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AMYLOSE, AMYLOPECTIN, VOLUME EXPANSION RATIO AND KERNEL ELONGATION RATIO OF RICE LAND RACES IN BANGLADESH

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ABSTRACT

Khatoon M, Islam MT (2020) Amylose, amylopectin, volume expansion ratio and kernel elongation ratio of rice land races in Bangladesh. *Int. J. Sustain. Crop Prod.* 15(2), 1-3.

Rice is the staple food and leading cereal crop in Bangladesh which is cooked and consumed as whole grain. Coking quality is directly related to the physical and chemical characteristics of the starch in the endosperm. Amylose, amylopectin, volume expansion ratio and kernel expansion ratio were determined of 36 land races and a high yielding variety BRRI dhan48 of Bangladesh to give an idea to the consumers of the cooking quality of the land races they consume and help breeders for development of better quality rice. The results revealed that amylose and amylopectin of the rice land races ranged from 15.92 to 24.34 and 75.66 to 86.72%, respectively. Amylose content was the highest in Basmoti sufaid and the lowest in Jara dhan. On the other hand, Tilokkachori showed the highest amylopectin and Basmoti sufaid had the lowest. Volume expansion ratio and kernel expansion ratio of the rice land races ranged from 1.37 to 2.28 and 1.09 to 1.54, respectively. Kataribhog showed the highest volume expansion ratio and Lal sora-2 showed the least. Whereas, BRRI dhan48 had the highest kernel elongation ratio and Lal sora-1 had the lowest.

Key words: *amylose, amylopectin, volume expansion ratio, kernel elongation ratio, rice land races*

INTRODUCTION

Rice is the staple food and leading cereal crop in Bangladesh which is cooked and consumed as whole grain. Rice is the synonym for food in Bangladesh and had been the traditional source of carbohydrates and proteins since the prehistoric days (Shozib *et al*. 2017). Grain quality of rice is determined the factors such as grain appearance, nutritional value, cooking and eating quality (Juliano *et al*. 1990). The cooking qualities are amylose content, alkali spreading value, water uptake, volume expansion ratio and kernel elongation ratio. The gelatization temperature, gel consistency and amylase content are major traits, which are directly related to eating and cooking quality (Little *et al*. 1958). On the other hand, amylase content amylopectin structure and protein composition explained the difference in cooking quality of rice (Lisle *et al*. 2000). Coking quality is directly related to the physical and chemical characteristics of the starch in the endosperm. In this study, we have evaluated some cooking quality characters of land races of Bangladesh to assist in enlighting the consumers of the cooking quality of the land races they consume and help breeders for development of better quality rice.

MATERIALS AND METHODS

Rice sample preparation

Thirty seven rice genotypes (36 land races and 1 high yielding variety) were collected from Bangladesh Rice Research Institute and different cities of Bangladesh. The samples were manually cleaned to remove cracks kernels and the husk of the paddy was removed to get rice. Rice grains were grinded for analyzing. For determining physical characteristics 1000 grains are clean, sun dried whole paddy seeds were randomly selected from the sample, counted carefully and weight measured by using electronic balance and expressed in gram (g).

Determination of amylose content

Amylose was determined following the method of Robyt and Whelan (1968). Accurately weighed 100 mg of powdered sample was taken and 1mlk of 95% ethanol and 9 ml of 1N NaOH were added and warmed for 5 min in water bath to gelatinize the starch. The content transferred in 100 ml volume with water cooled and brought to volume with water. 5 ml solution was taken into a 100 ml volumetric flask, 1 ml of acetic acid and 2 ml of iodine solution were added and made up to the volume with water, stirred and allowed to stand for 20 min before taking optical density at by spectrophotometer at 590 nm.

Preparation of standard curve

100 mg of anhydrous potato amylose was dissolved in 100 ml of alcoholic NaOH (10 ml ethyl alcohol and 90 ml 1N NaOH). Portions containing 0.25, 0.50, 0.75, 1.00, 1.25, 1.50, 1.75 and 2 mg of amylose transferred to 100ml flask. The solution was acidified with 1N acetic acid by adding 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5 and 4 ml respectively and color was developed using iodine solution. Optical density was taken at 590 nm in Spectrophotometer. The amylose content of the each sample was calculated from standard curve.

Calculation of amylopectin content

Amylopectin is a calculated value which is obtained from the value of total amylose. % of amylopectin = 100-% of amylose (Jane *et al*. 1999).

Determination of volume expansion ratio

Volume expansion ratio of raw milled rice and cooked rice was determined by water displacement method by using a measuring cylinder. A sample of 5 gm of rice grains poured into a measuring cylinder containing 15 ml of water and total volume was observed. The initial increase in volume after adding 5 gm of rice was recorded (Y) and soaked for 10 min. Rice grain sample was cooked for 20 min in a water bath at 90^0C. All the 5 gm of cooked rice were placed in 50 ml water taken in 100 ml measuring cylinder and the increase in volume of water was measured (X). The volume raise was recorded (X-50). Where, (X-50) is the volume of cooked rice (ml) and (Y-15) is the volume of raw rice (ml).

Determination of kernel elongation ratio (KER)

Kernel elongation after cooking and kernel elongation ratio (KER) was determined by Juliano 1971. In this method, 10 whole kernels after cooking (20 min in a water bath at 90^0C) was measured by using slide calipers and average kernel length was determined. Kernel elongation was calculated by dividing the average length of cooked kernel by the average length of the raw (uncooked) rice.

