Threatened Ethnomedicinal Plants of Singalila National Park in Darjeeling Himalaya, including their ethnic drug dosimetry: A Report on an Extensive Field Survey

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Abstract

Several field tours were conducted in and around Singalila National Park area in Darjeeling Himalaya from December 2011 to October 2016 as a result of National and State-level Projects. As a result, a good number of threatened species of ethnomedicinal angiosperm plants were observed, some of which are considered as Endangered or Critically Endangered. One of the main reasons for this is mass collection of these plants by herbalists and local medicine men due to their high medicinal potentialities, as well as the porous Indo-Nepal border in the area of this Park; these factors make this National Park vulnerable. This work enumerates 92 species in 74 genera and 44 families of ethnomedicinal plants from Singalila National Park area of Darjeeling, based on field surveys at different localities in this park. Ethnomedicinal investigations were done with five Nepalese communities living in and around Singalila National Park area (Gurung, Tamang, Lama, Chhetri, Rai) and one Sherpa community (Kalapokhri) on 92 species of ethnomedicinal plants. More than 50 illnesses or maladies, including sciatica, arthritis, asthma, blood dysentery, diarrhoea, snake bite, insect bites, throat pain etc. can be treated by using different parts of these 92 documented ethnomedicinal plants, including their dosimetry based on Indigenous Traditional Knowledge (ITK) as well as new discovery of rich ethnomedicinal alkaloids from more than 50 species (of the 92 spp.) for treating various human ailments based on first-hand information collected during visits to these ethnic villages. This work also reports 1 endemic, 17 Critically Endangered and 74 Threatened ethnomedicinal species based on field surveys. Each species is provided with a present status based on population sampling during field visits and ethnic uses based on ethnic ITK. Botanical identity was confirmed by consulting the Central National Herbarium (CAL). Conservation measures were proposed in two places by putting Name plate boards and four awareness programs were conducted at Tumling, Gairibans, Kalapokhri & Gurdung for effective conservation purposes.

Key words: Himalaya, Darjeeling, Singalila National Park, nature protection, ethnomedicinal plants, ethnic drug, botany

Introduction

Several field visits were conducted in and around Singalila National Park area in Darjeeling Himalaya from December 2011 to October 2016 as a result of National and State-level Projects. Probably J. D. Hooker was the first to explore the present area of this Park extensively in April-August 1848 during his voyage to the Himalayas, and he published 7 volumes in the series "Flora of British India" (1875-1897) which are considered as the first documentation. Since Hooker, several other workers like C. B. Clarke (published in J. D. Hooker's Flora of British India), Gamble (1896), Biswas & Chopra (1956), Hara (1966), Biswas (1966), Mukherjee (1988), Das (1995, 2004), Saini (2000), Gurung & Palit (2007), Lama (2004), Rai (2006), Panda (2012, 2016), Panda & Reveal (2012) surveyed the area and documented floristic elements in various ways, but very few or no investigations regarding Traditional Knowledge and conservation of threatened taxa were made. Therefore, a detailed investigation regarding documentation of threatened categories, their population size (at different locations if present), their Traditional Knowledge and finally conservation strategies along with awareness programs among local people is urgently required to save the vulnerable Singalila National Park and its known and unknown resources. The present author observed some threatened species of ethnomedicinal angiosperm plants, some of which are considered as Critically Endangered. One of the main reasons for this is the mass collection of these plants by herbalists and local medicine men due to their high medicinal potentialities. Porters and Forest Guards reported that these plants are exploited due to mass collection by local herbalists from Nepal, as some parts of the Park are in Nepal. The India-Nepal border in the area of this National Park is extensively open to tourists, local medicine men, herbalists, foreigners, and ultimately to all, and therefore the National Park is now considered as Vulnerable.

Therefore, the main aim of this paper is to locate different populations of threatened plants (mainly threatened medicinal plants), estimate the size of populations (based on applying List Quadrat), their documentation, ethnomedicinal first-hand information (Gurung & Tamang Nepalese, Sherpas and Tibetans) and to propose conservation strategies at different locations in this National Park.

The present work enumerates 92 species under 74 genera and 44 families of ethnomedicinal plants from the Singalila National Park area of Darjeeling based on field surveys (Tonglu-Gairibans, Gairibans, Kaiankata, Kalapokhri, BK Bhanjang, Sandakphu, Sabarkum, Phalut, Gorkhey, Molle, Gurdung and Srikhola) and Herbarium consultations (CAL, BSIS, Lloyd Bot. Garden). Ethnomedicinal investigations were based on 5 Nepalese communities living in and around Singalila National Park area (Gurung, Tamang, Lama, Chhetri, Rai) and one Sherpa community (Kalapokhri) on 92 species of ethnomedicinal plants.

History of Singalila National Park

Singalila National Park is a transboundary protected area at the border with Nepal. Singalila National Park is located at 27°14'N and 88°07'E, in the north-western part of Darjeeling District. Its total area is about 78.6 km², and it is well known owing to the Sandakphu trekking route that runs through it. It is bordered on the north by the state of Sikkim, west by the country of Nepal and to the south & east by the state of West Bengal (Map 1). The Core Area of Singalila National Park is located on the Singalila Ridge at altitudes ranging from 8000 - 12000 ft in Darjeeling district of West Bengal, although the average altitude of the Buffer area is about 6000 ft. The Park was declared as wildlife Sanctuary in 1986, and was made a National Park in 1992. The two highest peaks Sandakphu (3630 m) and Phalut (3600 m) are located on the ridge and inside the Park. The Rammam and Srikhola Rivers

flow down through the Park. Earlier, Singalila Forest was under the control of the Raja of Sikkim Forest. In 1882, British Government brought these Singalila forest on lease from the Sikkimese Raja. After Independence, this forest became part of Darjeeling District (West Bengal) and in 1992, it was declared as the National Park for the conservation of this forest and was placed under the Wildlife Forest Department and named "Singalila National Park". The main motivation of the Government in declaring Singalila forest as Singalila National Park was that it was a home to 80-90 species of mammals, and several threatened medicinal plant species such as *Aconitum* spp., *Dactylorhiza* sp., *Rheum nobile*, *Valeriana jatamansi*, *Picrorhiza kooroa*, *Swertia chirayita*, Himalayan ginseng etc. Some threatened species of animals, such as Red Panda, Leopard, Chinese Pangolin, Himalayan Black Bear, Red Throated Hill Partridge, Satyr Tragopan, Blood Pheasant, Slender Billed Babbler etc. are found in this National Park. Beside this, about 25 species of *Rhododendron* are also found in this National Park. Singalila National Park is divided into two Ranges: I. North Range (Rimbik) and II. South Range (Maneybhanjyang). Within these two ranges there are four beats, namely, a. Gairibas, b. Sandkphu, c. Rammam and d. Gorkhey. The Singalila National Park also has 7 blocks, namely a. Rithu, b. South Rimbick, c. Sandakphu, d. Siri, e. Rammam, f. Sabarkum or Sabargram and g. Phalut (Map 2).

Materials and Methods

The present work is the result of a critical study of literature and specimens in herbaria and the field, and a few experimental works in the laboratory. The work was carried out in the laboratory of Angiosperm Taxonomy & Ecology, Post-Graduate Department of Botany, Darjeeling Govt. College and partly at the Central National Herbarium, Botanical Survey of India, Howrah. In the first part, published and documented ethnomedicinal plants of Singalila National Park were listed based on literature and herbarium data. To collect the literature, the following libraries were consulted: Central National Herbarium (CAL), Botanical Survey of India, Howrah, Botanical Survey Sikkim Himalayan Circle (BSHC), Gangtok and Lloyd Botanical Garden, Darjeeling. Herbaria such as the Central National Herbarium (CAL), Industrial Section Indian Museum (BSIS), Kolkata, and Lloyd Botanical Garden Herbarium were visited for herbarium consultations.

For detailed study of some important taxa, floral parts of live plants were dissected and examined. The terminology for different external morphological characters mainly followed Lawrence (1951), Featherly (1954), Stearn (1983), Radford (1986) and Veldkamp in Vogel (1987). All measurements are metric. In the case of herbarium specimens, after the evaluation of the annotations of earlier workers on the herbarium specimens and comparing them with the type specimens and protologues and with live materials where collected, a detailed enumeration of all taxa were made.
Besides the study of specimens in different herbaria, studies were conducted to observe the plants in their natural habitats, to record the colour of flowers, fragrance and indumentum, the range of variation, their abundance or rarity, presence of nectaries, associated plants, altitude, habitat and to assess their conservation status.

