebuconazole, simaconazole and chlorothalonil have found effective in controlling the disease [10, 11, 12, 13, 14, 15, 16, 17, 18]. In addition to the solo molecules, many combination products such as trifloxystrobin 25% + tebuconazole 50% at 0.4gm/lt and azoxystrobin (18.2%) SC + difenconozole (11.4%) SC at were also reported to be effective against false smut disease [2, 19].
Although, trifloxystrobin 25% + tebuconazole 50% has been reported to be effective in reducing the false smut severity in different locations such as, Punjab, Uttar Pradesh and

Kerala, no systemic reports are available for its efficacy from irrigated ecosystem of Karnataka such as, Thungh-Bhadra paddy zone. Therefore present investigation was designed to identify the effect of solo/combination fungicides against false smut.

Material and Methods

The experimental design and crop establishment: the field experiment was carried out in two consecutive *kharif* seasons of 2017 and 2018 at Agricultural Research Station, Gangavathi (15.4319° N, 76.5315° E). Three replications of eleven fungicides were imposed to a Randomized Block Design experiment (Table 1) planted with a popular rice cultivar BPT5204 and bioefficacy was evaluated under natural epiphytic condition. Crop was raised fallowing standard agronomical package of practices for rice. Two sprays of fungicide was given for each treatment at booting stage [80 days after transplanting (DAT) and post flowering (100 DAT) stage.

Disease recording: Observations on disease were recorded after grain maturity, whereas, data on yield was recorded during crop harvesting. Various parameters of diseases were recorded such as, percent infected grains and panicles and disease severity were calculated as per the formulae given below as described previously [20, 21].

$$\text{Per cent infected tillers} = \frac{\text{Number of infected tillers / m}^2}{\text{Total number of tillers / m}^2} \times 100$$

$$\text{Percent infectedgrains} = \frac{\text{Number of diseased grains / panicle}}{\text{Total number grains / panicle}} \times 100$$

Disease Severity (%) = Infected tillers (%) × Smutted grains (%).

Statistical analysis: Disease severity in each treatment was analyzed in ANOVA and recorded standard error of mean and critical difference between the treatments was calculated.

Results and Discussion

False smut of rice is an emerging global threat for rice cultivation. In absence of host resistance, several solo and combination fungicides have been reported previously against false smut disease [1, 19, 22]. Rice occupies significant area in Karnataka where false smut disease is causing significant yield losses in all cultivated rice varieties [23]. Despite of wider prevalence of disease, the reports on bioefficacy of different fungicides for its filed management is limited to only few solo and combination fungicides. Therefore we designed this study to appreciate novel, solo/combination fungicides for management of disease in the field.

Based on the two consecutive *Kharif* season experiment, it revealed that all fungicides tested are effective in reducing the percent disease severity compared to untreated control. Among the different solo fungicide tested, Azoxystrobin 25 SC at 1ml/lt and propiconazole at 1ml/lt was found to be effective in reducing the false smut (67.71 and 87.81%).

Whereas, combination of fungicides are better than all solo fungicides tested. Among the combination fungicides, trifloxystrobin 25% + tebuconazole 50% at 0.4 gm/lt. was superior and recorded least disease severity (35.87%) fallowed by azoxystrobin 18.2% `+ difenoconazole 11.4% w/w SC (39.90%).

In recent times, in paddy, many combination fungicides have been reported to be highly useful compare to other solo fungicides due to their broad spectrum action at lower dosages, target multiple diseases and most importantly low rate of fungicide resistance development [24, 25, 26, 27, 28, 29, 30, 31, 32]. Our research suggested that combination products are more effective than solo molecules as reported previously [2]. Trifloxystrobin 25% + tebuconazole 50% is an novel broad spectrum fungicide and has been reported to reduce the disease severity of many rice diseases such as sheath blight [31, 32, 33] and blast [32, 24, 34], grain discoloration [35]. In this study, we report its field efficacy against false smut disease of rice.

