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STUDIES ON SURVEY, COLLECTION AND EVALUATION OF WATER CHESTNUT (*TRAPA NATANS* VAR. *BISPINOSA* ROXB.) UNDER SATHIAON BLOCK OF AZAMGARH DISTRICT OF UTTAR PRADESH.

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ABSTRACT

The investigation entitled "studies on survey, collection and evaluation of water chestnut (*Trapa natans* var. *bispinosa* Roxb.) under Sathiaon Block of Azamgarh District of Uttar Pradesh" was carried out comprising eight villages viz., Pahi Ghat, Mafiya, Pichari, Rasulpur, Amilo, Baniyapara, Hafizpur, Ojhauli in the Azamgarh district of U.P. in 2007-08. The Physico-chemical parameters were observed in the Laboratory of the Department of Applied Plant Science (Horticulture), Babasaheb Bhimrao Ambedkar University, Lucknow. Fifteen cultivars Khas Gulab-1, Chhota Dana, Light green (Safed)-1, Hara-1, Khas Gulab-2, Hardiya-1, Hara-2, Light Green (Safed)-2, Khas Gulab-3, Dambu-1, Hara-3, Bhudiya-1, Hardiya-2, Dambu-2, Khas Gulab-4 were found to grow under these villages. It has been observed that maximum length of fruit and cheek diameter was recorded in cultivar Khas Gulab-1 (4.810 cm and 4.646 cm, respectively). Maximum fruit breadth, weight and breadth of Kernel was recorded in cultivar Hara-2 (4.716 cm, 37.796 g. and 3.916 cm, respectively). Maximum peel weight was recorded in cultivar Hardiya-1 (23.836 g). Maximum weight, length of kernel and cheek diameter was recorded in cultivar Dambu-1 (14.500 g, 3.838 cm. and 3.863 cm, respectively). Maximum T.S.S. content was recorded in cultivar Hardiya-2 (10.533 ^{0}Brix). Maximum ascorbic acid and acidity content was recorded in cultivar Khas Gulab-2 (9.703mg/100g and 0.0910 %, respectively), while the minimum acidity was recorded in cultivar Bhundiya-1 (0.0640 %).

INTRODUCTION

Water chestnut (*Trapa natans* var. *bispinosa* Roxb.) commonly known as 'Singhara' or 'Pani Phal' all over India belongs to family Trapaceae and is a minor fruit of India. It is an aquatic nut crop usually grown in rainy season in ponds and lakes. The edible portion is mature kernel **(Chakor, 1974).**

The fruit is a one seeded, top shaped drupe. The fleshy pericarp of which is delicious and covers a large two or four horned stony endocarp (Pyxen**a**). Based on colour of the husk, water chest nut is categorized into three types: completely green , completely red and green blended with red (**Ahmad and Singh, 1998).**

Although water chest nut is a tropical crop but is cultivated commercially in tropical and subtropical parts of the world such as Pakistan, Sri Lanka, Indonesia, Africa, South-Eastern countries of Asia and USA. Currently it is also cultivated in Japan, Taiwan, China, Thailand as well as Australia. In India, it is cultivated in U.P., Bihar, Tamilnadu, W.B., Assam, Orissa and Jammu & Kashmir **(Chakor, 1974).**

