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## Analysis of qualitative characteristics among and between populations of *Grewia optiva* Drummond (Beul)

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### Abstract

Thirty Populations of superior plus trees (20-30 cm diameter) of *Grewia optiva* Drummond (Beul) have been selected for study in six districts of Himachal Pradesh viz. Solan, Sirmour, Una, Mandi, Hamirpur and Kangra, to study the variation in morphological descriptors among different populations to study qualitative characteristics, On the basis of overall scoring index of useful desired traits, in bark feature silver brown has the maximum percentage value (56.11%), in leaf characteristics ovate leaf shape (95%), leaf colour 135-A (Dark green) (26.11%), leaf serrate margin (87.77%) and leaf apex acuminate has the maximum percentage value i.e. (85.55%) among all other qualitative traits studied.

Study concludes with natural phenotypical variation and scoring index on each individual traits for selection and screening of superior individuals within the populations, so as to get improved genetic gain and establishment of gene bank of superior families and best genotypes of the best families. These desired traits viz silver brown bark ovate leaf shape dark green colour Leaf serrate margin are recommended for selection after screening of identified features of the morphotypes.

**Keywords:** *Grewia optiva*, features, variation, qualitative, beul, population

### 1. Introduction

*Grewia optiva* Drummond locally called as 'Beul' is an important agroforestry tree species of the low and mid hill regions in the Western and Central Himalayas, which constitutes 44 genera and 400 species, distributed globally throughout the tropical, sub-tropical and temperate regions of the world. In hilly and mountain regions, the demand of feeds and fodder for livestock is much higher than their availability (Singh and Bimal, 2004) [13]. *Grewia optiva* Drummond (Beul) is one of the most important tree species used as fodder in Himachal Pradesh (Singh, 2005) [12]. It belongs to family Tiliaceae and naturally distributed in India, Bhutan, Nepal, and Pakistan. There are about 150 species in the world, 42 in India and 5 in Himachal Pradesh (Hooker, 1875) [6]. *Grewia optiva* is very important multipurpose or agroforestry tree species having the chromosome number  $2n=18$  (Coleman, 1982) [4] and popular for its utility as fodder, fuel and fiber. It is a small to medium sized deciduous tree, 5-12 m in height; Crown spreading; bole clear, 3-4 m and about 1m in diameter. Branches smooth pale silvery brown; bark dark brown, thick and roughish, exploiting in small woody scales. Leaves opposite, ovate, acuminate, closely serrate, rough and hairy. (Sankhyan HP, 2020) [11] Fruit is a drupe, 1-4 locked, olive green and black when ripe (Troup, 1921) [14]. Leaves are shed in March and April and new ones appear in the month of April to May. The fruits are formed soon after and attain full size by September, ripening between October and December. The fruits are borne on previous year's shoots. The first pre-requisite step to undertake breeding and tree improvement programme and to obtain improved genetic gain is the selection of best population and best individuals within the population, to select finally best families and best genotypes of the best families. The present study was undertaken to study variation in qualitative characteristics among and between different populations to select plus trees (Superior trees) of *Grewia optiva* Drummond (Beul) in Himachal Pradesh. The genetic improvements cannot be achieved unless the natural variation of the species of interest is understood.

