



Research Article

SURVEY AND DISTRIBUTION PATTERN OF DIFFERENT SPECIES OF WEEDY RICE IN DIFFERENT RICE ECOSYSTEM UNDER RED AND LATERITIC BELT OF WEST BENGAL

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Abstract: A preliminary survey on weedy rice infestation in rice fields was carried out in different rice ecosystem in red and lateritic belt of West Bengal, India during *kharif* and *rabi* season of 2012 and 2013. The Survey was carried out in 81, 77, 75 and 21 villages from 17, 18, 18 and 7 blocks out of 19, 22, 19 and 7 blocks present in Purulia, Bankura, Birbhum and parts of Burdwan district respectively. Four weedy rice species viz. *Oryza rufipogon* Griff., *O. barthii* A. Chev., *O. minuta* Presl. Ex. Presl., *O. nivara* Sharma et Shastri were identified during the survey. It was observed that population of weedy rice was higher in Birbhum district as compared to other districts under the survey area. The study revealed that almost all rice fields were found heavily infested with weedy rice. The frequency percentage and absolute density were 54.9 and 0.80, 44.0 and 0.70, 40.4 and 0.57 and 35.7 and 0.43 in Birbhum, Parts of Burdwan, Bankura and Purulia district respectively. Out of 81, 77, 75 and 21 villages under survey 26, 31, 42 and 11 villages come under the categories where the frequency percentage more than 50 percent in Purulia, Bankura, Birbhum and parts of Burdwan district respectively. The damage is likely to increase exponentially in subsequent years, if not managed effectively, challenging the rice production system in the country.

Keywords: Absolute density, Frequency percentage, Red and lateritic belt, Rice, Weedy rice

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Introduction

Weedy rice, which is a product of the natural hybridization between cultivated varieties and wild rice relatives, has become a serious threat in rice ecosystem in many countries. These weeds are now affecting rice areas of various countries in Asia, including India, Malaysia, Sri Lanka, Philippines, Thailand, Viet Nam, and South Korea. It is an emerging problem in many rice-growing areas in Asia [1, 2, 3, 4]. In India, weedy rice infestations have been found in major paddy growing belts of West Bengal, Andhra Pradesh, Assam, Bihar, Karnataka, Madhya Pradesh, Orissa, Tamil Nadu and Uttar Pradesh. It is known by different names in different countries. Examples are "Padi Angin" in Malaysia, "Lua Lon" in Vietnam, "Lutao" in China, "Akamai" in Japan, "Sharei" in Korea, "Khao Pa" in Laos, "Khao Nok" in Thailand, "Jhora Dhan" in Bangladesh and West Bengal. This weed contributes to high production costs through a yield reduction [5]. In Malaysia, weedy rice caused rice yield loss of 60% to 80% under moderate (15-20 weedy rice panicles m⁻²) to high (21-30 panicles m⁻²) infestations [6]. In an earlier study conducted in the United States, 1 to 3 plants m⁻² of weedy rice were the threshold infestation to prevent yield losses of rice [7]. In addition to reducing grain yield due to competition, it also lowers the value of cultivated rice in markets as the colored pericarps of weedy rice grains contaminate grains of cultivated rice [8]. The important characteristics of these species are early shattering habits, early vigour, greater tillering, irregular dormancy of seeds, high seed persistence in soil and high nitrogen use efficiency [9]. This weed had already caused a major damage to rice production by reducing rice grain yield and quality in China, the major rice producer [10]. Various methods are available for the control of these noxious weeds in rice ecosystem, but none are distinctly effective [11]. Immediate attention should be given on identification of species, to study the intensity of infestation of the specific weedy rice, its origin, biology and management. With this background, survey has been conducted under red and lateritic belt of West Bengal on pilot

basis to identify different species of weedy rice and their distribution as well as the level of infestation in Aman paddy ecosystem (rainfed condition).

Materials and methods

Survey for predominant species of weedy rice indifferent rice ecosystem in red and lateritic belt of West Bengal was conducted during *kharif* and *rabi* season of 2012 and 2013. The Survey was carried out in 81, 77, 75 and 21 villages from 17, 18, 18 and 7 blocks out of 19, 22, 19 and 7 blocks present in Purulia, Bankura, Birbhum and parts of Burdwan district (comes under red and lateritic belt of West Bengal) respectively. For recording observations on the infestation of weedy rice in rice field under survey area a stop will be made after every 10 km and site for recording observation was selected 4-5 fields away from the main road so that it should represent an undisturbed situation with natural weed flora. Ten spots were considered in each village. The number of rice field infested with weedy rice was recorded. The species of weedy rice was identified after emergence of panicle or setting fruit. Ecological analysis of weedy rice infestation was done by traditional quantitative method on the basis of frequency and absolute density. Ten fields in each village were selected randomly and the number of fields in which weedy rice present was recorded. Ten quadrates of 1.0 m × 1.0 m size were thrown in the rice field and number of weedy rice in each quadrate was counted and noted. Percentage frequency and density were calculated by the following formulas.

