Distribution of *Hippophae* throughout the Himalayan Region

Geographical Distribution

This plant can be found in all the countries of the Himalayan Region, and its distribution extends for over 35 00 km from east to west. It grows abundantly throughout this vast mountain area. There are four species and nine sub-species worldwide, of which four species and four sub-species are in the Himalayas and the other five sub-species are distributed throughout Eurasia. It is believed that the Hindu Kush-Himalayas and the Qinghai Tibetan Plateau are the main areas of distribution and origin of this genus.

The following Tables (3 and 4) contain data on the uses of *Hippophae* in the Hindu Kush-Himalayan Region and its uses and potentials are subsequently discussed.

Table 3: Principal Chemical Components of the Juice of Seabuckthorn (*Hippophae L.*) in the Himalayas (China)

Species	Collecting Province	Wt per 100 fruits (g)	Rate of juice (fresh wt%)	Soluble sugar (%)	Organic acid (%)	Vitamin C (mg/100ml)	Free amino (mg/100ml)
H. rhammnoides L. sub sp. *gyantsensis rousi*	Zhedang, Xizang	6.5	33.5	3.7	2.2	23.4	65.7
H. rham. L. sub sp. *turkestanica rousi*	Huocheng, Xinjing	19.5	80.8	7.2	3.5	471.5	122.0
H. rham. L. sub sp. *yunnananensis rousi*	Zhongdian, Yunnan	16.5	78.1	6.1	4.6	1129.0	108.0
H. rham. L. sub sp. *sinensis rousi*	Xiaojin, Sichuan	18.3	79.1	6.8	6.2	1289.5	83.6
H. thibetana schelechlend	Hongyuan, Sichuan	40.0	82.5	8.9	3.0	159.8	76.4
H. neurocarpa S. W. Liu et. T. N. He	Daocheng, Sichuan	4.5	trace	2.1	1.6	3.5	666.6

Source : Author

Table 4: The Chemical Components of the Fatty Acids in Seabuckthorn (*Hippophae L.*) in the Himalayas (China)

Species	Collecting Place	Fruit part analysed	Oil content (%)	Fatty Acid Component (%)		
				Sat (%)	Unsat (%)	Linoleic & Linolenic acid
H. rhammnoides sub sp. *sinensis rousi*	Xiaojin, Sichuan	Seed	9.87	13.7	86.6	64.6
		Pulp	2.02	27.3	71.2	11.4
H. rham. L. sub sp *turkestanica rousi*	Huocheng, Xizang	Seed	12.86	11.1	88.9	74.2
		Pulp	2.03	31.7	64.8	15.4
H. Rham. L. sub sp. *yunnanensis rousi*	Zhongdian, Yunnan	Seed	10.21	16.9	83.0	62.3
		Pulp	2.59	25.1	74.9	17.9
H. rham. L. sub sp. *gyantsensis rousi*	Zedang, Xizang	Seed	9.82	16.0	83.9	60.0
		Pulp	4.03	27.7	72.3	44.4
H. salicifolia D. Don	Chuona, Xizang	Seed	10.85	17.3	82.7	63.0
		Pulp	1.58	26.3	73.7	8.2
H. thibetana Schlechtend	Honyuan, Sichuan	Seed	19.51	11.7	88.2	64.9
		Pulp	3.50	16.1	81.3	8.0
H. neurocarpa S. W. Liu et T. N. He	Daocheng, Sichuan	Seed	16.12	14.0	85.9	65.5
		Pulp	8.60	24.1	75.8	47.7

Source : Author

Properties, and Uses

1. *Hippophae rhammnoides L.* of the sub-species *sinensis rousi* occupies the largest area, and is distributed throughout Shanxi, Shaanxi, Gansu, Qinghai, Sichuan, Nei Monggo, Hebei, and Liaoning at altitudes varying from 50-3,800 m.a.s.l.

This sub-species is most widely distributed in China and the plants are commonly found. The berries vary in shape, size, and shade of colour indicating diversity. The data in Table 3 indicate that this sub-species is a rich source of Vitamin C and organic acid and can, therefore, be used for making fruit juices. From the data in Table 4, it can be seen that the pulp and seeds are rich in oil, and linoleic and linoleic acid in the total fatty acids total more than 60 per cent. Therefore, this sub-species has a number of uses.

Currently, seabuckthorn products are extracted from plants that are growing naturally, and, because natural grooves are dispersed over a wide area, the yield is unstable. To enhance production from seabuckthorn, good seedlings with large berries should be selected which have a high content of Vitamin C. Dwarf-sized plants with a minimum of thorns are the best. These can be propagated by asexual reproduction and plantations established to raise the commercial value of this sub-species.

