International Journal of Biosciences (IJB)
ISSN: 2220-6655 (Print) 2222-5234 (Online)
Vol. 2, No. 12, p. 75-84, 2012
http://www.innspub.net

RESEARCH PAPER OPEN ACCESS

Phytosociological and ethnobotanical attributes of *Skimmia laureola*

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Received: 31 October 2012
Revised: 11 November 2012
Accepted: 14 November 2012

Key words: *Skimmia laureola,* flavoring agent, garlands, density hectare^{-1}.

Abstract

Skmmia laureola grow gregariously in shady forest at altitude ranging from 7000 to 8800 feet. Leaves are also used as coughs remedy and commercially harvested as flavoring agent in food, and in traditional healing. These are made into garlands and considered sacred culture practices. Smoke from the leaves and twig is considered demon repellent. The smoke of the dry leaves is used for nasal tract clearness. It is also used for cold, fever and headache treatment. A total of 44 species were found in association with *Skimmia laureola* in different localities. Seven species including *Adiantum venustum, Fragaria vesica, Indigofera heterantha, Isodon rugosus, Podophyllum hexandrum, Pteridium aquilinum* and *Taxus baccata* were found to be the constant species in all six stands studied. Density hectare^{-1} values showed quite large values, ranging from 312 to 4437.5. A highest value was found in Bahrain, Swat while lowest value was recorded from Tajaka-Barawal, Upper Dir. Regression analyses were carried out to find out Correlation of altitude with Density hectare^{-1}, importance values and importance value indices.ethnobotanical studies and marketing of the plant has also been carried out.

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Introduction

Phytosociology is a sub discipline of plant ecology that describes the co-occurrence of plant species in communities (Ewald, 2003). Vegetation and soil characteristics are so interacted and inter-dependent that they become indicative of each other. A habitat under certain existing ecological conditions would permit plants being adjusted to these conditions, thus soil-plant relationship becomes so close that plants reveal the ecological situation of the inhabited locality (Anonymous, 1991; Boggs, 2000). Vegetation diversity is primarily determined by a combination of interacting physical and chemical factors like water temperature, solar radiation, current flow velocity, which play a major role in determining floristic diversity in a given area (Hinterlang, 1992). The level of essential elements in plants is dependent on geochemical characteristics of the soil and on the form of their bond with the components of the soil. Plants obtain these elements through roots (Bin *et al.,* 2001).

"Ethnobotany is the knowledge of plants usage by the native people and their usefulness as understood to the people of a particular ethnic group, since information concerning a particular plant varies from one ethnic group to another" (Tor-Anyiin *et al*, 2003; Igoli *et al*, 2005). The traditional uses of plants in native cultures are manifold and very diverse. Many people still depend on plants for their economy, medicine, food, construction material, fire wood, dyes, ornamentals purposes etc. The aim of the ethnobotanical study is to create a better understanding of the local uses, to make improved use of resources, to find new ways for transferring this knowledge to future generations and to search for new pharmaceuticals to be used in biomedicine (Kufer *et al.,* 2005). Similarly ethnobotanical knowledge establishes priorities in the local communities and assists taxonomist, ecologists, pharmacologists, watershed and wild life managers in their efforts for improving the economic status of the area (Ibrar *et al.,* 2007).

In the present study, phytosocilogical and ethnobotanical information from different localities in Malakand division, Pakistan has been carried out.

Skmmia laureola grow gregariously in shaddy forest at altitude ranging from 7000 to 8800 feet. It is woody shrub up to 1 meter tall with grayish green stem which is dichotomously branched, flowered April to late June. Leaves are simple lanceolate or sublanceolate with short petiole and entire margins and arranged in whorls with terminal cluster. Leaf ranges from 25 to 80mm in length and 16 to 30mm in width. Adaxial surface shinny dark green with translucent oil glands. Lower surface is light green. Midrib prominent with reticulate venation. Flower small, sessile or subsessile, greenish white in color. Flowers polygamous i.e. both unisexual and bisexual, calyx; 5 sepals, corolla; 5 petals, androcium; 5 stamens, gyoecium; 2-5 carpels. Fruit bright red ovoid berry, (Fig. 1) (Ali & Qaiser, 1995-2007; Polunin & Stainton, 1984).

