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RESEARCH ARTICLE

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Diversity for branching habit in the natural population of walnut (*Juglans regia* L.) in the Kashmir valley

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ABSTRACT : The present investigation entitled diversity for growth habit in the natural population of walnut (*Juglans regia* L.) 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. Studies on .branching habit revealed substantial variability among the seedling raised walnuts genotypes in Kashmir valley. In this study it was found that 30 genotypes (19.73%) possessed sparse branching habit, 57 genotypes (37.50%) exhibited intermediate branching habit and 65 genotypes (42.77%) had dense branching habit.

KEY WORDS : Walnut, Diversity branching habit

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INTRODUCTION

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

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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 variations are dependent on different environmental conditions to which the plants are subjected before and after propagation (Ibrahim *et al.*, 1978 and Qureshi and Dalal, 1985). Micro propagation studies in walnut are not so well established nor is any full proof protocol yet developed for efficient and faster multiplication of superior plants. The presence of phenolic compounds and entophytic bacteria are still the main limiting factors for establishing plant micro propagation in walnuts. The use of young vegetal material is the usual technique for *in vitro* set up of walnut (Driver and Kuniyuki, 1984 and Jay-Allemand *et al.*, 1993). Quality in regeneration of *in vitro* plant material is correlated with maintenance of mother plants in the controlled environments, with regular hormone application and proper choice of physiological stage for collecting materials. The correct temperature in growth chambers is essential for a proper regeneration as well for subsequent multiplication (Dolcet-Sanjuan *et al.*, 1993). The addition of PVP to the culture medium as well as the substitution of agar by gelrite are the main factors reported for the control of phenolic compounds.

The current methodology of woody crop rooting by a bietapic process is well documented in walnut (Driver *et al.*, 1984) with the use of IBA. Walnut is hard to propagate through micro propagation. Various attempts have been made using different types of explants, media, culture condition and rooting techniques (Driver and Kuniyuki, 1984). Poor proliferation and rooting rate is one of the main obstacles that limit the micro propagation efficiency in walnut. Intensive and well planned research is needed to develop a perfect protocol for micro propagation for this crop. Genotype plays a major role in vegetative propagation, in particular for micro propagation.

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; Perez *et al.*, 1983); chestnut (Vieter and Vieiter, 1980) and almond (Mehra and Mehra, 1974). But reports on *in vitro* walnut culture are scarce.

EXPERIMENTAL METHODS

The present investigation entitled diversity for growth habit in the natural population of walnut (*Juglans regia* L.) 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 (IPGR)

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 (Anonymous, 1984).

The branching habit of the tree was recorded as per the relative degree of branching.

Sparse	-	3
Intermediate	-	5
Dense	-	7

EXPERIMENTAL RESULTS AND ANALYSIS

One hundred fifty (150) seedling genotypes found growing in various regions of Kashmir valley together with two standard checks (Sulaiman and Hamdan). Most of the seedling trees were indigenous of Kashmir valley. Tremendous variation in configuration of land surface, vegetation aspect, meteorology and soil type was encountered during the study. The geographical variation has resulted in sizeable genetic diversity in walnuts. The seedlings identified and catalogued in this study represent a cross section of walnut germplasm available in Kashmir. An attempt has been made to evaluate this germplasm in respect of various descriptive and perusal of the Table 1 revealed that. In this study it was found (Table 3) that 30 genotypes (19.73%) possessed sparse branching habit, 57 genotypes (37.50%) exhibited intermediate branching habit and 65 genotypes (42.77%) had dense branching habit. Branching habit of the genotypes WS-24, WS-25, WS-27, WS-29, WS-31, WS-33, WS-35, WS-40, WS-42, WS-49, WS-50, WS-52, WS-54, WS-59, WS-60, WS-67, WS-69, WS-71, WS-77, WS-83, WS-84, WS-90, WS-91, WS-100, WS-108, WS-112, WS-118, WS-119, WS-120 and WS-142 was sparse. The genotypes, WS-08, WS-09, WS-11, WS-12, WS-15, WS-20, WS-21, WS-WS-23, WS-26, WS-28, WS-32, WS-34, WS-38, WS-44, WS-45, WS-48, WS-53, WS-55, WS-57, WS-64, WS-65, WS-68, WS-72, WS-73, WS-75, WS-78, WS-79, WS-81, WS-89, WS-92, WS-94, WS-97, WS-99, WS-103, WS-104, WS-107, WS-110, WS-111, WS-115, WS-116, WS-117, WS-122, WS-123, WS-124, WS-125, WS-127, WS-129, WS-130, WS-131, WS-136, WS-140, WS-141, WS-145, WS-148, WS-149, WS-150 and Sulaiman were intermediate in branching habit, while the genotypes WS-01, WS-02, WS-03, WS-04, WS-05, WS-06, WS-07, WS-10, WS-13, WS-14, WS-16, WS-17, WS-18, WS-19, WS-22, WS-30, WS-36, WS-37, WS-39, WS-41, WS-43, WS-46, WS-47, WS-51, WS-56, WS-58, WS-61, WS-62, WS-63, WS-66, WS-70, WS-74, WS-76, WS-80, WS-82, WS-85, WS-86, WS-87, WS-88, WS-93, WS-95, WS-96, WS-98, WS-101, WS-102, WS-105, WS-106, WS-109, WS-113, WS-114, WS-121, WS-126, WS-128, WS-132, WS-133, WS-134, WS-135, WS-137, WS-138, WS-139, WS-143, WS-144, WS-146, WS-147 and Hamdan were found to have dense branching habit

