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## Analysis on morphological descriptors of Seabuckthorn (*Hippophae rhamnoides* L.) in cold desert eco-system of Himachal Pradesh

**Dr. HP Sankhyan, Dr. Sanjeev Thakur, Dr. SS Sharma and Dr. Arun Negi**

### Abstract

Analysis on morphological descriptors of Seabuckthorn (*Hippophae rhamnoides* L.) in Cold Desert Ecosystem of Himachal Pradesh was undertaken in different ten major gene pool areas of seabuckthorn in Spiti Valley of Himachal Pradesh, where 80 per cent population is of (*Hippophae rhamnoides* L.). Twenty plants of each gene pool area were selected during the end of growing season. Plant shoot, Leaf blade, Pubescence and Fruit characteristics were recorded. Twenty two morphological traits were recorded for vegetative and reproductive descriptors, which is comprised of Qualitative and Quantitative characteristics. Study concluded with preparation of DUS (Distinctiveness, Uniformity and Stability) guidelines for developing a new species/sub species or variety or new clone which will help in further breeding and genetic improvement programme. The present study identifies the morphological descriptors that are most relevant for characterization of Seabuckthorn (*Hippophae rhamnoides* L.) in Cold Desert Eco-system of Himachal Pradesh.

**Keywords:** Morphological descriptors, *Hippophae rhamnoides*, gene pool areas, genetic improvement, ecosystem, cold desert

### Introduction

Seabuckthorn (*Hippophae rhamnoides* L) also called Sallow thorn belonging to the family Elaeagnaceae, is a deciduous shrub with yellow or orange fruits (Li, 1996) [3]. It rapidly develops an extensive roots system and is therefore, an ideal plant for preventing soil erosion (Yao and Tigerstedt, 1994) [8]. Seabuckthorn has also been used in land reclamation (Schroeder and Yao, 1995) [7] for its ability to fix atmospheric nitrogen and conserve other essential nutrients (Akkermans *et al*, 1983) [1]. It can withstand temperatures from -43 to 40 °C (Lu, 1992) [5]. Although it is considered to be drought resistant (Heinze and Fiedler, 1981) [2], irrigation is needed in regions receiving <400 mm of rainfall per year for better growth (Lu, 1992) [5]. Seabuckthorn used to grow in sand dunes along the sea beaches. Taxonomically there are three major *Hippophae* species: *H. rhamnoides* L, *H. salicifolia* D. Don and *H. tibetana* Schlecht (Rousi, 1971) [6]. A fourth species, *H. neurocarpa* Liu & He, was described in 1978 (Liu and He, 1978) [4]. Seabuckthorn is distributed widely in Asia Russia, Germany, China, France, Romania, Central Asia, Nepal, Pakistan, Bhutan and India. The plant is Dioecious and so both male and female plants must be grown in order to obtain fruits. Cross-pollination occurs through wind. The fruits of Seabuckthorn represent one of the important vitamin sources for people living in cold and long winter regions of the world. Because of its multiple uses, Seabuckthorn is known as wonder plant. The bud break takes place during March and April, leaf emergence is between March and May (depending upon locality) and complete leaf flush is by the end of May. Flowering period is during June, while the seed set takes place by July. Fruit and seed maturity is completed by October end. Fruit weight varies between 8 to 27g / 100 fruits in *H. rhamnoides*. The insufficiency of morphological descriptors reveals the importance of studies related to this topic for the genetic improvement of seabuckthorn. Accordingly analysis on morphological descriptors of seabuckthorn in cold deserts eco-system of HP was undertaken in different ten major gene pool of seabuckthorn in cold deserts eco-systems of Himachal Pradesh in Spiti valley, where 80 per cent population is of *Hippophae rhamnoides* L, which is locally known as Chamma, Sutz/Sarla/Tirku, an important valuable bio resource of cold deserts having ecological and economical potentials.

## Materials and Methods

For morphological characterization, collection, evaluation and documentation of naturally growing species of Seabuckthorn (*Hippophae rhamnoides*) in cold deserts of Spiti valley, ten sites (major gene pool areas) were selected in Spiti Valley of Himachal Pradesh. Twenty plants were selected from each gene pool areas during end of growing season. The selected plants were used for screening of best and promising

genotypes. Multistage Random Sampling Technique was used to select the plants of Seabuckthorn. Berries, leaves and morphological data were collected from nine sites (major gene pool areas) in Spiti valley of Himachal Pradesh. Selected major gene pool areas of naturally growing species of Seabuckthorn (*Hippophae rhamnoides*) in cold deserts of Spiti Valley for screening of best and promising genotypes is presented in Table-I.

