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AN ACCOUNT OF SAMBUCUS L. IN THE HIMALAYAN REGIONS OF INDIA

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ABSTRACT

Keeping conformity with the taxonomic study on Caprifoliaceae Juss. in India the present authors could record as many as four species of SambucusL. (S. adnata Wall. ex DC., S.canadensis L., S.javanica Blume and S.wightiana Wall. ex Wight et Arn.) from the subtropical and temperate regions of the Himalaya. The present taxonomic account of Sambucus includes an artificial key to the identification of the concerned species, their brief description, information about flowering and fruiting periods, distribution and specimens examined.

KEYWORDS : Artificial key, Caprifoliaceae, *Sambucus*, Himalaya, Taxonomic Account

Sambucus L., the elderberry, has always been a taxon of debatable concern in assignment of its systematic position. *Sambucus* along with *Viburnum*, is traditionally given the membership of Caprifoliaceae sensu lato (Hara, 1966 1971; Heywood, 1978; Ohashi, 1975; Punt et al., 1974; Rau, 1975;Willis, 1982).Cronquist (1988) considered *Sambucus* as a genus of Caprifoliaceae belonging to the order Dipsacales Dumortier of the subclass Asteridae Takhtajan under the class Magnoliopsida Brongniart. *Sambucus*L. was placed in its own family Sambucaceae Batsch ex Borckhausen by Takhtajan (1997), Villareal-Quintanilla (2008), Sosa et al.(2010) and in Adoxaceae (Dumort.)E. Meyer by Watson and Dalwitz (1992 onwards), Zomlefer (1994), Judd etal. (1999), Mabberley (2008), APGIII (2009) on the basis of the molecular sequence data of Backlund & Bremer (1997) and Donoghue et al. (1992) respectively. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants(APGIII,2009) puts the family under Dipsacales Dumortier of the clade Campanulids belonging to Asterids of Core Eudicots under Eudicots, one of the major clades of Angiosperms.

The circumscription and phylogeny of this taxon has been very judiciously dealt with by Cronquist (1988). According to Cronquist (1988) if *Sambucus* and *Viburnum* are excluded, there seems little doubt that the remainder of the Caprifoliaceae should be associated with Valerianaceae and Dipsacaceae. Species of *Sambucus* have some similarities with *Viburnum* especially in pollen morphology (Bohnke-Gutlein and Weberling, 1981) and chromosomes (Sax and Kribs, 1930; Benko-Iseppon and Morawetz,1993) but differ in tetrasporic female gametophyte, dissected leaves, thick and soft pith, narrow tick walled pericycle in stem, simple perforation of vessels, paratracheal axial parenchyma, fibres with small simple pits, semitectate pollen grains, (Bassett and Compton,1970), 5-3 pyrenous berries and longer embryo (Takhtajan,1997).However, serologically *Viburnum* is closer to *Sambucus* than to all tested members of Caprifoliaceae (Hillebrand and Fairbrothers, 1970).

The elderberries are known to have immense ecological, horticultural, edible and medicinal values (Charlebois et al., 2010) for which they are praiseworthy deserving consideration in broad spectrum scientific research. In view of immense importance of *Sambucus* the present work was undertaken to document its species from its abode in the Himalaya .

MATERIALS AND METHODS

This work is based on thorough study and scrutiny of pertinent literature, specimens preserved in the Central National Herbarium (CAL) as well as the herbaria of the Lloyd Botanic Garden, Darjeeling (LBG), Sikkim Circle of Botanical Survey of India, Gangtok (BHSC), Burdwan University (BURD), North Bengal University, Eastern Regional Centre, Botanical Survey of Indioa, Shillong (ERC,BSI), Arunachal Pradesh Field Station, Botanical Survey of India, Itanagar (ARUN) and those collected during field work in the eastern Himalyan region since 2011 in conformity with earlier work (Mukherjee, 1988). Standard taxonomic methods were followed to describe each species and to prepare a comprehensive key to identification of the concerned species. The recorded

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species have been arranged alphabetically giving their scientific names, citations, basionyms and synonyms wherever necessary along with information about flowering and fruiting periods, distribution and specimen examined and use.

RESULTS

Sambucus L., Sp. Pl. 1: 269. 1753.