## 2. Materials and Methods

The study on *Grewia optiva* Drummond (Beul) was undertaken in Low and Mid Hills Zones in different sites of Himachal Pradesh. The present study was carried out in six districts of Himachal Pradesh viz. Kangra, Mandi, Hamirpur, Solan, Una and Sirmour, keeping in view the rich genetic diversity and phenotypically superior plant populations of *Grewia optiva*. The selection criteria of superior plants within the thirty populations were 20-30 cm diameter class. The population includes six superior plants on the same site, which is identified, marked and data is presented as mean value of six superior plus trees and also presented on individual tree basis in the same population. Observation on variation in leaf qualitative characteristics, Bark characteristics among different populations were undertaken as per standard methodology suggested by (Robinson, *et al.* 1951) [9] and (Al- Jibouri, *et al.* 1958) [11]. The bark colour was recorded on main stem 25cm above the soil level. Observation on leaf blade shape made on mature leaves taken from middle of the shoot, the third leaf of current season grown from the middle part of the plant. Leaf colour observations were recorded on fully mature leaves during the month in end of the November and first week of December and matched with colour chart (Royal Horticulture Society Chart). Visual observations on bark colour/feature were recorded by visual method (Visual assessment by single observation of a group of plants or parts of the plants observation) The observations on all qualitative traits viz: leaf colour leaf shape, leaf apex, leaf margin were recorded during the month of October when leaves were on full maturity and ready to harvest to feed cattle and animal growth of the plant was almost over. Collection and selection of leaves samples were made during this period depending upon the climatic condition. The effects of young juvenile and old leaves in different period of time were also taken into this consideration. The variation in leaf characteristics (Bark Feature, Leaf shapes, Leaf colour, leaf margin and leaf Apex) were as per method adopted by (Kaushal PS, 1978) [7]. Altitude ranged 1318 meter to 445 meter above mean sea level in the study area and altitude related observations were recorded with the help of Global Positioning System (GPS) and GPS mobile app. Scoring of morphological leaf characteristics (leaf shape, color of leaf, leaf margin and leaf apex), plant characteristics (Bark Feature), characteristics populations were calculated on the basis of percentage scoring index of each desired and useful traits under study, which were considered as desired traits among all other qualitative traits (QL). There is no direct tool and defined methodology to study qualitative characteristics. However observations made and recorded on the basis of standard procedure to record observations on qualitative characterization and data is presented in mean value of hundred percent basis.

## 3. Results and Discussion

The variation in bark features (Bark Colour/ Shade) was

measured by Royal Horticulture Society Colour Chart and leaf characteristics (Shape of leaves, leaf colour, margin of leaf, Apex of leaf), were observed as qualitative characteristics.

To study the variation in Bark feature and leaf characteristics, all the qualitative and pseudo qualitative characteristics were recorded. On the basis of overall scoring index of useful and desired characteristics, the population sites viz Solan, Sirmour, Hamirpur, Kangra, Mandi and Una districts in the range of 445- 1318 a msl were the ecological niches of this study undertaken.

The observations on bark features were classified as silver brown, silver pale, silver brown and silver. Table-1.1 and 1.2 reveal Bark features Silver Brown (56.11%), Silver pale (1.11%), Silver black (33.33%), Silver (9.44%), of total bark characteristics/features. It is concluded from the Tables that the bark feature silver brown has the maximum 56.11%, whereas the bark feature silver has the minimum 9.44% share among all the features under study.

The observation on leaf shape were classified as ovate, acuminate and aristate. Table-2.1 and 2.2 explain variation in leaf shape qualitative characteristics among the population and between the population of *Grewia optiva* in selected sites Leaf shapes Ovate (95%), Acuminate (3.33%) and leaf shape Aristate 1.66% were observed, It is concluded from the tables that the Leaf shapes ovate has the maximum (95%), whereas the Leaf shape Aristate has the minimum (1.66%) among all leaf shape features in the category of QL traits.

Four leaf colour categories were found i.e. colour group the dark green, green, green and light green. Table-3.1 and 3.2 explain variation in leaf color feature qualitative characteristics among the population and between the population of *Grewia optiva*, among selected sites showed leaf colour N137- (11.66%), 137- (16.11%), 143- (22.22%) and 137A – (50%) has maximum percentage among all leaf colour features.

Three type of leaves observed in population and individuals of the population depicted as serrate, denticulate and serrulate. Table -4.1 and 4.2 explain variation in leaf margin feature qualitative characteristics among the population and between the population of *Grewia optiva* in selected sites leaf Margin Serrate 87.77 percent, Denticulate 0.55 percent and the leaf margin Serrulate repeated 21 time means 11.66 percent. On the basis of this, It is concluded that the leaf margin Serrate has the maximum 87.77 percent, whereas the leaf margin Denticulate has the minimum 0.55 percent among all margin features.