Table 1: Management of false smut disease of rice during *Kharif* 2017 and 2018 (Pooled data)

Tr. No.	Treatments	Dosage	Per cent infected tillers	Per cent infected grains	Percent Disease severity	Yield (q/ha)
T1	Azoxystrobin 25 SC	1.0 ml/l	8.56 (17.00)	7.92 (16.33)	67.71 (55.35)	49.95
T2	Difenconazole 25 EC	1.0 ml/l	9.11 (17.56)	8.43 (16.87)	76.76 (61.15)	48.92
T3	Azoxystrobin 18.2%+ Difenoconazole 11.4% w/w SC	1.0 ml/l	6.22 (14.44)	6.42 (14.67)	39.90 (39.16)	52.69
T4	Metiram 55% + Pyraclostrobin 5% WG	1.0 g/l	6.27 (14.50)	6.26 (14.48)	39.22 (38.76)	53.39
T5	Pencycuron 22.9%	1.0 ml/l	8.10 (16.52)	8.38 (16.82)	67.84 (55.43)	49.82
T6	Tebuconazole 250 EC	1.0 ml/l	9.55 (17.99)	9.21 (17.65)	87.91 (69.62)	47.92
T7	Thiafluzamide 24% SC	0.7 ml/l	9.55 (17.99)	9.60 (18.04)	91.68 (73.21)	45.08
T8	Flusilazole 25%+ Carbendazim 12.5%	1.0 ml/l	7.23 (15.59)	6.74 (15.04)	48.70 (44.24)	52.14
T9	Propiconazole 25 EC	1.0 ml/l	9.20 (17.65)	9.55 (17.99)	87.81 (69.54)	46.21
T10	Trifloxystrobin 25% + Tebuconazole 50%	0.4 g/l	4.67 (12.48)	7.68 (16.08)	35.87 (36.77)	53.70
T11	Control		9.90 (18.33)	9.85 (18.28)	97.52 (80.90)	38.65
	S.Em		0.17	0.17		0.67
	C.D (5%)		0.49	0.49		1.96
	CV		3.92	3.85		2.57

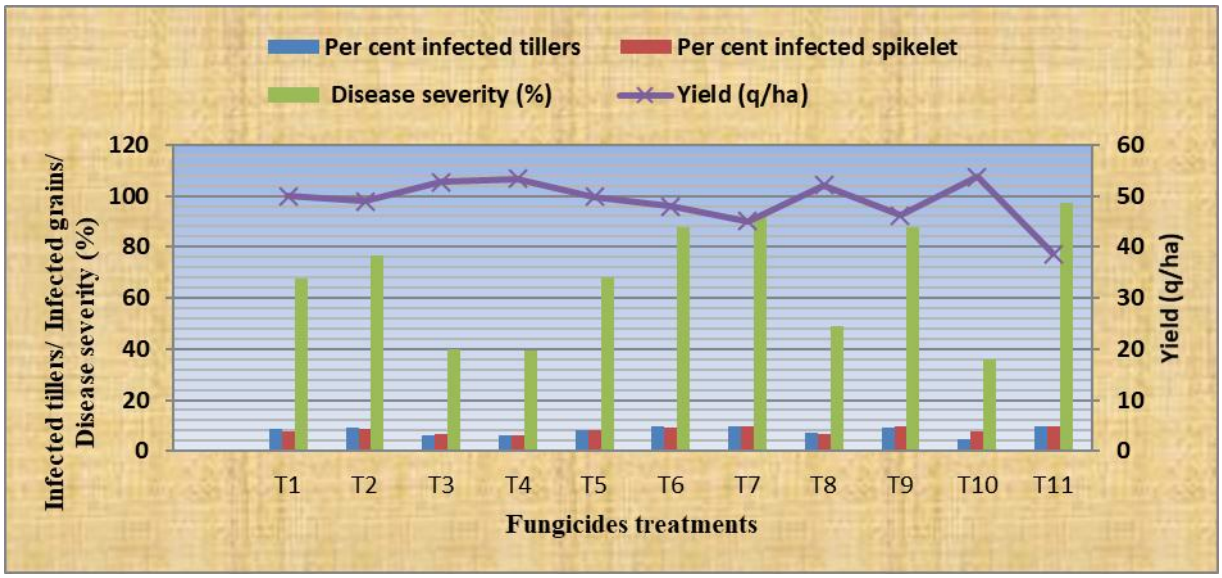

Fig 1: Effect of different fungicides and their combinations on false smut disease of paddy under field conditions during *Kharif* 2017and 2018.