RESULTS AND DISCUSSION

The results revealed that amylose and amylopectin of the rice land races ranged from 15.92 to 24.34 and 75.66 to 86.72 mg, respectively (Table 1). Amylose content was the highest in Basmoti sufaid and the lowest in Jara dhan. On the other hand, Tilokkachori showed the highest amylopectin and Basmoti sufaid had the lowest. Volume expansion ratio and kernel expansion ratio of the rice land races ranged from 1.37 to 2.28 and 1.09 to 1.54, respectively. Kataribhog showed the highest volume expansion ratio and Lal sora-2 showed the least. Whereas, BRRI dhan48 had the highest kernel elongation ratio and Lal sora-1 had the lowest. The results are in conformity of Anjum and Hossain (2019), Ojha *et al*. (2018), Chukwuemeka *et al*. (2015), Umadevi *et al*. (2010), Shipla (2010), Shipla and Sellappan (2010).

Table 1. Amylose, amylopectin, volume expansion ratio and kernel expansion ratio of rice genotypes

Genotypes	Amylose (%)	Amylopectin (%)	Volume expansion ratio	Kernel elongation ratio
Doiargura	20.29a-e	79.71b-f	2.20ab	1.41a-e
Boishaki	20.82a-e	79.18b-f	1.52h-k	1.28e-k
Tulsimala	20.98a-e	79.02b-f	1.45jk	1.23g-l
Kalajira-TAPL	18.20b-f	81.80b-e	1.72d-i	1.35c-g
Bashmoti	19.86a-e	80.14b-f	1.44jk	1.15kl
Kataribhog	19.91a-e	80.09b-f	2.28a	1.33c-i
Jirakatari	20.61a-e	79.39b-f	1.76c-h	1.20h-l
Lal sora 1	21.42a-d	78.58c-f	1.88cde	1.09 l
Bowigiaki	18.38b-f	81.62b-e	2.02bc	1.11 l
Lal sora 2	18.79b-e	81.21b-e	1.37k	1.21g-l
Madhi madob	19.09a-e	80.91b-e	1.57g-k	1.21g-l
Jara dhan	15.92ef	84.08ab	1.46jk	1.16kl
Chinikarai	17.78b-f	82.22bcd	1.73d-i	1.22g-l
Deshi kaluni	16.11def	83.89ab	1.96cd	1.43a-d
Jirabhog	19.51a-e	80.49b-f	1.85cde	1.38b-f
Bashmoti sufaid	24.34a	75.66f	1.80c-g	1.41a-e
Tulsimala 2	16.94c-f	83.06abc	1.74d-i	1.22g-l
Kalaribhog	20.13a-e	79.87b-f	1.82c-g	1.26f-k
Lunia	18.20b-f	81.80b-e	1.82c-g	1.19i-l
Bashmoti 71	20.38a-e	79.62b-f	1.73d-i	1.22g-l
Begunbitchi	18.77b-e	81.23b-e	1.78c-g	1.32c-j
Badsabhog	19.50a-e	80.50b-f	1.83c-g	1.26f-k
Ranisalut	18.17b-f	81.83b-e	1.82c-g	1.34c-h
Baoibhog	18.44b-f	81.56b-e	1.80c-g	1.49ab
Sakkorkhani	22.39abc	77.61def	1.69e-j	1.46abc
Kultichikon	20.15a-e	79.85b-f	1.78c-g	1.23g-l
Sakkorkhora	19.34a-e	80.66b-e	1.91cde	1.32c-j
Jirakalani	18.03b-f	81.97b-e	1.79c-g	1.18jkl
Saubail	19.02a-e	80.98b-e	1.75d-i	1.31d-j
Noyonmoni	21.35a-e	78.65cdef	1.77c-h	1.23g-l

Cont'd

Genotypes	Amylose (%)	Amylopectin (%)	Volume expansion ratio	Kernel elongation ratio
Tilokkachori	13.28f	86.72a	1.84c-f	1.20h-l
Bashful	18.51b-f	81.49b-e	1.50ijk	1.21g-l
Kamianasaru	19.27a-e	80.73b-e	1.91cde	1.43a-d
Chiniatob	19.17a-e	80.83b-e	1.58f-jk	1.16kl
Gahinda	21.37a-e	78.63c-f	1.75d-i	1.34c-h
Baila aman	19.33a-e	80.67b-e	1.79cg	1.20i-l
BRRI dhan48	23.00ab	70.00e-f	1.47jk	1.54a

Common letter(s) in a column do not differ significantly at 5% level as per DMRT

CONCLUSION

Amylose and amylopectin of the rice land races of the studied rice land races of Bangladesh ranged from 15.92 to 24.34 and 75.66 to 86.72%, respectively. Amylose content was the highest in Basmoti sufaid and the lowest in Jara dhan. Tilokkachori showed the highest amylopectin and Basmoti sufaid had the lowest. Volume expansion ratio and kernel expansion ratio of the rice land races ranged from 1.37 to 2.28 and 1.09 to 1.54, respectively. Kataribhog showed the highest volume expansion ratio and Lal sora-2 showed the least. Whereas, BRRI dhan48 had the highest kernel elongation ratio and Lal sora-1 had the lowest.

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