These groups of leaf apex features observed having acute and acuminate in the population of *Grewia optiva*. Table- 5.1 and 5.2 explain variation in leaf Apex feature qualitative characteristics among the population and between the population of *Grewia optiva* of selected sites indicates that leaf Apex Acuminate has repeated 154 times which means 85.55 percent, whereas the leaf apex Acute has repeated 26 times that means 14.44 in the total overall percent share.

**Table 1.1:** Variation in Bark feature qualitative characteristics among and between population of *Grewia optiva* Drummond (Beul)

District	Population	Altitude (m) a msl	Tree 1	Tree 2	Tree 3	Tree 4	Tree 5	Tree 6
Solan	Kothi Kunal	1540	Silver Brown	Silver Black	Silver Brown	Silver Brown	Silver Black	Silver Brown
	Uncha Gaon	1978	Silver Black	Silver Brown	Silver Black	Silver Black	Silver Black	Silver Brown
	Neri Kalan	1525	Silver	Silver	Silver Brown	Silver	Silver	Silver Brown
	Sabathu	1265	Silver Brown	Silver Black	Silver Black	Silver Black	Silver Black	Silver Brown
	Seri Devera	1050	Silver Black	Silver Black	Silver Black	Silver Black	Silver Brown	Silver Black
Sirmour	Machair	882	Silver Brown	Silver	Silver	Silver Brown	Silver	Silver

	Jajjer	1763	Silver	Silver	Silver	Silver	Silver	Silver
	NeharBagh	1520	Silver Brown	Silver	Silver	Silver Brown	Silver Brown	Silver
	Badon	819	Silver Brown	Silver Black	Silver Pale	Silver Brown	Silver Black	Silver Brown
	Dhar Kyari	932	Silver Brown	Silver Brown	Silver Black	Silver Black	Silver Black	Silver Brown
Una	Kant	395	Silver Brown	Silver Brown	Silver Black	Silver Brown	Silver Black	Silver Brown
	Nawami	561	Silver Black	Silver Brown	Silver Black	Silver Black	Silver Black	Silver Black
	Kharuni (Bangana)	558	Silver Brown	Silver Black	Silver Black	Silver Black	Silver Brown	Silver Brown
	Badwar	496	Silver Brown	Silver Brown	Silver Brown	Silver Brown	Silver Black	Silver Black
	Lambalahri	510	Silver Black	Silver Black	Silver Black	Silver Black	Silver Black	Silver Brown
Hamirpur	Janhen	802	Silver Brown	Silver Black	Silver Brown	Silver Brown	Silver Brown	Silver Brown
	Jhinhakari	818	Silver Brown	Silver Black	Silver Brown	Silver Brown	Silver Black	Silver Brown
	Harbal Neri	625	Silver Brown	Silver Brown	Silver Brown	Silver Brown	Silver Brown	Silver Brown
	Anu Khurad	765	Silver Brown	Silver Black	Silver Brown	Silver Brown	Silver Brown	Silver Brown
	Bhaleth	708	Silver Brown	Silver Brown	Silver Brown	Silver Black	Silver Brown	Silver Brown
Kangra	Katoi	500	Silver Black	Silver Brown	Silver Brown	Pale Silver	Silver Brown	Silver Brown
	Baluglua	445	Silver Black	Silver Brown	Silver Brown	Silver Brown	Silver Brown	Silver Brown
	Old Kangra	639	Silver Brown	Silver Brown	Silver Brown	Silver Brown	Silver Brown	Silver Brown
	Dohan	897	Silver Black	Silver Brown	Silver Black	Silver Brown	Silver Brown	Silver Brown
	Balla	1046	Silver Brown	Silver Brown	Silver Brown	Silver Brown	Silver Brown	Silver Brown
	Patta	554	Silver Brown	Silver Brown	Silver Brown	Silver Black	Silver Black	Silver Black
Mandi	Gangal	737	Silver Black	Silver Black	Silver Brown	Silver Brown	Silver Brown	Silver Brown
	Bagla	764	Silver Brown	Silver Black	Silver Black	Silver Brown	Silver Black	Silver Brown
	Balt	845	Silver Black	Silver Black	Silver Brown	Silver Black	Silver Black	Silver Brown
	Bharnoi	1318	Silver Black	Silver Brown	Silver Brown	Silver Brown	Silver Brown	Silver Black

**Table 1.2:** Percent score on each desired morphological Bark features among and between population *Grewia optiva* (Beul).