**Table 1:** Major gene pool areas of Seabuckthorn (*Hippophae rhamnoides* L) in cold deserts eco-system of Himachal Pradesh

S. No	Code	Major Gene pool areas	Latitude (north)	Longitude (east)	Altitude (m)
1	GPA1	Rangreek	32°15.179'	078°00.242'	3826
2	GPA2	Kaza	32°13.596'	078°03.815'	3601
3	GPA3	Sheigo	32°10.583'	078°06.242'	3538
4	GPA4	Schilling	32°08.648'	078°13.195'	3437
5	GPA5	Poh	32°07.083'	078°19.186'	3386
6	GPA6	Tabo	32°05.710'	078°22.166'	3342
7	GPA7	Lari	32°04.379'	078°25.463'	3309
8	GPA8	Mane	32°02.006'	078°14.192'	3453
9	GPA9	Hurling	32°03.787'	078°33.048'	3149
10.	GPA10	Pin valley	31°14.176'	077°08.824'	3840

### Characteristics containing the following key were used

- Plant: Observations made during winter dormancy.
- Shoot: Observations made during active growth.
- Leaf blade: Observations made on mature leaves taken from the middle third of the current season's growth in the middle part of plant.
- Pubescence: Observations made using a magnifying glass.
- Fruit: Observations made at the time of fruit maturity.

The vigour of the plant was considered as the overall abundance of vegetative growth, Lateral thorns were assessed exclusively, since the terminal thorns (at the tip of the central leading shoots) were longer, The time of beginning of flowering is when 10% of the flowers are fully open and the time of fruit maturity was when at least 90% of fruits have achieved full colour were recorded and measured accordingly. Twenty two morphological traits were observed namely; Plant: Sex, Plant: Growth Type, Plant: Attitude of Branches, Plant: Vigor, Plant: Density of Shoots, Plant: Position of Inflorescence, One-year-old Shoot: Thickness, Shoot: Number of thorns ( from middle part to top), Shoot: length of Thorns, Leaf Blade: Shape, Leaf Blade: Size, Leaf Blade: Undulation of Margin, Leaf Blade: Colour of Upper side, Leaf Blade: Intensity of Green Colour of upper side, Leaf Blade: Pubescence of Lower side, Fruit: Size, Fruit: Shape, Fruit: Colour of Skin, Fruit: Pubescence, Fruit: Length of Stalk, Time of Beginning of Flowering and Time of beginning of Fruit Ripening. Qualitative (QL) and Quantitative characteristics (QN) were observed and recorded following visual assessment by observation of individual plants or parts of plants (VS), visual assessment by a single observation of group of plants or parts of plants (VG), Measurement of a number of individual plants or parts of plants (MS) and Single measurement of a group of plants or parts of plants (MG).

### Results and Discussion

Morphological descriptors developed and prepared reveals the importance of the study related to this research work for the genetic improvement of the seabuckthorn to decide and select most useful traits for the programme. Observation recorded on plant, shoot, leaf blade, pubescence and fruits among different gene pool areas of seabuckthorn growing in spiti

valley of Himachal Pradesh (Table-2). Qualitative (QL) and Quantitative characteristics (QN) were observed and recorded following different methods/measurements reveals that major population in gene pool areas on the basis of sex characteristics is female in all gene pool areas. On the basis of plant growth type tree type and bush type stage of expression revealed that tree type is available as major occurrence GPA-2 and bush type GPA-1 and GPA-5. Plant: Attitude of Branches indicate erect stage of expression in GPA8, Semi-Erect in GPA-4, Horizontal in GPA-5, GPA-7, GPA-9, GPA-10. Plant: Vigor major occurrence observed as Medium in GPA-7, Strong GPA-1 and Very Strong in GPA-4, GPA-5. Plant: Density of Shoots observed as Sparse in GPA-7, GPA-9, Medium GPA-1, GPA-5, GPA-10 and Dense GPA-5, GPA-6, GPA-8. Plant: Position of Inflorescence indicate on one year-old Shoots only in GPA-3, GPA-4, GPA-10 and Both on one-year-old and older Shoot in GPA-2, GPA-7.

One-year-old Shoot: Thickness major occurrence observed as Thin GPA-8, GPA-10, Medium GPA-1, GPA-3, GPA-4 and Thick GPA-5. Shoot : Number of thorns ( from middle part to top) observed as Absent or very Few in GPA-9, Few in GPA-5, Medium in GPA-3 and Many in GPA-1, GPA-6, GPA-8. Shoot: length of Thorns observed as Short in GPA-3, GPA-6, Medium GPA-8 and Long GPA-1, GPA-4, GPA-5.