$$\text{Frequency (\%)} = \frac{\text{Number of fields of occurrence of weedy rice}}{\text{Total number of field studied}} \times 100$$

$$\text{Density (no./m}^2\text{)} = \frac{\text{Total number of individuals of weedy rice}}{\text{Total number of quadrat studied} \times \text{area of the quadrat}}$$

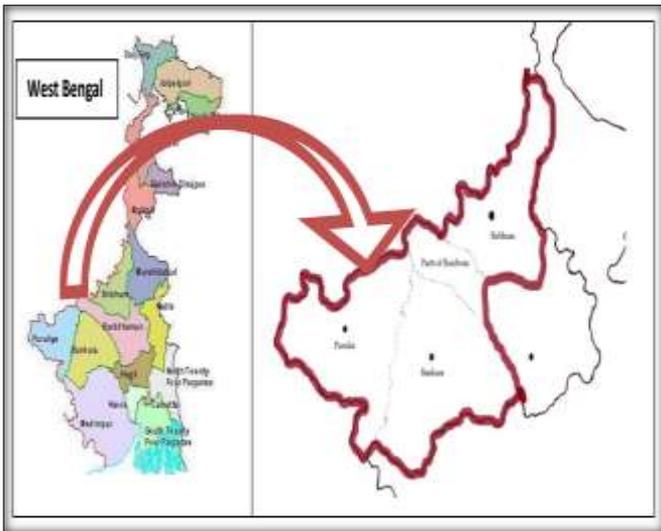


Fig-1 Grid Map and Survey area of Purulia, Bankura, Birbhum and parts of Burdwan districts of West Bengal.

Results and discussion

Identification and studies on distribution of different weedy rice species

Four weedy rice species were identified viz. *Oryza rufipogon* Griff., *O. barthii* A. Chev., *O. minuta* Presl. Ex. Presl., *O. nivara* Sharma et Shastry during the survey conducted in four different study location (Purulia, Bankura, Birbhum and parts of Burdwan districts under the red and lateritic belt of West Bengal). After identifying the species, the distribution of the four species over the four districts under study has been studied.

Occurrence of *Oryza rufipogon*

Generally, the species are taller than the cultivated rice varieties in the red and lateritic belt of West Bengal. The culm is thin and very slender and ligules are narrow and triangular in *O. rufipogon*. It has long awn and red in colour. Out of 81 villages surveyed four rice species were observed in 53 villages out of which *Oryza rufipogon* was noticed in 52 villages in Purulia district. In Bankura district out of 77 villages surveyed 55 were infested by weedy rice species out of which *Oryza rufipogon* was found in 54 villages. It is revealed that 55 villages were infested by the species *Oryza rufipogon* out of 55 villages where infestation of weedy rice species was noticed in Birbhum district. *Oryza rufipogon* was found in all the villages (11) where weedy rice species were recorded in parts of Burdwan district where a total of 21 villages were surveyed [Fig-2].

Occurrence of *Oryza nivara*

Oryza nivara plants are also taller than the cultivated varieties of rice in these districts. Sometimes it has similar plant height with the cultivated varieties. It has thick and strong culm. The ligules are long and triangular in shape. The species has long awn which is red in colour. From the data recorded from the location under survey revealed that 22, 23, 31 and 5 villages of Purulia, Bankura, Birbhum and parts of Burdwan districts were infested by the species *Oryza nivara* and occurrence of this particular species was 81, 77, 75, 21 and 53, 55, 55, 11 respectively [Fig-3].

Occurrence of *Oryza barthii*

These plants are also taller than the cultivated varieties of rice in these districts cultivated in kharif season. It has thick and strong culm. The ligules are narrow and triangular in shape. The species has long awn which is red in colour. Infestation of *Oryza barthii* in the surveyed area depicted in [Fig-4]; which shows that *Oryza barthii* was found in 19, 30, 34 and 5 villages of Purulia, Bankura, Birbhum and parts of Burdwan districts respectively.