Sr. No.	Bark Features	Occurrence of Colour	Bark Feature (%)
1	Silver Brown	101	56.11
2	Siler Pale	2	1.11
3	Silver Black	60	33.33
4	Silver	17	9.44
	Total	180	99.99



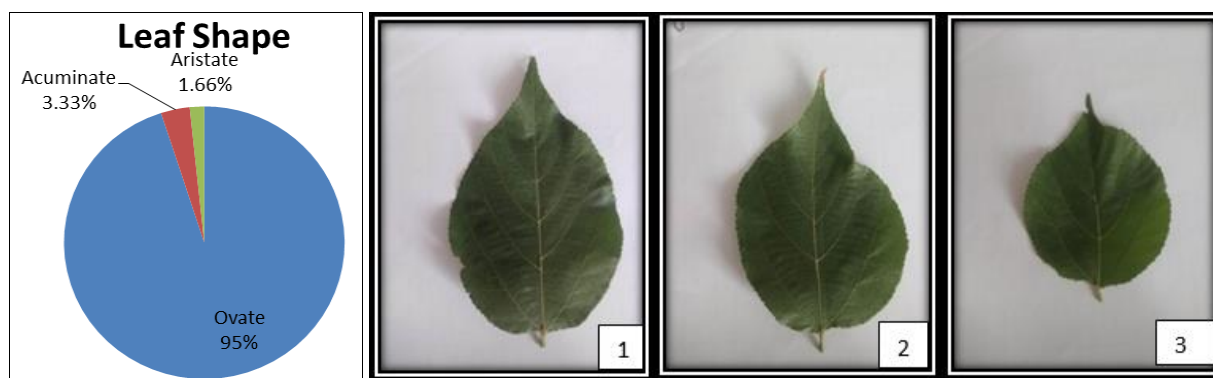
**Table 2.1:** Variation in leaf Shape qualitative characteristics among and between population of *Grewia optiva* Drummond (Beul).

District	Population	Altitude (m) a msl	Tree 1	Tree 2	Tree 3	Tree 4	Tree 5	Tree 6
Solan	Kothi Kunal	1540	Ovate	Ovate	Ovate	Ovate	Ovate	Ovate
	Uncha Gaon	1978	Ovate	Ovate	Ovate	Ovate	Ovate	Ovate
	Neri Kalan	1525	Ovate	Ovate	Ovate	Ovate	Ovate	Ovate
	Sabathu	1265	Ovate	Ovate	Ovate	Ovate	Ovate	Ovate
	Seri Devera	1050	Ovate	Ovate	Ovate	Ovate	Aristate	Ovate
Sirmour	Machair	882	Ovate	Ovate	Ovate	Ovate	Ovate	Ovate
	Jajjer	1763	Ovate	Ovate	Ovate	Ovate	Ovate	Ovate
	NeharBagh	1520	Ovate	Ovate	Ovate	Ovate	Ovate	Ovate
	Badon	819	Ovate	Ovate	Ovate	Ovate	Ovate	Ovate
	Dhar Kyari	932	Ovate	Ovate	Acuminate	Acuminate	Ovate	Ovate
Una	Kant	395	Ovate	Ovate	Ovate	Ovate	Ovate	Ovate
	Nawami	561	Ovate	Ovate	Ovate	Ovate	Ovate	Ovate
	Kharuni (Bangana)	558	Ovate	Ovate	Ovate	Ovate	Ovate	Ovate
	Badwar	496	Ovate	Ovate	Ovate	Ovate	Ovate	Ovate
	Lambalahri	510	Ovate	Ovate	Ovate	Ovate	Ovate	Ovate
Hamirpur	Janhen	802	Ovate	Ovate	Aristate	Ovate	Ovate	Ovate
	Jhinhakari	818	Ovate	Ovate	Ovate	Ovate	Ovate	Ovate
	Harbal Neri	625	Ovate	Ovate	Acuminate	Ovate	Ovate	Ovate

