DOI : 10.5958/0974-0112.2016.00082.7

Indian J. Hort. 73(3), September 2016: 387-390

Genotypic variation in hip traits of Indian rose varieties

D.V.S. Raju*, K.V. Prasad, Namita, Kanwar Pal Singh, T. Janakiram and A. Nagaraja**

Division of Floriculture and Landscaping, ICAR-Indian Agricultural Research Institute, New Delhi 110012

ABSTRACT

The study was carried out to characterize the hips of the Indian garden rose varieties. Hips of eleven varieties, *viz*., Jantar Mantar, Pusa Pitamber, Rose Sherbet, Jawani, Manmatha, Delhi Princess, Dr Benjamin Pal, Pusa Veerangana, Pusa Mohit, Jawahar and Surabhi were studied. Significant variation was found between varieties with respect to hip length, hip width, hip form index, hip weight, hip flesh weight, hip flesh ratio, total number of achenes per hip, total achene weight per hip, titrable acidity and ascorbic acid content. The rose hip form index was between 0.95-1.21. The flesh weight of hips and hip: flesh ratio ranged between 1.38-5.80 and 66.70-84.00%, respectively. The number of achenes per hip ranged between 9.20-27.60. The titrable acidity (%) and ascorbic acid content in the varieties ranged between 1.33-3.13 and 20.88- 68.97 mg 100 g^{-1}, respectively. It can be concluded from the present study that garden varieties, *viz*., Pusa Veerangana, Pusa Mohit and Jawahar have favourable fruit traits like higher hip weight, better hip flesh ratio and higher vitamin C content among the selected garden varieties. These varieties have favourable traits that make them ideal candidates as donor parents for production of varieties suitable for processing.

Key words: Rose hip, ascorbic acid, hip form index, *Rosa* sp.

INTRODUCTION

Rose is universally acclaimed as "Queen of flowers". It occupies first position in the international trade. Rose is one of the most economically important ornamental species used as cut flower, potted and landscape plant in the world. For more than five thousand years, roses have delighted humans as ornamental plants, and have been used as medicinal plants and even as food (Gudin, 6). The fruit of the rose known as hip, is an excellent source of total phenolics (Hvattum, 8), vitamin C (Sen and Gunes, 11), carotenoids, sugars and mineral elements. The fruits or hips of rose are commonly used to make jam, marmalade, fruit juice *etc.* (Uggla and Nybom, 12); while the dried fruits and roots are excellent for making tea (Sen and Gunes, 11). Wild rose species have been domesticated for rose hip cultivation in several countries. Despite their wide usage, standard rose hip cultivars have not been developed till now (Ericsli, 4). Wild genotypes vary widely in terms of productivity and fruit characteristics such as size, shape, colour, flavour and nutritional value (Ercisli and Estiken, 3). There are no reports of characterization of hips of Indian varieties of garden roses. The present study was carried out to characterize hips of promising Indian varieties of garden roses.

MATERIALS AND METHODS

The material for the study was collected from the varieties being grown at the Research Farm of the Division of Floriculture and Landscaping, IARI, New Delhi in May, 2013. The farm is situated at 77° 12 'E longitude, 28° 40' N latitude and an altitude of 228.16 m above mean sea level. The climate is semi-arid, sub-tropical with hot summers and cold winters. The rose hip samples were collected from 11 varieties (Jantar Mantar, Pusa Pitamber, Rose Sherbet, Jawani, Manmatha, Delhi Princess, Dr Benjamin Pal, Pusa Veerangana, Pusa Mohit, Jawahar and Surabhi). The varieties were planted in Randomized Block Design in open field at a spacing of 60 cm × 60 cm. All the selected cultivars were given uniform cultural practices for proper growth and development. The parameters observed were hip length, hip width, hip form index, hip weight, hip flesh weight, hip: flesh ratio, number of achenes, and total achene weight per hip. Hip length and width were determined by using digital Vernier calipers. Hip form index was determined by the ratio of hip length and weight. Hip: flesh ratio was determined by the ratio of hip flesh weight and weight. Total achene weight per hip is the total weight of all the achenes in a hip. Titrable acidity was determined by titration method (Ranganna, 10) and expressed in mg g^{-1} fresh weight. Ascorbic acid was determined as per the standard method suggested by Ranganna (10) and expressed in mg 100 g^{-1} fresh weight. The data was analyzed with WASP 2.0 package for calculation of F- values and significance of means was estimated by applying RBD ($p \leq 0.05$) test.

