K.M.A.S.K. Rupasingha[1], Disna Ratnasekera[2], A.P.T. Subhashi[3] and Gamini Senanayake[4]

Morphological variability, Germination ability and Survival rate of Weedy rice seeds in Ampara and Matara districts in Sri Lanka.

(1), (2), (3), (4) Department of Agricultural Biology, Faculty of Agriculture, University of Ruhuna, Kamburupitiya, Sri Lanka.
(email: disnar@agbio.ruh.ac.lk, disnaratnasekera@gmail.com)

Abstract: High diversity in morphology and physiology of weedy rice is important resource for rice breeding. Present study was aimed to determine the seed morphological diversity, germination percentage and survival rate of weedy rice populations in Matara and Ampara districts. Significant diversity of seed shape, awn length, hull color and pericarp color was observed. Germination percentage and survival rates were highly variable. Our results showed that great diversity in weedy rice seeds and the favorable characteristics such high germination percentage, high survival ability, own less seeds, proper seed shape and pericarp color can be incorporated into cultivated rice varieties in rice breeding programs.

Keywords: weedy rice, seed morphology, germination ability, survival rate

Introduction

Weedy rice (*Oryza sativa* complex) is a conspecific weedy relative of cultivated rice (*Oryza sativa* L.) that occurs in rice fields' worldwide (Michael *et al.*, 2010). In mid1990's, weedy rice was first identified as a threat from Vavunia, Ampara, and Batticaloa districts (Marambe and Amarasinghe, 2000) and at present that is most common in all rice growing area in Sri Lanka. The superior competitive ability of weedy rice over cultivated rice has contributed to its rapid spread in the country (Abeysekera *et al.*, 2010). Weedy rice has close affinity with cultivated rice, in terms of morphological and physiological characteristics (Fogliatto *et al.,* 2011). This similarity has even led weedy rice to be classified as the same species as cultivated rice (Vaughan *et al.*, 2001). Morphologically, weedy rice is highly variable in almost all the vegetative and reproductive characteristics with each other and appears to be an intermediate between wild and cultivated rice (Cao*et al.*, 2006). Weedy rice is considered as a useful germplasmas it has successfully adapted to the natural growing conditions (Heu *et al.*, 1990). It also has many useful genes for cold tolerance (Chang *et al.,* 2004), grain quality and germination characteristics (Ma *et al.*, 2008) and high salinity and drought tolerance (Jiang *et al.,*1985). Morphological traits such as seed color and seed shapes and own characters are highly variable in weedy rice and physiological traits such as degree of dormancy, germination ability, viability and longevity also showed high variability. Seed traits of white pericarps, own less, non-dormant, higher survival rates are useful characteristics for crop improvement in rice breeding. Therefore, this study was aimed to determine the morphological diversity, germination percentage and survival rate of selected weedy rice populations. The information gathered in this study may be useful in rice improvement programs in the future.

Material and methods

An extensive field survey was carried out at Ampara and Matara districts in Sri Lanka and total of 06 weedy rice infested locations were selected intentionally as sampling sites. The selected sites were Akuressa, Thihagoda and Mulatiyana from Matara district and Akkareipattu, Ampara and Lahugala from Ampara district. Panicles from 30 individuals were collected from each location. Seed morphology was recorded by

playing attention to awn traits, seed shape, and seed size and pericarp pigmentation. The collected mature seeds were dried to 14% of moisture and 10 weedy rice seeds were randomly collected from each panicle from each population, mixed well and randomly collected100 seeds were used for germination test with four replicates. Weedy rice seeds were soaked in water for 24 hours, covered for 24 hours by cloth bag (standard germination percentage testing method) and they were put on the humid filter paper in the petri dish with sufficient light. The numbers of germinated seeds were counted (as seeds had radical appearing). Germinated seeds were transferred into mud trays and healthy plants were counted after 21 days. Survival rate was assessed the percentage of germinated seeds.

Results

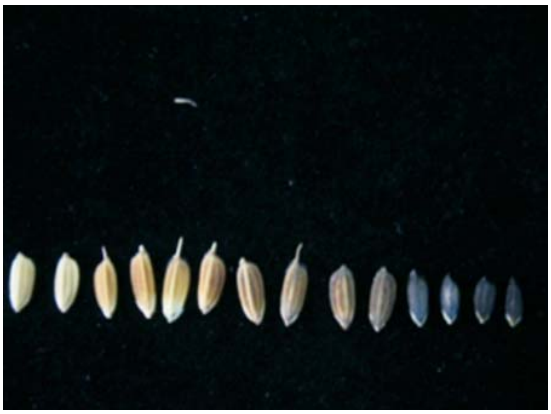
Seed morphological diversity

Our results showed that there is a great diversity in seeds in terms of seed shape, awn length, hull color and pericarp color.

Weedy rice seed collected from Matara and Ampara districts showed great variation for the own length which varied from 0 (ownless) to 10 cm (Fig.1a). A considerable diversity was observed in seed shape (Fig.1b) andhull color which varied from pale white to black (Fig.1c). Pericarp color varied from white to brownish red (Fig.1d). This variability observed among populations as well as within the populations.

a. Variation in own length

b. Variation in seed shapes



c. Variation in hull color

d. Variation in pericarp color

Fig.1. Morphological diversity of weedy rice seeds collected from Ampara and Matara districts in 2012.

