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SEED GERMINATION POTENTIAL AND SEEDLING VIGOUR OF INDIGENOUS RICE (O*ryza sativa* L.) LANDRACES OF KORAPUT, ODISHA (INDIA)

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ABSTRACT

This paper describes the seed germination and seedling vigour of selected indigenous rice landraces, which are traditional rice varieties cultivated in the interior localities of Koraput district, Odisha (India). A total of 10 varieties of rice befitting the agro-climatic conditions of the place have been identified. The majority of them is lowland and up land varieties suitable for cultivation. In addition, they are also resistant to water logging and flooding. It is evident from the present investigation that the traditional landraces of Koraput like Matidhan, Mundadhan and Samudrabali and latimachi have more germination potential and seedling vigour than that of modern high yielding cultivar Lalata and Kamal, which provide farmers' livelihoods and thus provide a strong argument for the cultivation of more native cultivars. Conservation of the existing indigenous traditional varieties can play an important role in the development of sustainable agriculture and also valuable to the local farmers for agronomic, social and cultural reasons.

Key words: Germination; Indigenous Landraces; Rice; Seedling vigour

INTRODUCTION

Rice (*Oryza sativa* L.) is the main crop used for staple food in India, where it is cultivated in irrigated or upland cultivation systems. It covers around 25% of the gross sown area [1] and plays an important role in Indian agriculture [2]. India is known as one of the mega centre of biodiversity and Jeypore tract in the Odisha state considered as a centre of origin of rice [3]. It is inhabited by ancient farming community with intense belief in tradition including crop cultivation. Rice varieties that are used in various occasions like festivals, ancestral ceremonies, family functions and rituals are given top priority for conservation [4]. Sharma et al. [4] reported that this area could be a centre of origin of the aus (early maturing upland varieties) ecotypes. The rice of the Jeypore tract have many special features such as short height, thin culm, few tillers, small panicles with awns, and often black/brown husk. The Indians have a long tradition of rice cultivation. The country is supposed to be the centre of origin of rice, where maximum genetic diversity of this crop is seen. In fact, there were about 30,000 types of indigenous rice cultivars available in India [5] possessing many interesting and beneficial characters befitting the diverse geo-climatic conditions of this land. But today only about 8000 botanically different varieties of rice are in existence in the whole world, out of which more than 4000 varieties are identified in India [6-7]. Odisha, in eastern India, harbours a rich diversity of rice varieties and is a premier rice growing state. The state has 0.44 million hectares of land under this crop, producing 10,322,325 tons of paddy per annum [8]. The farmers of Odisha have cultivated traditional varieties of rice from time immemorial, the methods of which have been developed by continuous practice and trial. The

knowledge acquired through long experience has been transmitted from generation to generation orally in the form of popular folklores and folk sayings [9-10]. However, this scenario changed in the latter part of the 20thcentury, as a result of which much of those landrace became extinct or are the verge of extinction. The farmers of the country welcomed the hybrid revolution in agriculture (during the 1960s-70s) and gladly accepted the hybrid seeds for higher yield. Higher yields and greater food security have come at the expense of higher inputs of fertilizers and pesticides [11]. The extensive cultivation of this scientifically developed crop varieties has also led to serious genetic erosion due to fast replacement of traditional varieties from agro ecosystems [12].

As a result, the landraces and specifically the traditional rice varieties have lost their acceptability, and those of the indigenous rice cultivars became extinct, save a few in some interior places and tribal pockets of the country. The rate of loss of folk varieties has increased with the modernization and internationalization of agriculture, especially the introduction of modern crop varieties. The collection, characterization of traditional varieties have then become inevitable so that their agronomic important traits can be saved and utilized in future for developing suitable new varieties. In this context, reports from Koraput district of Odisha are still lacking. This paper will attempt to examine the germination potential and early seedling vigour of some selected indigenous rice landraces of Koraput.

MATERIALS AND METHOD

The study was conducted by taking 10 local rice land races collected from different tribal pockets of Koraput districts of Odisha (India) namely lactimochi, Godikabri, Samudrabali, Mundadhan, Mattidhan, Kalajeera, Lalat, Kamal, Umriachudi and Ratanjodi and the information about the landraces were presented in Table 1.

The cultivars were sown directly in earthen pots containing two kg of farm soil and farmyard manure in a 3:1 ratio. Plants were grown in a open shade subjected to natural solar radiation, with daily maximum photosynthetic photon flux density, air temperature and relative humidity being about 1660 µ mol m^{-2} s^{-1} and 30.6 ^{o}C and 70-75% respectively. The plants were maintained up to 12 days after sowing. The experiments were carried out in three replications. The seed germination percentage was recorded 3, 5 and 7 days after sowing..