2. *Hippophae rhammnoides L.* of the sub species *turkestanica* grows on the terraces of river valleys, on open slopes, and in river valleys at altitudes between 800 to 3,000m in Western Xizang in Tibet, the USSR, Afghanistan, Northern Pakistan, and North-west India. It is found throughout the arid regions of Xizang and Central Asia. From Table 3, it can be seen that the content of Vitamin C in this sub-species is much lower than in *Hippophae rhammnoides L.* of the sub-species *sinensis*, so it is not a good source of fruit juice. However, the oil content of the seeds is 12.86 per cent higher than in other sub-species. The arid climate in which it grows, abundant sunshine, and a wide range of temperatures are favourable for oil formation.

3. *Hippophae rhammnoides* of the sub-species *yunnanensis rousi* is distributed throughout the gorges and along the river banks of North-West Yunnan, South-West Sichuan, Eastern Tibet, and Northern Burma. The characteristics of this sub-species are very similar to those of the sub-species *Sinensis*. The two sub-species are often found together in Southern Sichuan and Eastern Tibet, and it is difficult to identify them by plant morphology. From Tables 3 and 4 it can be seen that there are no distinct differences in berry quality between the two sub-species. Both of them are used for making fruit juices.

4. *Hippophae rhammnoides L.* of the sub species *gyantensis rousi* grows on terraces and river banks at altitudes from 3,200m to 3,800m along the Yaly Tsangpo River in Tibet and Sikkim. The berries have ridges on them. Table 3 shows that the juice extraction rate is only 33.5 per cent, and this is half the rate of other sub-species. The Vitamin C content is also much lower, so it is not suitable for making juices. However, the pulp and seed oil can still be used.

   This sub-species is distributed throughout the arid region of Tibet and flourishes in river valleys where the precipitation is below 300mm. Its introduction into other arid and semi-arid regions is considered feasible. This sub-species differs from others in terms of morphology, biological features, geographic distribution, and chemical composition. Taxonomist A. Rousi identified it as a sub-species under *Hippophae rhammnoides*. The author believes that it should be subjected to further study.

5. *Hippophae salicifolia D. Don* is found in gorges and on the edges of forests in alpine areas, at altitudes ranging from 2,800-3,700m, in Southern Tibet, Kashmir, Nepal, Sikkim, and Bhutan.

   It is an endemic species in the Himalayan Region; grows vigorously and has few thorns. Compared to *Hippophae rhammnoides L.*, sub-species *sinensis*, the quality is better. The

amounts of Vitamin C, sugar, organic acid, and free amino acid are higher than those of the sub-species *sinensis*. Most important is the fact that the Vitamin C content is 1,700mg/100ml, and this is much higher than in any of the other sub-species. This species is widely distributed throughout Southern Tibet and it is necessary to introduce it into other regions also.

6. *Hippophae thibetana Schlechtend* is distributed throughout the grasslands and on the river banks of the Qinghai Plateau, Gansu, Tibet, Sichuan, Sikkim, Nepal, and Northern India at altitudes from 3,000 to 5,200m.

It is a short species, ranging in height from eight to 60 cm, with few thorns. From Tables 3 and 4, it can be seen that its berries are the largest and its juice the richest. Although the content of Vitamin C is lower than that of sub-species *sinensis*, the pulp and seed oil contents are higher, making it useful for the production of oil. Being a dwarf plant, with large berries and few thorns, it is easy to pick and suitable for close planting. In the alpine areas and on the plateaux, this species is of both economic and ecological significance making it an excellent resource for propagation and cultivation purposes.

7. *Hippophae neurocarpa S. W. Liu et T.N. He* is distributed throughout the river valleys and plateaux at altitudes ranging from 2,800 to 4,300 m in Qinghai, Gansu, Sichuan, and Tibet.

From Tables 3 and 4, it can be seen that this sub-species has the smallest berries, little juice, and a low content of sugar, organic acid, and Vitamin C. The pulp and seed, however, contain oil with more than 75 per cent of fatty acids. In particular, the content of linoleic and linoleic acid in its pulp oil is higher than in other sub-species.

In areas above 3,500m, where it is difficult to find trees other than the willow, *Hippophae neurocarpa* grows to a height of from one to three metres. Moreover, it can resist strong winds and grows in masses in natural groves which makes it of importance ecologically.

To conclude, all seven species and sub-species have their own particular characteristics which make them important for cultivation and propagation. Because of the rich juice content of the *Hippophae rhammnoides* sub-species *sinensis*, *yunnanensis*, and *salicifolia*, they are suitable for a number of food and drink products. The high oil content in the *Hippophae rhammnoides* sub-species *turkestanica* and *thibetana* are suitable for producing oil and *gyantsensis* and *neurocarpa* also.

Each one of them has a different ecological adaptability and can be grown throughout the Hindu Kush-Himalayas in different natural conditions.