It is known as Ner (English) Namer, Nazar Panra (Pashto) Patar, Barru (Kashmiri), Ner (Gujri), Nera (Hindko), Sheshar (Punjabi) (Shah & Khan, 2006).

In Pakistan, *Skimmia laureola* grows at an altitude of 5500- 10000 feet, under shady conditions in forest. It is common in the Hazara region, Murree Hills and Kashmir, in Upper Swat and Shangla, (Hamayun *et al*., 2006; Ali & Qaiser, 1995-2007). Upper and Lower Dir. In Nathia gally the plant is growing gregariously around the tract leading to Mukshpuri top.

Skimmia laureola is an important medicinal plants used traditionally for various purposes. Leaves give a musky odor due to the presence of a poisonous compound skimnianine (Ali & Qaiser, 1995-2007). Smoke from dried leaves is used to ward off evils. Leaves are also used as coughs remedy (Joan *et al*: 2004) and commercially harvested as flavoring agent in food, and in traditional healing. These are made into garlands and considered sacred culture practices (Bhattarai & Karki, 2006). The leaves of *S. laureola*

are dried, pulverized to powder form, and given to livestock with wheat flour for treating anthelmintic diseases. Smoke from the leaves and twig is considered demon repellent (Hamayun *et al.*, 2006). The smoke of the dry leaves is used for nasal tract clearness. It is also used for cold, fever and headache treatment. The leaves are used as insecticides and pesticides (Qureshi *et al.*, 2009).

Materials and methods

Phytosociology

Many trips to different localities were undertaken for phytosociological study of *Skimmia laureola* during 2008-2010. For this purpose six localities i.e Malamjabba (Swat), Bahrain (Swat) Matiltan (Swat) and Barawal (Upper Dir), Jagam (Upper Dir) and Patrak (Upper Dir) were selected (Fig. 2). Vegetation sampling was carried out in places where there were no sign of recent disturbance. For each stands altitude, latitude and exposure were recorded (Siddique *et al.*, 2009). Quantitative data was recorded using 10 quadrates of 10x10 m, 4x 4m, and 1x 1m for trees, shrubs and herbs respectively. The herb cover was determined by the Daubenmire's cover scale (Daubenmire, 1959). Tree diameter at breast height (1.5m) (dbh method) was measured to obtain basal area (Hussain, 1989). Density, cover and frequency were measured and then these values were converted to relative density, relative cover and relative frequency for each species (Phillips, 1959). The Importance Value (IV) for the species was determined as the sum of the relative frequency, relative density and relative coverage. Dividing this value by 3, Importance value index (IVI) was obtained (Curtis & Cottam, 1956). IV is used for determining dominant species in each stand. Density per hectare was calculated following Mueller-Dombois & Ellenberg, 1974.

Soil analysis

Soil samples from the habitat of the proposed plants were collected at a depth of 0-15 cm. The samples were air dried and analyzed for physicochemical characteristic including

Soil texture (Piper, 1966), Soil organic matter (Rayan *et al.*, 1997), Nitrogen contents (Subbiah & Asija, 1956). Phosphorus (Watanabe & Olsen, 1965), Pottassium, Iron, Zinc, Cupper (Jackson, 1958) and pH (Hussain, 1989).

Fig. 1. *Skimmia laureola* growing in natural habitat.

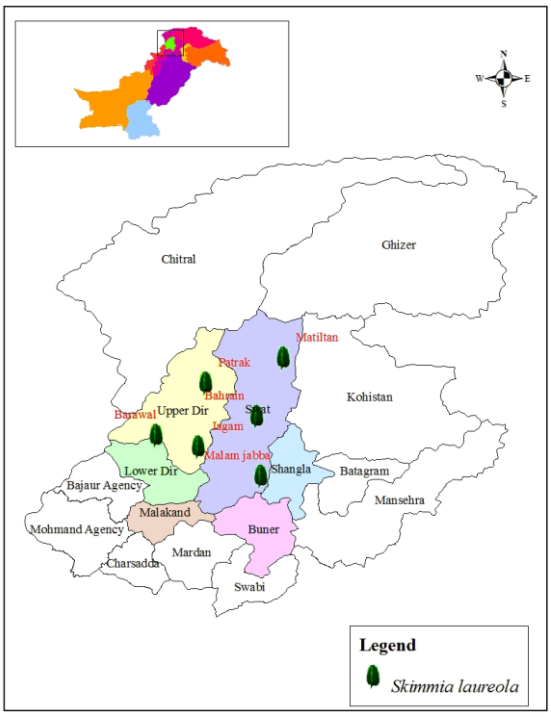

Fig. 2. Map representing natural habitate of *Skimmia laureola*.

