

Original Research Article

<https://doi.org/10.20546/ijcmas.2018.704.430>

A Contemporary Narration on Presence of Cluster Bearing Trait in *Juglans regia* L. in Indian Himalayan Region

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ABSTRACT

Keywords

Juglans regia, Bearing habit, Cluster bearing, Fruits per cluster, Genotype

Article Info

Accepted:

30 March 2018

Available Online:

10 April 2018

Persian walnut belongs to genus *Juglans* of family Juglandaceae and valued for its nutritious kernels. The Persian walnut (*Juglans regia* L.) bear fruit in panicle of 1 to 3 fruits and occasionally with five fruits per panicle. Previous report showed that cluster bearing is a rare trait in *J. regia*. A selective survey was conducted with the objective to identify cluster bearing walnut genotypes and an intensive survey was done in four village viz., Dadom Pora, Nowhar, Hanjum, Shum Nag of Budgam district of Jammu & Kashmir (India) during 2015-16. As a result, one cluster bearing genotype of *J. regia* was identified from Shum Nag village and named as SN-1. This genotype was found with up to 10 fruit per terminal having approximately 40-50 percent frequency of clusters of 10 fruits. However, maximum terminals were observed with 2-10 fruits per cluster. In this genotype, mean nut weight, kernel weight and kernel recovery were recorded 13.11g, 6.16g and 46.24%, respectively.

Introduction

Among the temperate fruits, nut crops particularly walnut (*Juglans* spp.) has great scope to satisfy diversified needs of the farming community. Walnut was revered since ancient times as a symbol of intellectual, since their kernels have convoluted surface inside the shell resembling as that of brain. Its wood considered as best for making furniture and

other purposes like interior decoration, panelling and flooring of houses. Walnut shells are also used to burn in the famous *Kangree* (traditional fire pot) for heating the room by hill community of the region. Walnut is valued and appreciated for its nutritious kernels which contain 64.5 % fats, 15.6 % protein, 10.6 % carbohydrates and 687 calories of energy per 100 g (Singh *et al.*, 1967). Its bark, leaves and hull are used

traditionally for staining the gums and lips by the ladies of the region. Immature fruits are also used for preparation of delicious *chutney*.

It is a (walnut) perennial plant which belongs to Juglandaceae family, order fagales and is a diploid species ($2n=32$). Depending upon the sex expression, walnut exhibits both monocious and hetero-dichogamous habit (Gleeson, 1982), where mostly (~80%) protandrous type, a small number (~12%) is protogynous type and only a few (~8%) can be found as homogamous. It has been propagated through seed from centuries, which resulted in a heterogeneous population because of out-breeding (Cerovic *et al.*, 2010). Climatic variations and evolutionary pressures further influence the geographic distribution and evolution of its new species. At present, about 21 species of *Juglans* were noticed and among these, *Juglans regia* L. was reported to be most economically and commercially exploited species. Vavilov considered Central Asia to be the primary center of origin where probably walnut domesticated (Vavilov, 1931).

It is native to region stretching from the Balkans eastward to the Western Himalayan (Fernandez-Lopez *et al.*, 2000). North-Western Himalayan region of India is gifted with very rich diversity of walnut with high morpho-genetic variability. In India, Persian walnut is mainly grown in Jammu & Kashmir, Uttarakhand, Himachal Pradesh, and minor production is also comes from North-Eastern Himalayas. The agro-climatic conditions of Jammu & Kashmir (from an altitude of ~900m amsl in Rajouri and Kathua districts to ~3150m amsl in Leh and Kargil districts) are ideally suited for walnut growth and production. Some of the trees in Jammu and Kashmir are reported several centuries old and its long cultivation history has also resulted in the evolution of wider morpho-genetic variability in walnut varieties.

The tree canopy architecture is characterized by the two important morphological traits *i.e.* branching nature and fruiting / bearing habit. Usually branching habit in walnut is proleptic and develops from winter buds (Wu and Hinckley, 2001) and male and female flowers are borne at different location on the same tree. Male flower develop laterally from simple buds on 1-year-old wood while female flowers develop generally in panicle of 1-3 flowers from mixed buds in which flowering take place at terminal position of current season's leafy shoot irrespective of the bearing habit. Branching density and position of flowering buds on annual shoots is directly associated with fruit bearing habit of walnut crop (Germain, 1990 and 1992).