Measurement of chlorophyll index by SPAD meter

Chlorophyll index were made on the fully expanded leaf of 5 different plants using an SPAD 502 chlorophyll meter (KONIKA MINOTA SENSING JAPAN) calculate the SPAD value on the intensity of light transmitted 650 nm under ambient environmental condition. The 2nd and 3rd leaf from the top were selected and kept inside the chamber until stable reading was recorded.

Estimation of Chlorophyll (Chl) content

For Chl estimation, 100 mg of finely chopped fresh leaves were placed in a 25 mL capped-measuring tube containing 10 mL of 80 % cold acetone, and kept dark inside a refrigerator (4°C) for 48 h .The Chl was measured spectro-photometrically by taking optical density at 663.6 and 646.6 nm. The Chl a and Chl b contents were calculated using the equations following Porra [13].

RESULTS AND DISCUSSION

Ten different landraces were collected from three different tribal groups like Paraja, Bhumia and Gadaba. Out of 10 varieties five varieties are lowland and five varieties are upland sowing different durations of maturity starting from 70 days to 140days. The characteristics of this variety were presented in Table 1.

Germination potential of local land races

Germination potential of local landraces of Koraput was studied in a pot culture experiment. The data revealed that except kalajeera all the cultivars showed germination after 3 days but the percentages of germination varied from 2- 90 % during different days. Among 10 cultivars Godikabri and Mattidhan showed early germination (Figure 1) and more than 90% germination followed by Mundadhan (88 %) and Samudrabali (86%) but germination was below 15 % in Umariachudi and Ratanjodi after 7 days of sowing.

Photosynthetic pigment content and SPAD Chlorophyll index

Comparison of leaf photosynthetic pigments chlorophyll a, Chlorophyll b and total chlorophyll content among local landraces of rice after 12 days was presented in Table 2. The total chlorophyll found to be more in Godikabri, Samudrabali and followed by Mundadhan and Mattidhan and least in Lalata and Latimachi.SPAD chlorophyll index are presented in Table 2. The SPAD index was varied from 17.28 to 28.7 among the cultivar. The SPAD index found to be more in Mundadhan (28.7±4.9) followed by Samudrabali (24.94±2.3) and least was in lactimachi (19.82±1.1).

Comparison of seedling growth and Vigour among local landraces

Seedling growth and vigour among local landraces in terms of fresh weight, dry weight and dry matter accumulation was presented in Table 3. Fresh weight of 12 days old seedlings was found to be more in Mundadhan followed by Lalata and least in Kamal. Dry matter accumulation was varied from 76 to 86.7 % among the cultivars and more value was observed in Latimachi

followed by Lalata and Samudrabali. The root length and shoot length of local landraces of rice after 12 days was presented in Table 3. More shoot growth and root growth was observed in Mundadhan followed by Godikabri and least was observed in lactimachi.

During the present investigation, it was observed that in some places tribal villages the planting of native varieties has been actually forbidden; though the goal of high productivity has, above all else, been responsible for the exclusion of local varieties. This present finding is in agreement with Lansing [14]. As climate change has made frequent floods and prolonged droughts the order of the day in Koraput district, the modern high yielding rice varieties and hybrids suffer the most, leading to a partial or total loss of crops. Conversely, the genetic variability of traditional landraces provides some built-in insurance against hazards of diseases and pest; and they provide some good yields despite drought, standing water, hail, frost, diseases and pests etc. [15]. Such indigenous plants have the ability of physiological adaptation, suitable for a particular area i.e. mixed cultivation, along with fish, duck and molluscs. Most of them produce a good yield, requiring no chemical fertilizer or pesticides. It is evident from the present investigation that the traditional landraces of Koraput like Matidhan, Mundadhan, samudrabali and latimachi have more germination potential and seedling vigour than that of modern high yielding cultivar Lalata Kamal, which provide farmers' livelihoods and thus provide a strong argument for the cultivation of more native varieties. The present study can provide a baseline data for the proper maintenance and conservation of valuable land races that is available and cultivated in Koraput region. Conservation of the existing folk varieties is of prime and urgent importance because they can play an important role in the development of sustainable agriculture for the future.