References

1. Ou SH. Rice diseases. Kew, England, Commonwealth Mycological Institute, 1985, 307-310.
2. Muniraju KM, Pramesh D, Mallesh SB, Mallikarjun K, Guruprasad GS. Novel fungicides for the management of false smut disease of rice caused by *Ustilaginoidea virens*. Intl. J Curr. Microbiol. Appl. Sci. 2017; 6(11):2664-2669.
3. Webster RK, Gunnell PS. Compendium of rice diseases. St. Paul, Minn. (USA): American Phytopathol. Soci, 1992, 62.
4. Bhargava P, Kumar A, Kumar S, Kumar S. Physiological Dynamics of *Ustilaginoidea virens* Causing False Smut Disease of Rice. Int. J Curr. Microbiol. App. Sci. 2018; 7:4562-4566.
5. Ashizawa T, Takahashi M, Moriwaki J, Hirayae K. Quantification of the rice false smut pathogen from soil in Japan using real-time PCR. Europ. J Pl. Pathol. 2010; 128:221-32.
6. Koiso Y, Li Y, Iwasaki S, Hanaoka K, Kobayashi T, Sonoda R *et al*. antimitotic cyclic peptides from false smut balls on rice panicles caused by *Ustilaginoidea virens*. J Antibiotics. 1994; 47:765-773.
7. Kumar A, Shailbala. Efficacy of different fungicides for the management of false smut disease of rice in Bihar. IJCS. 2019; 7(3):4220-4222
8. Ashizawa T, Takahashi M, Moriwaki J, Hirayae K. A refined inoculation method to evaluate false smut resistance in rice. J Genet. Pl. Pathol. 2011; 77(1):10-16.
9. Huang F, Li Y, Shi J, Fan J, Li D, Xu Y, Wang W. Screening and polymorphism analysis of rice germplasms for resistance to false smut disease in Sichuan province. Acta Phytopathologica Sinica. 2016; 46(2):247-257.
10. Hegde Y, Anahosur KH, Srikant K. Chemical control of false smut of rice caused by *Claviceps oryzae-sativae* Hashioka. Karnataka J Agr. Sci. 2000; 13(3):623-627.
11. Singh RA. False smut of rice. Experiment Station Research Bulletin No. 111. G.B. Pant Univ. of Agric. and Tech. Uttarakhand (India), 1984, 108.
12. Singh H, Singh N. Chemical control of false smut of paddy caused by *Ustilaginoidea virens*. Indian Phytopathol. 1985; 38:593.
13. Tsai WH, Chien CC, Hwang SC. Ecology of rice false smut disease and its control China. J Agric. Res. 1990; 39:102-112.
14. Chen Y, Zhang Y, Yao J, Li YF, Yang X, Wang WX, Zhang AF, Gao TC. Frequency distribution of sensitivity of *Ustilaginoidea virens* to four EBI fungicides, prochloraz, difenconazole, propiconazole and tebuconazole and their efficacy in controlling false smut in Anhui Province of China. Phytoparasitica. 2013; 14(3):277-284.
15. Xiong QT, Zhang C, Xia YS. The experiment of hexaconazole SC 30% against rice false smut.
16. Wen YG, Fu CK, Zhang CL. The effect criterions of 10% Validamycin SC against rice false smut, neck blast and sheath blight. Agric. Technol. Ser. 2010; 27:591-592.
17. Shim HS, Ryu JD, Han SS. Incidence of rice false smut caused by *Ustilaginoidea virens* in different geographic regions and cultivars and its chemical control. 2001; 7:102-106.
18. Tasuda M, Sasahera M, Ohara T, Kato S. Optimal application timing of simeconazole granules for control of rice kernel smut and false smut. J General Pl Pathol. 2006; 72:301-304.
19. Ladhalakshmi D, Madamsetty SP, Vellaichamy P, Donempudi K, Banda S, Singh R *et al*. Geographic distribution of false smut disease of rice in India and efficacy of selected fungicides for its management. Intl. J Pest Mgt. 2018; 65(2):177-185.
20. Mandhare VK, Gawade SB, Game BC, Padule DN. Prevalence and incidence of bunt and false smut in paddy (*Oryza sativa* L.) seeds in Maharashtra. Agric. Sci. Dig. 2008; 28(4):292-294.
21. Singh RA, Dube KS. Assessment of loss in seven *rice* cultivars due to false smut. Intl. Rice Res. Inst., Philippines, 1978, 49-55.
22. Pandey SK, Masurkar P, Singh RK. Status and incidence of False Smut Disease in rice and their chemical management. J. Pharmacognosy Phytochem. 2018; 7(3):588-590.
23. Muniraju KM, Pramesh D, Mallesh SB, Mallikarjun K, Guruprasad GS. Disease severity and yield losses caused by false smut disease of rice in different rice ecosystems of Karnataka. Intl. J Microbiol. Res. 2017b; 9(10):955-958