Worldwide, most of the Persian walnut (*J. regia* L.) varieties had been found with 1-3 fruits per panicle and occasionally with five nuts per panicle (Thakur 1993, Sharma and Sharma 1998 and McGranahan and Leslie, 2009). The cluster bearing trait (in which flowers borne in cluster on long raceme) had been reported in some species of *Juglans viz. J. cinerea* L., *J. ailantifolia* Carr., *J. mandshurica* Maxim (McGranahan and Leslie, 2009). Although, very few reports from different walnut growing countries was evidencing the cluster bearing habit in *J. regia* L. (Zarubin, 1954; Duskabilov, 1983; Xi, 1985; Reid, 1987; Thompson, 1993; Akca *et al.*, 2001, Sutyemez and Caglar, 2001, Simsek *et al.*, 2010 and Cerovic *et al.*, 2010). As concerns in India, the cluster type bearing has nevertheless been revealed, interestingly in this study it is being recorded as in *J. regia*. Cluster bearing trait serves potential role for higher yield in walnut improvement. There are possibilities to develop / evolve new genotypes with cluster bearing habit and other important agronomic traits. Hence, in the light of above facts and views, a target specific survey was conducted with the objective to identify cluster bearing walnut genotypes.

Materials and Methods

An intensive survey was done in four village *viz.*, Dadom Pora, Nowhar, Hanjum, Shum Nag of Budgam district of Jammu & Kashmir (India). The survey area located at an altitude ranging between 1820 to 1960m above mean sea level. Natural stand of approximately 2000 trees (500 trees in each village) on isolated hillocks of these four villages were observed for cluster bearing traits. First expedition was made during June, 2016 to see the bearing habit of natural walnut stands and second expedition was made during October (appropriate time for walnut fruit collection), 2016 at fruit maturity.

The morphological traits of walnut trees were recorded as per descriptor for walnut (IPGRI, 1994). Tree characteristics *viz.*, tree growth habit, tree height and trunk circumference at base and at breast height, branching density, bearing habit, fruits per cluster, hull dehiscence were recorded. Fifteen leaves were collected during first expedition from selected tree and leaf characteristics (leaf type, number of leaflet, leaflet arrangement, leaflet shape, leaflet margin, leaflet apex shape and base shape, petiole length of compound leaf, length and width of compound leaf, middle leaflet and terminal leaflet) were recorded in laboratory of ICAR-Central Institute of Temperate Horticulture, Srinagar (ICAR-CITH). Nut samples were collected during second expedition and after sun drying, fifteen nuts were taken randomly for shell characteristics (texture, colour, seal, strength, integrity), nut characteristics (shape, weight, length, diameter, thickness, shell thickness) and kernel characteristics (weight, recovery, colour, fill and plumpness).

Results and Discussion

In survey area, most of the trees were found with terminal bearing habit (fruits on terminal

position of leafy shoots which arises from terminal bud of 1-year-old shoots). During survey visit, four trees which were given some direction towards trait of interest were tagged from different villages of Budgam district and named as DP-1 (from village Dadom Pora), NW-1 (from village Nowhar), HJ-1 (from village Hanjum) and SN-1 (from village Shum Nag).

DP-1 was having up to 5 fruits per panicle but only few terminals with five fruits and trees having spreading growth habit were found (Figure 1A). NW-1 was identified from village Nowhar which again having up to five fruits per terminal but very few terminals with five fruits. Tree having upright growth habit with sparse branching (Figure 1B).

Similar results with respect to bearing habit, growth type and number of fruits per panicle was reported by Thakur (1993) and Sharma and Sharma (1998a) where trees bearing 5 or less than 5 fruits per panicle having spreading, semi-spreading, semi-erect and erect type of tree growth. Intermediate bearing habit which is another promising trait for walnut improvement reported from Hanjum village in HJ-1 (Figure 1C). Only few trees were found with intermediate bearing habit in which fruits were borne on both terminal and sub terminal buds of 1-year-old shoots. Similar intermediate bearing habit along with terminal and lateral bearing had also been reported by Aleta and Ninot (1997) from Mediterranean and Atlantic Spanish Coast.

Only one tree (SN-1) was identified with cluster bearing trait from village Shumnag on which, fruits were borne on terminal long stalk arising on leafy shoots and having up to 10 fruits per cluster (approximately 40-50% of a cluster of 10 fruits) (Figure 1D). Remaining terminals were having fruits in cluster with varying number ranging between 2-10 fruits per cluster.