Deciduous shrubs or small trees or perennial herbs, nectariferous (extra-floral); branches smooth, striate, or warty often with conspicuous pith. Leaves opposite or alternate, imparipinnate or incompletely bipinnate; exstipulate or not so; leaflets serrate or lobed. Flowers in terminal flat topped umbellate or in pyramidal paniculate corymbose cymes, actinomorphic, occasionally dimorphic, sometimes with nectaries, articulate with pedicel; ebracteate, bracteoles 1 or absent. Calyx tubular with 35-parted limbs. Corolla white, rotate with 35 lobes. Stamens 5, basally epipetalous; filaments filiform, erect; anthers 2-celled, oblong. Carpels 3, compound forming 35 celled ovary; ovules solitary in each cell; style cushion-like; stigmas 3 - 5. Fruits berry like, with 3-5 pyrenes. Seeds 3-5, each triquetrous or ellipsoid.

Key to the species

1a. Shrubs or small trees; lenticels conspicuous; young branches rounded; lower pair of leaflets frequently 2-3 lobed ..... 3. S. *canadensis*.

1b. Perennial herbs or shrubs; lenticels absent or inconspicuous; young branches striate; lower pair of leaflets not lobed ..... 2.

2a. Flowers all fertile, rotate; leaflets 3-5,terminal ones often connected to next lower leaflet pair.... 1. S. *adnata*

2b. Flowers some sterile; leaflets 5-9, terminal ones not connected to next lower leaflet pair.....3

3a. A small straggling shrub; lateral leaflets proximally with 24 glandular teeth, some flowers converted into persistent urceolate nectaries..... 2. S. *javanica*

3b. A low growing strong herb or undershrub; lateral leaflets lacking glandular teeth, some flowers barren.....4. S.*wightiana*

Systematic account

1. *Sambucus* adnata Wall. ex DC., Prodr. 4: 322. 1830. C.B. Clarke in Hook.f.,Fl. Brit. India 3:2.1880.*Sambucus* gauischii Wettst. in Oesterr. Bot. Z. 40(6): 230231 1890. *Sambucus* schweriniana Rehd., in Pl. Wilson. 1(2): 306-307, 1912.

Common name: Asian Dwarf Elder

An undershrub, up to 1m in height, rhizomatous. Pith of roots and rhizomes white or red. Stem herbaceous, young branches striate; with white or red pith, lacking lenticels. Leaves imparipinnate; stipules linear; leaflets 35 pairs, narrowly elliptic to narrowly ovate or lanceolate, 415 × 1.52.5cm, abaxially sparsely pubescent, more densely pubescent on veins, base obtuse and oblique, margin serrate, apex acuminate; terminal pair of leaflets often decurrent and connected to next lower pair of leaflets, remaining leaflets alternate or sometimes subopposite; stipules of leaflets reduced to urceolate glands. Inflorescences terminal umbellate cymes with 35 rays, 1215 cm wide, young dense yellow pubescent and often with glandular hair, usually leafy at the base. Flowers white, all normal, none reduced to glands, 45 mm in width, faintly fragrant; bracteoles minute or 0. Calyx 5, urceolate, pubescent. Corolla 5, broad-campanulate, white; stamens 5, filaments dilated at base, anthers yellow; ovary 3 celled; styles short or nearly absent; stigma 3-lobed. Fruits berry like, globose, 34 mm wide, orange or red, black when dry; pyrenes ovoid, rugose or smooth. Seeds ellipsoid, ca.2.5mm long.

Flowering and fruiting: MayOctober.

Field note: A low growing shrub in hill slopes on roadside.

Distribution: Himalaya: Nepal, Sikkim, Bhutan, Darjeeling; up to an altitude of 3500m.

Specimens examined: Syssecbangla, Sikkim,11,000', Dr. King's collector194615; Phallbong ridge,9000', N.Gamble812 (CAL); Lamteng, Sikkim, Prain; Thangu, Sikkim, D.Prain 182; Phallabong ridge, Sikkim, 9000', N.Gamble 96c 812; Kalimpong,3500', S.K.Mukherjee5090; Kalimpong, Dr.K.Biswas8440; Sandakphu,7500' Dr.K.Biswas 8244; Lachung, 9000', G.A.Gammie681; On the way from Lachen to Thangu, North Sikkim.P.Chakraborty 2342; MizoHills,R.M.Dutta, 33588 (ERC,BSI);Manigong, West Siang, M.Bhaumik, 27661, (ARUN); Gohpur, near Ganga lake ,Arunachal Pradesh, Acharya and Mukherjee 130 (BURD).