24. Sood GK, Kapoor AS. Efficacy of new fungicides in the management of rice blast. Pl. Dis. Res. 1997; 12:140-142.
25. Tirmali AM, Latake SB, Bendra NJ. Evaluation of new fungicides for control of blast disease of rice. J Maharashtra Agr. Univ. 2001; 26:197-198.
26. Prabhu AS, Filippi MC, Zimmermann FJP. Cultivar response to fungicide application in relation to rice blast control, productivity and sustainability. Pesquisa Agropecuária Brasileira. 2003; 38(1):11-17.
27. Usman GM, Waqas W, Sahi ST, Saleemil-Yasin. Influence of various fungicides on the management of rice blast disease. Mycopathol. 2009; 7:29-34.
28. Naik GR, Naik GB, Naik BT, Naik KR. Fungicidal management of leaf blast disease in rice. Global J Biosci. Biotech. 2012; 1:18-21.
29. Bhuvaneswari V, Raju KS. Efficacy of new combination fungicide against rice sheath blight caused by *Rhizoctonia solani* (Kuhn). J Rice Res. 2012; 5(1):2-5.
30. Bag MK, Yadav M, Mukherjee AK. Bioefficacy of strobilurin based fungicides against rice sheath blight disease. Transcriptomics. 2016; 4:128-131.
31. Pramesh D, Mallikarjun K, Guruprasad GS, Mahantashivayogayya K, Mastanareddy BG, Gowdar SB. Bio-efficacy of a combination fungicide against of blast and sheath blight disease of paddy. J Expt. Agr. Intl. 2016a; 14(4):1-8.
32. Pramesh D, Maruti, Saddamhusen A, Muniraju KM, Guruprasad GS. A new combination fungicide active ingredients for management of sheath blight disease of paddy. Adv. in Res. 2016b; 8(5):1-7.
33. Bag MK. Efficacy of a new fungicide 'Trifloxystrobin 25%+ Tebuconazole 50%'75WG against sheath blight (Rhizoctonia solani Kühn) of rice. Journal of Crop and Weed. 2009; 5(1):224-226.
34. Balgude YS, Kshirsagar CR, Gaikwad AP. Evaluation on the Efficacy of Modern Fungicides against Blast and Sheath Rot of Rice. Int. J Curr. Microbiol. App. Sci. 2019; 8(3):83-88.
35. Bag MK, Saha S. Fungitoxic effect of Nativo 75 wg (trifloxystrobin 25%+tebuconazole 50%) on grain discoloration (GD) disease of rice in West Bengal. Pestol. 2009; 33(7):47-49.