Table.1 Tree and leaf characteristics of cluster bearing genotype (SN-1)

Trait	Value	Trait	Value
Tree growth habit	Semi-upright	Leaflet shape	Elliptical
Tree height	Approx. 12-13 m	Leaflet margin	Entire
Trunk circumference at basal portion	105 cm	Leaflet apex shape	Obtuse
Trunk circumference at breast height	89 cm	leaflet base shape	Obtuse
Branching density	Intermediate	Compound leaf: petiole length (cm)	9.31
Bearing	Terminal in cluster	Compound leaf: length	38.20 cm
Number of fruit per cluster	1-10	Compound leaf: width	22.87 cm
Hull dehiscence	Dehiscent	Terminal leaflet: Length	19.40 cm
Leaf type	Pinnately compound	Terminal leaflet: Width	12.43 cm
Number of leaflet	5-7	Middle leaflet: length	14.90 cm
Leaflet arrangement	Opposite	Middle leaflet: width	6.68 cm

Table.2 Nut and kernel characteristics of cluster bearing genotype (SN-1) (mean of 15 nuts)

Trait	Value/state	Trait	Value/state
Nut shape	Short trapezoid	Nut length (mm)	36.19
Shell texture	Medium	Nut diameter (mm)	29.92
Shell colour	Light	Nut thickness (mm)	31.80
Shell strength	Strong	Shell thickness (mm)	2.18
Shell integrity	Complete	Kernel recovery (%)	46.24
Shell seal	Strong	Kernel fill	Moderate
Nut weight (g)	13.11	Ease in removal of kernel halves	Moderate
Kernel weight (g)	6.06	Kernel colour	Light

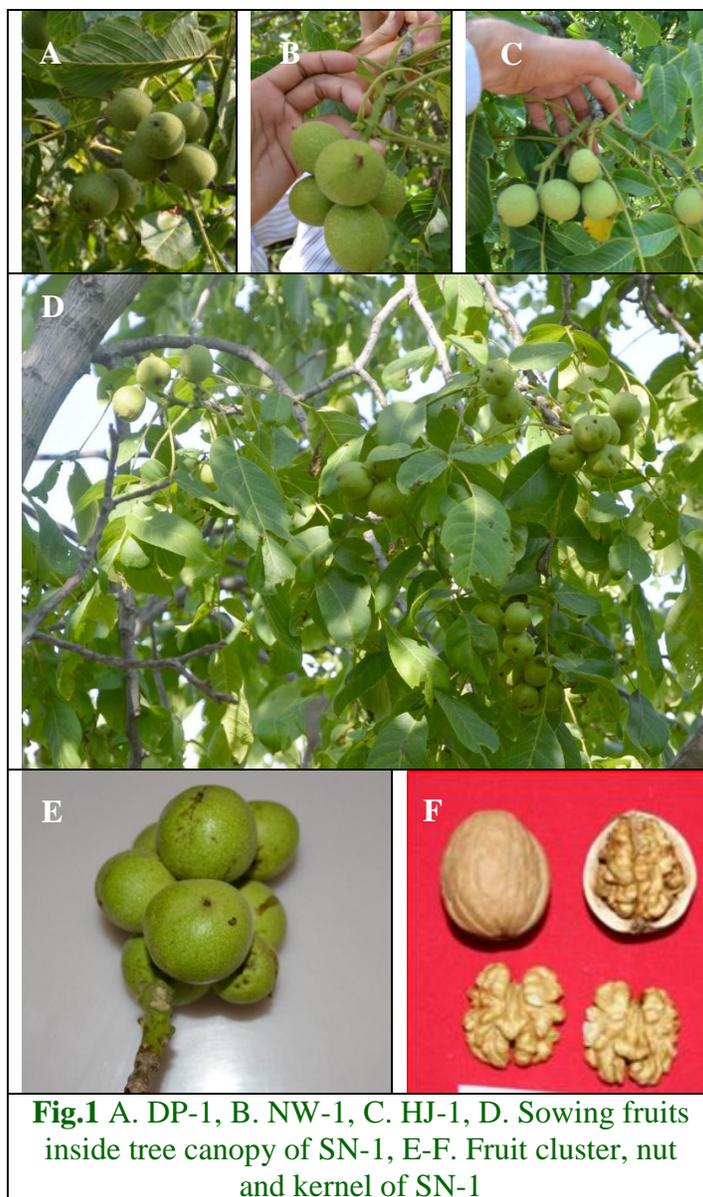


Fig.1 A. DP-1, B. NW-1, C. HJ-1, D. Sowing fruits inside tree canopy of SN-1, E-F. Fruit cluster, nut and kernel of SN-1

