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Status of Kernel Smut of Rice in Andhra Pradesh

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ABSTRACT Three thousand three hundred and twenty samples from different agro climatic zones of Andhra Pradesh were analyzed for the prevalence of paddy bunt disease during 1993-2008. Highest infected samples (47.99%) were recorded in Krishna - Godavari zone followed by northern Telangana Zone (30.8%) in farmers seed lots as compared to processed seed samples which recorded 20.5 per cent and 13.4 per cent in the above two zones, respectively. Among different varieties, IR-64 (2.28%) recorded maximum bunt infection in farmers seed lots, which was above seed certification standard of 0.5 per cent. In processed seed samples also maximum infection was recorded in IR-64 (1.22%). The infected samples that crossed the seed certification standard in farmers samples were found to be (31) and 2 infected samples that crossed the seed certification standard of 0.5 per cent in processed seed samples. Krishna Godavari Zone and northern Telangana Zones of Andhra Pradesh were identified as hot spots for paddy bunt infection.

Keywords: Kernel smut, paddy bunt, *Tilletia barclayana*, Rice

Rice (*Oryza sativa* L.) is the staple food for more than half of the global population. More than 90 per cent of the rice is produced and consumed in Asian countries. Among the rice growing countries, India has the largest area of 44.4 million hectares with the production of 84.9 million tonnes. One of the major constraints in increasing productivity of paddy is its susceptibility to a large number of diseases. Paddy bunt, kernel bunt or kernel smut incited by *Tilletia barclayana* or *Neovossia horrida* is prevalent in most of the paddy growing states in India [1]. Kernel smut is organspecific and it converts the grain completely or partially into black spore mass, which contains numerous teliospores of the pathogen and causes heavy quantitative and qualitative losses [2, 3, 4]. The disease is one of the designated disease and the certification standards of 0.1 and 0.5 per cent have been fixed for the infected seeds by number in foundation seed and certified seed lots, respectively [5].

If due care is not taken to check further spread, the disease may cause 20-25 per cent losses similar to Karnal bunt of wheat. The role of seed, soil and environment in the spread of this disease has not been fully established. Completely smutted grains are lost during harvesting operations and add a lot of inoculum in the soil, and releases bunt spores imparting grey colour to the milled rice and adversely affect the market value of rice. Rice samples containing 3 per cent bunted kernels are graded as smutty [6]. But the role of infected seed can not be ruled out and thus there is every chance that this disease may serve as a potential threat to paddy cultivation particularly in Andhra Pradesh. In India, the disease was reported for the first time by Butler in 1913 [7]. Since then, it has spread to all the rice growing states of India including Andhra Pradesh [8, 9]. In India, a heavy attack of bunt was recorded is a number of states. The incidence of the disease ranged from 8-63 per cent in Assam [10], 22-43 per cent in Tamil Nadu and 16-35 per cent in Andhra Pradesh [11] and they observed that the disease infection is more

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in *Kharif* than in *Rabi* (2-22 per cent). Bunt infected seeds are responsible for poor germination, vigour and crop stand [12].

The symptoms of the disease appear at the time of crop maturity only a few grains in panicle are infected. Normally, only a part of the grain is affected, but many a times, the entire grain is replaced with a black powdery mass of bunt spores. Such grains show minute black pustules or streaks. Since Andhra Pradesh is an important paddy growing state, it was felt desirable to record the seed borne infection of the disease in the state. Paddy samples comprising of farmer's samples directly from farmers and processed seed samples from processing units/seed companies were collected and analyzed at Seed Research and Technology Centre, ANGRAU, Rajendranagar, Hyderabad during 1993-2008. The results from 1985 to 1991 were reported earlier on prevalence of paddy bunt in Andhra Pradesh [8, 9]. In the present study, results of the survey from 1993 to 2008 (16 years) are being reported.