Ethnobotany

To know the local traditional uses of the *S. laureala*, an open questionnaire was prepared to interview local inhabitants, Hakims and pansaries (local medicine man) during the field surveys of different localities. Questionnaire was filled on the spot as majority of the respondents were illiterate. Vernacular names, harvesting, collection, processing methods and manner of recipe used to treat human ailments along with other ethno botanical uses were

recorded for the proposed plants. Eighty four respondents, including pansaries, elder knowledgeable people (both men and women), having information about the plant, were interviewed. Only that information was considered authentic and reported, when at least 10 interviewees attested to the name and usage of the plants (Barkatullah *et al*., 2009).

Market survey

Market surveys were carried out in nearby area of their natural habitats in order to get data from local collectors, purchasers and dealers of the proposed research plants for their collection, storage, packing and marketing status (Hamayun *et al*., 2003).

Results and discussions

Phytosociology of Skimmia laureola

Skimmia laureola is a shrub growing gregariously in shady forests floor at altitude, ranging from 5500 to 10000 feet (Hassan-Ud-Din & Ghazanfar, 1980).

Six different localities in the natural habitat of Malakand division, Khyber Pukhtunkhwah, Pakistan were selected for phytosociological study of *S. laureola* (Table 1). This plant is distributed at the north facing slope at the elevation ranging from 7000 to 8800 feet.

A total of 44 species were found in association with *Skimmia laureola* in different localities. Seven species including *Adiantum venustum, Fragaria vesica, Indigofera heterantha, Isodon rugosus, Podophyllum hexandrum, Pteridium aquilinum* and *Taxus baccata* were found to be the constant species in all stands. Four species, *Abies pindrow, Barberis lyceum, Rubus fruticosus* and *Voila odorata* were the mostly present species, while six species including *Bergenia himalaica*, *Pinus wallichiana, Ranunculus laetus, Rumex dentatus, Trifolium repens, ,* and *Valeriana jatamansi* were the often present species in association with *S. laureola*. The associated flora also includes 14 seldom and 12 rare species (Table 2). *S. laureola* was found dominant in all sites except one where it was third dominant species (Table 3). The average importance value for *S. laureola* was 26.88, with average importance value index of 8.96. Maximum IV was 48.89 at Bahrain, District Swat while minimum IV was 4.86 at Tajaka, Barawal Upper Dir. Associated shrubs found in co-dominance with *S. Laureola* were *Indigofera heterantha, Isodon rugosus,* and *Rubus fruiticosus* with variable importance values (Table 3). The number of herbaceous species in each stand ranged from 12-19, showing that the ground flora exhibited somewhat variation. Among the herbaceous flora *Adiantum venustu, Fragaria vesica, Podophyllum hexandrum* and *Pteridium aquilinum* were the constant species with IV of 12.33, 38.36, 3.74 and 29.67 respectively. *Voila odorata* was the only species that fall in "mostly present" class of Raunkiaer's constancy classes. Most of the herbs were categorized as seldom and rare species having narrow range of distribution with *S. laureola*. Five trees were found in all localities in association with *S. laureola,* in which *Taxus baccata* was the only constant tree species. *Abies pindrow* was found to be mostly present while *Pinus wallichiana* was oftenly present spp. *Picea smithiana* and *Cedrus deodara* were the seldom and rarely present species in all the localities. *Cedrus deodara,* although present in only one stand had the highest importance values of 13.48 among the tree species.