For ethnomedicinal investigation, first hand Indigenous Traditional Knowledge (ITK) or information was recorded during field visits to different localities in Singalila National Park (Tumling, Gairibas, Kaiankanta, Kalapokri, Sandakphu, Phallut, Gorkhey, Molle, Gurdung, Srikhola, Dhotrey etc.) through oral interviews of experienced and elderly tribal people, local medicine men and field guides. Detailed information regarding local names(s), part(s) used, mode of administration or preparation and dosimetry were recorded in the field note book. Botanical identity was confirmed by herbarium consultations in the Central National Herbarium (CAL). Important voucher specimens were deposited in the laboratory of Angiosperm Taxonomy & Ecology, Botany Dept., Darjeeling Govt. College, Darjeeling.
Presentation of data: This work incorporates conventional herbarium methods currently in use as well as live materials in their natural habitats. All categories of taxa are arranged alphabetically family-wise. Authors of scientific names are abbreviated according to Brummitt & Powell (1992), 'Authors of Plant Names'. Books titles are abbreviated according to Stafleu & Cowan (1976), Taxonomic Literature (ed. 2, vols. 1-7) and Supplements (1-6) by Stafleu & Minnega (1992-2000). Herbarium acronyms are followed according to Holmgren et al. (1990), Index Herbariorum, Part 1 (ed. 8). Besides the original citations, those of revisionary, monographic, floristic and taxonomic works are also given in chronological order. For species, the correct or accepted name of a species is followed by original citation and reference to revisionary, monographic and floristic works. This is followed by basionyms, if any, and other synonyms both homotypic and heterotypic and then types, and herbaria where they are located, and whether they are examined or not. At the end of the section of citations, a reference to an illustration or photograph is also given where available. Nomenclature is followed by available vernacular names along with the language in parenthesis where available. This is followed by a brief description, which in turn, is followed by distribution, habitat, flowering, fruiting, specimens examined, ethnomedicinal uses and notes. The distributional and phenological data provided here are based on specimens represented in different herbaria, published literature and data collected during field trips.
The sequence presentation of data of the species are given below:

- Correct or accepted name of the species
- Original citation and other references
- Synonyms, if any
- Reference to an illustration or photograph
- Vernacular names along with languages in parenthesis where available
- Brief field description
- Distribution
- Habitat
- Flowering
- Fruiting
- Specimens examined
- Ethnomedicinal uses

Enumeration

Enumeration of threatened ethnomedicinal plants of Singalila National Park in Darjeeling was performed, based on Field surveys (December 2011, April-May 2012, May 2013, September 2013, November 2013, March 2014, May 2014, September 2014, December 2014, June 2015, November, 2015 and October 2016) and Herbarium consultations in three Indian herbaria (CAL, BSIS, Lloyd Botanical Garden Herbarium). This work includes 92 threatened ethnomedicinal species in 74 genera and 44 families given below. Species and genera are provided under respective families which are given alphabetically. Description of Families and genera are not provided as these are already known. In the case of species, only important field descriptions are provided for easy identification purposes. All voucher and herbarium specimens are deposited in Darjeeling Govt. College Herbarium, unless otherwise mentioned. Singalila National Park is abbreviated as SNP in all cases. Methodology on collecting first-hand information on ethnomedicinal plants from local people followed Jain (1991).

Acanthaceae Juss.

Strobilanthes Bl., Bijdr.: 781. 1826.

1. *S. discolor* (Nees) T. Anders., J. Linn. Soc. Bot. 9: 477. 1867. Hu Jia-qi & J. R. I. Wood. China 19: 426. 2011. (*Goldfussia discolor* Nees in A. DC.), Prodr. 11: 172. 1847. Vernacular name: Pracho (Sherpas of Kaiankata) (Plate 1 A). Field characters: An erecto-scandent undershrub up to 3 ft high; leaf cuspidate-acuminate at apex; corolla dark purple. Flowering: November. Fruiting: November to December. Habitat: growing very rarely on rocky slope and marshy places. Field Status: Threatened (8-10 discontinuous populations in 10 km area). Distribution: India (E. Himalaya & NE India in Meghalaya), Nepal and Bhutan. Specimen examined: Singalila National Park (SNP), on the way to Kaiankata from Gairibans, 10/11/2013, S. Panda 27. Ethnomedicinal use: extract of the corolla used to treat cutaneous skin disease. 3-4 corollae are administered per spot on the diseased skin.

Actinidiaceae Gilg & Walderm

Actinidia Lindl., Nat. Syst. Bot. ed. 2: 439. 1836.

2. *A. callosa* Lindl., Nat. Syst. Bot. ed. 2: 439. 1836. Shu, Fl. China 12: 342. 2007. Vernacular name: Thekiphal (Nepalese of Lamedura, Meghma & Gairibans); kiwi (English) (Plate 1 B). Field characters: Large climber up to 6 metres; petioles blood-red; inflorescence 1-3-flowered cymes, corolla white, fruits dark green berries. Occurring in natural habitat as wild. Flowering: April - June. Fruiting: September- November. Habitat: growing on rocky slopes, mostly along other trees. Field Status: Threatened (12 wild populations observed throughout the National Park, in most cases, number of individuals are 3-4). Distribution: India (E. Himalaya & NE India), Nepal, Bhutan, China, N Myanmar, Taiwan. Specimens examined: SNP, on the way to Kaiankata from Gairibans, 20/09/2014, S. Panda 158. Ethnomedicinal use: Local liquor is prepared from its ripe fruits, which gives energy during work.

Aquifoliaceae DC. ex A. Rich

Ilex L., Sp. Pl. 1: 125. 1753.

3. *I. insignis* Hook. f. in Hook. f., Fl. Brit. India 1: 599. 1875. Vernacular name: Lise (Nepalese of Gairibans). Field characters: Trees up to 4 m, bark whitish, corolla light green, fruits globose, blood-red. Flowering: April - June. Fruiting: July - August. Habitat: growing on rocky slopes. Field Status: Threatened (only 5 populations were observed, each population possesses 2-4 plants). Distribution: India (E. Himalaya), Nepal, Bhutan, China, N Myanmar. Specimens examined: SNP, on the way to Kalapokhri from Gairibans, 20/05/2014, S. Panda 93. Ethnomedicinal use: Seeds of dried fruits are made into dust and are mixed during tea processing (5g seeds per 5 kg tea leaves) for stimulation and energy.

Acoraceae Mart.

Acorus L., Sp. Pl. 1: 324. 1753.

4. *A. calamus* L., Sp. Pl. 1: 324. 1753; Li Heng et al., Fl. China 23: 1: 2010. Vernacular name: Bhojo (Nepalese of Gurdung & Sri Khola) (Plate 1 C). Field characters: An erect & stout rhizomatous aromatic herb up to 70 cm high; spathe leaflike, 30-50 cm long. Flowering: July - September. Fruiting: not known. Habitat: cultivated luxuriantly on moist rocky slopes. Status: Common in cultivation. Distribution: Cultivated throughout northern hemisphere - India (Himalayas, NE India and other areas from 100 m to 2800 m), Afghanistan, Pakistan, Nepal, Bhutan, Sri Lanka, Bangladesh, SW China, Myanmar, Taiwan, Mongolia, Vietnam, Laos, Thailand, Malaysia, Indonesia, Philippines, Japan, Europe & N America. Specimens examined: SNP, on the way to Sri Khola from Gurdung, 21/09/2014, S. Panda 162. Ethnomedicinal use: extract of fresh (100g) or dried (50g) rhizomes are used to treat throat pain, and skin allergy in dogs (200 g per day for 2 weeks).

Araceae Juss.

Arisaema Mart., Flora 14: 459. 1831.

5. *A. speciosum* (Wall.) Mart. ex Schott & Endl., Melet. Bot.: 17. 1832; Li et al., Fl. China 23: 54. 2010. *Arum speciosum* Wall., Tent. Fl. Nepal: 29. 1824. Vernacular name: Sapko makai jato-a (Nepalese of Tonglu, Gairibans, Kaiankata, Kalapokhri, Gurdung, Gorkhey busty & Molle) (Plate 1 D). Field characters: Erect herb up to 3 ft high, rhizome cylindrical, lamina 3-foliolate, peduncle whitish with tiny brown dots, spathe dark purple with whitish longitudinal lines. Flowering: April - June. Fruiting: September-October. Habitat: growing rarely on moist rocky slopes and in crevices. Status: Threatened (more than 40 populations observed, but in most of the cases, number of individual plants are 4-5). Distribution: India (E. Himalayas & NE India), Nepal, Bhutan, SW China and N. Myanmar. Specimens examined: SNP, on the way to Gairibans, 29/05/2014, S. Panda 94. Ethnomedicinal use: extract of the rhizome is used for the treatment of chronic constipation, indigestion, abdominal pain and dysentery. 50 g dried or 100 g raw rhizome extract is taken in a glass of water after meals for at least 7 days (one time per day).

6. *A. nepenthoides* (Wall.) Mart. ex Schott & Endl., Melet. Bot.: 17. 1832; Li et al., Fl. China 23: 57. 2010. *Arum nepenthoides* Wall., Tent. Fl. Nepal: 26. 1824. Vernacular name: Sapko makai jato-b (Nepalese of Gairibans) (Plate1 E). Field characters: Erect herb up to 2 ft high, rhizome short-cylindrical, lamina digitate, peduncle reddish, spathe cylindrical, yellowish with brownish spots on both sides. Flowering: May-June. Fruiting: August-September. Habitat: growing rarely on moist rocky slopes and in crevices. Status: Threatened (only single populations observed). Distribution: India (E. Himalayas & NE India), Nepal, Bhutan, SW China and N. Myanmar. Specimens examined: SNP, near Gairibans, 29/05/2014, S. Panda 95. Ethnomedicinal use: extract of rhizome is used for the treatment of chronic constipation, indigestion and dysentery. 100 g dried or 200 g raw rhizome extract is taken in a glass of water after meals for at least 7 days (one time per day).

7. *A. tortuosum* (Wall.) Schott in Schott & Endl., Melet. Bot.: 17. 1832; Li et al., Fl. China 23: 61. 2010. Vernacular name: Sapko makai jato-c (Nepalese of Tonglu & Gairibans) (Plate 1 F). Field characters: Erect herb up to 4 ft high, rhizome short-cylindrical, lamina pedate, peduncle light green, spathe light green. Flowering: June. Fruiting: August. Habitat: growing rarely on moist rocky slopes and in crevices. Status: Threatened (only eight plants seen). Distribution: India (E. Himalayas), Nepal, Bhutan, SW China and N. Myanmar. Specimens examined: SNP, on the way to Gairibans, 29/05/2014, S. Panda 96. Ethnomedicinal use: extract of rhizome is used for the treatment of chronic constipation, indigestion, abdominal pain and dysentery. 25 g dried or 50 g raw rhizome extract is taken in a glass of water after meals for at least 7 days (one time per day).