	Anu Khurad	765	Ovate	Ovate	Ovate	Ovate	Ovate	Ovate
	Bhaleth	708	Ovate	Ovate	Ovate	Ovate	Ovate	Ovate
Mandi	Patta	554	Ovate	Ovate	Ovate	Ovate	Ovate	Ovate
	Gangal	737	Ovate	Ovate	Ovate	Acuminate	Ovate	Ovate
	Bagla	764	Ovate	Ovate	Ovate	Ovate	Ovate	Ovate
	Balt	845	Ovate	Ovate	Ovate	Ovate	Acuminate	Ovate
	Bharnoi	1318	Ovate	Ovate	Ovate	Ovate	Ovate	Ovate
Kangra	Katoi	500	Ovate	Ovate	Ovate	Ovate	Ovate	Ovate
	Baluglua	445	Ovate	Aristate	Ovate	Ovate	Ovate	Ovate
	Old Kangra	639	Ovate	Ovate	Ovate	Ovate	Ovate	Acuminate
	Dohan	897	Ovate	Ovate	Ovate	Ovate	Ovate	Ovate
	Balla	1046	Ovate	Ovate	Ovate	Ovate	Ovate	Ovate

**Table 2.2:** Percent score on each desired morphological leaf Shapes features among and between population *Grewia optiva* (Beul)

Sr. No.	Shapes	Occurrence of Shape	Leaf Shape (%)
1	Ovate	171	0.95
2	Acuminate	6	3.33
3	Aristate	3	1.66
	Total	180	99.99

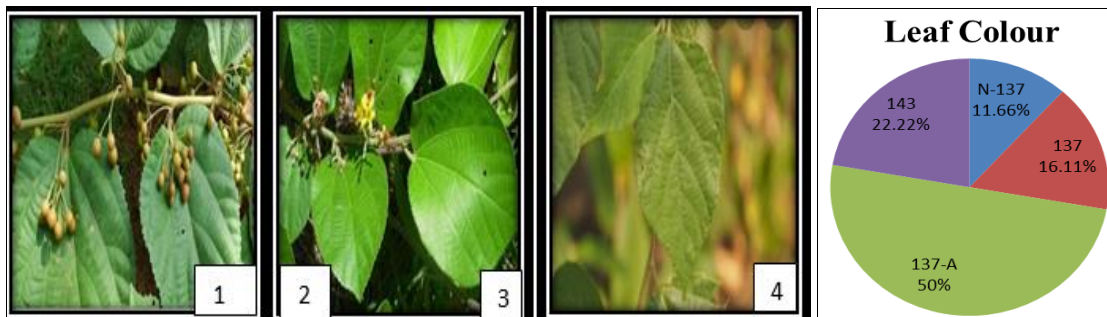


**Table 3.1:** Variation in Leaf color feature qualitative characteristics among and between population of *Grewia optiva* Drummond (Beul).

District	Population	Altitude (m) a msl	Tree 1	Tree 2	Tree 3	Tree 4	Tree 5	Tree 6
Solan	Kothi Kunal	1540	137	137-A	137-A	137-A	137-A	143
	Uncha Gaon	1978	137-A	N-137	137-A	137-A	137-A	137-A
	Neri Kalan	1525	137	137	137	137	137	137
	Sabathu	1265	N-137	137-A	143	143	137-A	137-A
	Seri Devera	1050	137-A	137-A	137	143	143	143
Sirmour	Machair	882	137-A	137	137	137	143	137
	Jajjer	1763	N-137	N-137	N-137	137-A	137-A	137-A
	NeharBagh	1520	137-A	137	137	137-A	137-A	143
	Badon	819	137-A	137-A	137	143	137-A	143
	Dhar Kyari	932	137-A	137-A	143	137-A	137-A	143
Una	Kant	395	137	137-A	137-A	137	137-A	137-A
	Nawami	561	137-A	137-A	143	137-A	143	137-A
	Kharuni (Bangana)	558	137-A	137-A	137-A	143	137-A	137-A
	Badwar	496	137-A	143	137-A	143	143	143
	Lambalahri	510	137-A	143	137-A	143	137-A	143
Hamirpur	Janhen	802	137-A	143	137-A	137-A	137-A	N-137
	Jhinhakari	818	137-A	143	143	137-A	137-A	137-C
	Harbal Neri	625	137-A	143	137-A	137	143	137-A
	Anu Khurad	765	137-A	143	137-A	137-A	137-A	137-A
	Bhaleth	708	137	143	137-A	137-A	137-A	137-A
Kangra	Katoi	554	N-137	137	137	137-A	143	143
	Baluglua	737	N-137	137-A	137-A	N-137	137-A	137
	Old Kangra	764	137	143	137-A	143	137	143
	Dohan	845	143	137-A	N-137	N-137	137-A	137-A
	Balla	1318	143	137	137-A	137-A	137-A	137
	Mandi	Patta	500	137-A	137-A	N-137	137-A	137-A
	Gangal	445	137-A	137	N-137	N-137	143	N-137
	Bagla	639	137-A	137-A	N-137	N-137	N-137	137-A
	Balt	897	137-A	137-A	N-137	N-137	143	137-A
	Bharnoi	1046	137-A	143	137	143	137-A	N-137