Sambucus canadensis L. Sp. Pl. 1: 269. 1753; Hara in Fl. E. Himal.319.1966.; in Enum. Fl. Pl. Nepal 2:197.1979. Mukherjee, Fl. Pl. Darjiling 110. *Sambucus* nigra L. subsp. canadensis (L.) Bolli in Diss. Bot. 223: 168. 1994. *Sambucus* nigra var. canadensis (L.) B.L. Turner, Sida, Bot. Misc.24:6.2003.

Common name: American elderberry.

A small tree, 3-4 m in height. Stem round, conspicuously lenticellate. Leaves pinnately compound, opposite, bright green, exstipulate or stipules inconspicuous; leaflets 5-7, oval to ovate, 3-7 x 1.5-4 cm; serrate; acute; adaxially glabrous to strigose, abaxially slightly downy and pale green; veins strigose; lower pair frequently 2-3 lobed. Flowers white, in 5-rayed terminal umbellate cymes stretching up to 15 cm in width; pedicel jointed, glandular below the joint; bracteole minute. Calyx teeth 5, minute,. Corolla rotate with 5, somewhat round lobes; lobes 1.5 mm long, 3-nerved.Stamens 5; anthers oblong, 1 mm long; filaments 2 mm long. Ovary locules 3; styles very short; stigma 3, almost sessile. Fruits berry like, globose, 5-6 mm in diameter, dark brownish to black; pyrenes oblong, surface rugose. Seeds oblong, 2.5-3.0 mm long.

Flowering and fruiting: May November.

Field note: A small tree found growing in both wet and dry soils, primarily in sunny hill slopes, waste places on roadside and in shrubberies; often cultivated.

Distribution: Eastern Himalaya extending to North East. A native to South-west N. America and Central America, also known to occur in central and southern Europe, northwest Africa and southwest Asia. Often cultivated in Europe and Asia.

Use: Ripe fruits are edible, seen to be consumed by birds. The soft pith is used in laboratories for cutting plant sections for histological studies, making toys, decorative articles.

Notes: It is very close to the European *Sambucus* nigra, and Bolli (1994) treated S. Canadensis as its subspecies and Turner (2003) treated it as a variety of *Sambucus* nigra.

Specimens examined: Myelliem Village, Acharya and Mukherjee 61 (BURD);Lohit, Arunachal Pradesh, Wakro road side, A.S. Chauhan, 98064, (ERC,BSI) MawlaiPhudmawri, B.B.Pramanik,32770, (ERC,BSI); Laitmukhrah, Shillong, G.K.Deka, 19133(2) and 33173, (ERC,BSI) Shillong, S.K.Kar, 25302(2), (ERC,BSI); Nongpoh, Noonmati- Borholong, J. Joseph, 42397, (ERC,BSI); Dhankheti, Shillong (Khasi and Jayanti Hills), S.K.Kar, 32840, (ERC,BSI); E.B.Garden, B.K. Sihna,2005 (ERC,BSI); Shillong, G.Panigrahi, 21746 and 45379, (ERC,BSI) Nongstoin forest (West Khasi Hills), in the forest, near the river bank, A.S. Chauhan, 73879(2), (ERC,BSI) Shillong, G.K. Deka, 45380 and 22705, (ERC,BSI) Upper Shillong, G.K.Deka, 12864, (ERC,BSI) On thw way to Assam rible road, open places, Sankar Das,13167, (ERC,BSI) Noonmati, Borholong, Nongpoh, Joseph, 42397, (ERC,BSI) Nongstoin, G.V. Subbarao, 28428, (ERC,BSI) ShillongMustafi Cottage, G.K. Deka, 40134, (ERC,BSI) Shillong, G. Panigrahi, 22332, (ERC,BSI); BipinBalodi, 10306, (ARUN). Gohpur, near Ganga lake ,Arunachal Pradesh, Acharya and Mukherjee 129 (BURD) .