*Corresponding author's E-mail : rajivalex@gmail.com

**Division of Fruits and Horticultural Technology, ICAR-IARI, New Delhi

RESULTS AND DISCUSSION

The hip characters of the rose varieties evaluated were significantly different (Tables 1 & 2). The length of the rose hips varied from 15.05-27.60 mm. The length was highest in cv. Surabhi and was lowest in cv. Manmatha. The width of rose hips in the varieties varied from 16.21 to 24.04 mm. The rose hip width was highest in cv. Dr Benjamin Pal and was lowest in cv. Pusa Pitamber and Rose Sherbet. The rose hip form index was between 0.95-1.21. The hip form index was highest in cv. Surabhi and lowest in Jawani. Hip form index indicated that that the hip form is more or less round to oval and less elongated. Elongated hips with highest hip form index (1.30-2.14) were reported in *R. canina* by Kovacs *et al.* (9). Higher hip form index is required for varieties and species to be grown for their ornamental value in landscaping.

The hip weight varied significantly among the varieties studied. The hip weight ranged between 2.59-7.70 g. Highest hip weight was recorded in cv. Surabhi and lowest in cv. Rose Sherbet. The highest hip weight reported was in *R. canina* (2.60-5.4 g) by various workers (Kovacs *et al*., 9; Gunes, 7; Celik, 2). Cultivars and species with higher fresh weight are desirable candidates for processing. The flesh weight of hips varied significantly among the varieties and ranged between 1.38-5.80 g. Flesh weight was highest

Table 1. Rose hip attributes of garden rose varieties.

Treatment	Rose hip length (mm)	Rose hip width (mm)	Rose hip form index	Rose hip wt. (g)	Flesh wt. of hip	Hip: flesh ratio (%)
Jantar Mantar	16.11	16.76	0.96	3.09	2.07	66.70
Pusa Pitamber	16.92	16.21	1.04	2.72	1.97	72.41
Rose Sherbet	16.68	16.21	1.04	2.59	1.73	67.00
Jawani	16.90	17.83	0.95	3.31	2.55	77.40
Manmatha	15.05	14.29	1.06	1.70	1.38	81.80
Delhi Princess	18.33	17.40	1.03	3.17	2.33	73.10
Dr. Benjamin Pal	23.96	24.04	1.00	6.99	5.69	81.50
Pusa Veerangana	19.66	20.72	0.97	4.45	3.24	73.10
Pusa Mohit	19.38	19.96	0.96	4.09	3.22	78.10
Jawahar	23.49	17.61	1.35	3.34	2.80	84.00
Surabhi	27.60	22.86	1.21	7.70	5.80	74.50
CD ($p \leq 0.05$)	1.39	1.98	0.09	1.02	0.66	5.01

Table 2. Rose hip attributes of garden rose varieties.

Treatment	No. of achenes/ hip	Achene length (mm)	Total wt. of achenes per hip	Titrable acidity (%)	Ascorbic acid (mg/100 g)
Jantar Mantar	25.00	6.24	1.02	2.12	24.44
Pusa Pitamber	18.70	6.01	0.76	3.13	26.09
Rose Sherbet	13.50	6.15	0.86	1.33	26.81
Jawani	17.30	6.04	0.74	2.13	20.88
Manmatha	11.80	5.47	0.33	2.14	24.88
Delhi Princess	11.30	7.17	0.84	1.74	25.62
Dr Benjamin Pal	21.60	6.56	1.30	2.32	27.33
Pusa Veerangana	18.20	6.84	1.13	1.95	68.97
Pusa Mohit	19.00	6.03	0.89	2.33	65.15
Jawahar	9.20	6.24	0.54	2.54	49.41
Surabhi	27.60	6.67	1.90	2.18	37.78
CD ($p \leq 0.05$)	4.29	0.49	0.24	0.14	4.78

in cv. Surabhi and lowest in Manmatha. There was significant variation with respect to hip flesh ratio. Hip flesh ratio ranged between 66.70-84.00% among the varieties. The cv. Jawahar was having the highest hip flesh ratio and the lowest was recorded in cv. Jantar Mantar. The hip: flesh ratio was almost similar to the ratio (59.0-80.9%) as reported by Gunes and Sen (11). There was significant variation in the number of achenes per hip in the varieties studied and it ranged between 9.20-27.60. The highest numbers of achenes per hip was found in cv. Surabhi and the lowest in cv. Jawahar. Ercisli and Guleryuz (5) indicated that hips of rose species have on an average 40 seeds per fruit. Approximately, 30-35% of fruit is made of seed, while the remaining 65-70% is pericarp. In contrast to the species, the number of achenes in the varieties studied was lower. The hip: flesh ratio is also favourable making them suitable candidates for use in breeding programme to produce varieties for processing. Varieties like Jawahar having less number of achenes and having high hip: flesh ratio are desirable for processing. Varieties like Surabhi having the highest number of achenes per hip can be used effectively as female parents in rose breeding programme. The achene length varied from 5.47-7.17 mm and the variation was significant. Highest achene length was observed in cv. Delhi Princess and lowest in Manmatha. The total weight of achenes in a hip varied from 0.33-1.33 g among the varieties. It was highest in cv. Dr Benjamin Pal and lowest in Manmatha.