Araliaceae Juss.

Macropanax Miq., Bonpl. 4: 139. 1856.

8. *M. undulatus* (Wall. ex G. Don) Seemann, *J. Bot.* 2: 294. 1864 ["*undulatum*"]; Xiang & Lowry, Fl. China 13: 465. 2007. *Hedera undulata* Wall. ex G. Don, Gen. Hist. 3: 394. 1834. Vernacular name: Chinde

(Nepalese of Meghma & Gairibans) (Plate 2 A). Field characters: Trees up to 2 m high, leaflets 3-5, inflorescence paniculate, corolla white, fruits ovoid, ribbed when dry. Flowering: May - June. Fruiting: August - October. Habitat: growing rarely on moist rocky slopes and in crevices. Status: Threatened (several populations observed in 30 sq. km area in 3 seasons, but number of individuals always 2-4). Distribution: India (Himalayas), Nepal, Bhutan, SW China, N. Myanmar, Thailand, Vietnam. Specimens examined: SNP, on the way to Kalapokhri, 30/05/2014, S. Panda 97. Ethnomedicinal use: 25g dry bark is allowed to boil in 200 ml water for 10 minutes. The resultant soup is administered to drink in the morning with an empty stomach to treat Diabetes mellitus.

Asteraceae Bercht. & J. Presl (Compositae Giseke)

Duhaldea DC., Prodr. 5: 366. 1836.

9. *D. cappa* (Buch.-Ham. ex D. Don) Pruski & Anderb., Compositae Newsletter 40: 44. 2003; Chen & Anderb., Fl. China 21: 844. 2011. *Conyza cappa* Buch.-Ham. ex D. Don, Prodr. Fl. Nepal.: 176. 1825. *Inula cappa* (Buch.-Ham. ex D. Don) DC., Prodr. 5: 366. 1836. Vernacular name: Gai tihare (Nepalese of Gairibans) (Plate 2 B). Field characters: a robust erect undershrub up to 1 m high; capitulum golden yellow. Flowering: January - October. Fruiting: August - December. Habitat: growing as discontinuous patches on rocky slopes, marshy places and even on rocky walls. Status: Threatened (several discontinuous populations observed in 30 sq. km area in 3 seasons). Distribution: India (Himalayas & NE States), Nepal, Bhutan, China, Myanmar, Thailand, Vietnam, Laos, Malaysia (300 m-2800 m). Specimens examined: SNP, Gairibans, 20/09/2014, S. Panda 164. Ethnomedicinal use: Extract of roots (100g fresh & washed) or juice is administered to patients suffering from acute gastritis and indigestion problems.

Siegesbeckia L., Sp. Pl. 2: 900. 1753.

10. *S. orientalis* L., Sp. Pl. 2: 900. 1753; Yousheng & Nicholas Hind, Fl. China 21: 866. 2011. Vernacular name: Dudhe jhar (Nepalese of Gairibans & Gorkhay) (Plate 2 C). Field characters: An annual pendent undershrub with glandular pubescent hairs up to 40 cm high; capitulum light yellow. Flowering: September- November. Fruiting: November - January. Habitat: growing as discontinuous patches on rocky slopes, marshy places and even on rocky wall. Status: Threatened (several populations observed, but mostly possess a few in number). Distribution: cosmopolitan in tropical and subtropical regions of the world. Throughout India ascending up to 2300 m in the Himalayas and other mountains and other SE Asian countries. Specimens examined: SNP, Gairibans, 20/09/2014, S. Panda 167. Ethnomedicinal use: Extract of leaves & twigs are applied to skin to treat irritating skin disease.

Sonchus L., Sp. Pl. 2: 793. 1753; Zhu & Kilian, Fl. China 21: 240. 2011.

11. *S. arvensis* L., Sp. Pl. 2: 793. 2011. Vernacular name: Ban rayo;mulo pata (Nepalese of Srikhola) (Plate 2 D). Field characters: An perennial erecto-pendent undershrub with stipitate-glandular peduncle; capitulum yellow. Flowering: July - September. Fruiting: August - October. Habitat: growing luxuriantly on rocky slopes, marshy places and even on rocky wall. Status: Common. Distribution: It is widely introduced and naturalized throughout tropical & subtropical regions of the world. Throughout India, ascending up to 2200 m in the Himalayas and other areas and other SE Asian countries. Specimens examined: SNP, Gurdung to Srikhola, 21/09/2014, S. Panda 168. Ethnomedicinal use: decoction of roots is applied as a paste on an affected tooth to relieve toothache. 2-3 leaves (entire) are mildly heated and pasted on external swellings of the body as well as on the back to relieve back pain, sciatica pain and on the outside of the throat to relieve throat pain and tonsillitis.

Balsaminaceae A. Rich.

Impatiens L., Sp. Pl. 2: 937. 1753.

12. *I. arguta* Hook. f. & Thomson, J. Linn. Soc. Bot. 4: 137. 1860. *I. gagei* Hook. f. in Hook., Icon. Pl. 30: f. 2951. 1911 (Plate 2 E). Vernacular name: Turie (Nepalese of Gairibans). Field characters: erect herb up to 40 cm long, corolla dark purple to red-purple. Flowering: July - October. Fruiting: August - October. Habitat: growing on moist and shady places on rocky slopes. Status: Threatened (Several discontinuous populations observed mixed with other *Impatiens* spp., but number of individuals are always fewer). Distribution: Distribution: India - (E Himalayas - Sikkim, Darjeeling in West Bengal, Arunachal Pradesh, Nagaland, Manipur, Meghalaya); Nepal, Bhutan, SW China, N Myanmar at altitudes ranging from 1800 to 3200 m . Specimens examined: SNP, Gairibans, 20/09/2014, S. Panda 170. Ethnomedicinal use: Corollae are used to treat abdominal pain, carbuncles and urinary problems.

13. *I. falcifer* Hook. f., Bot. Mag.: t. 7923. 1903; Yilin et al., Fl. China 12: 83. 2007 (Plate 2 F). Vernacular name: Turie (Nepalese of Kalapokhri). Field characters: erect herb up to 25 cm long, corolla lady's slipper-like, golden yellow with dark brown spots. Flowering: September - October. Fruiting: September - October. Habitat: growing very rarely on moist rocky slopes and in crevices. Status: Extremely threatened (only three populations were observed in 30 sq m area in 5 seasons, where the number of individuals is from 3 to 12). Distribution: India -E Himalaya (Sikkim, Darjeeling in West Bengal), Nepal, Bhutan, SW China at altitudes ranging from 2300 to 3300 m. Specimens examined: SNP, on the way to Kalapokhri, 20/09/2014, S. Panda 147. Ethnomedicinal use: extracts of leaves are used to treat old wounds.

Begoniaceae C. Agardh

Begonia L., Sp. Pl. 2: 1056. 1753.

14. *B. josephii* A. DC., Ann. Sci. Nat. Bot. ser. 4, 11: 126. 1859 ["*josephi*"]; G. Cuizhi et al., Fl. China 13: 180. 2007. Vernacular name: phule (Nepalese of Gairibans) (Plate 3 A). Field characters: A rhizomatous herb up to 10 m high; lamina purple; corolla light pink to white.

Flowering: July – September. Fruiting: August - November. Habitat: growing rarely on rocky slopes, marshy places and even on rocky wall. Status: Extremely threatened (several discontinuous populations observed in 30 sq km area in three seasons, but number of individuals is always few). Distribution: India - India (E. Himalaya and Meghalaya), Nepal, Bhutan, China. Specimens examined: SNP, on the way to Gairibans, 19/09/2014, S. Panda 171.
Ethnomedicinal use: sour stem and branches are chewed raw to give energy during long walks. Extracts of tender leaves are taken as a blood purifier.

Berberidaceae Juss.

Berberis L., Sp. Pl. 1: 330. 1753.

15. *B. asiatica* Roxb. ex DC., Syst. Nat. 2: 8. 1821. Vernacular name: Chutro (Nepalese of Kalapokhri) (Plate 3 B). Field characters: A bushy shrub up to 2 m high; lamina obovate to elliptic with 2-10 spinulose toothed margin, corolla yellow, 1 cm in diam., fruits short-cylindric berries, green-purple to dark purple. Flowering: April – June. Fruiting: May - October. Habitat: growing rarely in rocky slopes and in crevices. Status: Threatened (several discontinuous populations were observed where number of individuals is from 2 to 10). Distribution: India (Himalayas), Nepal, Bhutan. Specimens examined: SNP, on the way to Gurdung, 21/05/2013, S. Panda 01. Ethnomedicinal use: extract of leaves, roots and bark are used to treat scurvy, and some toothaches.

Buddlejaceae Wilhelm

Buddleja L., Sp. Pl. 1: 112. 1753.

16. *B. asiatica* Lour., Fl. Cochinch. 1: 72. 1790; Ping-tao & Leeuwenberg, Fl. China 15: 335. 1996. Vernacular name: Bhimsenpati (Nepalese of Srikhola) (Plate 3 C). Field characters: A tall and erect shrub up to 2 m high; twigs, abaxial leaves, petioles and inflorescence beset with dense white woolly stellate hairs; corolla white. Flowering: January - October. Fruiting: March - December. Habitat: growing very rarely in rocky slopes and in crevices. Status: Extremely Threatened (only 2 populations were observed in 30 sq km area in 3 seasons, where number of individuals are varying from 2 to 4). Distribution: India (Himalayas & NE States), Pakistan, Nepal, Bhutan, Bangladesh, China, Myanmar, Taiwan, Thailand, Laos, Cambodia, Vietnam, Malaysia, Indonesia, Philippines and New Guinea. Specimens examined: SNP, on the way to Srikhola from Molle, 15/11/2013, S. Panda 28. Ethnomedicinal use: tender leaves are used to prepare a local drink which gives energy during work. Extract of leaves in the form of a paste used to treat scabies.