Sambucus javanica Blume in Bijdr., Fl. Ned. Ind. 13: 657 1825.C.B. Clarke in Hook. f., Fl. Brit. India 3:2. Wen,JunPlants of Tibet.2009.Ebulus chinensis (Lindley) Nakai, Tent. Capr. Japan 13 1921.; E. formosana Nakai in Bot. Mag. (Tokyo) 31(367): 211 1917. *Sambucus* argyi H. Léveillé in Bull. Géogr. Bot. 24: 292 1914.; S. chinensis Lindley in Trans. Hort. Soc. London 6: 297 1826. ; S. chinensis var. formosana (Nakai) H. Hara in Ginkgoana 5: 291295.; S. chinensis var. pinnatilobata G. W. Hu; S. henriana Samutina in Bot. Žurn. (Moscow & Leningrad) 71/8: 1121 1986. S. hookeri Rehder, Pl. Wilson. 1(2): 308309. 1913.Hara in Fl. E. Himal. 319.1966; in Enum. Fl. Pl. Nepal 2:197.1979.Mukherjee, Fl. Pl. Darjiling 110. ; S. javanica var. argyi (H. Léveillé) Rehder; S. javanica subsp.chinensis (Lindley) Fukuoka, Acta Phytotax. Geobot. 62: 1987.

Common name: Chinese elder.

A perennial herb or a small straggling shrub, up to 2.5m in height, with extra-floral nectaries on the petioles, branchlets, young stems, peduncle, and inflorescence branches. Stem striate at least when young; with white pith; lenticels inconspicuous. Leaves imparipinnate, opposite, of 5-9 leaflets, up to 45cm in length, stipules minute leaf-like

or blue gland like or absent; leaflets free, alternate or opposite, narrowly oblong-lanceolate to somewhat ovate, up to 18 × 3 cm, acuminate, serrulate, lateral ones often with 1 to several glandular teeth in proximal margins, puberulous or almost glabrous, basal pair of leaflets shortly petiolulate; base obtuse and oblique, cuneate,. Inflorescence terminal umbellate cymes, laxly 3-5 rayed, sparingly yellowish pubescent, some flowers converted into persistent urceolate nectaries; distinctly pedunculate, bracts leafy; bracteoles minute, ovate. Calyx tubular- urceolate, teeth triangular. Corolla broadly campanulate with basally connate lobes, white or pale pink.Stamens 5; anthers yellow or purple. Ovary locules 3; styles short or nearly absent; stigma 3-lobed.Fruits berries, subglobose, 3-4 mm wide, red turning blue black; pyrenes 3, ovoid, verrucate.Seeds oblong, ca.2.5 mm long.

Flowering and fruiting: April to September.

Field note: A straggling shrub in hill slopes on roadside and in shrubberies.

Distribution: A native to subtropical and tropical Asia; Himalaya (Nepal to Bhutan); Khasia from foothills to 1400-2400 m; N. Burma, Java, Cambodia, Indonesia, China(except in the north), Japan, Laos, Malaysia (in Sabah), Philippines, southern Thailand, and Vietnam.

Use: Plant parts are used locally for treatment of rheumatism and painful swellings from injury.