The trees of central Asian group are vigorous and long-lived with small but dense branched crowns. The

Table 1 : Diversity for branching habit in the natural population of walnut (*Juglans regia* L.) in the Kashmir valley

Descriptor*	Score*	Accession number	Total	% of the population
Sparse	3	WS-24, WS-25, WS-27, WS-29, WS-31, WS-33, WS-35, WS-40, WS-42, WS-49, WS-50, WS-52, WS-54, WS-59, WS-60, WS-67, WS-69, WS-71, WS-77, WS-83, WS-84, WS-90, WS-91, WS-100, WS-108, WS-112, WS-118, WS-119, WS-120 and WS-142	30	19.73
Intermediate	5	WS-08, WS-09, WS-11, WS-12, WS-15, WS-20, WS-21, WS- WS-23, WS-26, WS-28, WS-32, WS-34, WS-38, WS-44, WS-45, WS-48, WS-53, WS-55, WS-57, WS-64, WS-65, WS-68, WS-72, WS-73, WS-75, WS-78, WS-79, WS-81, WS-89, WS-92, WS-94, WS-97, WS-99, WS-103, WS-104, WS-107, WS-110, WS-111, WS-115, WS-116, WS-117, WS-122, WS-123, WS-124, WS-125, WS-127, WS-129, WS-130, WS-131, WS-136, WS-140, WS-141, WS-145, WS-148, WS-149, WS-150 and Sulaiman	57	37.50
Dense	7	WS-01, WS-02, WS-03, WS-04, WS-05, WS-06, WS-07, WS-10, WS-13, WS-14, WS-16, WS-17, WS-18, WS-19, WS-22, WS-30, WS-36, WS-37, WS-39, WS-41, WS-43, WS-46, WS-47, WS-51, WS-56, WS-58, WS-61, WS-62, WS-63, WS-66, WS-70, WS-74, WS-76, WS-80, WS-82, WS-85, WS-86, WS-87, WS-88, WS-93, WS-95, WS-96, WS-98, WS-101, WS-102, WS-105, WS-106, WS-109, WS-113, WS-114, WS-121, WS-126, WS-128, WS-132, WS-133, WS-134, WS-135, WS-137, WS-138, WS-139, WS-143, WS-144, WS-146, WS-147 and Hamdan	65	42.77

*As per the IBPGR Descriptor

Irano-Caucasian group are not as vigorous or long lived. It has smaller trees and thicker twigs that come into bearing early and require shorter chilling period. The Zhungar Zailij group is the most primitive with trees smaller than semi-cultivated seedlings of central Asian group but having greater winter hardiness. Most central Asian apricots are self compatible with some notable exceptions like "Perfection", "Riland", "Shakha" and "Chothagold" cultivars. "Charmagz" was found to be most vigorous and "Ladakhi" the least out of the six varieties evaluated at Mashobra for their cumulative trunk girth, tree height and spread (Sharma, 1976). The apricot cv. "CHARMAGZ" was found most vigorous of the 10 varieties evaluated (Mehbial, 1990).

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