In the present study density hectare^{-1} values were recorded for *S. laureola* which showed quite large values, ranging from 312 to 4437.5 (Fig. 3). A highest value was found in Bahrain, Swat while lowest value was recorded from Tajaka-Barawal, Upper Dir. As compared to other sites, Tajaka, Upper Dir was under intense biotic pressure because *S. laureola* is uprooted for commercial purposes and being grazed by goats during intense cold season. Because of these reasons this important plant is near to extinction in this area. Haq (1983) has reported *S. laureola* as endangered species in many localities of District Batagram, Pakistan. Similar situation might be occurring in other areas including the present research sites, as population size of this important

plant is decreasing day by day due to habitat loss, over exploitation and overgrazing.

Table 1. Localities selected for phytosociological studies of *Skimmia laureola*.

S. No.	Locality	Aspect	Slop	Altitude(Feet)	Coordinates
1	Bahrain Swat	North facing	Moderate to high	8500-8600	35° 12′ 10.86″ N 72° 29′ 57.63″ E
2	Malam Jabba Swat	North facing	Moderate to high	7200-7300	34° 48′ 16.76″ N 72° 37′ 10.44″ E
3	Matiltan Kalam Swat	North facing	Moderate to high	8750-8800	35° 34′ 57.25″ N 72° 40′ 13.41″ E
4	Tajaka Barawal Upper Dir	North facing	Moderate to high	8700-8800	35° 00′ 07.77″ N 72° 07′ 11.72″ E
5	Jagam Upper Dir	North facing	Moderate to high	7000-7100	35° 04′ 45.27″ N 71° 50′ 40.14″ E
6	Patrak Kumrat Upper Dir	North facing	Moderate to high	7900-7950	35° 25′ 15.58″ N 72° 09′ 57.86″ E

Regression analyses were carried out to find out Correlation of altitude with Density hectare^{-1}, importance values and importance value indices. Very less significant correlation (r^2 = 0.03393, P > 0.001) was found between altitude and Density hectare^{-1}. Similarly weak correlation was observed between importance values (r^2= 0.1214, P >0.001) and importance values indices (r^2 = 0.3193, P > 0.001). Significant correlation was found present between density hectare^{-1} and importance values (r^2 = 0.9636, P < 0.001) for *S. laureola* (Fig. 3).

Soil analysis

Soil analysis of the six stands of S. *laurola* growing in understory was carried out for physical, chemical and biological properties. Soil profile, soil pH and various nutrients were detected as their presence in soil affect the growth and distribution of plants (Sharma & Kumar, 1991). Texture of the soils was found clay loamy in four sites while loamy in the other two sites (Table 4). Nitrates contents were varied from 22.45 to 40.52 ppm. Phosphorus was found maximum in Bahrain Swat and Tjaka, Upper Dir while in other areas it has variable amounts. Similarly K, Fe, Zn and Cu were also detected in variable amounts in different localities. The pH of the soils ranged from 6.04 to 6.10 showing that *S. laureola* grows in weak acidic soil with organic contents ranging from 1.12 to 1.22 (Table 4). The present results are also in lineage with Rashid *et al.* (2011), who characterized soils from various spots of the surroundings of Malam Jabba, District Swat.

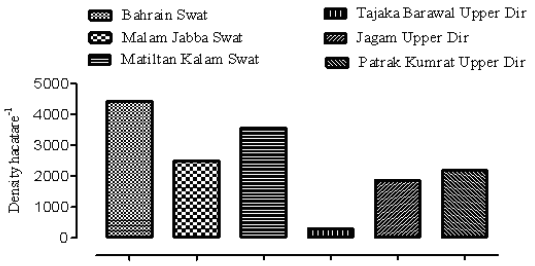

Fig. 3. Bars represent the density per hectare of *Skimmia laureola* in different localities.

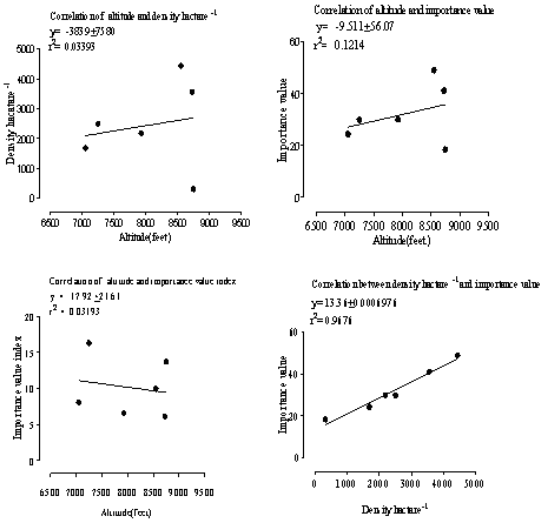

Fig. 4. Regression among some variables for phytosociological study of *Skimmia laureola*.