Campanulaceae Juss.

Campanula L., Sp. Pl. 1: 163. 1753.

17. *C. pallida* Wall., Asiat. Res. 13: 375. 1820; Deyuan et al., Fl. China 19: 533. Vernacular name: Lote phul (Nepalese of Gorkhay) (Plate 3 D). Field characters: An erect, ramified and flexuous dwarf shrub up to 1 ft high; corolla purple-blue. Flowering: April – June. Fruiting: May - September. Habitat: growing rarely on rocky slopes, marshy places and even on rocky wall. Status: Threatened (several populations were observed throughout SNP, but number of individuals is always few, varying from 2 to 10). Distribution: India (Himalayas and Meghalaya), Nepal, Bhutan, China, Myanmar, Afghanistan and Pakistan. Specimens examined: SNP, on the way to Gorkhay from Phallut, 23/05/2013, S. Panda 03. Ethnomedicinal use: extract of leaves is used as a paste on wounds, fresh cuts and some skin diseases.

Codonopsis Wall. in Roxb., Fl. Ind. 2: 103. 1824.

18. *C. purpurea* Wall. in Roxb., Fl. Ind. 2: 105. 1832; Deyuan et al., Fl. China 19: 520. 2011. Vernacular name: lote phul (Nepalese of Gorkhay) (Plate 3 E). Field characters: A glabrous, rambling shrub with opposite leaves; flowers solitary on axillary and terminal peduncles, greenish-purple. Flowering: July - September. Fruiting: August - November. Habitat: growing rarely on rocky slopes, marshy places and even on rocky wall. Status: Threatened (several populations were observed throughout SNP, but number of individuals is always few, varying from 1 to 5). Distribution: India (Himalayas and Meghalaya), Nepal, Bhutan, SW China and N Myanmar. Specimens examined: SNP, on the way to Gorkhay from Phallut, 23/05/2013, S. Panda 04. Ethnomedicinal use: extract of leaves is used as a paste on wounds, fresh cuts and some skin diseases.

Lobelia L., Sp. Pl. 2: 929. 1753.

19. *L. nummularia* Lamk., Encycl. 3: 589. 1793; Deyuan & Lammers, Fl. China 19: 556. 2011. Vernacular name: Lanka-sanoy (Nepalese of Kalapokhri) (Plate 3 F). Field characters: Perennial prostrate herb up to 30 cm; corolla purple-red; berries purple-red. Flowering & Fruiting: Throughout the year. Habitat: growing luxuriantly on rocky slopes, marshy places and even on rocky wall. Status: Common. Distribution: India (Himalayas and NE States), Nepal, Bhutan, Bangladesh, Sri Lanka, SW China, N Myanmar, Thailand, Laos, Vietnam, Malaysia, Philippines & New Guinea. Specimens examined: SNP, on the way to Kalapokhri from Gairibans, 20/09/2014, S. Panda 172. Ethnomedicinal use: Juice of leaves + water (50:50 - total 40 ml) are given to patients suffering from amoebic and bacterial dysentery. Mature red-purple fruits (4-5 per day in the morning) are chewed raw to treat tonsillitis and throat pain.

Caprifoliaceae Juss.

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

20. *S. hookeri* Rehd. in Pl. Wilson 1: 308. 1913, pro parte; Mukherjee, Flower. Pl. Darjeeling: 110.1988. Vernacular name: moti swan (Nepalese of Gairibans) (Plate 4 A). Field characters: A straggling shrub; corolla white. Flowering: July - September. Fruiting: August - November. Habitat: growing rarely on rocky slopes, marshy places and even on rocky wall. Status: Threatened (several populations were observed throughout SNP, but number of individuals are varying from 1 to 5). Distribution: India (E Himalayas), Nepal, Bhutan. Specimens examined: SNP, on the way to Gairibans, 19/09/2014, S. Panda 173. Ethnomedicinal use: extract of flowers and flower buds are used to treat nasal ulcers.

Viburnum L., Sp. Pl. 1: 267. 1753.

21. *V. nervosum* D. Don, Prodr. Fl. Nepal.: 141. 1825; Quiner & Malecot, Fl. China 19: 581. 2011. Vernacular name: Asare jato-b (Nepalese of Meghma, Tumling, Gairibans, Kalapokhri, Molle) (Plate 4 B). Field characters: treelet up to 2 m high; bark grey-brown; corolla grey-white, sweet scented. Flowering: April to May. Fruiting: August - September. Habitat: growing rarely in rocky slopes and in crevices. Status: Threatened (only 9 populations were observed throughout SNP, but number of individuals in each population always varies from 2 to 7). Distribution: India (E Himalayas), Nepal, Bhutan, SW China, N Myanmar, N Vietnam. Specimens examined: SNP, on the way to Gairibans, 29/05/2014, S. Panda 100. Ethnomedicinal use: Leaves are poisonous, extracts of leaves are administered to treat acute skin diseases.

Dioscoreaceae R. Br.

Dioscorea L., Sp. Pl. 2: 1032. 1753.

22. *D. deltoidea* Wall. ex Griseb. in Mart., Fl. Bras. 3(1): 43. 1842; *T.* Chih-chi & M.G. Gilbert, Fl. China 24: 281. 2000. Vernacular name: Githa (Nepalese of Gurdung) (Plate 4 C). Field characters: A climbing shrub with ginger-shaped horizontal rhizome (tuber). Flowering: May - June. Fruiting: July - October. Habitat: growing rarely as threatened on rocky slopes, crevices, on trees and on rocky wall. Status: Threatened (several populations were observed throughout SNP, but number of individuals are always varying from 2 to 12). Distribution: India (Himalayas-Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Sikkim, Darjeeling in West Bengal, Arunachal Pradesh) & NE states, Nepal, Bhutan, China, Myanmar, Thailand, Vietnam at altitudes ranging from 1200-4000 m. Specimens examined: SNP, on the way to Gurdung from Sandakphu, 21/09/2014, S. Panda 178. Ethnomedicinal uses: Extract of tubers (100g mixed with a glass of hot water after meals each day) is prescribed to patients suffering from Diabetes mellitus. Principal chemical compounds reported: Diosgenin, epismilagenin, kryptogenin, nitrogenin, rhamnopyranoside, smilagenin, yamogenin (Husain et al. 1992; Sharma 2004). Pharmacological use: Diosgenin is used as anabolic, antiarthritic & anti-infertility drug (Sharma 2004).

Dipsacaceae Juss.

Dipsacus L., Sp. Pl. 1: 97.1753.

23. *D. inermis* Wall. Fl. Ind. 1: 367. 1820. Vernacular name: Ban karyal (Nepalese of Gurdung) (Plate 4 D). Field characters: An erect dwarf shrub up to 3 ft high; peduncle up to 1 ft high; corolla sweet aromatic scented, light yellowish-white to greenish-white; sepals and petals 4-lobed. Flowering: August - September. Fruiting: October - January. Habitat: growing very rarely on rocky slope and marshy places. Status: Extremely Threatened (several populations were observed throughout SNP, but number of individuals is always small, varying from 1 to 4). Distribution: India (Himalayas), Nepal, Bhutan, SW China, N Myanmar, Afghanistan and Pakistan. Specimens examined: SNP, on the way to Gurdung from Sandakphu, 21/09/2014, S. Panda 179. Ethnomedicinal uses: Extract of leaves (5-6 fresh leaves) is mixed with a glass of warm water and administered to patients suffering from sore throats and throat pain due to cold.

Ericaceae Juss.

Agapetes D. Don ex G. Don, Gen. Syst. 3: 862. 1834.

24. *A. hookeri* (C.B.Clarke) Sleumer, Bot. Jahrb. Syst. 70: 106. 1939; Banik in Sanjappa & Sastry, Fasc. Fl. India-Ericaceae: 371. 2014. *Pentapterygium hookeri* C. B. Clarke in Hook.f., Fl. Brit. India 3; 450. 1882. Vernacular name: Chara ko Khorsane jato-b (Nepalese of Srikhola) (Plate 4 E). Field characters: Bushy dwarf shrub up to 60 cm tall, often epiphytic, rarely terrestrial on rock crevices; calyx winged, red-purple; corolla greenish-yellow. Flowering: April - September. Fruiting: August - November. Habitat: growing very discontinuously in patch as an epiphytic on tree trunks or in rock crevices. Status: Threatened (only 5 populations were observed throughout SNP, number of individuals varying from 2 to 5). Distribution: Endemic to E Himalayas in India (E Himalayas: Sikkim & Darjeeling of West Bengal), Nepal & Bhutan. Specimens examined: SNP, on the way to Srikhola from Gurdung, 30/05/2014, S. Panda 101. Ethnomedicinal uses: Corollae (3-4) are eaten raw to relieve throat pain due to cold. Mature fruits (4-5 per day for 3 days) are eaten raw to kill and expel intestinal worms.