Occurrence of *Oryza minuta*

These plants are smaller than the cultivated varieties of rice in these districts. Sometimes it has similar plant height with the cultivated varieties. It has thin and

very slender culm. The ligules are long and triangular in shape. The species has very short awn which is black in colour. Out of 81, 77, 75 and 21 villages surveyed in Purulia, Bankura, Birbhum and Burdwan district *Oryza minuta* infestation was noticed in 10, 18, 25 and 5 villages [Fig-5].

Survey on of infestation

The frequency percentage and the absolute density of weedy rice (no. m⁻²) were worked out in selected district wise and duly presented in [Table-1].

Study location I (Purulia district)

The data depicted in [Table-1] revealed that the average frequency percentage and absolute density of weedy rice was 35.7% and 0.43 (no. m⁻²) respectively. From the survey it is made known that the 29 villages of Purulia district were under the frequency of less than 25%, 26 villages between 25-50%, 19 villages from 51-75% and only 7 villages more than 75% frequency of weedy rice infestation [Table-2].

Study location II (Bankura district)

It is expressed from the [Table-1] that the average absolute density (no m⁻²) recorded by the district was 0.57 and the average frequency percentage was 40.4. In the Bankura districts, out of 77 villages according to their frequency 24 comes under less than 25 %, 22 villages from 25-50%, 27 villages under 51-75% and only 4 villages more than 75% frequency [Table-2].

Study location III (Birbhum district)

From the [Table-1] where the frequency percentage and absolute density (no m⁻²) were presented of Birbhum district it revealed that the average frequency percentage of weedy rice infestation recorded to the tune of 54.9% in Birbhum district and the absolute density of infestation was 0.80. Among 75 villages under study; 24, 9, 12 and 30 villages were under less than 25%, 25-50%, 51-75% and more than 75% frequency percentage respectively [Table-2].

Study location IV (Burdwan district)

A small part of Burdwan is also under the red and lateritic belt; thus, we have surveyed those villages of Burdwan districts that are comes under this belt. Intensity of infestation presented in form of frequency percentage and absolute density (no m⁻²) revealed that 21 villages were surveyed during the survey and the average frequency percentage was 44.0% and the absolute density was 0.70 [Table-1]. According to the frequency percentage levels, out of 21 villages 10 were under the category of frequency percentage less than 25%, no village comes under the categories where the frequency percentage was 25-50%, 2 villages registered the value in between 51-75% of frequency and 9 villages were under more than 75% frequency [Table-2].

Table-1 Frequency and absolute density of weedy rice in the red and lateritic belt of West Bengal

Name of the districts	Frequency (%)	Absolute density (No./m ²)
Purulia	35.7	0.43
Bankura	40.4	0.57
Birbhum	54.9	0.80
Parts of Burdwan	44.0	0.70

Table-2 Number of villages under different frequency percentages of different districts of red and lateritic belt of West Bengal

Name of the districts	Number of Villages according to the frequency percentages			
	<25 %	25-50 %	50-75 %	> 75 %
Purulia	29	26	19	7
Bankura	24	22	27	4
Birbhum	24	9	12	30
Parts of Burdwan	10	0	2	9

From the results it revealed that during the survey year the weedy rice infestation was higher in Birbhum district followed by Burdwan, Bankura and then Purulia. Infestation of any weed species depends on many factors. It might be due to the rice ecosystem, types of soil, amount and frequency of rainfall and depth of water standing in rice field and cropping system of the district.