Leaf Blade: Shape indicates Very Narrow Elliptic stage of expression in GPA-4, GPA-10, Narrow Elliptic in GPA-2 and Narrow Ovate GPA-8. Leaf Blade: Size observed as Small in GPA-7, Medium GPA-2, GPA-3, GPA-5, GPA-6, GPA-8, Large in GPA-4, GPA-10. Leaf Blade: Undulation of Margin absent in GPA-5, GPA-6, GPA-8, GPA-10 and Present in GPA9. Leaf Blade: Colour of Upper side observed as Green GPA-1, GPA-6 and Silverish in GPA-3, GPA-7, GPA-9, GPA-10. Leaf Blade: Intensity of Green Colour of upper side observed as Light in GPA-7, GPA-10, Medium in GPA-1, GPA-9 and Dark in GPA-8. Leaf Blade: Pubescence of Lower side observed as Weak in GPA-1, GPA-3, GPA-6, GPA-7, GPA-8, Medium in GPA-2 and Strong in GPA-4.

Fruit: Size major occurrence observed as Small in GPA-1, GPA-6, GPA-8, Medium in GPA-6 and Large in GPA-8. Fruit: Shape indicate Ovate GPA-8, Circular GPA-7, Elliptic GPA-6 & GPA-8 and Oblong in GPA-3, GPA-5 & GPA-6. Fruit: Colour of Skin indicate Yellow Orange stage of

expression in GPA-3, GPA-5, GPA-6, GPA-7 & GPA-8 and Orange Red in GPA-1, GPA-2. Fruit: Pubescence major occurrence observed as Week in GPA-9, Medium in GPA-4 and Strong in GPA-3. Fruit: Length of Stalk observed as Short in GPA-2, GPA-7, Medium in GPA-5 and Long in

GPA9. Time of Beginning of Flowering major occurrence observed as Early in GPA-10, Medium in GPA-4 & GPA-6 and Late in GPA5. Time of beginning of Fruit Ripening observed as Very Early in GPA-7, GPA-10, Early in GPA-4, GPA-10, Medium in GPA-6 and Late in GPA-5.

**Table 2:** Preparation of descriptions and analysis on morphological descriptors of seabuckthorn (*Hippophae rhamnoides* L.) in cold deserts ecosystem

Sr. No.	Characteristics	States of expression	Notes	Example Varieties	Stage of Observation	Type of Assessment
1. (+)QLG	Plant: Sex	Female	1	GPA1, GPA2, GPA3, GPA4, GPA5, GPA6, GPA7, GPA8, GPA9, GPA10	(b)	VG
		Male	2	----		
2. (+)QLG	Plant: Growth Type	Tree Type	1	GPA2	(a)	VG
		Bush Type	2	GPA1, GPA5		
3. PQG	Plant: Attitude of Branches	Erect	1	GPA8	(a)	VG
		Semi- Erect	2	GPA4		
		Horizontal	3	GPA5, GPA7, GPA9, GPA10		
		Arching	4	-----		
4. QN	Plant: Vigor	Weak	3	-----	(a)	VG
		Medium	5	GPA7		
		Strong	7	GPA1		
		Very Strong	9	GPA4, GPA5		
5. QN	Plant: Density of Shoots	Sparse	3	GPA7, GPA9	(b)	VG
		Medium	5	GPA1, GPA5, GPA10		
		Dense	7	GPA5, GPA6, GPA8		
6. QN	Plant: Position of Inflorescence	On one year- old Shoots only	1	GPA3, GPA4, GPA10	(b)	VG
		Both on one-year-old and older Shoot	2	GPA2, GPA7		
7. QN	One- year-old Shoot: Thickness	Thin	3	GPA8, GPA10	(b)	VG
		Medium	5	GPA1, GPA3, GPA4		
		Thick	7	GPA5		
8. QNG	Shoot: Number of thorns (from middle part to top)	Absent or very Few	1	GPA9	(b)	VG
		Few	3	GPA5		
		Medium	5	GPA3		
		Many	7	GPA1, GPA6, GPA8		
9. (+)PQ	Shoot: length of Thorns	Short	3	GPA3, GPA6	(b)	VG
		Medium	5	GPA8		
		Long	7	GPA1, GPA4, GPA5		
10. (+)PQ	Leaf Blade: Shape	Very Narrow Elliptic	1	GPA4, GPA10	(c)	VG
		Narrow Elliptic	2	GPA2,		
		Narrow Ovate	3	GPA8		
11. QN	Leaf Blade: Size	Small	3	GPA7	(c)	MG/VG
		Medium	5	GPA2, GPA3, GPA5, GPA6, GPA8		
		Large	7	GPA4, GPA10		
12. QL	Leaf Blade: Undulation of Margin	Absent	1	GPA5, GPA6, GPA8, GPA10	(c)	VG
		Present	9	GPA9		
13. QL	Leaf Blade: Colour of Upper side	Green	1	GPA1, GPA6	(c)	VG
		Silverish	2	GPA3, GPA7, GPA9, GPA10		
14. QN	Leaf Blade: Intensity of Green Colour of upper side	Light	1	GPA7, GPA10	(c)	VG
		Medium	2	GPA1, GPA9		
		Dark	3	GPA8		
15. QN	Leaf Blade: Pubescence of Lower side	Weak	3	GPA1, GPA3, GPA6, GPA7, GPA8	(d)	VG
		Medium	5	GPA2		
		Strong	7	GPA4		
16. QN	Fruit: Size	Small	3	GPA1, GPA6, GPA8	(d)	VG
		Medium	5	GPA6		
		Large	7	GPA8		
17. (+)PQ	Fruit: Shape	Pear-Shaped	1	-----	(d)	VG
		Ovate	2	GPA8		
		Transverse Elliptic	3	-----		
		Circular	4	GPA7		
		Elliptic	5	GPA6, GPA8		
18. PQ	Fruit: Colour of Skin	Oblong	6	GPA3, GPA5, GPA6	(d)	VG
		Light Yellow	1	----		
		Dark Yellow	2	-----		
		Yellow Orange	3	GPA3, GPA5, GPA6, GPA7, GPA8		
		Orange Red	4	GPA1, GPA2		
19. QN	Fruit: Pubescence	Red	5	-----	(d)	VG
		Week	3	GPA9		
		Medium	5	GPA4		
20. QN	Fruit: Length of Stalk	Strong	7	GPA3	(d)	VG
		Short	1	GPA2, GPA7		