25. *A. serpens* (Wight) Sleumer, Bot. Jahrb. Syst. 70: 105. 1939; Banik in Sanjappa & Sastry, Fasc. Fl. India-Ericaceae: 382. 2014. Vernacular name: Chara ko Khorsane jato-a (Nepalese of Gairibans & Srikhola). (Plate 4F). Field characters: Epiphytic or lithophytic bushy dwarf shrub up to 1 m tall, often hanging down from tree trunks or rock crevices; corolla blood-red. Flowering: April -May & October - December. Fruiting: June -August & January. Habitat: growing luxuriantly in patch as an epiphytic on tree trunks or in rock crevices. Status: Common. Distribution: Endemic to E Himalayas in India (E Himalayas: Sikkim & Darjeeling of West Bengal), Nepal, Bhutan & SW China. Specimens

examined: SNP, on the way to Srikhola from Gurdung, 30/05/2014, S. Panda 102. Ethnomedicinal uses: Corollae (8-10) are prepared as chutney which is taken to relieve indigestion problems.

Enkianthus Lour., Fl. Cochinch. 1: 276. 1790.

26. *E. deflexus* (Griff.) C. K. Schneid., Ill. Handb. Laubh. 2: 521. 1911. *Rhodoraceae deflexa* Griff., Itin. pl. Khasyah mts. (Posthumous Papers 2): 148. 1848. *Rhodora deflexa* Griff., Itin. pl. Khasyah mts. (Posthumous Papers 2): 187. 1848. *Meisteria deflexa* (Griff.) Nakai, Bot. Mag. Tokyo 38: 39. 1924. *Enkianthus himalaicus* Hook. f. & Thomson in Hook., J. Bot. Kew Gard. Misc. 7: 125, t. 3, 1855. Vernacular name: phulo (Nepalese of Tumling & Gairibans) (Plate 5 A). Field characters: Lithophytic tall shrub up to 3 m high; corolla blood-red to greenish-yellow with red vertical lines. Flowering: May – June. Fruiting: August - September. Habitat: growing very rarely in patch in rock crevices or on rocky slopes. Status: Extremely Threatened (only 3 fragile populations were observed throughout SNP, number of individuals are varying from 1 to 4. Immediate conservation requires. This works conducted an awareness programme in Tonglu-Tumling & Gairibans areas during September-2014 to conserve the populations of this species. Distribution: Endemic to E Himalayas in India (E Himalayas: Sikkim, Darjeeling of West Bengal & Arunachal Pradesh), Nepal, Bhutan, SW China and N Myanmar. Specimens examined: SNP, Tumling to Gairibans, 30/05/2014, S. Panda 103; Gairibans to Kaiankata, 20/09/2014, S. Panda 182. Ethnomedicinal uses: Twigs are cut into pieces, then mixed with boiling dal which is taken to relieve gastric and indigestion problems (Plate 21F).

Gaultheria L., Sp. Pl. 1: 395. 1753 and Gen. Pl. 5: 187. 1754;

27. *G. akaensis* Panda & Sanjappa, Edinburgh J. Bot. 63 (1):15 - 17. 2006. Vernacular name: phulo (Nepalese of Tumling & Gairibans) (Plate 5 B, 15 B). Field characters: Prostrate or decumbent, stout shrub, 0.6-1 m high. Corolla caducous, urceolate, light pink to white, ca. 5 mm long. Flowering: June & December. Fruiting: not seen. Habitat: growing very rarely in patch in rock crevices or on rocky slopes. Status: Extremely Threatened. Immediate conservation required. This work conducted an awareness programme in Gairibans, Kaiakanta and Kalapokhri areas during September-2014 to conserve the populations of this species (Plate 16). Distribution: Endemic to E Himalayas in India only (E Himalayas: Darjeeling of West Bengal & Arunachal Pradesh). Specimens examined: SNP, Kaiakanta-Kalapokhri road, 20/09/2014, S. Panda 182. Ethnomedicinal uses: extract of leaves are used to relieve rheumatic and sciatica pain.

Phytochemistry of *G. akaensis*

Although the leaves of *G akaensis* are used by the Nepalese of Gairibans as a potential ethnomedicine for relieving rheumatic and sciatica pains, no information is available about its biologically active chemicals. Preliminary phytochemical analysis using High Performance Thin Layer Chromatography (HPTLC) revealed that the tender edible leaves are important source of Oleanolic acid and phytosterols having anti-inflammatory activity. The work was carried out in the Department of Biological Sciences, Presidency University, Kolkata.

28. *G. nummularioides* D. Don, Prodr. fl. nepal.: 150. 1825; Panda in Sanjappa & Sastry, Fasc. Fl. India-Ericaceae: 191. 2014. Vernacular names: Kalizar (Nepalese of Gairibans) (Plate 5 C). Field characters: Procumbent, dwarf shrub, 10 - 40 (- 50) cm long, often creeping and hanging down from rock crevices. Corolla caduous, pink with greenish stripes, broadly ovoid-urceolate, 5-6 mm long. Flowering: September. Fruiting: October -January.

Habitat: This species grows gregariously in moist degraded loose soil, often in landslide areas, old tree trunks and mossy banks, usually hanging down from humus-clad rock crevices at altitudes ranging from (1400 -) 1600 - 3500 (- 3800) m. Status: Common. Distribution: India: Himalayas (Jammu & Kashmir, Himachal Pradesh, Sikkim, West Bengal and Arunachal Pradesh) and NE India (Meghalaya, Nagaland and Manipur), Pakistan, Nepal, Bhutan, W China, N Myanmar, Sri Lanka and Malesia (including Indonesia). Specimens examined: SNP, Kaiakanta-Kalapokhri road, 20/09/2014, S. Panda 183. Ethnomedicinal uses: the extract of the whole plant is mixed with the leaf extract of *G. trichophylla* Royle (3 : 1) and used in massage during headache. Immature fruits are eaten raw to expel intestinal worms.

29. *G. stapfiana* Airy Shaw, Kew Bull. 1952: 171. 1952; Panda in Sanjappa & Sastry, Fasc. Fl. India-Ericaceae: 191. 2014. Vernacular name: patpate (Nepalese of Gairibans) (Plate 5 D). Field characters: Stout, erect, bushy shrub, 0.3-2 m high, often hanging down from rock crevices. Corolla globose to tubulo-urceolate, greyish-white, 4 - 5 × 2- 3 mm. Flowering: May - June & December. Fruiting: July - September. Habitat: This is a rare species grown in discontinuous patches on moist humus-covered rocky slopes, rarely on loose humus-covered boulders, often hanging down from rock crevices at altitudes ranging from (1600-) 2200 - 3500 m. Status: Threatened. Immediate conservation required. This work conducted an awareness programme in Gairibans, Kaiakanta and Kalapokhri areas during September-2014 to conserve the populations of this species. Distribution: Endemic to E Himalayas in India only (E Himalayas: Siim, Darjeeling of West Bengal & Arunachal Pradesh), Nepal, Bhutan, SW China & N Myanmar. Specimens examined: SNP, Kaiakanta-Kalapokhri road, 20/09/2014, S. Panda 184. Ethnomedicinal uses: Immature fruits (5-6 in the early morning for 3 days) are eaten raw to expel intestinal worms.

Lyonia Nutt., gen. N. Amer. pl. 1: 266. 1818.

30. *L. ovalifolia* (Wall.) Drude in Engl. & Prantl, Nat. Pflanzenfam. 4 (1): 44. 1889; Panda in Sanjappa & Sastry, Fasc. Fl. India-Ericaceae: 231. 2014. *Andromeda ovalifolia* Wall., Asiat. Res. 13: 391. 1820 and Numer. List: no. 763. 1829. Vernacular names: Angiri (Nepalese of Gairibans) (Plate 5 E). Field characters: Stout, erect shrub, treelet to medium-sized tree, 0.5- 2 (-18) m high. Corolla tubular, white, snow white, yellowish-white to greenish-white, 7-12 × 3-6 mm, villous outside, glabrous or villous inside. Flowering: May – June. Fruiting: July - December.

Habitat: This variety grows gregariously in dry as well as moist rocky slopes, sometimes on loose humus-covered rocky soils at altitudes ranging from (500 -) 900 - 3100 (- 3500) m. Status: Common. Distribution: India: Himalayas (Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Sikkim, West Bengal and Arunachal Pradesh) and NE India (Meghalaya, Nagaland, Manipur and Mizoram), Pakistan, Nepal, Bhutan, Bangladesh, W China (including Hainan), Taiwan, N Myanmar, Thailand, Malesia and Japan. Specimens examined: SNP, Kaiakanta-Kalapokhri road, 29/05/2014, S. Panda 104. Ethnomedicinal uses: extract of tender leaves are used to treat cutaneous skin diseases.

Pieris D. Don, Edinburgh New Philos. J. 17: 159. 1834.

31. *P. formosa* (Wall.) D. Don, Edinburgh New Philos. *J.* 17: 159. 1834; Panda in Sanjappa & Sastry, Fasc. Fl. India-Ericaceae: 243. 2014. *Andromeda*? *formosa* Wall., Asiat. Res. 395. 1820 and Numer. List: no. 761. 1829. Vernacular names: Bolu, Balu (Nepalese of Gairibans, Gurdung) (Plate 5 F). Field characters: Stout, erect shrub or treelet, 1-5 (-13) m high. Corolla tubulo-urceolate, urceolate to rarely pouch-like ovoid-urceolate, white, greyish-white, pinkish-white to light green, 7-11 mm long, 4-5 m diameter, pilose or rarely glabrous. Flowering: March - May. Fruiting: Late May - September. Habitat: This species grows gregariously on moist humus-covered rocky slopes, often in moist loose rocky soils at altitudes ranging from (1500 -) 2300 - 3300 m. Status: Common. Distribution: India: E Himalaya (Sikkim, West Bengal and Arunachal Pradesh) and NE India (Meghalaya, Nagaland and Manipur), Nepal, Bhutan, SW China, N Myanmar and Vietnam. Specimens examined: SNP, Kaiankata, 29/05/2014, S. Panda 105. Ethnomedicinal uses: extract of leaves & twigs are highly poisonous to people and local animals (contains potassium cyanide in an undissolved state). Tender leaves (1 or 2 leaves are enough, if more leaves are applied, it may cause black pigmentation) are used to treat irritating skin diseases.