Table.1 Characteristics of local rice landraces of Koraput collected from different tribal communities

Sl No.	Variety	Low land	Up land	Duration (days)	Tribe	Place
1	Lactimochi	√		90	Bhumia, Gadaba	Jayntigiri
2	Umrichudi	√		85	Paraja	Kathraguda
3	Ratanjodi		√	100	Paraja	Kathraguda
4	Godikabri		√	120	Paraja	Kathraguda
5	Samudrabali		√	90	Bhumia, Gadaba	Jayntigiri
6	Kalajeera	√		140	Bhumia, Paraja	Jayntigiri
7	Munda dhan		√	120	Paraja	Kathraguda
8	Matti dhan		√	70	Paraja	Kathraguda
9	Kamal	√		120	Bhumia, Gadaba	Jayntigiri
10	Lalat	√		90	Bhumia, Paraja	Kathraguda

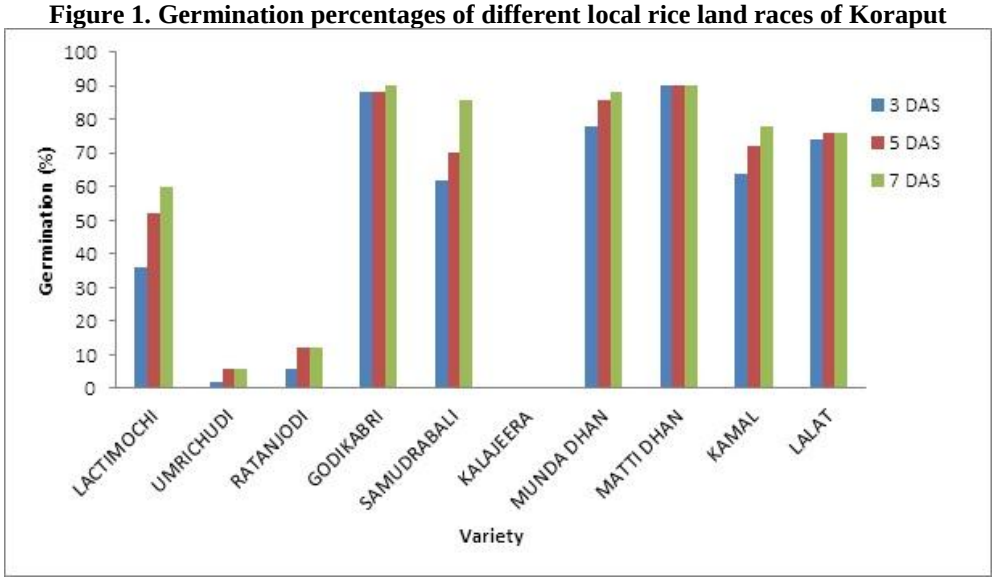
Table 2. SPAD index and Chlorophyll content of different rice landraces of Koraput. Data are the mean of 3 replications and presented in Mean ± Standard Deviation

Variety	SPAD Index	Chl a (mg gmf wt^{-1})	Chl b (mg $gmfwt^{-1}$)	Total Chl (mg $gmfwt^{-1}$)
Lactimochi	19.82±1.1	0.62±0.018	1.02±0.025	1.64±0.043
Godikabri	22.06±1.67	0.66±0.023	1.10±0.060	1.77±0.070
Samudrabali	24.94±2.3	0.66±0.036	1.11±0.090	1.77±1.023
Mundadhan	28.7±4.9	0.67±0.022	1.08±0.043	1.75±0.063
Mattidhan	21.82±4.0	0.66±0.017	1.07±0.044	1.73±0.060
Kamal	26.32±3.6	0.64±0.021	1.08±0.013	1.72±0.022
Lalat	21.84±2.7	0.61±0.002	1.03±0.023	1.65±0.026

Table 3. Seedling growth and dry matter accumulation (%) of different rice landraces of Koraput after 12days of sowing. Data are the mean of 3 replications and presented in Mean ± Standard deviation

Variety	Fresh weight (g/2pl)	Dry weight (g/2pl)	Dry matter accumulation (%)	Root Length cm	Shoot Length cm
Lactimochi	0.11±0.009	0.014±0.016	86.7	2.84±0.55	14.4±2.76
Godikabri	0.30±0.107	0.079±0.045	73.9	4.16±0.83	24.8±0.90
Samudrabali	0.11±0.026	0.025±0.027	78.1	2.06±0.57	20.8±2.23
Mundadhan	0.21±0.02	0.05±0.002	76.4	4.36±0.43	25.2±2.40
Mattidhan	0.23±0.004	0.05±±0.004	78.1	5.48±0.99	23.6±0.83
Kamal	0.15±0.01	0.03±0.0.003	76	2.68±0.36	14.7±2.47
Lalat	0.20±0.303	0.04±0.008	79.5	3.54±0.83	17.9±1.19

Figure 1. Germination percentages of different local rice land races of Koraput



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