**Table 3.2:** Percent score on each desired morphological leaf colour features among and between population *Grewia optiva* (Beul)

Sr. No.	Leaf colour code	Occurrence of Colours	Leaf Colour (%)	Colour Group
1	N-137	21	11.66	Dark green
2	137	29	16.11	Green
3	137-A	90	50.00	Green
4	143	40	22.22	Light Green
		180	99.98	

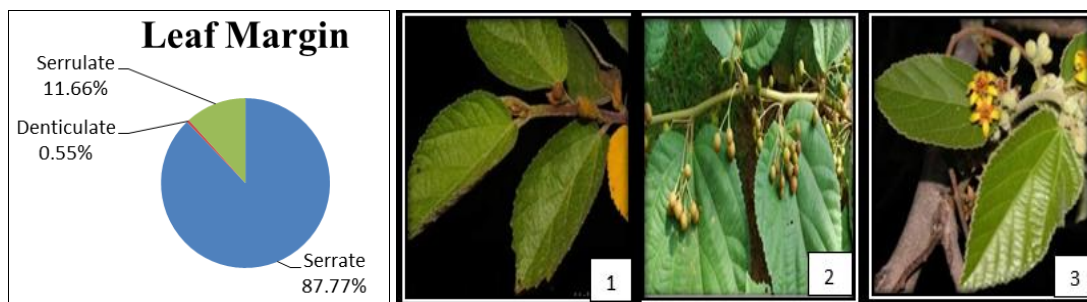


**Table 4.1:** Variation in Margin qualitative characteristics among and between populations of *Grewia optiva* Drummond (Beul).