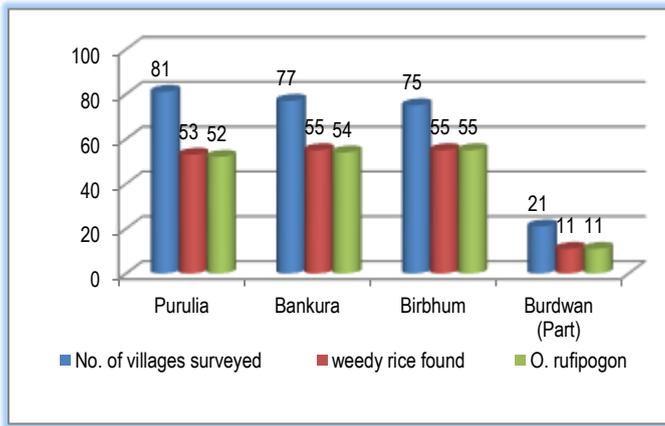


Fig-2 Infestation of *O. rufipogon* in different districts



Plate-1(a) *Oryza rufipogon*

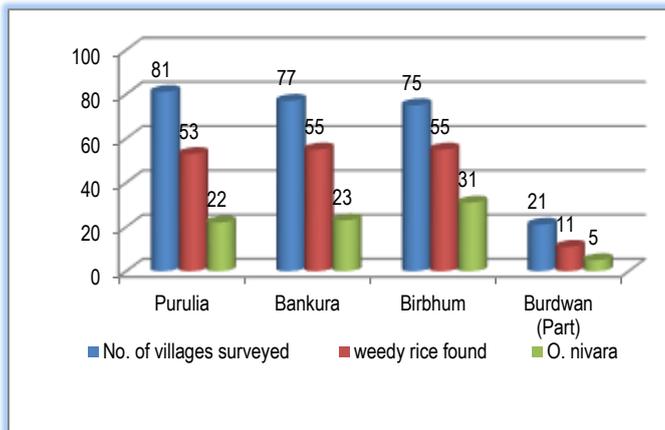


Fig-3 Infestation of *O. nivara* in different districts



Plate-1(b) *Oryza nivara*

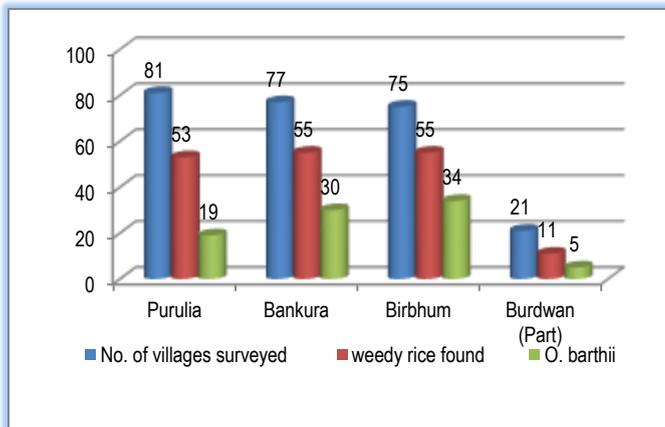


Fig-4 Infestation of *O. barthii* in different districts



Plate-1(c) *Oryza barthii*

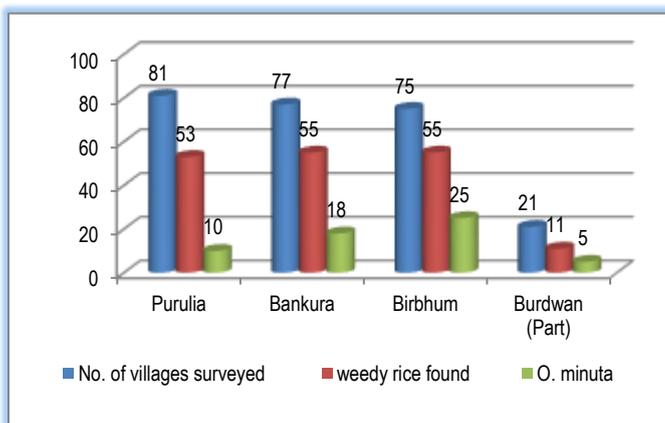


Fig-5 Infestation of *O. minuta* in different districts



Plate-1(d) *Oryza minuta*

Plate-1(a-d) Four weedy rice species observed in lateritic belt of West Bengal

Most of the rice fields in Birbhum district are under high to medium land where water depth is less and many a times, depending on the rainfall, the soil remains only moist with a situation just like direct seeded rice. Similar findings were reported by [12]. The occurrence of weedy rice may also be higher in fields planted with farmers' own seeds than that of paddy fields cultivated with certified seeds, and the longer the period farmers' seeds were used, the more weedy rice occurred in paddy fields. Similar results were reported by [13].

Conclusion

In this study, the frequency of occurrence was the highest in Birbhum district followed by Bankura, Purulia and Parts of Burdwan and the absolute density was the highest in Birbhum followed by parts of Burdwan, Bankura and Purulia which is a serious threat for upcoming time for the rice ecosystems of Purulia, Bankura, Birbhum and Parts of Burdwan districts of West Bengal. For better management of weedy rice in the red and lateritic belt of West Bengal immediate attention should be given towards investigating the weedy rice infestation which is only possible through the proper survey of these area.

Application of research: Weedy rice is one of the serious threats in paddy cultivation particularly for maintaining a germplasm. Early shattering habit of these particular species make it difficult to control if not isolated and removed. During vegetative stage identification these species is difficult, thus serious nutrient loss in main field is another serious issue. This study focuses on the identification and infestation of the specific weedy rice found in rice ecosystem under red and lateritic belt of West Bengal.

Research Category: Weed science

Abbreviations

no.: Number
m: Metre
km: Kilometre

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