Ethnobotany of Skimmia laureola

Harvesting and collection: As *S. laureola* is perennial shrub growing at high altitudes, therefore young twigs with leaves are harvested throughout the year except winter, when it is covered under snow. They are plucked with hands and collected in sacs. The twigs are then tide into small bunches for sale. In winter these are sold in dry form. In hilly areas red fruits of *S. laureola* are collected and arranged into garland for ornamental purposes.

Table 2. Summary of the of the phytosociological attributes of *Skimmia laureola* and associated flora in sampling areas. Species are listed in alphabetical order.

S. No	Species name	No, of STP	Constancy	Importance Value(IV)			Importance value Index (IVI)		
				Max.	Min.	Aver.	Max.	Min	Aver
1	*Abies pindrow* (Royle ex D.Don) Royle	4	IV	10.69	7.35	9.02	3.56	2.45	3.01
2	*Adiantum venustum* D.Don.	6	IV	14.33	10.33	12.33	4.78	3.44	4.11
3	*Anaphalis spp*	1	I	4.06	4.06	4.06	1.35	1.35	1.35
4	*Andrachne cordifolia* (Wall. ex Decne.) Müll. Arg.	1	I	11.58	11.58	11.58	3.86	3.86	3.86
5	*Aquilegia pubiflora* Royle	1	I	15.56	15.56	15.56	5.19	5.19	5.19
6	*Arisaema propinquum* Schott	1	I	3.53	3.53	3.53	1.18	1.18	1.18
7	*Artemisia maritima* L.	2	II	4.06	2.57	3.32	1.35	0.86	1.11
8	*Barberis lyceum* Royle	4	IV	6.21	2.36	4.29	2.07	0.79	1.43
9	*Bergenia himalaic*a Boriss.	3	III	8.66	2.42	5.54	2.89	0.81	1.85
10	*Calamanthus* sp	1	I	7.38	7.38	7.38	2.46	2.46	2.46
11	*Caralluma tuberculata* Wall	2	II	12.39	1.40	6.90	4.13	0.47	2.30
12	*Cedrus deodara* (Roxb.) G.Don	1	I	13.48	13.48	13.48	4.49	4.49	4.49
13	*Cymbopogon distans* (Nees ex Steud)	1	I	13.49	13.49	13.49	4.50	4.50	4.50
14	*Diplachne fusca* (L.) P.Beauv.	2	II	20.03	8.63	14.33	6.68	2.88	4.78
15	*Epilobium angustifolium* L.	2	II	3.71	2.08	2.90	1.24	0.69	0.97
16	*Euphorbia wallichii* Hook. f.	1	I	8.38	8.38	8.38	2.79	2.79	2.79
17	*Fimbristylis squarrosa* Vahl	2	II	18.07	14.17	16.12	6.02	4.72	5.37
18	*Fragaria vesica* L.	6	V	46.34	30.37	38.36	15.4	10.1	12.79
19	*Galium aparine* L.	1	I	3.33	3.33	3.33	1.11	1.11	1.11
20	*Girardinia heterophylla* (Vahl) Decne.	1	I	13.16	13.16	13.16	4.39	4.39	4.39
21	*Heteropogon contortus* (L.) Beauv. ex Roemer & JA Schultes	2	II	18.72	16.10	17.41	6.24	5.37	5.80
22	*Impatience* sp.	1	I	8.10	8.10	8.10	2.70	2.70	2.70
23	*Indigofera heterantha* L.	6	V	18.55	10.74	14.65	6.18	3.58	4.88
24	*Isodon rugosus* Wall. ex Benth	6	V	9.14	4.50	6.82	3.05	1.50	2.27
25	*Origanum vulgare L.*	2	II	6.41	5.59	6.00	2.14	1.86	2.00
26	*Paeonia emodi* Wall. ex Royle	2	II	13.03	2.79	7.91	4.34	0.93	2.64
27	*Picea smithiana* (Wall) Boiss.	2	II	4.43	3.71	4.07	1.48	1.24	1.36
28	*Pinus wallichiana* A.B. Jacks	3	III	17.07	6.30	11.69	5.69	2.10	3.90
29	*Plantago lanceolata* L.	1	I	8.41	8.41	8.41	2.80	2.80	2.80
30	*Podophyllum hexandrum* Royale	5	V	4.18	3.29	3.74	1.39	1.10	1.25
31	*Polygonatum verticillatum* (Linn.) All.	2	I	8.62	8.62	8.62	2.87	2.87	2.87
32	*Pteridium aquilinum* (L.) Kuhn	6	V	38.25	21.08	29.67	12.7	7.03	9.89
33	.	3	III	12.91	7.90	10.41	4.30	2.63	3.47
34	*Rhus punjabensis* J. L. Stewart ex Brandis	2	II	2.15	0.82	1.49	0.72	0.27	0.50
35	*Rubus fruticosus* Agg.	4	IV	27.50	3.02	15.26	9.17	1.01	5.09
36	*Rumex dentatus* L.	3	III	6.94	6.52	6.73	2.31	2.17	2.24
37	*Saccharum bengalens* Retz.	2	II	11.18	10.11	10.65	3.73	3.37	3.55
38	***Skimmia laureola* (DC.) Sieb. & Zucc. ex Walp**	6	V	48.89	4.86	26.88	16.3	1.62	8.96
39	*Swertia chirayita* (Roxb. ex Fleming) Karsten	2	II	7.40	4.13	5.77	2.47	1.38	1.92
40	*Taxus baccata* L.	5	V	13.29	9.16	11.23	4.43	3.05	3.74
41	*Trifolium repens* L.	3	III	36.47	19.95	28.21	12.2	6.65	9.40
42	*Valeriana jatamansi* Jones	3	III	7.84	2.81	5.33	2.61	0.94	1.78
43	*Viburnum grandiflorum* Wall. ex DC.,	2	II	24.51	17.41	20.96	8.17	5.80	6.99
44	*Viola canescens* Wall ex Roxb.	1	I	5.37	5.37	5.37	1.79	1.79	1.79
45	*Viola odorata* L.	4	IV	35.21	11.71	23.46	11.7	3.90	7.82

