

RESEARCH ARTICLE

DOI: 10.15740/HAS/IJFCI/8.1/12-16

Estimation of variability and genetic parameters for nut characters (weight, diameter and length) in the seedling raised natural walnut (*Juglans regia* L.) population in the Kashmir valley

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ABSTRACT : The present investigation entitled estimation of variability and genetic parameters for nut characters (weight, diameter and length) in the seedling raised natural walnut (*Juglans regia* L.) population in the Kashmir valley was carried out in order to document the available genetic variability in walnut germplasm and to select elite walnut genotypes possessing superior attributes and quality traits. During the survey, data was recorded on one hundred fifty two (152) walnut trees growing in different areas of Kashmir valley. Remarkable variability was observed in seedling walnut trees for different morphological, nut and kernel characters. Similarly, variations were also reported for other characters viz., tree vigour, growth habit, branching habit, leaflet shape, shoot colour, nut shape, shell texture, shell colour, shell seal, shell strength, shell integrity, kernel shrivel and kernel colour. The nut length varied from 30.0-60.0 mm with a population mean of 55.62 ± 3.28 mm. The phenotypic and genotypic variance was 605.14 and 427.56, corresponding to their co-efficients of variation to the extent of 44.25 and 37.17 per cent, respectively. Heritability (broad sense) and expected gain (% of the mean) was 70.65 per cent and 64.36, respectively. Nut weight revealed a population mean of 14.48 ± 2.54 g with a range of 8.50-30.0 g. The phenotypic (18.785) and genotypic (12.760) variance when translated into their respective co-efficients of variation gave the estimate of 27.98 and 23.02 per cent, respectively. Broad sense heritability was 67.9 per cent and expected genetic gain (% of the mean) as 39.15.

KEY WORDS : Walnut, Nut characterises, Weight, Length

HOW TO CITE THIS ARTICLE : Lone, Imtiyaz Ahmad (2017). Estimation of variability and genetic parameters for nut characters (weight, diameter and length) in the seedling raised natural walnut (*Juglans regia* L.) population in the Kashmir valley. *Internat. J. Forestry & Crop Improv.*, 8 (1) : 12-16, DOI: 10.15740/HAS/IJFCI/8.1/12-16.

ARTICLE CHRONICAL : Received : 10.04.2017; Revised : 26.04.2017; Accepted : 06.05.2017

INTRODUCTION

The Persian walnut (*Juglans regia* L.), known as

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the English walnut, belongs to the family Juglandaceae. English walnut has its origin in the eastern Europe, Asia minor and points eastward to Himalayan mountains. The native habitat of walnut extends from the Carpathian mountains to Europe across Turkey, Iraq, Afghanistan, South Russia and further eastward into the foot hills of

the Himalayas. In India walnuts are usually grown in the mid hill areas of Jammu and Kashmir, Himachal Pradesh, and upper hills of Uttarakhand and Arunachal Pradesh. The soil most suitable for its cultivation should be well-drained and deep silt loamy containing organic matter in abundance. It should not have a fluctuating water level, hard pan and/or sandy sub-soil with alkaline reaction. A soil 2.5 to 3.0 m deep gives best results because the roots can penetrate deep and utilize residual soil moisture during dry spell and also make available sufficient nutrients. Furthermore, availability of sufficient moisture in the leaves can reduce the damage due to sun burning of leaves, shoots and young fruits. Walnut is grown commercially in about 48 countries with an area of 66, 58, 966 hectares. The world walnut production is about 16, 70, 109 MT. The chief walnut producing countries are China (22%), USA (20%), Iran (12%) and Turkey (10%) (Anonymous, 2007). India accounts for about 2.0 per cent of the world production. In India, Jammu and Kashmir is leading both in area as well as in production with an area of 82.04 thousand ha and production of 146.78 thousand tonnes. However, the productivity level of 1.79 t ha⁻¹ is far below than other countries. Himachal Pradesh has an area of 6.54 thousand ha with a production of 1.24 thousand tonnes and productivity level of 0.19 t ha⁻¹; while Uttarakhand has an area of 19.26 thousand ha with a production of 8.73 thousand tonnes and productivity level of 0.45 t/ha and Arunachal Pradesh has an area of 2285 ha with a production of about 51 tonnes and productivity level of 0.022 t/ha.