Rhododendron L., Sp. Pl. 1: 392. 1753.

32. *R. anthopogon* D. Don, Mem. Wern. Soc. 3: 409. 1821; Bhattachryya in Sanjappa & Sastry, Fasc. Fl. India-Ericaceae: 76. 2014. Vernacular name: Dhupi, Sunpati (Nepalese of Kalapohri & Sandakphu) (Plate 6 A). Field characters: Shrub, up to 1.5 m tall, Corolla hypocrateriform, white to pinkish, cream-coloured to yellowish, translucent, 5-12 mm long, glabrous outside, densely pilose inside. Flowering: late May - July. Fruiting: October. Habitat: The species grows in alpine regions at altitudes ranging from 3300 - 4800 m. Status: Common.

Distribution: India: Himalayas (Uttarakhand, Sikkim, Darjeeling in West Bengal and Arunachal Pradesh), Nepal, Bhutan and SW China.

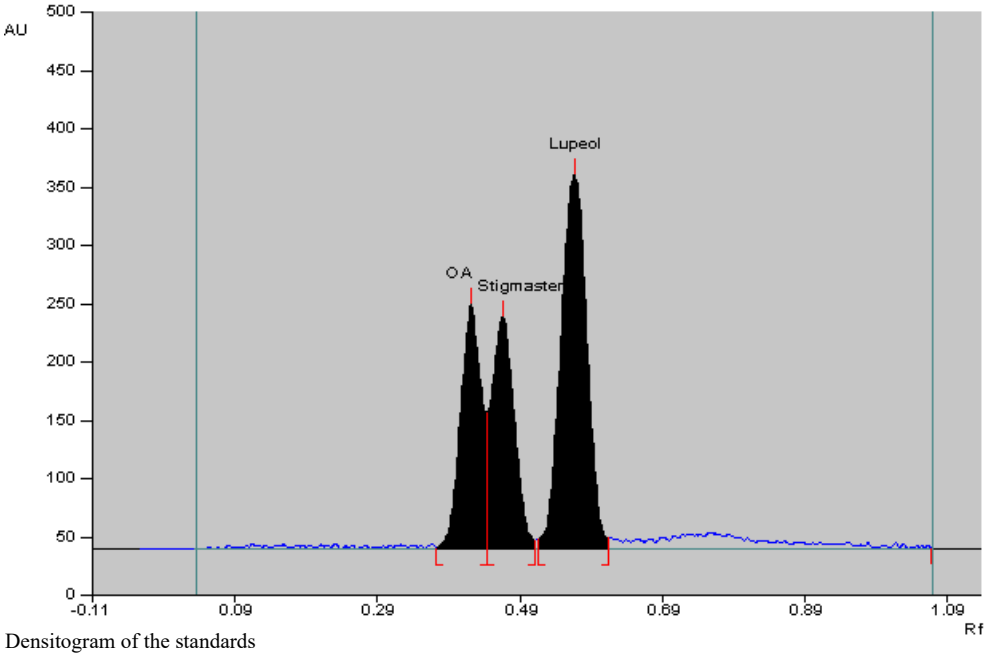
Specimens examined: SNP, BK Bhanjang to Sandakphu, 30/05/2013, S. Panda 05. Ethnomedicinal uses: decoction of leaves and flowers are used to treat colds, coughs (no dose mentioned), chronic bronchitis (50g extract per day), asthma (50g) and in treating indigestion and lung infection (50g).

33. *R. barbatum* Wall. ex G. Don, Gen. Hist. 3: 844. 1834; Bhattachryya in Sanjappa & Sastry, Fasc. Fl. India-Ericaceae: 98. 2014. Vernacular name: lal chimal (Nepalese of Gairibans) (Plate 6 C). Field characters: Shrub or treelet, 2-6 m tall, Corolla 5-lobed, tubulo-campanulate, 25-35 mm long, fleshy, blood red with darker nectar pouches at base. Flowering: April - May. Fruiting: October - November. Habitat: The species is grown at the junction of subtropical and temperate regions at altitudes ranging from 2500 - 3500 m. Status: Common. Distribution: India: Himalayas (Uttarakhand, Sikkim, Darjeeling in West Bengal, Arunachal Pradesh), Nepal, Bhutan and SW China. Specimens examined: SNP, Tonglu-Gairibans hill trek, 29/5/2014, S. Panda 107. Ethnomedicinal use: Extracts of corollae are used as an ingredient of narcotic drugs.

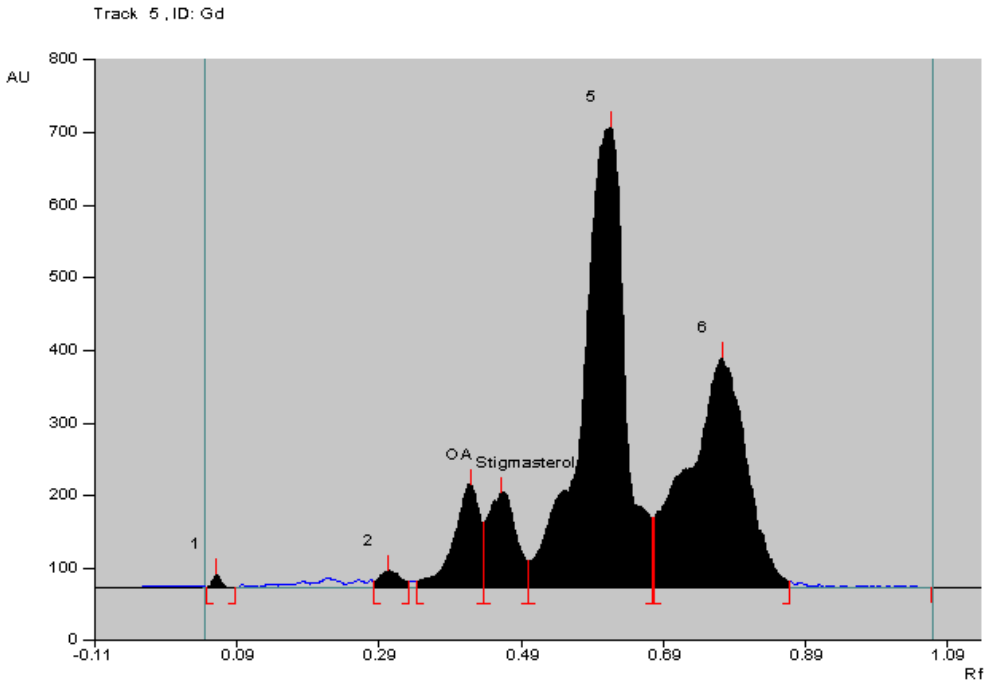
34. *R. cinnabarinum* Hook. f., Rhododendr. Sikkim-Himalaya: t. 8. 1849; Bhattachryya in Sanjappa & Sastry, Fasc. Fl. India-Ericaceae: 23. 2014. Vernacular name: Sanu Chimal (Plate 6 E). Field characters: Shrub, 2-4 m tall, Corolla 5-lobed, tubular to campanulate, 25-35 mm long, orange red, salmon to cinnabar-red, waxy. Flowering: April - early June. Fruiting: November. Habitat: This species grows in temperate regions at altitudes ranging from 2400 - 3700 m. Status: Threatened (2 discontinuous populations observed inside SNP, and 1 just outside SNP, number of individuals is few). Distribution: India: E Himalaya (Sikkim, Darjeeling in West Bengal and Arunachal Pradesh), Nepal, Bhutan and SW China. Specimens examined: SNP, Tonglu-Gairibans hill trek, 29/5/2014, S. Panda 108. Ethnomedicinal uses: Smoke from leaves is passed over old wounds for 5 minutes a day for at least 3 days to treat them.

35. *R. falconeri* Hook. f., Rhododendr. Sikkim-Himalaya: t.10. 1849; Bhattachryya in Sanjappa & Sastry, Fasc. Fl. India-Ericaceae: 112. 2014. Vernacular name: Korlinga (Nepalese of Gairibans) (Plate 6 F). Field characters: Tree, 5-12 m. Corolla oblique-campanulate, 24-53 x 20-35 mm, cream-coloured to light yellow with purple blotch at base, rarely pinkish in bud. Flowering: April - May. Fruiting: November. Habitat: The species grows luxuriantly in temperate forests at altitudes ranging from 2600 - 3400 m. Status: Common but Threatened (several populations observed from Tonglu up to Kalapokhri, but most of the populations are decreasing in number day by day. Immediate conservation steps should be taken to conserve it, especially Tonglu area). Distribution: India: E Himalaya (Sikkim Darjeeling in West Bengal and Arunachal Pradesh), Nepal, Bhutan and W China. Specimens examined: SNP, Gairibans, 29/5/2014, S. Panda 109. Ethnomedicinal use: Extracts of scented corollae are used to treat nose ulcers, sinus pain and headaches.