District	Population	Altitude (m) a msl	Tree 1	Tree 2	Tree 3	Tree 4	Tree 5	Tree 6
Solani	Kothi Kunal	1540	Serrate	Serrate	Serrate	Serrate	Serrate	Serrate
	Uncha Gaon	1978	Serrate	Serrulate	Serrate	Serrate	Serrulate	Serrate
	Neri Kalan	1525	Serrate	Serrate	Serrate	Serrate	Serrate	Serrate
	Sabathu	1265	Serrate	Serrate	Serrate	Serrate	Denticulate	Serrulate
	Seri Devera	1050	Serrate	Serrulate	Serrulate	Serrulate	Serrulate	Serrulate
Sirmaur	Machair	882	Serrate	Serrate	Serrate	Serrate	Serrate	Serrate
	Jajjer	1763	Serrate	Serrate	Serrate	Serrate	Serrate	Serrate
	NeharBagh	1520	Serrate	Serrate	Serrate	Serrate	Serrate	Serrate
	Badon	819	Serrulate	Serrate	Serrate	Serrulate	Serrate	Serrate
Una	Dhar Kyari	932	Serrulate	Serrulate	Serrate	Serrulate	Serrate	Serrate
	Kant	395	Serrate	Serrate	Serrate	Serrate	Serrate	Serrate
	Nawami	561	Serrate	Serrate	Serrate	Serrate	Serrate	Serrate
	Kharuni (Bangana)	558	Serrate	Serrate	Serrate	Serrate	Serrate	Serrate
Hamirpur	Badwar	496	Serrate	Serrate	Serrate	Serrate	Serrate	Serrate
	Lambalahri	510	Serrate	Serrate	Serrate	Serrate	Serrate	Serrate
	Janhen	802	Serrate	Serrate	Serrate	Serrate	Serrate	Serrate
	Jhinhakari	818	Serrate	Serrate	Serrate	Serrate	Serrate	Serrate
Kangra	Harbal Neri	625	Serrate	Serrate	Serrate	Serrate	Serrate	Serrate
	Anu Khurad	765	Serrate	Serrate	Serrate	Serrate	Serrate	Serrate
	Bhaleth	708	Serrate	Serrate	Serrate	Serrate	Serrate	Serrate
	Katoi	554	Serrate	Serrate	Serrate	Serrate	Serrate	Serrate
Mandi	Baluglua	737	Serrate	Serrulate	Serrate	Serrate	Serrate	Serrate
	Old Kangra	764	Serrate	Serrate	Serrate	Serrate	Serrate	Serrate
	Dohan	845	Serrate	Serrate	Serrate	Serrate	Serrate	Serrate
	Balla	1318	Serrate	Serrate	Serrate	Serrate	Serrate	Serrate
Mandi	Patta	500	Serrulate	Serrulate	Serrate	Serrulate	Serrate	Serrate
	Gangal	445	Serrulate	Serrate	Serrate	Serrate	Serrate	Serrate
	Bagla	639	Serrulate	Serrate	Serrate	Serrate	Serrate	Serrate
	Balt	897	Serrulate	Serrate	Serrate	Serrate	Serrulate	Serrate
	Bharnoi	1046	Serrate	Serrate	Serrate	Serrate	Serrate	Serrate

**Table 4.2:** Percent score on each desired morphological leaf margin features among and between population *Grewia optiva* (Beul)

Sr. No.	Margin of Leaf	Occurrence of Margin	Leaf Margin (%)
1	Serrate	158	87.77
2	Denticulate	1	00.55
3	Serrulate	21	11.66
	Total	180	99.90

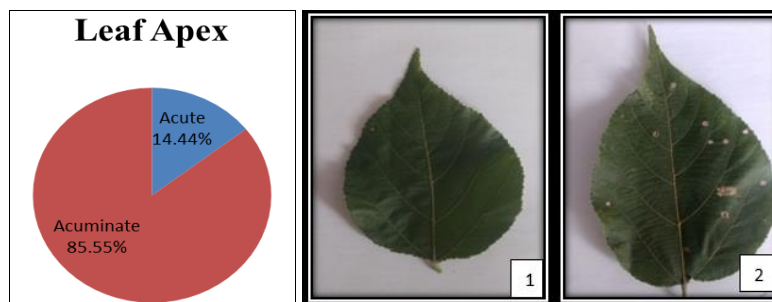


**Table 5.1:** Variation in Apex qualitative characteristics among and between population of *Grewia optiva* Drummond (Beul).