Prof. R.B. Ram

Prof. R. B. Ram, born on April 14, 1957 at Rampur Balbhadra (Jakhanian), Ghazipur, Uttar Pradesh. He did his B.Sc (Ag.), M.Sc (Ag.) and Ph.D (Horticulture) from Banaras Hindu University. Awarded, Verma Endowment Merit Scholarship, BHU; JRF (ICAR) and JRF & SRF (UGC) for pursuing B.Sc (Ag.) and M.Sc (Ag.) & Ph.D programmes in Horticulture, respectively. He has outstandingly contributed to Horticultural teaching, research and development in his career spanning 25 years, with his distinguished academic record, commitment and vision. Starting his career as a scientist, Defence Agricultural Research Laboratory (now DIBER, Haldwani) at Almora in 1985. He held various positions which include Scientist B to D, especially as Officer – in – charge of its various Field stations viz., Auli (Joshimath), Panda (Pithoragarh), Jhakri (H.P.), Pooh (Kinnour), Sumdho (Lahaul – Spiti), H.P. and Haldwani (Nainital). In the year 1997, he joined as a Reader, Horticulture under Centre for Rural Technology and in 2000 as Head, Deptt. Of Applied Plant Science (Horticulture), became Professor, DAPS (Hort.) in 2006 and Dean, on September 27, 2008, School for Biosciences & Biotechnology till date, Babasaheb Bhimrao Ambedkar University, Lucknow. His contribution as an academician, Dean, Procter, D.S.W., Coordinator, C.R.T. , Head, D.A.P.S & D.A.A.S. and Finance Officer & Registrar (Officiating), Babasaheb Bhimrao Ambedkar University, Lucknow. From 2008, he has been closely associated with activities of National Assessment and Accreditation Council (NAAC), Bangalore. Dr. Ram has been instrumental in organizing one National Seminar, several special lecture series, Development of Horticultural Research Farm, creation of state–of-the–art lab and some varieties of fruit crops are under the process of development at Babasaheb Bhimrao Ambedkar University, Lucknow. He has provided leadership to Horticulture and is credited to have authored one book, 5 Bulletins, besides 100 Research papers and guided 6 Ph.D in Horticulture. In addition to this, honoured for outstanding work in the field of horticulture on Waste Land Management, especially guava crop by CISH (ICAR), Lucknow during Ist International Guava Symposium - 2005. He is also life member of 6 Professional Societies and had been associated with 12 Agricultural R & D projects. Of these, under 2 projects, he worked as a Principal Investigator. The major areas of research *inter alia*: Crop Improvement, Crop Production, Crop Protection and Crop Utilization. Expertise has been gained in the field of Horticulture viz., Fruit Science, Vegetable Science, Floriculture (Ornamental Gardening & Landscaping), Medicinal and Aromatic Plant etc. through teaching /learning, research, extension and training programme.

The pulp contains 70% moisture, 23.9% Carbohydrate, 4.7% Protein, 0.2% Fats, 1.1% minerals and 20 I.U. vitamins A (**Aykroyed, 1941)**. It has 9.8 mg /100g Vitamin C, T.S.S. 7 ^{0} Brix and acidity 0.09%. This crop has got medicinal important due to starchy nature. In certain tribal villages, the flour is used for treatment of diarrhoea and abdominal pain. It is used in textile industry also **(Kumar, 1984)**. It is necessary to not only study and identify cultivars but also to make proper rich collections for their preservation **(Zahedi and Sanei, 2006).** Physico-chemical characteristics of fruit play an important role in fruit improvement programmes since, superior quality cultivars can be selected after a detailed survey of area in which they are indigenous and adopted for commercial cultivation.

Keeping this in view, the present study was undertaken for screening the chestnut (*Trapa natans* var. *bispinosa* Roxb.) cultivars Under Sathiaon Block of Azamgarh District of Uttar Pradesh.

MATERIALS AND METHODS

The present investigation entitled "Studies on survey, collection and evaluation of water chestnut (*Trapa natans* var. *bispinosa* Roxb.) under Sathiaon Block of Azamgarh District" was conducted in the Research Laboratory of the Department of Applied Plant Science (Horticulture), Babasaheb Bhimrao Ambedkar University, Lucknow, during in the year 2007-2008.

A survey was carried out in eight villages of Azamgarh district of U.P. viz., Pahi Ghat, Mafiya, Pichari, Rasulpur, Amilo, Baniyapara, Hafizpur, and Ojhauli in 2007-08. Fifteen cultivars Khas gulab-1 (T_1) Chhota Dana (T_2), Light green (Safed)-1 (T_3), Hara-1-(T_4), Khas gulab-2 (T_5) Hardiya-1 (T_6), Hara-2 (T_7), Light green Safed-2 (T_8), Khas gulab-3 (T_9), Dambu-1 (T_{10}), Hara-3 (T_{11}) Bhundiya-1 (T_{12}), Hardiya-2 (T_{13}), Dambu-2 (T_{14}), Khas gulab-4 (T_{15}) were found to grown under these villages.

The Physico-chemical parameters were observed in the Laboratory of the Department of Applied Plant Science (Horticulture), Babasaheb Bhimrao Ambedkar University, Lucknow. The study has been divided in to two parts:

Table-1- Physical characteristics of fruit of Water chestnut.