MATERIALS AND METHODS

To study the distribution and the prevalence of the disease in different areas of Andhra Pradesh, an extensive survey was conducted from 1993 to 2008. Seed samples of different paddy varieties were collected from farmer's seed (1798) and processed seed samples (1522) from notified processing plants of Andhra Pradesh State Seed Corporation units belonging to different agro climatic zones and districts of Andhra Pradesh in order to observe the frequency of occurrence of paddy bunt. The agroclimatic zones and the districts to which the samples belongs to are as follows:

1. Krishna - Godavari zone: West Godavari, East Godavari, Krishna and Guntur
2. Northern Telangana zone: Nizamabad, Warangal, Karimnagar, Khammam, Adilabad
3. Southern Telangana zone: Ranga Reddy, Nalgonda Mahaboobnagar and Medak
4. North coastal zone: Vijayanagaram, Visakhapatnam and Srikakulam
5. Southern zone: Nellore, Chittor, Cuddapah and Prakasham
6. Scarce Rainfall zone: Kurnool and Ananthapur.

The analysis of bunt was done by NaOH seed soak method [12]. Each seed sample was tested in four replicates of one thousand seed each and expressed in percentage. Seed samples were soaked in 0.2 per cent sodium hydroxide solution for 24 hours at $25\pm2^{\circ}C$. The solution was decanted after 24h and seeds were thoroughly washed with water. Later seeds were spread over blotter paper to remove the excess water. The seeds exhibiting shiny jet-black discolouration were counted as infected seeds and the mean per cent kernel smut infection was calculated from the total number of grains analyzed [12].

RESULTS AND DISCUSSION

In the present investigation, a total of 3320 samples were collected and analysed. Out of which 902 (27.17%) were infected in both farmers and processed seed samples (Table 1). Among different zones, fairly large number of samples were analysed from the Krishna - Godavari zone, northern Telangana zone and southern Telangana zones. Maximum percentage of samples infected were from the Krishna Godavari zone, (34.2%), northern Telangana zone (22.1%) and southern Telangana zones (20.23%), respectively. This observation is in confirmation with earlier reports [8, 9] where higher percentages of samples were infected in Krishna Godavari and northern Telangana zones.

Farmer's seed samples collected from Krishna - Godavari zone showed maximum infection (47.99%) followed by northern Telangana zone (30.8%) as compared to processed seed samples (20.5 per cent and 13.4 per cent in the above zones, respectively). Seed lots showing maximum infection as high as 2.28 and 2.2 per cent, respectively were recorded. Infected samples, which were above the certification standards of

0.5 per cent in Krishna – Godavari and northern Telangana zone were found to be 31 in the present studies. As compared to 37 samples recorded in the earlier studies [8]. The above trend indicates that these two zones were found to be hot spots for the bunt disease. In southern Telangana zone, 27.46 per cent of the seed samples in farmer's saved seed and 13.0 per cent in processed seed lots were found infected. Whereas 26.6 per cent, 25.9 per cent and 21.2 per cent of farmer's samples were infected in North coastal zone, southern zone and Scarce Rainfall zone, respectively (Table 1).

In a study on different varietal response to bunt infection, farmer's seeds of forty five varieties and processed seeds of twenty-four varieties were analyzed for bunt infection. Out of forty five varieties, thirty seven varieties recorded bunt infection with a range of 0.01 per cent to 2.28 per cent in farmers seed lots and eleven varieties of processed seed lots showed bunt infection. Maximum infection was noticed in farmer's samples of IR 64 (2.28%) followed by MTU 1042 (0.45%), MTU 7029 (0.43%), MTU 2077 (0.4%) and BPT 5204 (0.37%). Infection was not observed in the remaining 8 seed samples (Table 2).

In processed seed samples (Table 3) an infection ranging from 0.01 to 1.22 per cent was observed and maximum infection was recorded in IR 64 (1.22%) followed by MTU 2067 (0.22%). Infection was not observed in RDR-763, MTU-7024, IET 1444 and NDLR-8 and Surekha varieties. This can be attributed due to genotypic differences (13).

The overall record of spread and prevalence of the disease in the state shows that an average of 21.3 per cent of both farmers and processed seed samples were found infected by bunt in different zones during 1993 – 2008. The results obtained in this study indicate that paddy bunt considered to be a minor disease is now gaining importance. Hence farmers are advised to use processed certified seed of resistant varieties for getting maximum yields.