		Medium	2	GPA5		
		Long	3	GPA9		
21. (+)QN	Time of Beginning of Flowering	Early	3	GPA10	(b)	VG
		Medium	5	GPA4, GPA6		
		Late	7	GPA5		
		Very Early	1	GPA7, GPA10		
22. (+)QN	Time of beginning of Fruit Ripening	Early	3	GPA4, GPA10	(e)	VG
		Medium	5	GPA6		
		Late	7	GPA5		
		Very Late	9	-----		

### Conclusion

Study revealed and concluded developing morphological descriptors for plant growth and shoot traits, leaf blade, pubescence and fruit traits which is clean cut indication for studying reproductive as well as vegetative morphology of plants. Information generated for developing plant descriptors will certainly help for the genetic improvement of seabuckthorn. Best genotypes are also identified for different traits under study so as to harness the full potentials of this valuable plant resource. Preliminary study provides baseline information for development of better strains satisfying Distinctiveness, Uniformity and Stability (DUS) criteria.

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### References

1. Akkermans ADL, Roelofsen W, Blom J, Huss-Danell K, Harkink R. Utilization of carbon and nitrogen compounds by *Frankia* in synthetic media and in root nodules of *Alnus glutinosa*, *Hippophae rhamnoides* and *Datisca cannabina*. Can J Bot. 1983; 61:2793-2800.
2. Heinze M, Fiedler HJ. Experimental planting of potash waste dumps I. Communication: pot experiments with trees and shrubs under various water and nutrient conditions. Acker-und pflanzenbau and Bo-denkunde. 1981; 25:315.
3. Li TSC, Schroeder WR. Seabuckthorn (*Hippophae rhamnoides* Linn)-A multipurpose plant. Hort. Tech. 1996; 6:370-380.
4. Liu SW, TN He. The genus *Hippophae* from the Quin-Zing plateau. Acta Phytotaxon. 1978; 16:106-108.
5. Lu R. Seabuckthorn: A multipurpose plant species for fragile mountains. International Centre for Integrated Mountain Development, Kathamandu, Nepal, 1992, 62.
6. Rousi A. The genus *Hippophae* Linn. A taxonomic study, Ann Bot Fennici. 1971; 8:177-227.
7. Schroeder WR, Yao Y. Seabuckthorn: A promising multipurpose crop for Saskatchewan, Prairie Farm Rehabilitation Administration. Agriculture and Agri-Food Canada, 1995, 14.
8. Yao Y, Tigerstedt PMA. Genetic diversity in *Hippophae* and its use in plant breeding Euphytica. 1994.77, 165-169.