Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

Shilpa Singh
Department of Biochemistry, Narendra Deva University of Agriculture and Technology, Narendra Nagar Kumarganj, Faizabad, Uttar Pradesh, India

Ankita Sagar
Department of Biochemistry, Narendra Deva University of Agriculture and Technology, Narendra Nagar Kumarganj, Faizabad, Uttar Pradesh, India

Chetna Gangwar
Department of Biochemistry, Narendra Deva University of Agriculture and Technology, Narendra Nagar Kumarganj, Faizabad, Uttar Pradesh, India

RP Singh
Department of Biochemistry, Narendra Deva University of Agriculture and Technology, Narendra Nagar Kumarganj, Faizabad, Uttar Pradesh, India

An analysis of some selected physical characteristics of different varieties of hybrid rice in eastern Uttar Pradesh, India

Shilpa Singh, Ankita Sagar, Chetna Gangwar and RP Singh

Abstract
The experiment was carried out at the Department of Biochemistry of Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Faizabad as a part of Ph.D. work. The seven varieties of hybrid rice namely- Dhani, US-312, 6201, 6302, 6444, JK-401, PHB-71 and 3 check varieties namely-Swarna, Sambhamah and Pusa Basmati were purchased from local market at Kumarganj, Faizabad from year 2012 to- 14. The results indicated that, the hybrid rice variety 6444 was recorded highly superior over Pusa Basmati and Sambhamah with highest germination (96.5%) followed by (95.5%) in PHB-71.The variety Dhani of hybrid rice was found as short bold type and PHB-71 short slender. The all check varieties observed as long slender type and rest found medium. The kernel length was recorded maximum in Pusa Basmati (7.90 mm) followed by Sambhamah (7.41 mm) and 6444 (6.86 mm) and found significantly superior among all the varieties and highly superior over 6302.The kernel breadth was found maximum in PHB-71 (2.16 mm) followed by Swarna (2.14mm), JK-401 and Dhani (2.13 mm) was significantly superior among all the varieties and highly superior over 6302. The L/B ratio was recorded highest in Pusa Basmati (4.40) followed by 6444 (3.81) and found highly superior over JK-401. The test weight was recorded maximum in Pusa Basmati (24.61 g) followed by 6444 (23.86 g) and was significantly superior among all the varieties and highly superior over US-312 and 6302.

Keywords: Hybrid rice, germination, kernel length, kernel breadth, length to breadth ratio, test weight

Introduction
India has a long history of rice cultivation. Globally, it stands first in rice area and second in rice production, after China. It contributes 21.5 per cent of global rice production. Within the country, rice occupies one-quarter of the total cropped area, contributes about 40 to 43 per cent of total food grain production and continues to play a vital role in the national food and livelihood security system. India is one of the leading exporters of rice, particularly basmati rice. It is cultivated in all the continents except Antarctica, Tropical and sub-tropical regions between 550N and 360S in a variety of ecosystem ranging from favorable irrigated to rain fed upland and lowlands flash flooded and deep water areas.

The projected demand for rice can only be met by maintaining steady increase in production over the years. Several breeding strategies are being employed in increasing the yield potential of rice and those among the available strategies; hybrid rice offers an immediate opportunity to break the yield plateau set by the semi-dwarf rice varieties after the first green revolution.

In the recent years, much emphasis is given for the cultivation of hybrid varieties. Hybrid rice technology has proved to be one of the most feasible and readily adoptable approaches to break the yield barrier, as they produced about 15-20 per cent more than the best of the improved or high yielding varieties. Being convinced of the potential of hybrid rice technology in enhancing the production, India adopted this technique and has released nearly more than forty-three hybrids for commercial cultivation. Hybrid technology has been widely acclaimed and accepted. Hybrid rice is the commercial rice crop from F1 seeds of cross between two genetically dissimilar parents. Good rice hybrids have potential of yielding 15-20 per cent more than the best inbred variety grown under similar conditions (Nguyen van Suan, 1998) [6]. Hybrid rice was introduced commercially in China in 1976.

It has been proved practically for many years that hybrid rice has more than 20% yield advantage over improved inbred varieties. The nationwide average yield of hybrid rice is 7t ha-1, about 1.4 t ha-1 higher than that of inbred commercialized hybrid rice (Yuan, 2004). Because of planting hybrid rice on large scale commercial production, China and Vietnam becomes the first and second largest rice export countries in Asia. Besides, many other countries, such as the Philippines, Bangladesh, Indonesia, Pakistan, Equador, Guineas and the USA have also achieved great progress in extending hybrid rice technology.