Table 1. Prevalence of paddy bunt in different agro climatic zones of Andhra Pradesh during 1993-2008

Agro climatic zone	Farmer's saved seed						Processed seed samples					
	Analyzed	Infected	Infected samples (%)	Max. infection	ASCS	ASCS out of infected	Analyzed	Infected	Infected samples (%)	Max. infection	ASCS	ASCS out of infected
Krishna Godavari Zone	752	360	47.9	2.28	21	5.83	661	136	20.5	1.22	2	1.47
Northern Telangana Zone	491	151	30.8	2.2	10	6.62	261	35	13.4	0.2	-	-
Southern Telanagana Zone	335	92	27.46	0.44	-	-	600	78	13.0	0.12	-	-
North Coastal Zone	15	4	26.6	0.10	-	-	-	-	-	-	-	-
Southern Zone	54	14	25.9	0.05	-	-	-	-	-	-	-	-
Scarce Rain fall Zone	151	32	21.2	0.075	-	-	-	-	-	-	-	-
Total	1798	653	29.97	2.28	31	-	1522	249	12.62	1.22	-	-

ASCS: Above seed certification standard

Table 2. Prevalence of paddy bunt infection in different varieties of farmers saved seed samples of paddy (1993-2008)

S.No.	Varieties	No.of samples		Infe-cted(%)	Maxi-mum
		Analysed	Infected		Infec-tion(%)
1.	BPT 5204	387	134	34.62	0.37
2.	MTU 7029	105	18	10.75	0.43
3.	BPT 3291	35	7	20.0	0.20
4.	MTU 2067	100	10	10.0	0.10
5.	MTU 2077	58	10	17.24	0.40
6.	MTU 4870	3	2	66.6	0.10
7.	IR 64	324	194	59.87	2.28
8.	MTU 1010	267	110	41.2	0.33
9.	Tellahamsa	80	15	18.75	0.15
10.	MTU 5293	4	1	25.0	0.05
11.	Sarjoo 52	20	1	5.0	0.05
12.	MTU 1001	127	28	22.04	0.2
13.	NLR 28600	119	1	0.80	0.025
14.	JGL 1798	30	8	26.6	0.05
15.	RDR 763	20	1	5.0	0.05
16.	MTU 1742	2	1	50.0	0.05
17.	MTU 1008	31	7	22.50	0.025
18.	PLA 1100	26	3	11.53	0.22
19.	WGL 48684	8	1	12.50	0.01
20.	Local variety	8	4	50	0.025
21.	RNR 1446	19	11	57.89	0.12
22.	JGL 1792	4	2	50.0	0.05
23.	Nellore samba	2	1	50.0	0.10
24.	Godavari	6	3	50.0	0.05
25.	Erramallelu	3	2	66.60	0.075
26.	JGL 384	10	4	40.0	0.15
27.	WGL 32100	2	2	100.0	0.05
28.	NLR 34445	1	1	100.0	0.05
29.	WGL 14	1	1	100.0	0.10
30.	MTU 1061	3	3	100.0	0.70
31.	MTU 3626	3	2	66.60	0.40
32.	MTU 1081	2	1	50.00	0.10
33.	Molakolukulu	1	1	100.0	0.05
34.	MTU 1075	2	2	100.0	0.17
35.	MTU 1042	1	1	100.0	0.45
36.	MTU 5293	1	1	100.0	0.05
37.	MTU 2716	1	1	100.0	0.40

The remaining varieties of paddy were free from bunt infection

Table 3. Bunt infection in different varieties of processed seed samples of paddy (1993-2008)

S.No.	Varieties	No.of samples		Infe-cted(%)	Maxi-mum
		Analysed	Infected		Infec-tion(%)
1.	IR 64	205	50	24.40	1.22
2.	MTU 2067	52	11	21.10	0.22
3.	MTU 2077	129	12	9.30	0.07
4.	MTU 1010	199	43	21.60	0.10
5.	MTU 7029	98	15	17.90	0.07
6.	JGL 1798	12	1	10.00	0.05
7.	WGL 48684	4	1	25.00	0.10
8.	MTU 5293	20	2	10.00	0.07
9.	MTU 1001	186	40	21.50	0.10
10.	BPT 5204	164	15	9.15	0.10
11.	PLA 1100	43	15	34.90	0.04

The remaining varieties of paddy were free from bunt infection

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