In the state of Jammu and Kashmir, Anantnag is the leading district both in area as well as production corresponding to an area of 13647 ha and production of 41180 tonnes with a productivity level of 3.01 t ha⁻¹, followed by the Kupwara district that covers an area of 8175 ha with 22103 tonnes production and a productivity level of a 2.70 t ha⁻¹. Kulgam ranks 6th in area and 3rd in production in the J&K state and has the highest productivity of 3.52 t ha⁻¹, which is even higher than that of USA. This indicates that the state has the right type of agro-climatic conditions and vast potential to produce export quality walnut and kernels. The walnut in Jammu and Kashmir state, due to their origin to non-descriptive type of seedlings, has resulted in the production. The cultivar evaluation has scientific merits for a system that can ensure the release of genetically distinct elite cultivars. These in turn can promote its productivity,

contribute to conservation of genetic resources and also promote breeding strategies that will support both horticulture and plant breeding (Smith and Smith, 1988). of a mixed crop that envisages lot of variation in the nut and kernel characteristics (Bhat *et al.*, 1999). In many cases the propagation ratio can be improved by using a stronger cytokinin or increasing its concentration. However, this can sometimes have detrimental effects in the later stages of micro propagation. Micro propagation studies have also been carried out in some other species of nuts and similar trees like hazelnut (Radojevic *et al.*, 1975; Mele and Messeguer, 1983 and Perez *et al.*, 1983); chestnut (Vieter and Vieter, 1980) and almond (Mehra and Mehra, 1974). But reports on *in vitro* walnut culture are scarce.

EXPERIMENTAL METHODS

The present investigation entitled estimation of variability and genetic parameters nut characters (weight, diameter and length) in the seedling raised natural walnut (*Juglans regia* L.) population in the Kashmir valley was carried out during the crop seasons of 2013 and 2014. The studies comprised two clusters of germplasm extending over the main geographical distribution of cultivation in the Jammu and Kashmir state. Genetic variability studies and diversity were estimated in the natural walnut population of Kashmir valley forming two cluster populations. Two standard check cultivars (Sulaiman and Hamdaan) were used for comparison.

Cluster-I :

Plant materials in this cluster comprised 75 *in situ* earmarked seedling raised plants that were identified after detailed survey of the areas having large concentration of the crop in the districts of Kupwara and Baramulla.

Cluster-II :

In this cluster plant materials also comprised 75 *in situ* earmarked seedling raised plants that were identified after extensive survey of promising materials in the Pulwama and Shopian districts of South Kashmir and Budgam district of central Kashmir. The data of both the clusters (over 2 years) was pooled together for statistical analyses. Morphological characters were recorded as per the Standard Descriptor of Walnut recommended by IBPGR. Colour of the kernels was scored as for nut and

kernel characters a random sample of 20 nuts was selected from the harvested lot of each earmarked tree in both the years and data recorded after proper drying of the nuts. Following characters were studied as per the Descriptor

Nut weight (g) :

The weight of 20 randomly selected dried nuts from the harvested lot of each tree was recorded on a high precision technical balance and the average expressed in grams.

Nut diameter :

The diameter of randomly selected dried nuts taken for nut weight was measured by using vernier calliper and expressed in millimetres both for suture and cheek.

Nut length :

The length from distal to top proximal end was measured for each of the 20 randomly selected dried nuts by using vernier calliper and expressed in millimetres.

parameters for these two traits were nearly similar. Population mean was 33.73 ± 2.82 and 34.63 ± 2.92 mm, respectively. Range of variability as 24.5- 50.5 and 25.5-50.0 mm, respectively. Phenotypic variance as 18.544 and 19.457 and genotypic variance as 10.421 and 12.338, respectively. Phenotypic co-efficient of variation as 12.76 per cent in both the traits, while genotypic co-efficient of variation was 9.53 and 10.13 per cent, respectively. Heritability (broad sense) was 56.2 and 63.1 per cent, respectively. The expected genetic gain (% of the mean) was 14.77 and 16.59, respectively. Nut size especially diameter at suture line is an important attribute for commercial grading standard and should not be less than 3.11 mm (Serr and Forde, 1956). Four selections P-3, P-123, V-I and Wosan-3, had a nut diameter ranging between 3.41 and 3.70 cm (Bhat *et al.*, 1992). Beyham and Permir (2006) evaluated 13 promising walnut genotypes. In the selected genotypes the nut length ranged from 34.48-60.42 mm, nut width from 30.38-45.24 mm, nut diameter at the cheek from 32.54-47.96 mm, nut size at the suture from 33.97-50.80 mm and nut weight from 11.84-24.19 g. Akea and Sen (2001) reported that the genetic variability in nut weight of the seedling raised population of walnut varied from 9.36-18.60g. Sharma and Sharma (2001) observed that for nut characters the magnitude of variation was 6.40-20.55 g (nut weight), 27.05-47.15mm (nut length), 0.59-1.09 (index of nut roundness) and 2.30-6.95mm (pad width). Guzken and Weiching (1990) reported that nut weight could serve as a good parameter for selection in walnuts. Lal *et al.* (1993) recorded a nut weight of 10.97 to 11.55g per cent kernel oil content in 48 specimens of walnuts. In Jammu and Kashmir walnut cultivation is mainly based upon