Table 3. Dominant shrubby species on the bases of important value (IV) in the selected localities for *S. laureola*.

S. No.	Localities	Ist dominant	2nd dominant	3rd dominant	Position of *S. laureola*
1	Bahrain	*Skimmia laureola*	*Rubus fruiticosus*	*Indigofera heterantha*	1st
2	Malam Jabba	*Skimmia laureola*	*Viburnum grandiflorum*	*Isodon rugosus*	1st
3	Matiltan- Kalam	*Skimmia laureola*	*Viburnum grandiflorum*	*Isodon rugosus*	1st
4	Tajaka-Upper Dir	*Indigofera heterantha*	*Rubus fruiticosus*	*Skimmia laureola*	3rd
5	Jagam - Upper Dir	*Skimmia laureola*	*Rubus fruiticosus*	*Indigofera heterantha*	1st
6	Patrak-Upper Dir	*Skimmia laureola*	*Indigofera heterantha*	*Rubus fruiticosus*	1st

Table 4. Physicochemical analysis of the soil in different localities of *skimmia laureola*.

S. No.	Sample Description	Textural Class	No^{3-} (ppm)	P (ppm)	K (ppm)	Fe (ppm)	Zn (ppm)	Cu (ppm)	pH	Organic matter
1	Bahrain, Swat	Clay loamy	40.52	11.29	98	16.40	1.70	3.02	6.04	1.21
2	Malam Jabba	Clay loamy	24.60	2.70	256	20.36	1.56	3.67	6.09	1.12
3	Matiltan Kalam,	Clay loamy	22.45	2.09	239	18.03	1.45	3.87	6.10	1.14
4	Tajaka Upper Dir	Loamy	36.21	9.20	197	17.42	1.62	3.12	6.07	1.22
5	Jagam Upper Dir	Loamy	27.62	3..70	253	22.33	1.53	3.62	6.08	1.21
6	Patrak Upper Dir	Clay loamy	24.55	3.21	241	19.42	1.48	3.88	6.08	1.22

Table 5. Market value chain of minimum, maximum and average prices in Pakistani Rupees (PRs.) per kilogram of *Skimmia laureola* at different market points on the basis of data collected from local dealers, hakims and Pansaries.