Correspondence
Shilpa Singh
Department of Biochemistry, Narendra Deva University of Agriculture and Technology, Narendra Nagar Kumarganj, Faizabad, Uttar Pradesh, India

Storability of hybrid seeds in general, compared to the inbred varieties of the same crop species has been found to be poor, probably due to the sterility associated negative factor. In China, it has been established that F1 hybrid and CMS line seeds of rice have poor endurance during storage and exhibited 10 per cent lower viability than those of inbred varieties under same storage environment because of pre-harvesting deterioration, seed processing deterioration and post-harvesting deterioration (Zhao, 1995) [16].

Germination percentage expresses the proportion of the total number of seeds that are alive. Good seeds have more than 80% germination rate. Many varieties have a dormancy period immediately after harvest. When stored under traditional open systems, the germination rate of most rice seed begins to deteriorate rapidly after 6 months. Volume expansion is mostly determined by water uptake, but is also influenced by kernel texture (Zaman, 1981) [15].

Keeping in view of above facts, potentially inclination towards hybrid rice by developed country community and having vital chemical constituents hidden in it, the present study entitled "Biochemical and shelf life studies for quality of hybrid rice." was conducted

Methodology
The research was carried out at the Department of Biochemistry of Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Faizabad as a part of PhD work from 2012 to 2014. The details of material used and standard methods employed in present investigation are being summarized below-

Seven hybrids (Dhani, US-312, 6201, 6302, 6444, JK-401, PHB-71) and 3 checks (Swarna, Sambhamah and Pusa Basmati) were collected from local market at Kumarganj, Faizabad and Department of GPB of Narendra Deva University of Agriculture and Technology. The experiment was carried out at the Department of Biochemistry of Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Faizabad (U.P.) India, located in the Indogangetic plains of Eastern Uttar Pradesh at 26-46 °N latitude and 82.12 °E longitudes at an altitude of 113 meters above the mean sea levels (MSL). The study was started with equal level of moisture content in all the germplasm of hybrid rice (Rice 13%). The Completely Randomized Design (CRD) was employed with three replications. As per requirement the following observation were recorded-

1. Germination: The seed of hybrid rice were soaked in water for 24 hours. One hundred soaked seeds were arranged in a grid pattern on a wet paper towel. Paper was placed in a closed container or cover the seeds with another moist paper towel and roll together by placing the sample in a plastic bag, ensure paper remains moist (but not wet otherwise seed will rot). Germinated seeds were counted after the 3 and 5 days later and recorded how many seeds have germinated. The germination percentage was computed using the following formula:

$$\text{Germination percent} = \frac{\text{Number of seeds germinated}}{\text{Total number of seeds on the tray}} \times 100$$

2. Kernel length (mm): Ten dehusked whole kernels were measured for length with the help of DIAL, Thickness Gage No. 7301 and its average length was taken to find out kernel length.

3. Kernel Breadth (mm): Ten dehusked whole kernel were measured for breadth with the help of DIAL, Thickness Gage No. 7301 and its average breadth was taken to find out kernel breadth.

4. L/B ratio: Length to Breadth ratio of various treatments was determined on the basis of average length and breadth ratio of rice kernel.

5. Test weight: 1000 seeds were counted manually and weighed on electronic balance and finally weight was recorded up-to two decimal places in gram.

6. Kernel shape: Shape was classified according to the method described by Cruz and Khush (2000).

Results and Discussion
Theinvestigation was under taken and results of the experiments presented, discussed and interpreted in the following-

Table 1: Average germination (%) and Kernel shape of hybrid rice.