Cultivars	Parameters					
	Length (cm)	Breadth (cm)	Cheek Diameter of (cm)	Weight (g)	Specific gravity	Peel weight (g)
Khas Gulab-1 (T_1)	**4.810**	4.473	**4.646**	23.493	1.356	16.826
Chhota Dana (T_2)	3.746	**3.800**	3.956	20.516	**1.497**	9.706
Light green (Safed)-1 (T_3)	3.736	4.166	3.906	23.443	1.311	11.000
Hara-1 (T_4)	4.310	4.113	4.306	21.773	1.426	12.886
Khas Gulab-2 (T_5)	3.956	4.476	4.103	21.706	1.219	12.100
Hardiya-1 (T_6)	3.866	4.586	4.270	37.570	1.114	**23.836**
Hara-2 (T_7)	4.683	**4.716**	**4.646**	**37.796**	1.192	23.136
Light green Safed-2 (T_8)	4.123	4.420	4.186	26.993	1.056	15.616
Khas gulab-3 (T_9)	4.143	4.230	4.190	21.706	1.209	11.333
Dambu-1 (T_{10})	3.850	3.896	3.883	21.070	1.094	**9.163**
Hara-3 (T_{11})	4.110	4.116	4.050	20.733	1.157	10.203
Bhundiya-1 (T_{12})	**3.660**	4.043	**3.683**	20.536	1.084	10.756
Hardiya-2 (T_{13})	3.866	4.410	4.263	27.696	1.102	14.183
Dambu-2 (T_{14})	3.786	4.053	3.703	**20.043**	1.137	11.636
Khas gulab-4 (T_{15})	4.070	4.376	4.513	26.653	**1.023**	17.510
C D at 5 %	0.416	0.386	0.360	4.915	0.0287	**1.212**

1. Survey of water chestnut growing areas in Sathiaon Block of district Azamgarh.
2. Collection and Evalution of germplasm of water chestnut from ponds of Sathiaon Block of Azamgarh District of Uttar Pradesh:

Fruit of water chestnut from different villages as cited above were collected in the month of October – November. Mature fruits of water chestnut were harvested from the ponds where they are grown on commercial level. The fruits were collected in polythene bas along with some water and brought for the physico – chemical analysis in the Horticultural Laboratory of the Department. The experiment was laid out in a Completely Randomized Block Design (CRD) and was replicated thrice. Nine healthy water chestnut fruits of uniform size were taken for observations. Physical parameters of fruit was recorded on length of fruits (cm), breadth of fruits (cm), cheek diameter of fruits (cm), weight of fruits (g), volume of fruits (ml), specific gravity of fruits, length of kernel (cm.), breadth of kernel (cm), cheek diameter of kernel (cm), weight of kernel (g), volume of kernel fruits (ml), specific gravity of kernel, weight of peel (g) and kernel: peel ratio.

For Bio-chemical parameters, nine fully matured fruits were selected randomly. The T.S.S. was recorded directly with the help of hand refractometer (ERMA, Japan, 0-30 °Brix), while acidity was determined by diluting the juice and titrating it against 0.1N NaOH using phenolphthalein indicator and was expressed as percent citric acid. Ascorbic acid was determined with the help of three percent metaphosphoric acid and 2, 4 - dichlorophenol-indophenol dye **(Ranganna, 1991).** The data recorded during observations was analyzed to test the level of significance as per standard method **(Chandel, 1984).**

Table: 2- Physico-Chemical characteristics of Kernel of Water chestnut.

Cultivars	Parameters							
	Length (cm)	Breadth (cm)	Cheek Diameter of (cm)	Weight (g)	Specific gravity	Total soluble solids(^{0}B)	Ascorbic acid (mg/100g)	Acidity (%)
Khas gulab-1 (T_1)	3.636	3.508	3.703	10.666	1.408	7.633	9.230	0.076
Chhota dana (T_2)	3.111	3.450	3.625	10.083	**1.910**	5.366	**8.046**	0.069
Light green (Safed)-1 (T_3)	**3.035**	3.406	3.558	**7.416**	1.412	4.700	8.993	0.083
Hara-1 (T_4)	3.473	3.396	3.555	10.250	1.170	5.833	**8.046**	0.082
Khas gulab-2 (T_5)	3.186	3.761	3.821	11.250	1.331	4.616	**9.703**	**0.091**
Hardiya-1 (T_6)	3.330	3.470	**3.425**	12.250	1.253	5.933	8.283	**0.091**
Hara-2 (T_7)	3.281	**3.916**	3.466	9.416	1.204	**4.600**	9.446	0.083
Light green Safed-2 (T)$_8$	3.311	3.700	3.625	9.666	0.972	6.133	8.756	0.074
Khas gulab-3 (T_9)	3.366	3.636	3.501	13.333	1.289	9.333	9.230	0.082
Dambu-1 (T_{10})	**3.838**	3.426	**3.863**	**14.500**	1.111	7.966	8.993	0.074
Hara-3 (T_{11})	3.323	3.483	3.611	11.833	1.028	7.800	9.230	0.076
Bhundiya-1 (T_{12})	3.261	3.490	3.791	10.250	1.213	7.500	8.520	**0.064**
Hardiya-2 (T_{13})	3.403	3.880	3.490	11.883	1.051	**10.533**	8.992	0.068
Dambu-2 (T_{14})	3.285	**3.306**	3.751	11.000	**0.931**	8.300	**8.046**	0.065
Khas gulab-4 (T_{15})	3.273	3.410	3.508	9.583	1.055	6.866	9.230	0.072
C D at 5 %	**0.079**	**0.059**	**0.073**	**0.317**	**0.085**	**0.503**	**0.370**	**0.006**