36. *R. fulgens* Hook. f., Rhododendr. Sikkim-Himalaya: t. 25. 1851; Bhattachryya in Sanjappa & Sastry, Fasc. Fl. India-Ericaceae: 124. 2014. Vernacular name: lali chimal (Nepalese of Sandakphu & Gurdung) (Plate 6 D). Field characters: Shrub or small tree, 2 - 3 m tall, Corolla 21-33 mm long, 21-33 mm across, blood-red, with darker nectar pouches at base, fleshy, shining. Flowering: May. Fruiting: July - August. Habitat: The species is grown on rocky slopes just below alpine scrubs at altitudes ranging from 3300-4100 m. Status: Threatened (several discontinuous populations were observed throughout SNP, mostly from Kalapokhri to Sandakphu, Sandakphu-Gurdum, Phalut-Gorkhay, but numbers of individuals are small). Distribution: India: E Himalaya (Sikkim, Darjeeling in West Bengal, Arunachal Pradesh), Nepal, Bhutan and W China. Specimens examined: SNP, BK bhanjang-Sandakphu road, 30/5/2014, S. Panda 111. Ethnomedicinal use: Red corollae are prepared as chutney or mixed with dal and taken as relief from indigestion and gastric problems.



Densitogram of the standards



Densitogram of *Gaultheria discolor* leaves showing the presence of Stigmasterol and OA

37. *R. lepidotum* Wall. ex G. Don, Gen. Hist. 3: 845. 1834; Bhattachryya in Sanjappa & Sastry, Fasc. Fl. India-Ericaceae: 39. 2014. Vernacular name: Bhale Sunpatie (Nepalese of Sandakphu) (Plate 6 B). Field characters: Stout dwarf shrub up to 1m high, aromatic fragrant. Corolla broadly campanulate with short tube, colour varies from greenish-white, light yellow to pink. Flowering: June - October. Fruiting: September - December. Habitat: The species grows gregariously in temperate forests at altitudes ranging from 2200-4000 m. Status: Common. Distribution: India: Himalayas (Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Sikkim, Darjeeling in West Bengal and Arunachal Pradesh) and NE India (Nagaland: Saramati Mt. peak: Hynniewta, 1994), W Pakistan, Nepal, Bhutan, SW China and NE Myanmar. Specimens examined: SNP, Sandaphu, 30/5/2014, S. Panda 112. Ethnomedicinal uses: extract of leaves is used in the treatment of colds, coughs, chronic bronchitis and asthma.

Vaccinium L., Sp. Pl. 1: 349. 1753 and Gen. Pl. 5: 166. 1754.

38. *V. dunalianum* Wight, Calcutta J. Nat. Hist. 8: 175. 1847 ("*Dunallianum*") & Ic. Pl. 4 (1): t. 1194. 1850; Panda in Sanjappa & Sastry, Fasc. Fl. India-Ericaceae: 395. 2014. Vernacular name: rate (Nepalese of Gairibans) (Plate 7 A). Field characters: Stout, erect shrub to treelet, 1-5 (-10) m high, often epiphytic, scandent; corolla broadly to rarely narrowly campanulate, light green to light pink, 5 - 7 mm long; berry globose, dark green (immature) to pinkish (mature). Flowering: April - June. Fruiting: May - December. Habitat: This species grows very rarely in dry and moist rocky slopes, often epiphytic at altitudes ranging from (900 -) 1600 - 2800 m. Status: Extremely Threatened (only two populations were observed throughout SNP, where number of individual plants are varying from 1-3). Distribution: India: E Himalaya (Sikkim, Darjeeling in West Bengal and Arunachal Pradesh) and NE India (Meghalaya, Nagaland and Manipur), Nepal, Bhutan, SW China, Taiwan, N Myanmar and Vietnam. Specimens examined: SNP, Gurdung-Srikhola road, 21/09/2014, S. Panda 185. Ethnomedicinal use: tender leaf extracts are used to treat intestinal worms.

39. *V. nummularia* Hook. f. & Thomson ex C. B. Clarke in Hook. f., Fl. Brit. India 3: 451. 1882; Panda in Sanjappa & Sastry, Fasc. Fl. India-Ericaceae: 404. 2014. Vernacular name: Tamarke didi (Sherpas of Kaiankata (Plate 7 B). Field characters: Stout, erect, pendent, dwarf epiphytic shrub, up to 2 m high, sometimes hanging down from rock crevices; Corolla ovoid-urceolate to somewhat tubulo-urceolate, light pink, ca. 6 mm long; berry globose, light green (immature) to blackish-brown (mature). Flowering: April - May. Fruiting: July - September. Habitat: This species grows gregariously as epiphytic in moss-covered old tree trunks, mostly on *Quercus* and *Rhododendron* spp., often hanging down from moist humus-covered rocky slopes in association with *Gaultheria griffithiana*, *G. trichophylla* and *Vaccinium retusum* at altitudes ranging from 2200 - 3500 m. Status: Common. Distribution: India: E Himalaya (Sikkim, Darjeeling in West Bengal and Arunachal Pradesh) and NE India (Nagaland), Nepal, Bhutan, SW China and N Myanmar. Specimens examined: SNP, Gairibans-Kaiankata Road, 29/5/2014, S. Panda 113.Ethnomedicinal use: Flowers and immature fruits are eaten raw to improve appetite.

40. *V. retusum* (Griff.) Hook.f. ex C. B. Clarke in Hook. f., Fl. Brit. India 3: 451. 1882; Panda in Sanjappa & Sastry, Fasc. Fl. India-Ericaceae: 410. 2014. *Thibaudia retusa* Griff., Not. pl. asiat. 4: 300. 1854 and Icon. pl. asiat. 4: t. 509. 1854. Vernacular names: Tamarke dada (Sherpas of Kaiankata); Ruk-ko-aziro (Nepalese of Kalapokhri) (Plate 7 C). Field characters: Stout, erect, epiphytic shrub, up to 3 m high, often grown in moist rock crevices; corolla ovoid-urceolate, pink, c. 5 mm long; berry globose, blackish-purple. Flowering: Late March – May & January. Fruiting: June - October. Habitat: This species grows gregariously as epiphytic on old tree trunks, mostly on *Quercus incana* and *Rhododendron* spp., sometimes on moist humus-covered rocky slopes, rarely in rock crevices at altitudes ranging from (1400 -) 1900 - 3500 (- 3800) m. Status: Common. Distribution: India: E Himalaya (Sikkim, Darjeeling in West Bengal and Arunachal Pradesh) and NE India (Nagaland and Manipur), Nepal, Bhutan, SW China and N Myanmar. Specimens examined: SNP, Kaiankata road side hilly slopes, 29/5/2014, S. Panda 114. Ethnomedicinal uses: Immature fruits are cooked with dal as an appetizer, while mature dark purple fruits are used to prepare jams, also as appetizers.

41. *V. vacciniaceum* (Roxb.) Sleumer, Bot Jahrb. Syst. 71: 479. 1941; Panda in Sanjappa & Sastry, Fasc. Fl. India-Ericaceae: 433. 2014. Vernacular names: godra dana; bandri phool (Nepalese of Srikhola) (Plate 7 D). Field characters: Stout, erect, epiphytic shrub, up to 1 m high, often grown in moist rock crevices; corolla ovoid-urceolate, light green, ca. 5 mm long; berry globose, green to white. Flowering: May. Fruiting: June - August. Habitat: This species grows gregariously as epiphytic on old tree trunks, sometimes on moist humus-covered rocky slopes, rarely in rock crevices at altitudes ranging from (1400 -) 1700 - 2200 m. Status: Common. Distribution: India: E Himalaya (Sikkim, Darjeeling in West Bengal and Arunachal Pradesh) and NE India (Nagaland and Manipur), Nepal, Bhutan, SW China and N Myanmar. Specimens examined: SNP, Gurdung-Srikhola road side tree, 30/5/2014, S. Panda 115. Ethnomedicinal uses: Extracts of tender leaves are used to stop bleeding of fresh cuts; fruits are eaten raw to expel intestinal worms.

Fumariaceae DC (Mingli et al. placed under Papaveraceae Juss. in Flora of China-2008)

Dactylicapnos Wall., Tent. Fl. Nepal. 2: 51. 1826; Mingli et al., Fl. China 7: 291. 2008.

42. *D. scandens* (D. Don) Hutch., Bull. Misc. Inform. Kew. 1921: 105. 1921; Mingli et al., Fl. China 7: 292. 2008. *Diclytra scandens* D. Don, Prodr. Fl. Nepal.: 198. 1825. *Dicentra scandens* (D. Don)Walp., Rep. 1: 118. 1842. *Dicentra thalictrifolia* (Wall.) Hook. f. & Thomson, Fl. Ind.: 273. 1855. Vernacular name: Lahara mutu (Nepalese of Gorkhay & Srikhola) (Plate 7 F). Field characters: A slender scandent undershrub, glabrous with angled stem; corolla greenish yellow to yellow. Flowering: July - August. Fruiting: September - October. Habitat: growing rarely on rocky slopes, crevices and on rock walls. Status: Threatened (several discontinuous populations were observed throughout SNP, but number of individuals always varies from 1 to 15). Distribution: India (E Himalayas), Nepal, Bhutan, SW China and N Myanmar. Specimens examined: SNP, Gorkhay to Srikhola, 13/05/2013, S. Panda 06. Ethnomedicinal uses: decoction of root tubers are used to prepare medicines for heart problems.

Corydalis DC. in Lamk. & DC., Fl. Franc. Ed. 3: 637. 1805.

43. *C. flaccida* Hook. f. & Thomson, Fl. Ind. 1: 260. 1855; Mingli et al., Fl. China 7: 321. 2008. Vernacular name: Pahenli (Nepalese of Gorkhay & Srikhola) (Plate 7 E). Field characters: A slender perennial herb up to 70 cm; corolla purple. Flowering: June - July. Fruiting: July - August. Habitat: growing rarely on rocky slopes and in crevices as discontinuous patch. Status: Threatened (several discontinuous populations were observed throughout SNP with small numbers of individuals). Distribution: India (E Himalayas), Nepal, Bhutan, SW China and N Myanmar. Specimens examined: SNP, Gorkhay to Srikhola, 13/05/2013, S. Panda 07. Ethnomedicinal uses: decoction of roots (25g per day for at least 15 days) are used for the treatment of syphilis. Decoction of roots (50g per day for 3 days) are used to treat typhoid.