Varieties	Average germination (%)	Average Kernel shape
Dhani	92	Short bold
US-312	93	Medium
6201	94	Medium
6302	89.5	Medium
6444	96.5	Medium
JK-401	94	Medium
PHB-71	95.5	Short slender
Swarna (C)	91.5	Long Slender
Sambhamah (C)	90	Long Slender
Pusa Basmati (C)	90.5	Long Slender
S.Em±	1.183	---------
CD at 5%	3.514	---------

1. Germination percentage
The data pertaining to the observation shows that the germination percentage in different treatments was ranged between 89.5 to 96.5 per cent. The highest germination percentage was recorded in variety 6444 (96.5%) followed by PHB-71 (95.5%). All the treatments regarding germination percentage of hybrid rice were found statistically significant. Germination percentage ofhybrid rice variety 6444 was recorded highly superior over Pusa Basmati and Sambhamah. Variation in germination percentage are closely related and supported by Vibhuti et al. (2014) [14] and Talei et al. (2013) [11].

2. Kernel shape
Kernel shape of the hybrid rice and check varieties is depicted in Table 1. Hybrid rice varieties Dhani and PHB-71 are short bold type and all check varieties are long slender type and rest of the hybrid rice varieties found medium. The present data obtained was similar to earlier reported by Sarkar et al. (1994) [8] and Rebeira et al. (2014) [7].

Table 2: Average Kernel length and Kernel Breadth of hybrid rice

Varieties	Average Kernel length (mm)	Average Kernel Breadth
Dhani	6.62	2.13
US-312	6.34	2.08
6201	6.66	2.05
6302	5.46	1.67
6444	6.86	1.80
JK-401	6.47	2.14
PHB-71	6.83	2.16
Swarna (C)	6.54	2.14
Sambhamah (C)	7.41	2.11
Pusa Basmati (C)	7.90	1.8
S.Em±	0.07	0.01
CD at 5%	0.22	0.03

3. Kernel length

Data related to Kernel length of the different treatments was determined from 5.46 mm to 7.90 mm. The kernel length was recorded maximum in Pusa Basmati (7.90 mm) followed by Sambhamah (7.41 mm) and 6444 (6.86 mm) and minimum was recorded in 6302 (5.46 mm). Kernel length of Pusa Basmati was significantly superior among all the varieties and highly superior over 6302. All the treatments regarding kernel length were found statistically significant. The variation of kernel length in different varieties may be due to its genetic characteristics. The present data obtained was found to be similar to the value reported by Bajpai *et al.* (2012) [2], Subudhi *et al.* (2012) [10] and Babu *et al.* (2013) [1].

4. Kernel breadth

Data related to Kernel breadth of different treatments was recorded from 1.67 to 2.16mm. The kernel breadth was found maximum in PHB-71 (2.16 mm) followed by Swarna (2.14mm),JK-401 and Dhani (2.13 mm) and minimum was recorded in 6302 (1.67 mm). Kernel breadth of PHB-71 was significantly superior among all the varieties and highly superior over 6302 in both the respective years. All the varieties of hybrid rice and check regarding kernel breadth during both years were found statistically significant. Similar observations have also been recorded by Bajpai *et al.* (2012) [2], Babu *et al.* (2013) [1] and Srivastava and Jaiswal (2013) [9].

Table 3: Average Kernel L/B ratio and Test Weight of hybrid rice

Varieties	Average Kernel L/B ratio	Average Test Weight (g)
Dhani	3.13	23.11
US-312	3.05	22.92
6201	3.23	23.28
6302	3.24	22.64
6444	3.81	23.86
JK-401	3.04	23.02
PHB-71	3.16	22.98
Swarna (C)	3.06	23.10
Sambhamah (C)	3.52	23.43
Pusa Basmati (C)	4.40	24.61
S.Em±	0.05	0.09
CD at 5%	0.14	0. 3

5. Kernel L/B ratio

L/B ratio can be observed from the Table 3 and Figure 4.3 that the variations in L/B ratio ranged from 3.05 to 4.40. L/B ratio was recorded highest in Pusa Basmati (4.40) followed by 6444 (3.81) and minimum was found in JK-401 (3.04). L/B ratio of Pusa Basmati was recorded highly superior over JK-401. All the treatments regarding kernel L/B ratio were found statistically significant in present research work. The present data obtained was similar to findings of as Dipti *et al.* (2002) [4], Trivedi (2007) [13] and Thomas *et al.* (2013) [12].