S. No	Market	Status	Purchase (PRs./Kg)			Sale (PRs./Kg)			Annual trade (Kg) approximatly.
			Min.	Max.	Ave.	Min.	Max.	Ave.	
1	Mingora	Fresh	30.00	65.00	47.50	50.00	120.00	85.50	480
		Dry	50.00	75.00	62.50	80.00	170.00	125.00	220
2	Buner	Fresh	40.00	75.00	57.50	65.00	95.00	80.00	550
		Dry	65.00	95.00	80.00	75.00	120.00	97.50	320
3	Upper dir	Fresh	80.00	120.00	100.00	95.00	135.00	115.00	300
		Dry	120.00	145.00	132.50	140.00	165.00	152.50	75
4	Temergara	Fresh	65.00	105.00	85.00	85.00	125.00	105.00	300
		Dry	90.00	140.00	115.00	110.00	170.00	140.00	100
5	Batkhela	Fresh	70.00	100.00	85.00	100.00	160.00	130.00	80
		Dry	120.00	130.00	125.00	140.00	190.00	165.00	30
6	Dargai	Fresh	100.00	150.00	125.00	180.00	200.00	190.00	70
		Dry	140.00	180.00	160.00	180.00	220.00	200.00	35

Local uses

S. laureola is used extinsively through out the area to ward of evils, as it is considered a sacred plant. Peoples keep this plant in homes in fresh or dry form and smoked occassionally to ward off evils from their homes. In some areas, decoction of the leaves is used in treatment of common cold. Hamayun *et al.* (2006) and Qureshi *et al*. (2009) reported that this plant is used as antiviral agent which substantiate this use. These authors also reported that this plant is given to cattle in crushed form with flour as fodder to make milk thick and viscous and also as anthelmintic. Hamayun *et al.* (2006) and Sher *et al.* (2011) also reported that this plant is used as anthelmintic and for other cattle ailments. In the present research areas too, the plant is used for similar purposes. Most of the local hakims, pansaries and common aged people considerd the leaves of *Skimmia laureola* as a best hypoglycemic agent. For this purpose leaves are dried, powdered and swollowed with water. This property of *S. laureola* is not reported from any part of Pakistan. Fruit of *S. laureola* is beautiful bright red, made into garland and is used for ornamental purposes.

A large number of the people depend on mountains and forest resources for the livelihood, but over exploitation by man and over grazing imbalance the usage and production of natural wild plants (Salva *et al.*, 2001). As this plant is mainly collected for commercial purpose and mostly collected by children and unskilled persons, they uproot the whole plant during collection, thus the population of this useful plant decreases day by day. If the local inhabitants are provided with information about its importance and scientific knowledge for its proper collection, then this plant can be used substantially for a long time.

Market survey of Skimmia laureola

It was noticed during the market survey, that there were regular collectors of *S. laurola*, who collect this plant in their native areas and supply it to the nearest local market. Main markets for this plant in Malakand division are Mingora, Buner and Upper Dir, from where these are supplied to other parts of the country. The purchase and sale prices of this important medicinal plant vary from place to place, season to season and on the destination from their place of collection (Table 5). Because of collection season and large supplies, low prices were observed during summer season as compared to winter. Local dealers in Mingora, Buner and Upper Dir purchase this plant in fresh form, packed in sacs and then supply it to small dealers and nearby towns. Some dealers make collection directly through their agents and supply it to Mardan, Peshawar, Rawalpindi, Islamabad, Lahore, Karachi and even abroad. Some collecters after collection and drying store the drug in plastic bags for higher rates later in winter, when it is not available in fresh form. Various purchase rate, sale rate and approximate annual consumption of *S. laureola* in different markets are given in Table , which shows that the average purchase price of *S. laureola* ranges from Rs. 47 to Rs. 160 and the average sale rate ranges from Rs. 80 to Rs 200 per kilogram, whereas the annual trade ranges from 35 to 550 kg in different markets of the area.

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