Similar results on were reported by Xi (1985) in China and found that there are certain types in which nuts are borne in clusters. In these types 10 fruits per cluster with a frequency of occurrence of such characters may be upto 50 per cent have been recorded and that the trees are small and do not need pruning. Sutyemez *et al.*, (1999) from the Bolu and Kahramanmaras province of Turkey found multiple fruited trees which given up to 20 nuts per cluster. Cerovic *et al.*, (2010) reported cluster bearing from Serbia and accepted as racemose type of fruit bearing.

Sutyemez and Caglar (2001) reported number of fruits ranging 3 to 26 on a cluster in Turkish walnut. Similar types of report has been obtained by Zarubin (1954) from Kirghizia, Duskabilov (1983) from Tadjikistan, Reid (1987) from Yugoslavia, Thompson (1993) from Soviet Union and Simsek *et al.*, (2010) from Turkey.

The mean nut weight, kernel weight and kernel recovery of SN-1 was recorded 13.11g, 6.16g and 46.24% respectively, with medium texture, light shell colour, strong seal and

strength, complete shell integrity, short trapezoid shape with other nut and kernel characteristics (Table 1 and Figure 1E-F). Similarly, from Kahramanmaras province of Turkey, Sutyemez and Cagler (2001) reported genotypes with 26 fruits per cluster having nut weight 8.02g, kernel weight 5.36g and kernel recovery 66.83% and from Bolu province was reported genotypes with 12 nuts per cluster having nut weight, kernel weight and kernel recovery of 11.0 g, 5.15g and 46.81% respectively. Cerovic *et al.*, (2010) have also been recorded nut weight up to 15.5 g and kernel recovery up to 51.2% in Tisa with 8 fruits per cluster. The tree growth habit is visually found to be semi-erect with intermediate branching and density, pinnate compound leaf and elliptical leaflet. Rouskas *et al.*, (1997), Vesilescu and Botu (1997) and Solar and Stamper (2006) had also reported semi-erect type of growth habit. Thakur (1993) and Shilpa (2014) were observed elliptical shape of leaflet in *J. regia*.

Although, cluster was compact in SN-1 and incidence of anthracnose was found in the tree. There are chances of availability of cluster bearing genotypes in walnut growing region of India which bear fruits loosely arranged on long stalk which may reduce chances of anthracnose. The higher number of fruit per cluster can be one of the important components in walnut productivity. Seedling size and precocity are very important trait interlinked with the vigour and height of walnut tree. Short sizes of seedlings are reported with low vigour and cluster bearing families by Rezaee *et al.*, (2006). Cluster bearing have dwarfing effect on scion which reduced the length of internodes of the scion shoots and increased formation of lateral shoot which is also an important trait (Mahmoudi, 2011) (Table 2).

This study was carried out to identify the cluster bearing trait in walnut in North-West

Himalayan Region of India. The results have implication in identifying cluster bearing genotypes (SN-1) of *J. regia*, had higher fruit yield with superior yield attributes like mean nut weight, kernel weight and kernel recovery. Further exhaustive investigations are needed to evaluate such type of walnut genotypes on different aspect of tree vigor, growth habit, yield consistency and possibility of dwarfing nature. Besides this, it will also helpful in conservation of the diverse genetic resources and its genetic improvement for higher yield.

Acknowledgements

Research was carried out with the financial assistance from Department of Science and Technology, Government of India (Grant number DST/SPLICE/CCP/NMSHE/TF-6/ICAR/2014 dated 16.03.2015) in the form of project “National Mission for Sustaining Himalayan Ecosystem-Task Force-6 (Himalayan Agriculture)”.

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How to cite this article:

Lal Chand, D.B. Singh, W.H. Raja, K.L. Kumawat, K.M. Rai, Iqra Qureshi, Pawan Saini and Asha Ram. 2018. A Contemporary Narration on Presence of Cluster Bearing Trait in *Juglans regia* L. in Indian Himalayan Region. *Int.J.Curr.Microbiol.App.Sci.* 7(04): 3827-3834.
doi: <https://doi.org/10.20546/ijemas.2018.704.430>