6. Test weight

Data related to test weight in hybrid rice is shown in Table 3 and Figure 4.3. Test weight of the different treatments was observed from 22.92 to 24.61 g. The test weight was recorded maximum in Pusa Basmati (24.61 g) followed by 6444 (23.86 g) and minimum was recorded in US-312(22.92g) and 6302 (22.64 g) respectively. Test weight of Pusa Basmati was significantly superior among all the varieties and highly superior over US-312 and 6302. All the treatments regarding test weight during both years were found statistically significant. Variation in test weight was proven statistically significant. It may be due to environment factor *i.e.* temperature effect seed weight and also correlated with moisture percentage. Variations in test weight are closely related with findings of Bezbaruha *et al.* (2011) [3], Kanchana *et al.* (2012) [5] and Babu *et al.* (2013) [1].

Conclusion

The variety Pusa Basmati found best as per kernel length, L/B ratio and test weight is concerned and found significantly superior among all the varieties followed by variety 6444.
As per germination is concerned hybrid rice variety 6444 was recorded highly superior with Pusa Basmati and Sambhamah and PHB-71. Although, high germination percentage was recorded in all the varieties.The variety Dhani was found as short bold type and PHB-71 short slender. The kernel breadth was found maximum in PHB-71.

References

1. Babu VR, Shreya K, Dangi KS, Usharani G, Nagesh P. Evaluation of popular rice (*Oryza sativa* L.) hybrids for quantitative, qualitative and nutritional aspects. International Journal of Scientific and Research Publications. 2013; 3(1):2250-3153.
2. Bajpai A, Singh Y, Singh US. Evaluation of grain quality of Kalanamak varieties/lines cultivated in Uttar Pradesh. International Journal of Scientific and Research Publications. 2012; 2(10).
3. Bezbaruha R, Sharma RI, Banik RC. Effect of nutrient management and planting geometry on productivity of hybrid rice (*Oryza sativa* L.) cultivars. American Journal of Plant Sciences. 2011; 2:297-302.
4. Dipti SS, Hossain ST, Bari MN, Kabir KA. Physiological and cooking properties of some fine rice varieties. Pakistan Journal of Nutrition. 2002; 1(4):188-190.
5. Kanchana S, Bharathi SL, Ilamaran M, Singaravadivel K. Physical quality of selected rice varieties. World Journal of Agricultural Sciences. 2012; 8(5):468-472.
6. Nguyen VN, Tran DV, Quach NH. The International Workshop held from 28 to 30 May 1998, Hanoi, Vietnam Ed. in Procd, 1998, 40-44

7. Rebeira SP, Wickramasinghe HAM, Samarasinghe WLG, Prashantha BDR. Diversity of Grain Quality Characteristics of Traditional Rice (*Oryza sativa* L.) Tropical Agricultural Research. 2014; 25(4):570-578.

8. Sarkar RK, Nanda BB, Dash AB, Lodh SB. Grain characteristics and cooking quality of aromatic and non aromatic, long and slender varieties of rice (*Oryza sativa* L.). Ind. J Agri. Sci. 1994; 20(2):132-142.

9. Srivastava AK, Jaiswal HK. Grain characteristics and cooking quality of indigenous aromatic and non-aromatic genotypes of rice (*Oryza sativa* L.). IJSRR., 2013; 2(1):36-41.

10. Subudhi HN, Swain D, Das S, Sharma SG, Singh ON. Studies on grain yield, physico-chemical and cooking characters of elite rice varieties (*Oryza sativa* L.) in Eastern India. Journal of Agricultural Science, 2012, 4(12).

11. Talei D, Valdiani A, Maziah M, Mohsenkhah M. The Scientific World Journal. 2013; 10:1155-1162.

12. Thomas R, Wan-Nadiah WA, Bhat R. Physiochemical properties, proximate composition and cooking qualities of locally grown and imported rice varieties marketed in Penang, Malaysia. International Food Research Journal. 2013; 20(3):1345-1351.

13. Trivedi V. Biochemical composition of aromatic rice. M.Sc. (Ag.) Thesis Department of Biochemistry, N.D.U.A. &T. Kumarganj, Faizabad, 2007.

14. Vibhuti SC, Bargali K, Bargali SS. Indian Journal of Agriculture Sciences. 2014; 85(1):102-108.

15. Zaman FU. Genetic studies on some of the cooking and nutritive qualities of cultivated rice (*Oryza sativa* L.). Ph.D., thesis, Univ of Bihar, 1981.

16. Zhao B. Examination of Hybrid Rice Seeds. International Hybrid Rice Training course. HHRRC, Changsha, China, 1995.