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Evaluation of Genetic Diversity of Seedling Raised Pecan Nut (*Carya illinoensis* K.) for Tree Growth Habit

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Abstract

The present investigation entitled evaluation of diversity for tree growing habit in seedling raised pecan nut [*Carya illinoensis* (Wang) K. Koch] was carried out to document the available genetic variability in pecan nut germplasm and to select elite pecan nut genotypes possessing superior attributes and quality traits. During the study, data was recorded on seventy pecan nut trees growing in experimental field orchard of Department of Fruit science YSPUHF, Nauni, Solan (HP). Remarkable variability was observed in seedling pecan nut trees for tree growth characters viz., tree growth habit, density of branching and shoot colour of one year old shoot. In this study 12 (17.14%) seedlings had upright growth habit, 33 (47.14%) were semi-upright and 25 (35.72%) were of spreading growth habit. 5 (7.14%) seedling trees possessed sparsely dense branching, 32 (45.72%) exhibited medium and 33 (47.14%) had highly dense branching. Twenty six (37.14%) seedling trees possessed greenish brown colour of one year old shoot, 38 (54.29%) had medium brown and 6 (8.57%) had reddish brown colour of one year old shoot.

Keywords: Branching density, *Carya illinoensis*, diversity, evaluation, pecan nut

1. Introduction

The pecan nut [*Carya illinoensis* (Wang) K. Koch] is one of the better known hickories. It is also famous as 'queen of nuts' and belongs to the family Juglandaceae. Pecan is native to North America and also exists in Texas and North of Mexico (Andersen and Crocker, 2012). Pecan nut thrives best in the areas which are considered somewhat lower in altitude and hotter for walnut cultivation (Sparks, 2000). In India pecan is very important temperate nut crop (next to walnut and almond) of colder areas covering an area of 1.14 thousand hectares with an annual production of approximate 0.19 thousand metric tonnes and is widely grown in Himachal Pradesh and Jammu and Kashmir (NHB, 2015). Pecans were introduced from USA (eight cultivars) by Punjab government in 1937 in India and were planted at Govt. Fruit Farm, Palampur, Himachal Pradesh, which became major source of planting material in Himalayan region.. Pecan nut has the recognition of being called "queen of nuts" because of its excellent kernel characteristics. Pecan having (flavor, 65-70% fats, 8-10% proteins, high in phosphorous, potassium and vitamins A, C, E and B complex) is superior to walnut in quality and thrives best in areas which are considered lower and hotter for walnut cultivation (Singh et al., 2011). Though introduced in Palmpur, Himachal Pradesh, way back in this nut crop could not assume commercial status for the want of suitable cultivars among orchardists, also this nut crop has huge potential for commercialisation being hardy to climatic vagaries and having export value. The motivation behind this study is to examine the degree of diversity in seedling pecan nut trees which has been planted in Nauni region of Solan district in Himachal Pradesh. These results will provide guidance about effective management, conservation, and improvement of pecan nut resources. In addition, the recent trends of expanding agriculture, increased urbanization and gigantic population growth are adding continuously to the extinction and genetic erosion of valuable pecan nut germplasm. Thus, there is a crucial need for exploration and conservation of the existing high quality pecan nut germplasm growing in this region.

The present study was conducted on pecan nut seedling selections planted in Experimental Farm of Department of Fruit science, YSPUHF, Nauni, Solan to estimate the extent of genetic variability and relationship by studying tree morphological character.

2. Materials and Methods

The present investigation was carried out during the years

2015-2017 in Experimental Farm of Department of Fruit science, YSPUHF, Nauni, Solan. The study area is situated at 30.85° north latitude and 77.17° east longitude at an altitude of about 1300 meters above sea level.

Seventy plants of seedling origin genotypes with divergent tree characters were selected. Codes were allotted to each genotype (as STN stands for seedling tree number). Regular visits were made and observation on different tree characters i.e., tree growth habit, density of canopy and one year old shoot colour were made at different stages of plant growth using different pecan nut descriptors given by UPOV (The International union for the protection of new varieties of plants) guidelines (UPOV, 2014).

The growth habit of all the pecan selections and cultivars was studied in the month of January during dormancy. Based on visual observations on spread of side branches and their competition with the central leader, each individual tree was grouped in one of the following categories:

1.	Upright	Branches grow conspicuously upward and tend to compete with central leader
2.	Semi-upright	Branches grow upward and do not tend to compete with central leader.
3.	Spreading	Side branches were spreading upward and do not compete with central leader.

On the basis of visual observations, colour of one year old shoots in each case was recorded in January. The categories made were greenish brown, medium brown and reddish brown. Number of secondary branches per metre shoot length of primary scaffold branches was counted in all the four directions of the tree to work out the average density of branching, and accordingly various selections/cultivars under study were categorized as sparse, medium, dense.

3. Results and Discussion

Tree characteristics are very important as far as diversity is concerned. In this study seedling pecan nut trees surveyed from different locations showed variability in tree characters.

The tree growth habit varied and was observed as upright, semi-upright and spreading. Out of 70 pecan nut genotypes 12 (17.14%) seedling origin pecan nuts had upright type of tree habit, 33 (47.14%) had semi-upright type of tree growth habit while remaining 25 (35.72%) had spreading tree growth habit. Maximum (47.14 %) were semi-upright in growth habit. Findings for tree growth habit are in agreement with the research observations by Grauke and Thomson (1996), Sharma (1977), Kaushal and Sharma (2005), Hensz *et al*. (1983), Sparks (1995) who also observed similar type of growth habit in seedling population as well as in the pecan cultivars. Recently, Rani *et al*. (2018) studied diversity in the tree growth habit in Jammu Province and the present data is very similar to their work. In walnut Akhiani et al. (2017) also recorded similar variation in growth habit, whereas semi spreading nature was more prevalent than other growth types (Table 1).