EXPERIMENTAL RESULTS AND ANALYSIS

Nut weight revealed a population mean of 14.48 ± 2.54 g with a range of 8.50-30.0 g. The phenotypic (18.785) and genotypic (12.760) variance when translated into their respective co-efficients of variation gave the estimate of 27.98 and 23.02 per cent, respectively. Broad sense heritability was 67.9 per cent and expected genetic gain (% of the mean) as 39.15. The size of the nut was measured in terms of its diameter at the suture line and cheek. The mean values for different variability

Table 1 : Estimation of variability and genetic parameters for nut characters (weight, diameter and length) in the seedling raised natural walnut (*Juglans regia* L.) population in the Kashmir valley (Pooled values over 2 years)

Parameters estimated	Nut weight (g)	Nut diameter		Nut length (mm)
		Suture (mm)	Cheek (mm)	
Population mean	14.48±2.54	33.73±2.82	34.63±2.92	55.62 ±3.28
Range	8.50-35.00	24.50-50.50	25.50-50.00	30.00-60.00
Phenotypic variance (σ^2_p)	18.785	18.544	19.457	605.14
Genotypic variance (σ^2_g)	12.760	10.421	12.338	427.56
Environmental variance (σ^2_e)	6.025	8.122	17.209	177.58
Phenotypic co-efficient of variation (PCV)	27.98%	12.76%	12.76%	44.25%
Genotypic co-efficient of variation (GCV)	23.02%	9.53%	10.13%	37.17%
Heritability broad sense (h^2)	67.9%	56.2%	63.1%	70.65%
Expected genetic gain (% of mean) at 5% selection intensity (k = 2.06)	39.15	14.77	16.59	64.36

conventional methods, with the result all the plantations own their origin to non-descript seedling and therefore, are extremely heterozygous in tree behaviour and quality attributes like nut size, colour and protein contents of kernels (Bhat *et al.*, 1999). The importance of nut and kernel traits of walnut in the international market has promoted the search for attributes such as nut size, nut thickness, nut colour and its smoothness, shelling percentage and other qualitative traits like kernel colour, fat content and protein percentage (Bhat and Mir, 1992). The improved nut and kernel characters could be utilised for a hybridization programme as well as for introgressing their useful traits in the commercial walnut cultivars/selection (Sharma and Sharma, 2001). Among the yield component traits the nut length varied from 30.0-60.0 mm around the population mean of 55.6mm. Phenotypic and genotypic co-efficients of variation were 44.3 and 37.2 per cent, respectively and broad sense heritability of 70.7 per cent. Nut weight ranged from 8.5 to 35.0g around a population mean of 14.5g and exhibited phenotypic and genotypic co-efficients of variation to the extent of 28.0 and 23.0 per cent, respectively with a heritability (broad sense) of 68.0 per cent. Nut size measured at suture and cheek revealed a range of nearly 25.0-50.0 mm with a population mean of nearly 34.0 mm in each case. Similarly, phenotypic and genotypic co-efficients of variation were nearly equal to 12.8 and 10.0 per cent in both traits, respectively. Heritability (broad sense) was 56.2 and 63.1 per cent for nut suture and cheek, respectively. Bhat *et al.* (2002) studied the genetic variability in natural seedling originated walnut population of Kashmir valley. Most of the nuts were round in shape, had smooth shell surface, light shell colour, intermediate shell seal and intermediate shell strength with light kernel colour. They observed that the natural walnut population of Kashmir valley has great variability in nut shape, shell strength and kernel colour

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