Variability of Some Morpho-Physiological Characteristics of Weedy Rice in Ampara District of Sri Lanka

K.M.A.S.K. Rupasingha, Disna Ratnasekera* and Gamini Senanayake

Department of Agricultural Biology, Faculty of Agriculture, University of Ruhuna, Kamburupitiya, Sri Lanka

Abstract

Weedy rice is considered as one of the most troublesome, difficult-to-manage and economically damaging weed in Sri Lanka. Weedy rice affects the growth, yield and quality of cultivated rice. However, weedy rice may contain important genes which can be incorporated into the cultivated varieties. Therefore, study on morpho-physiological characteristics of weedy rice are important to adopt efficient control measures and it may also be helpful to rice breeders in developing new rice varieties. Therefore, this study was aimed to determine the morpho-physiological diversity of weedy rice in Ampara district. Ampara, Akkareipattu and Lahugala locations from Ampara districts were selected as sampling sites.Weedy rice populations representing locations were grown in a common field in a complete randomized design with four replications. Plant height, thousand grain weight, own length, number of spikelet per panicle, number of filling seeds per panicle, number of unfilled grains per panicle, number of shattered seeds per panicle were measured and germination percentage and seed viability were tested. Significant variations were observed in measured characteristics of weedy rice populations in Ampara District. Number of shattered seeds per panicle showed the highest variablility (CV-76.7%) compared to all the other characteristics. Significant differences among three populations for all the measured characteristics except for plant height and viability percentage were observed. Measured characteristic of Lahugala population were very similer to that of wild rice and significantly differed from those from other two locations.

Key words: Morpho-physiological characterization, Variation, Weedy rice

Introduction

Rice is a staple food for nearly half of the world's population and it is the main staple food for Sri Lankans. Weeds are one of the main constraints affecting rice production worldwide. Among many other weeds, weedy rice is the main competitor with cultivated rice, affecting both growth and yield (Zainudin *et al.*, 2010).Weedy rice is currently considered as one of the most troublesome, difficult-to-manage and economically damaging weed in Sri Lanka due to its impact on the main staple food crop of Sri Lankans (Marambe, 2009). Weedy rice was first reported in Sri Lanka in 1990 in a small area in Ampara District in Eastern Province but, by 1997, it had become a serious problem in the area. At present, weedy rice is becoming common in most rice growing areas in Sri Lanka. 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 (Qianjin *et al.*, 2006). Weedy rice belogs to the same species of cultivated rice (i.e. it usually has the same genome), but it behaves differently. It normally grows faster; makes better use of the available N; produces more tillers, panicles and biomass in general; shatters earlier; has better resistance to adverse dry conditions; and possesses longer dormancy in soil. Higher levels of seed shattering and seed dormancy have enriched the soil seed bank of weedy rice in infested fields.

Weedy rice may contain important genes which can be incorporated into the cultivated rice. Since weedy rice is considered as a natural hybrid between cultivated rice and wild rice it may be possible to use weedy rice as a bridge to transfer genes from the secondary gene pool to cultivated rice. Thus, studies of morpho-

physiological characteristics of weedy riceare important to adopt efficient control measures and it may also be helpful to rice breeders in developing new rice varieties. Therefore, this study was aimed to determine the morpho-physiological diversity of weedy rice in Ampara district.

Materials and Methods

A higher weedy rice infested fields were selected as sampling sites. Three locations from Ampara districts were selected. The selected locations, were Ampara, Akkareipaththu and Lahugala. In each location 30 weedy rice panicles were randomly collected, 20 seeds were collected from each 30 panicles of a location and then those were mixed well and used for field experiment as a representative sample. This procedure was done for samples collected from all three locations.To eliminate environmental effects, weedy rice populations were grown in a common paddy field in 2 X 2 m plots in a completely randomized design with four replications. Weedy rice seedlings were transplanted in the plots with 20 X 20 cm inter and intra raw spacing and all the management practices were adopted according to the recommendations of the Department of Agriculture. Panicles were covered by netted nylon bags to collect shattered seeds.Ten plants from each of the weedy and cultivated rice per plot were randomly selected for measurement. Plant height, thousand grain weight, own length, number of spikelet per panicle, number of unfilled seeds per panicle and number of shattering seeds per panicle were measured at harvest stage. Germination percentage and seed viability were tested three months after harvesting. Statistical analysis was done using the SAS computer programme.

Results and Discussion

A higher level of variations was observed within selected characteristics of weedy rice among weedy rice populations in Ampara District. Shattering percentage was the highest variable characteristic (CV-76.7%) comparedto other characteristics (Table 1). The high seed shattering may enrich the soil seed bank of weedy rice in infested fields. Thousand seed weight was the lowest variable characteristic (CV-13.0%) compared to other characteristics (Table 1). No. of filled grains per panicle, No. of unfilled grains per panicle, Own length and germination percentage (3 months after harvesting) also showed high variability. Although a small area was selected for the study, results showed the high variability among location, so that weedy rice is a highly diverse weed.

Table 1. Mean comparisons and variation of some morpho-physiological characteristics among location specific populations of weedy rice in Ampara District.

Characteristics	Weedy rice population			Co efficient of variation among three locations (CV %)
	Ampara	Akkareipattu	Lahugala	
Plant height (cm)	139.2	137.9	140.1	14.2
Thousand seed weight (g)	25.7^{a}	24.5^{a}	20.9^{b}	13.0
No. of spikelets per panicle	114.0^{a}	97.5^{b}	73.8^{c}	21.2
No. of filled grain per panicle	57.5^{a}	45.6^{b}	12.9^{c}	35.9
No. of unfilled grains per panicle	42.2^{a}	43.8^{a}	60.9^{b}	33.4
No. of shattered seeds per panicle	12.9^{a}	9.9^{a}	66.0^{b}	76.7
Own length (cm)	0.9^{a}	1.8^{a}	6.5^{b}	69.5
Germination percentage (3 months after harvesting)	90^{a}	72^{b}	25^{c}	42.6
Viability percentage (3 months after harvesting)	93^{a}	92^{a}	89^{a}	14.8

Means with the same letter are not significantly different at P>0.05 within a characteristic.

Significant differences were founded among three populations for all the selected characteristics except for plant height and viability percentage (Table 1). This indicates that the morpho-physiological characteristic of weedy rice varied from a location to location even within a District. Lahugala population significantly differed from the other two locations for most of the characteristics (Table 1). Number of unfilled grains per panicle, Number of of shattered seeds per panicle and own length were very high and number of spikelets per panicle, thousand seed weight, number of filled grain per panicle, germination percentage (3 months after harvesting) were low in Lahugala population when compared to other two populations. Germination percentage was very low (25%) while viability percentage was very high (89%) three months after harvesting in Lahugala population so that seed dormancy appeared to be very high in Lahugala population. Due to seeds dormancy, weedy rice seeds may remain over long period in soil without losing viability and it will help to increase the soil seed bank. Most of the characteristics (longer own, less thousand seed weight, high number of unfilled grains per panicle, high number of shattered seeds per panicle and low germination percentage) in Lahugala population appeared very close to the characteristics, that can be seen in wild rice. Thus, it appeared that Lahugala population may have evolved by natural out-crossing of wild rice with cultivated rice.

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