Table 1: Variation in growth habit, shoot colour, density of branching, regularity in bearing in seedling population of pecan

Tree no.	Growth habit	Shoot colour	Density of branching
STN1	Spreading	Medium brown	Medium
STN2	Spreading	Greenish brown	Dense
STN3	Semi-upright	Medium brown	Sparse
STN4	Spreading	Greenish brown	Dense
STN5	Semi-upright	Medium brown	Dense
STN6	Spreading	Medium brown	Dense
STN7	Spreading	Greenish brown	Sparse
STN8	Semi-upright	Greenish brown	Dense
STN9	Spreading	Greenish brown	Dense
STN10	Upright	Medium brown	Medium
STN11	Semi-upright	Greenish brown	Medium
STN12	Semi-upright	Medium brown	Medium
STN13	Spreading	Medium brown	Sparse
STN14	Semi-upright	Greenish brown	Dense
STN15	Semi-upright	Medium brown	Sparse
STN16	Upright	Greenish brown	Dense
STN17	Semi-upright	Medium brown	Medium
STN18	Upright	Medium brown	Medium
STN19	Semi-upright	Greenish brown	Dense
STN20	Spreading	Medium brown	Dense
STN21	Semi-upright	Greenish brown	Medium
STN22	Spreading	Reddish brown	Dense
STN23	Semi-upright	Reddish brown	Medium
STN24	Spreading	Medium brown	Dense
STN25	Spreading	Medium brown	Medium
STN26	Upright	Greenish brown	Medium
STN27	Semi-upright	Medium brown	Medium
STN28	Upright	Medium brown	Medium
STN29	Spreading	Medium brown	Dense
STN30	Semi-upright	Reddish brown	Medium
STN31	Semi-upright	Greenish brown	Medium
STN32	Semi-upright	Greenish brown	Dense
STN33	Spreading	Medium brown	Dense
STN34	Semi-upright	Medium brown	Medium
STN35	Spreading	Reddish brown	Medium
STN36	Spreading	Medium brown	Dense

Table 1: Continue...

Tree no.	Growth habit	Shoot colour	Density of branching
STN37	Semi-upright	Greenish brown	Dense
STN38	Spreading	Medium brown	Dense
STN39	Semi-upright	Medium brown	Dense
STN40	Spreading	Greenish brown	Medium
STN41	Upright	Greenish brown	Dense
STN42	Semi-upright	Greenish brown	Dense
STN43	Spreading	Medium brown	Dense
STN44	Upright	Medium brown	Medium
STN45	Semi-upright	Medium brown	Medium
STN46	Semi-upright	Greenish brown	Medium
STN47	Spreading	Greenish brown	Dense
STN48	Semi-upright	Medium brown	Dense
STN49	Semi-upright	Medium brown	Dense
STN50	Upright	Medium brown	Dense
STN51	Semi-upright	Medium brown	Medium
STN52	Upright	Greenish brown	Medium
STN53	Semi-upright	Medium brown	Dense
STN54	Spreading	Medium brown	Dense
STN55	Semi-upright	Greenish brown	Medium
STN56	Spreading	Greenish brown	Dense
STN57	Semi-upright	Greenish brown	Medium
STN58	Spreading	Medium brown	Dense
STN59	Spreading	Medium brown	Medium
STN60	Upright	Medium brown	Medium
STN61	Semi-upright	Reddish brown	Medium
STN62	Upright	Greenish brown	Medium
STN63	Upright	Medium brown	Dense
STN64	Semi-upright	Greenish brown	Medium
STN65	Semi-upright	Medium brown	Medium
STN66	Semi-upright	Greenish brown	Sparse
STN67	Spreading	Medium brown	Dense
STN68	Semi-upright	Medium brown	Medium
STN69	Spreading	Medium brown	Dense
STN70	Semi-upright	Reddish brown	Medium

The accessions showed variation in density of branching i.e., sparse, medium and dense. Out of seventy seedling origin pecan nut genotypes 6 (8.57%) were having sparse, 32 (45.72%) were having medium dense and 33 (47.14%) were having dense branching. These results are similar to the results of Lone (2017), who observed that out of 150 seedling genotypes of walnut maximum (65) were having dense canopy (Table 2).

Table 2: Effect of cutting length on the growth parameters of Populus deltoids under nursery conditions

Characteristics	Extent of variation	Frequency (No. of genotypes)	Percentage
Growth habit	Upright	12	17.14
	Semi-upright	33	47.14
	Spreading	25	35.72
Shoot colour	Greenish brown	26	37.14
	Medium brown	38	54.29
	Reddish brown	6	8.57
Density of branching	Dense	33	47.14
	Medium	32	45.72
	Sparse	5	7.14

One year old shoot colour was categorised as greenish brown, medium brown and brown with greenish brown observed in 26 (37.14%) seedling origin pecan nut, medium brown in 38 (54.29%) genotypes and brown in 6 (8.57%) genotypes. Out of 70 seedling pecan nut trees maximum were having medium brown. In a similar study Sharma (1977) observed that colour of one year old shoot varied from medium brown, greenish brown to brown in walnut seedling trees growing in Himachal Pradesh.

4. Conclusion

To assess the relative magnitude of the existing genetic diversity is necessary to build a data base by putting all the information together with other selection parameters for the improvement of nut yield. The extent of genetic variability indicates the potential of exercising selection of a particular genotype. Accessing variability/diversity for tree growth traits in pecan nut populations (seedling origin) and subsequent identification of evaluated superior genotype is a must for further breeding programme in pecan nut.

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