RESULTS AND DISCUSSION

A very little work has been done on survey, collection and evaluation of physico-chemical parameters of water chestnut. The observations were recorded with respect to physical parameters of fruits and Bio-chemical parameters of fruits have been revealed through critically analysis is as follows:

Physical parameters of fruits:

In the present study, the observations recorded in all fifteen cultivars of water chestnut by different scientific methods were mostly significant. A statistically significant difference in length and cheek diameter of fruit was recorded in all fifteen cultivar of water chestnut. It has been observed that maximum length of fruit and cheek diameter was recorded in cultivar Khas Gulab-1 (4.810 cm and 4.646 cm, respectively), while the minimum fruit length and cheek diameter was recorded in cultivar Bhundiya-1 (3.660 cm and 3.683 cm, respectively).

It is evident from the table-1, that breadth of fruit shows significant difference. The maximum breadth and weight of fruit was 4.716 cm and 37.796 g., respectively, while minimum breadth (3.800cm.) was observed in cultivar Chhota Dana. The minimum weight of fruit (20.043 g) was found to be recorded in cv. Dambu-2. In the present study considerable variation were recorded in specific gravity of fruit of water chestnut. The variability in specific gravity of fruit was found to vary from 1.023 to 1.497. Maximum specific gravity of fruit was recorded in cultivar Chhota Dana-2 (1.497), while it was minimum (1.023) in cultivar Khas Gulab – 4. Maximum peel weight was recorded in cultivar Hardiya-1 (23.836 g.), while it was recorded minimum (9.163) in cv. Dambu -1. The observation regarding Peel weight

was in agreement with result of **Dixit and Banerjee (2003).**

Physico-chemical parameters - Kernel:

Significant variation in cheek diameter and length of kernel were observed. Maximum weight, length of kernel and cheek diameter was recorded in cultivar Dambu-1 (14.500 g., 3.838 cm. and 3.863 cm, respectively), while the maximum breadth of kernel was recorded in cultivar Hara-2 (3.916 cm), and it was recorded minimum (3.306 cm) in cv. Dambu-2. Variation observed in all fifteen cultivars was significant regarding to breadth of kernel. Minimum cheek diameter of kernel (3.425cm) was found to be in cv. Hardiya-1, while minimum weight and length of kernel was recorded in T_3 (7.416 g and 3.111 cm, respectively). The variation in weight of kernel may be because the latter stage of water chestnut had higher kernel weight (**Mandal *et al.*, 1997**). Maximum specific gravity was recorded in cultivar Chhota Dana (1.910), while the minimum (0.931) specific gravity of kernel was recorded in cultivar Dambu – 2.

In present studies a significant variation was recorded in all fifteen cultivar with regard to their total soluble solids (T.S.S.). Maximum T.S.S. content was recorded in cultivar Hardiya-2 (10.533 ^{0}Brix), while it was observed minimum (4.60 ^{0}Brix) in cultivar Hara-2. **Biswas and Roy (1983)** reported that in Litchi, TSS increased with increase in aril weight and advancement in the age of litchi fruit but the time taken to reach the highest value of T.S.S. varied widely with cultivars and the geographical location of the orchard site. Similar observations have been reported by **Roschowdhary *et al.* (1962)** who reported the vitamin-C contents of the kernel (9 mg/100 g). The ascorbic acid and acidity was found to vary significantly. Quantity of ascorbic acid and acidity was recorded maximum in cultivar Khas Gulab - 2 (9.703mg/100g and 0.0910 %, respectively), while the minimum ascorbic acid content was recorded in cultivar Chhota Dana-2, Dambu-2, Hara-1 (8.046 mg/100g) and acidity was minimum (0.0640 %) in cultivar Bhundiya-1. T.S.S. and acidity showed a tendency of increase with delayed harvesting and the harvesting delay also increased the Vitamin-C content **(Supe *et al.* 1998).** These observations were similar with studies of **Mustard (1952)**.

On the basis of overall performance it is concluded that the water chestnut cultivars Khas Gulab-1 was the best cultivar however, cultivars Hardiya-2 and Khas Gulab-2, Dambu-1, Hara-2 and Hardiya-1 were also found superior and more suitable for commercial cultivation under Sathiyaon Block of District Azamgarh, U.P. since they have a large fruit size, attractive appearance and better fruit quality parameters as compared to other cultivars.

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