There was significant variation with respect to titrable acidity (%) in the varieties and it ranged between 1.33-3.13. It was highest in cv. Pusa Pitamber and lowest in Rose Sherbet. Gunes (7) reported a range of 1.3-2.4% titratable acidity in rose species. Ascorbic acid content of rose hips varied significantly among the varieties and it ranged between 20.88-68.97 mg/100 g. It was highest in Pusa Veerangana and lowest in Jawani. Significant difference in ascorbic acid content was not found between Pusa Veerangana and Pusa Mohit. Pusa Mohit is a thornless variety and thornlessness was the major objective in rose breeding for hip programme to obtain thornless genotypes for ease of harvest (Ercisli, 4). The ascorbic acid content in the studied garden varieties was low. Gunes (7) reported a range of 190-1223 mg/100 g of ascorbic acid content among 13 promising rose hip selections. The ascorbic acid content of fruit is affected by genotype, fruit maturity, altitude (Celik *et al*., 1), light status and endogenous growth regulators. Celik *et al*. (1) reported that low temperature reduces the respiration rate of rose hips, which can slow or delay degradation of ascorbic acid. According to literature, the ascorbic acid content of *R. rubiginosa* was 1200 mg/100 g ascorbic acid and that of *R. canina* (734 to 1032 mg/100 g; Celik *et al*., 2). Vitamin C content of wild species grown in Turkey like *R. canina*, *R. rubignosa*, *R. dumalis*, *R. pisiformis*, *R. purvulenta* and *R. hemisphaerica* was high. The low ascorbic acid content in the selected varieties may be explained by involvement of fewer species containing higher ascorbic acid content in their ancestry. The selected Indian varieties may not have species like *R. canina* and *R. rubignosa* in their ancestry. In spite of their low ascorbic acid content the selected varieties have favourable hip characters like higher hip weight, lower achene content and better hip flesh ratio making them better candidates as donor parents for production of varieties. The present study is indicating the need to introgress the trait of species like *R. canina* and *R. rubiginosa* in modern garden varieties.

It can be concluded from the present study that garden varieties, *viz*., Pusa Veerangana, Pusa Mohit and Jawahar have favourable fruit traits like higher hip weight, better hip: flesh ratio and higher ascorbic acid content among the selected garden varieties and can be used as candidates for processing or as donor parents in breeding programme.

REFERENCES

1. Celik, F., Kazankaya, A. and Ercisli, S. 2006. Different altitudes on vitamin C content of rose hip (*Rosa* spp.) genotypes, *2nd National Minor Fruit Symposium*, Tokat, Turkey, pp. 313-16.

2. Celik, F., Kajankaya, A. and Ercisli, S. 2009. Fruit characteristics of some selected promising rose hip (*Rosa* spp.) genotypes from Van region of Turkey. *African J. Agri. Res.* **4**: 236-40.

3. Ercisli, S. and Estiken, A. 2004. Fruit characteristics of native rose hip (*Rosa* spp.) selections from the Erzurum province of Turkey. *New Zealand J. Crop Hort. Sci*. **32**: 51-53.

4. Ercisli, S. 2005. Rose (*Rosa* spp.) germplasm resources of Turkey. *Genet. Res. Crop Eval.* **52**: 787-95.

5. Ercisli, S. and Guleryuz, M. 2006. Fruit properties of promising rose hips (*Rosa* spp.) from the North-eastern Anatolia region of Turkey. *Asian J. Chem*. **18**: 239-42.

6. Gudin, S. 2000. Rose: Genetics and breeding. *Plant Breed. Rev*. **17**: 159-89.

7. Gunes, M. 2010. Pomological and phonological characteristics of promising rose hip (*Rosa*) genotypes. *African J. Biotech*. **9**: 6301-06.

8. Hvattum, E. 2002. Determination of phenolic compounds in rose hip (*Rosa canina*) using liquid chromatography coupled to electrospray ionization tandem mass spectrometry and diode-array detection. *Rapid Comm. Mass Spectrometry*, **16**: 655-62.

9. Kovacs, S., Toth, M.G. and Facsar, G. 2000. Fruit quality of some rose species native in Hungary. *Acta Hort*. **538**:103-08.

10. Ranganna, S. 1999. *Handbook of Analysis and Quality Control for Fruit and Vegetable Products* (II Edn.), Tata McGraw Hill Pub. Co. Ltd., New Delhi.

11. Sen, S.M. and Gunes, M. 1996. Some physical and chemical properties of rose hips grown in Tokat district. *Proceedings of the 1st Rose Hip Symposium*, 5-6 September, 1996, Gumushane, Turkey, pp. 231-39.

12. Uggla, M. and Nybom, H. 1996. Domestication of a new crop in Sweden-dog roses (*Rosa* sect. *caninae*) for commercial rose hip production. *Acta Hort.* **484**: 147-51.

Received : May, 2013; Revised : April, 2016;
Accepted : May, 2016