Specimens examined: Pherima Naga Hills,Assam, G.Watt 11818; Soodoong, Sikkim, Ribu943; Tadong, Sikkim, Dr. King's collector1320; Sikkim, R.Seshagiri Rao104; Sikkim, N.CMajumdar& R.N.Dutta336; Bansoi, Sikkim,7500', N.CMajumdar &R.N.Banerjee 420;Mangan, Sikkim,4000', N.CMajumdar& R.N.Banerjee7022; LuingBasty, Sikkim East District P.K.Hajra668(CAL);MawlaiBanalari(East Khasi Hills), , Acharya and Mukherjee 89 (BURD). Dreyi to Shoeliang Lohit F.D.(Arunachal Pradesh),R.S.Rao, 10536 (ERC,BSI); Subansiri F.D.(Arunachal Pradesh),Palin Village adjoining BSI Office, A.R.K. Sastry ,40660 (ERC,BSI) ; Dzuko Valley and Surr Hills Valley area, 2400m,, A.A.Mao and R. Gogoi, 109476(2), (ERC,BSI); Dampa TR, Mizoram,Saithapi,350m, B.K.Sinha and N.Odyew,112948(ERC,BSI); Nartiang Forest, S.R. Sharma,16418, (ERC,BSI); Khasi and Jayanti Hills,1300m, N.P. Balakrishnan,47159, (ERC,BSI) ;Jangkeng Village, on the way to Khonsa, TIRAP F.D (Arunachal Pradesh), D.B.Deb,25871, (ERC,BSI); Kothong, TIRAP, D.B.Deb,26078, (ERC,BSI) Sadiya District, Dikrong Forest, G.K.Deka, 22697, (ERC,BSI.); Raho to Vokanokra, TIRAP F.D (Arunachal Pradesh), G. Panigrahi,16802, (ERC,BSI); Waka, TIRAP F.D (Arunachal Pradesh), G. Panigrahi,14920 and16981, (ERC,BSI) Near PasighatN.E.Frontier, Upendranath Kanjilal,3197, (ERC,BSI) WarangChenngi, Kameng F.D.(Arunachal Pradesh), G.Panigrahi,15692A, (ERC,BSI); Daatuhaja,375m, Upendranath Kanjilal,5622, (ERC,BSI) Lakshmipur District, Assam, Jeypore, G.K.Deka,15770, (ERC,BSI); N.Cachar Hills, Daotuhaja,375m, U.Kanjilal, 5622, (ERC,BSI); Japihojia (Lakhimpur District),90m, U.Kanjilal, 3618, (ERC,BSI); Mizoram, S.L.Abbas, 102607(2), (ERC,BSI); Rua to Bimalpur, Tirap F.D (Arunachal Pradesh), G.Panigrahi, S. hookeriRebdr, 17024, (ERC,BSI); BipinBalodi, 10387, (ARUN).

Sambucus wightiana Wall.ex Wight &Arn. in Prodr. Fl. Ind. Orient.1: 388. 1834. Wendelbo in Rech. f., Fl. Iran. 10:2. 1965; R.R. Stewart, Ann. Cat. Vasc. Pl. W. Pak. & Kashm. 695. 1972.*Sambucus* ebulus auct.non L. Sp. Pl. 1: 269. 1753: C.B. Clarke in Hook.f.,Fl. Brit. India 3:2.1880.

Common name: Dwarf Elder, Kashmir Elder.

Local name: Gandula.

A perennial, strong herb or undershrub with subterranean rhizome, usually low growing may be up to 2 m in height. Leaves pinnate, opposite, up to 25 cm long; leaflets 5-9, free, 5-15 cm long, lanceolate, serrate, puberulous to glabrous, acute to acuminate; upper leaflets usually decurrent; stipules leaf-like, narrowly lanceolate to ovate-lanceolate,sharply serrate. Inflorescence corymbose with 3-5 primary rays, up to 10 cm across, with uppermost flowers barren, leafy at base. Flowers minute, c. 5 mm wide, with strong odour, pedicellate; pedicel jointed; bracteole subtending the joint, filiform, c. 1 mm. Calyx teeth 5, minute, deltoid; hypanthium turbinate, c. 1 mm long. Corolla rotate or broadly campanulate, c. 5 mm wide, whitish-yellow or whitish pink; lobes 5, 1.5 mm long, obtuse, 3-nerved. Stamens 5, adnate to the base of the corolla; anthers oblong, ca. 1mm; filaments ca.2 mm long.

Ovary locules 3; styles short; stigma 3, subsessile. Fruit berry like, globose, 5-6 mm in diameter, colour orange turning black. Seeds oblong, 2.7 mm long.

Flowering and fruiting: June- August.

Field note: A gregarious shrubby plant common in hill slopes.

Use: The local people in Kashmir use the fruit juice to induce vomiting for expelling disagreeable food and drinks from the stomach.

Distribution: Kashmir, Afghanistan, Himalayas in Pakistan and India, from 2000 to 2500 m.

Use: Different parts of the plant are used in medicine.