District	Population	Altitude (m) a msl	Tree 1	Tree 2	Tree 3	Tree 4	Tree 5	Tree 6
Solan	Kothi Kunal	1540	Acute	Acuminate	Acuminate	Acuminate	Acuminate	Acuminate
	Uncha Gaon	1978	Acuminate	Acuminate	Acuminate	Acute	Acuminate	Acuminate
	Neri Kalan	1525	Acuminate	Acuminate	Acuminate	Acuminate	Acuminate	Acuminate
	Sabathu	1265	Acuminate	Acuminate	Acuminate	Acuminate	Acuminate	Acuminate
	Seri Devera	1050	Acuminate	Acuminate	Acuminate	Acuminate	Acute	Acuminate
Sirmour	Machair	1763	Acute	Acuminate	Acuminate	Acuminate	Acuminate	Acuminate
	Jajjer	1520	Acuminate	Acuminate	Acuminate	Acute	Acuminate	Acuminate
	NeharBagh	819	Acute	Acuminate	Acuminate	Acuminate	Acuminate	Acuminate
	Badon	932	Acuminate	Acuminate	Acuminate	Acuminate	Acuminate	Acuminate
	Dhar Kyari	395	Acute	Acuminate	Acuminate	Acuminate	Acuminate	Acuminate
Una	Kant	561	Acuminate	Acuminate	Acuminate	Acuminate	Acuminate	Acuminate
	Nawami	558	Acuminate	Acuminate	Acuminate	Acuminate	Acuminate	Acuminate
	Kharuni (Bangana)	496	Acuminate	Acuminate	Acuminate	Acuminate	Acuminate	Acuminate
	Badwar	510	Acuminate	Acuminate	Acuminate	Acuminate	Acuminate	Acuminate
	Lambalahri	802	Acuminate	Acuminate	Acuminate	Acute	Acute	Acute
Hamirpur	Janhen	818	Acuminate	Acuminate	Acuminate	Acuminate	Acuminate	Acuminate
	Jhinjhakari	625	Acuminate	Acute	Acuminate	Acuminate	Acuminate	Acuminate
	Harbal Neri	765	Acuminate	Acuminate	Acute	Acuminate	Acuminate	Acuminate
	Anu Khurad	708	Acuminate	Acuminate	Acuminate	Acute	Acuminate	Acuminate
	Bha leth	1540	Acuminate	Acute	Acuminate	Acuminate	Acuminate	Acuminate
Kangra	Katoi	554	Acuminate	Acuminate	Acuminate	Acuminate	Acuminate	Acuminate
	Baluglua	737	Acuminate	Acute	Acuminate	Acuminate	Acuminate	Acuminate
	Old Kangra	764	Acuminate	Acuminate	Acuminate	Acuminate	Acute	Acuminate
	Dohan	845	Acuminate	Acuminate	Acuminate	Acuminate	Acuminate	Acuminate
	Balla	1318	Acuminate	Acuminate	Acuminate	Acuminate	Acute	Acuminate
Mandi	Patta	500	Acuminate	Acute	Acute	Acuminate	Acuminate	Acuminate
	Gangal	445	Acute	Acuminate	Acuminate	Acute	Acuminate	Acuminate
	Bagla	639	Acuminate	Acuminate	Acuminate	Acuminate	Acuminate	Acuminate
	Balt	897	Acuminate	Acuminate	Acuminate	Acute	Acute	Acute
	Bharnoi	1046	Acute	Acuminate	Acuminate	Acute	Acuminate	Acuminate

**Table 5.2:** Percent score on each desired morphological leaf apex features among and between population *Grewia optiva* (Beul).

Sr. No.	Leaf Apex	Occurrence of Apex	Leaf Apex (%)
1	Acute	26	14.44
2	Acuminate	154	85.55
	Total	180	99.99



**4. Conclusion**

Study concluded developing morphological descriptors bark feature Silver brown, leaf shape ovate, leaf colour 137-A (Green), leaf margin serrate and leaf apex acuminate showed

that these morphological characters were almost most common and same in each population which indicates similarly in qualitative indicators within and between populations. The fodder is preferred by cattle during lean

period in winter, as it possess high digestive quality. Fodder may be rich in crude protein among and within population. These characters of *Grewia optiva* proved the best quality of a superior plus trees as qualitative indicates of the plant growth. This is the first report of its own type and kind on this species. However variation studies in qualitative and Quantitative characteristics have been worked out by many authors workers on this species during different period of time (Kaushal 1978, Khosla *et al.* 1980 <sup>[7]</sup>, Gupta atul 1993 <sup>[5]</sup>, Thakur *et al.* 2000, Pant K.S. 2002 <sup>[8]</sup>, Sankhyan *et al.* 2012 <sup>[10]</sup>, Bhat *et al.* 2018 <sup>[2]</sup>, Shikha Bhagta 2019) <sup>[3]</sup>. These desired traits *viz* silver brown bark ovate leaf shape dark green colour Leaf serrate margin are recommended for selection after screening of identified features of the morphotypes.

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