Table 01:
Percentages of various categories of seed morphological traits of weedy rice collected from Matara and Ampara districts in 2012.

Population	Hull color			Pericarp color			Own length			Seed shape		
	Straw	Black	Gray	Red	Brown	White	Long	Medium	Own less	Long	Intermediate	Round
Akuressa	60%	10%	30%	88%	8%	4%	25%	35%	40%	30%	45%	25%
Thihagoda	70%	5%	25%	80%	15%	5%	22%	26%	52%	32%	43%	25%
Mulatiyana	62%	13%	25%	90%	6%	4%	18%	42%	40%	25%	55%	15%
Ampara	50%	22%	28%	78%	18%	4%	30%	25%	45%	45%	43%	12%
Akkaraipattu	56%	15%	29%	83%	11%	6%	35%	25%	40%	48%	38%	14%
Lahugala	63%	16%	21%	81%	12%	7%	45%	25%	30%	55%	35%	10%

With reference to the all populations straw hull color seeds occur in a higher percentage than black and gray hull color seeds. Red pericarp color seeds occur in a higher percentage (>80%) while white pericarp seeds occur in a lower percentage (<7%). Own less seeds has considerable percentage (>35%) in the all populations

Germination percentage was highly variable in weedy rice populations in Ampara and Matara districts. Ampara population showed highest germination percentage (89%) while Lahugala population showed lowest germination percentage (7%). The populations showing high germination percentages would be useful for plant breeding programs.

Germination ability

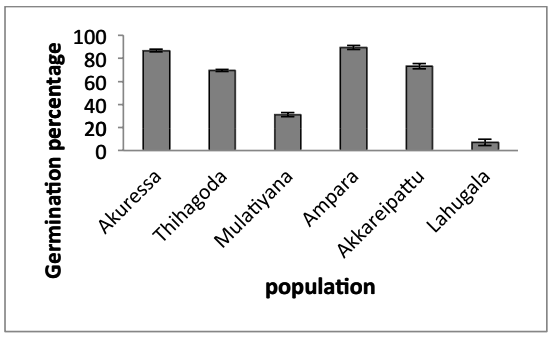


Fig.2: Germination percentage of weedy rice populations collected from Ampara and Matara districts in 2012.Vertical bars on the columns showed standard errors.

Survival rates

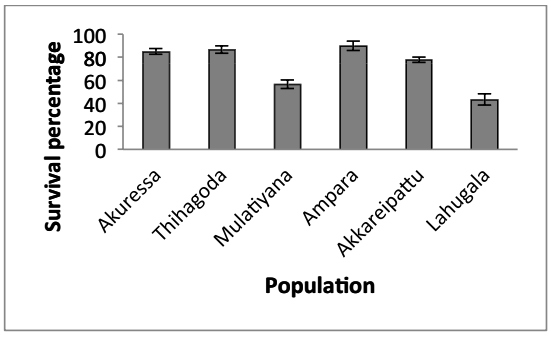


Fig.6: Survival percentage of weedy rice populations collected from Ampara and matara districts in 2012.

Survival percentage was highly variable in weedy rice population in Ampara and Matara districts. Ampara population showed highest survival percentage (90%) while Lahugala population showed lowest survival percentage (43.33%). Except Lahugala and Mulatiyana populations other populations showed high survival rates.

Discussion

There was a great diversity in seed morphological traits such as seed shape, own length, hull color and pericarp color within and among populations. Previous studies have reported that diversity of seed traits such as hull color in weedy rice is greater than cultivated rice (Fogliatto*et al*., 2011). Constantin (1960) reported three types of red rice based on hull color. Further, straw hull red rice is more common than black hull (Huey, 1978; Smith, 1981). In this study we mainly observed hull color of red brown that is with the agreement of Prathepa (2009). Morphological and topographical characteristics of plant organs such as the shape and size of seeds and the structure of incidental features have been useful weapons in identifying and classifying the plant and weed species (Noda *et al*., 1985). Own less seed is an improved traitand high diversity in seed shapes and pericarp color may be important for developing quality rice to meet diverse consumer demand. Populations with higher germination percentages (more than 80%) and higher survival ability (more than 80%) are important characteristics for crop improvement. Awn length and distribution, seed length, thousand seed weight and germination rates were the most important traits influencing the variability among populations (Fogliatto*et al*., 2011). The morphological diversity observed, not only among the weedy rice morphotypes but also within them, offers an array of traits that could be studied and incorporated to future rice-breeding programs (Griselda *et al*., 2004). Our results showed that great diversity in weedy rice seeds and the favorable characteristics such as high germination percentage, high survival ability, own less seeds, proper seed shape and pericarp color can beincorporated into cultivated rice varieties in rice breeding programs. In addition, proper understanding on seed germinability and survival is crucial for adopting efficient management practices.

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