Specimens examined: Gulmarg to Firospur, Jammu and Kashmir, 2500m, L.J.G. van der Maesen,2521(CAL); Sedau,1700m, Pulwama, Jammu and Kashmir, T.A.Rao ,9221 (CAL); Poosiana,7500m, Jammu and Kashmir, C.B.Clarke, 28461A (CAL); Kashmir, Falconer,509 (CAL); T.A.Rao,169 (CAL); Near Gulmarg, 2500m, Jammu and Kashmir, Acharya and Mukherjee 5 (BURD), L.J.G. van der Maesen,2521(CAL); Pangi, Himachal Pradesh, 3000m, Imauddin, 125 (CAL); Chamba,Himachal Pradesh, Harsukh194552(CAL); Pangi, 2400-2700m, Himachal Pradesh, J.H.Lace, 1249 (CAL); Luing Basty, Bhotay Goan, E.Sikkim, P.K.Hajra, 668 (CAL).

DISCUSSION

Sambucus which is familiar as elder or elderberry is a genus of deciduous shrubs, small trees and herbaceous perennial flowering plants. The taxon is traditionally placed in the honeysuckle family, Caprifoliaceae. *Sambucus* being a cold loving group of plants is known to occur in subtropical and temperate regions of the world, especially in the Northern Hemisphere. Interestingly only four species could be recorded from the Himalayan regions of India. Often S.canadensis and sometimes S. javanica are grown in parks and shrubberies for their ornamental leaves, large clusters of small white or cream-colored flowers and fruits. So far distribution of *Sambucus* is concerned S.wightiana was found to occur mostly in Jammu and Kashmir and Himachal Pradesh and scarcely in Sikkim. The other three species, viz. S. adnata, S.canadensis and S.javanica are more prevalent in the eastern Himalaya. Interestingly S.canadensis, a native to South-west N. America and Central America, spreads its natural abode from eastern Himalaya to Arunachal Prdesh in the North East and often gets cultivated in other Himalayan States. S.canadensis has its attendance also recorded in southwest Asia, central and southern Europe and in northwest Africa. S.javanica, a species native to subtropical and tropical Asia spreads itself in the Himalaya from Nepal to Bhutan to reach Khasia Hills in the North East India and further get distributed in N. Burma, Java, Cambodia, Indonesia, China(except in the north), Japan, Laos, Malaysia (in Sabah), Philippines, southern Thailand, and Vietnam (Hong et al, 2013).

All the four species of *Sambucus* were seen to offer their ripe berries as food to different types of birds and attract insects with their extra-floral nectaries. The edible use of ripe and cooked fruits of *Sambucus* and various ethno- and folk-medicinal uses of different plant parts are in record and their medicinal properties are under evaluation (Uncini-Manganelli et al.,2005; Merica et al.,2006; Thole et al., 2006; Charlebois, 2007; Malik et al., 2011 ; Duke, 2011; Chashoo et al.,2012). Evidence for 'Health Benefits, from elderberry, both direct and indirect, have been attracting scientists to find out ways and means to be aware of the toxicity (Website : Nova Scotia Museum, Poisonous plants; McVicar, 2007) and develop novel patient friendly medicines against many refractory and dreadful diseases like cancer from different species of Elderberry.

Field observations recorded in the present work indicate that all the species are capable of growing in wet as well as dry soils in roadsides, hill slopes and near streams with a preference to sunny habitats with soils rich in organic matter. The subterranean rhizomes enable them further to prennate and propagate sizably to give a green productive and protective cover to the hill slopes and contribute towards nature's economy. The shallow, aggressive root system and hardiness of the wild species make elderberry plants ideal for hill slope stabilization or shelterbelt establishment. They can also be praised for providing shelter and food to several species of birds and insects. The Elderberries are easy to grow and by virtue of their

ecological services *Sambucus* occupies a significant position in Himalayan ecosystem spreading its species from subtropical to temperate realms. Moreover its different species offer a wide range of medicinal applications. With the release of new cultivars, as well as additional basic horticultural research, they offer a huge potential to horticulture and food industry (Charlebois et al., 2010).The species of Sambucus thus deserve care for their sustenance and scientific attention so that they can perpetuate conveying benevolence to the Himalayan life as pointed out by Luther Burbank "The elderberry has qualities of its own that will commend it strongly"(Whitson et al., 1914).

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