Gentianaceae Juss.

Swertia L., Sp. Pl. 1: 226. 1753.

44. *S. bimaculata* (Sieb. & Zucc.) Hook.f. & Thomson ex C. B. Clarke, J. Linn. Soc. London 14: 449. 1875; Ting-nung & Pringle, Fl. China 16: 115. 1995. *Ophelia bimaculata* Sieb. & Zucc. in Abh. Akad. Wiss. München 4(3): 159. 1846. Vernacular name: Thulo Chiroto/chiraito (Nepalese of Srikhola) (Plate 8 A). Field characters: A stout and erect dwarf shrub up to 1 m high; corolla rotate, 5-lobed, greenish-yellow. Flowering: September. Fruiting: October - November. Habitat: growing very luxuriantly on rocky slopes, crevices and on rock walls. Field Status: Common. Distribution: India (E. Himalayas), Nepal, Bhutan, SW China & N Myanmar. Specimens examined: SNP, Gurdung to Srikhola, 21/9/2014, S. Panda 190. Ethnomedicinal Use: decoctions of leaves are used for the treatment of stomach disorder.

45. *S. chirayita* (Roxb. ex Fleming) H. Karst., Deuts. Fl.: 1025. 1883. *Gentiana chirayita* Roxb. ex Flemming in Asiat. Res. 11: 167. 1812. *Swertia chirata* (Wall.) C. B. Clarke in Hook. f., Fl. Brit. India 4: 124. 1883. Vernacular name: Chiroto/chiraito (Nepalese of Gairibans) (Plate

8 B). Field characters: A stout and erect dwarf shrub up to 3 ft high; corolla rotate, 4-lobed, dark purple. Flowering: September. Fruiting: October-November. Habitat: growing very rarely on rocky slopes, crevices and on rock walls. Field Status: Extremely Threatened (only three populations observed throughout SNP, where number of individual plants vary from 2 to 4). Distribution: India (Himalayas), Nepal and Bhutan. Specimens examined:SNP, Gairibans, 19/9/2014, S. Panda 191. Ethnomedicinal uses: decoctions of leaves and twigs are used as tonic, blood purifier, to treat stomach disorder, leucoderma, skin diseases and fever.

46. ***S. paniculata*** Wall., Asiat. Rar. 3: t. 205. 1832; Ting-nung & Pringle, Fl. China 16: 123. 1995. Vernacular name: Sanu Chiroto/chiraito (Nepalese of Gairibans) (Plate 8 C). Field characters: A stout and erect dwarf shrub up to 50 cm high; corolla rotate, 5-lobed, pale yellowish-green. Flowering: September. Fruiting: October - November. Habitat: growing discontinuously in patches on rocky slopes, crevices and on rock walls. Field Status: Threatened (Several populations were observed, but in all cases number of individuals is few). Distribution: India (Himalayas), Nepal, Bhutan, SW China & N Myanmar. Specimens examined: SNP, Gairibans, 19/9/2014, S. Panda 192. Ethnomedicinal Use: decoctions of leaves are used for the treatment of stomach disorders.

Tripterospermum Bl., Bijdr.: 849. 1826.

47. ***T. volubile*** (D. Don) Hara**,** J. Jap. Bot. 40: 21. 1965;. *Gentiana volubile* D. Don, Prodr., Fl. Nepal.: 126. 1825. *Crawfurdia japonica* var. *leutoviridis* (C. B. Clarke) C. B. Clarke in Hook. f., Fl. Brit. India 4: 108. 1883. Vernacular name: lote lahara (Nepalese of Srikhola) (Plate 8 D). Field characters: A twinning shrub; corolla tubular-campanulate, light green. Flowering: August - November. Fruiting: October - December. Habitat: growing very rarely on rocky slopes, crevices and on rock walls. Field Status: Threatened (Several populations were observed, but number of individuals are varying from 2 to 14). Distribution: India (E. Himalaya), Nepal, Bhutan, SW China, N. Myanmar. Specimens examined: SNP, Gurdung to Srikhola, 21/9/2014, S. Panda 193. Ethnomedicinal use: decoctions of root-tubers are used as medicine for heart problems.

Gesneriaceae Rich & Juss. ex DC.

Chirita Buch.-Ham. ex D. Don, Edinburgh Phil. J. 7: 83. 1822.

48. ***C. pumila*** D. Don, Prodr. Fl. Nepal.:90. 1825; Wentsai et al., Fl. China 18: 343. 1998. Vernacular name: Paharo ko Kan (Nepalese of Gairibans) (Plate 8 E). Field characters: An erect herb on rock crevice; corolla purple-blue. Flowering: July - August. Fruiting: August - September. Habitat: growing rarely on rocky slopes, crevices and on rock walls. Status: Threatened (several populations were observed, but number of individuals is few in each case). Distribution: India (Himalayas & Meghalaya), Nepal, Bhutan, SW China, N. Myanmar, Thailand. Specimens examined: SNP, Tonglu to Gairibans, 29/5/2014, S. Panda 116. Ethnomedicinal use: decoction of roots is used for the treatment of influenza.

Didymocarpus Wall., Edinburgh Phil. J. 1: 378. 1819.

49. ***D. villosus*** D. Don, Prodr. Fl. Nepal.: 123. 1825; Wentsai et al., Fl. China 18: 349. 1998. Vernacular name: Paharo ko Kan jato-b (Nepalese of Gairibans) (Plate 8 F). Field characters: An erect herb on rock crevice; corolla dark purple. Flowering: July - August. Fruiting: August - September. Habitat: growing rarely on rocky slopes, crevices and on rock walls. Status: Threatened (several populations were observed, but number of individuals is few in each case). Distribution: India (Himalayas), Nepal, Bhutan, SW China, N. Myanmar. Specimens examined: SNP, Tonglu to Gairibans, 29/5/2014, S. Panda 117. Ethnomedicinal use: decoction of roots is used for the treatment of influenza.

Helwingiaceae Decaisne

Helwingia Willd., Sp. Pl. 4: 634. 1806.

50. ***H. himalaica*** Hook. f. & Thomson ex C. B. Clarke in. Hook. f., Fl. Brit. India 2: 726. 1879; Qiuyun & Boufford, Fl. China 14: 228. 2005. Vernacular name: Pate Phul (Nepalese of Kaiankanta) (Plate 9 A). Field characters: A large glabrous pendent shrub up to 2 m high with 1-4-flowered umbels on the middle of adaxial leaves; corolla greenish-dark purple. Flowering: May. Fruiting: July - September. Habitat: growing rarely on rocky slopes and in crevices. Status: Extremely threatened (only 5 populations were observed throughout SNP, and number of individual plants varies from 1 to 5). Distribution: India (E. Himalaya), Nepal, Bhutan, SW China and N. Myanmar. Specimens examined: SNP, Gairibans to Kaiankanta, 20/09/2014, S. Panda 195. Ethnomedicinal use: Juice of leaves is used to stop bleeding of fresh cuts.

Hypericaceae Juss.

Hypericum L., Sp. Pl. 2: 783. 1753.

51. ***H. elodeoides*** Choisy in DC. Prodr. 1: 551. 1824; Xiwen et al., Fl. China 13: 24. 2007. *H. nepaulense* Choisy in DC. Prodr. 1: 552. 1824. *H. nervosum* D. Don, Prodr. Fl. Nepal.: 219. 1825. Vernacular name: Urilo (Nepalese of Gorkhay) (Plate 9 B). Field characters: A herb with numerous diffused branches; leaves sessile; flowers 8-10 mm across; corolla golden yellow. Flowering: July - September. Fruiting: August - October. Habitat: growing very rarely on rocky slopes, crevices and on rock walls. Status: Threatened (Several populations were observed, but number of individuals varies from 1 to 7). Distribution: India (E. Himalaya), Nepal, Bhutan, SW China & N. Myanmar. Specimens examined: SNP, Phallut to Gorkhay, 17/11/2013, S. Panda 29. Ethnomedicinal use: decoction of leaves is used to treat nasal bleeding and nose ulcers.

Liliaceae Juss.

Allium L., Sp. Pl. 1: 294. 1753; Xinqi et al., Fl. China 24: 165. 2000.

52. ***A. wallichii*** Kunth, Enum. Pl. 4: 443. 1843; Xinqi et al., Fl. China 24: 175. 2000. Vernacular name: Ban lasun (Nepalese of Kalapokhri) (Plate 9 C). Field characters: An erect herb up to 3 ft high; corolla blackish-purple. Flowering: July - September. Fruiting: August - October. Habitat: growing very commonly on rocky slopes and in crevices. Status: Common. Distribution: India (E. Himalaya), Nepal, Bhutan, SW China & N. Myanmar. Specimen examined: SNP, Kalapokhri to BK Bhanjang, 20/09/2014, S. Panda 197. Ethnomedicinal use: The raw bulbs are chewed to treat coughs & colds. Juice of bulbs is mixed with ghee (50g: 50g) and then allowed to boil for 5 minutes and used in the treatment of cholera & dysentery.

Lamiaceae Juss. (Labiatae Lindl.)

Colebrookea Sm., Exot. Bot. 2: 111. 1806.

53. ***C. oppositifolia*** Sm., Exot. Bot. 2: 111. 1806; Hsi-Wen & Hedge, Fl. China 17: 266. 1994. Vernacular name: Dhursool (Nepalese of Gorkhay & Srikhola) (Plate 9 D). Field characters: An erect tall shrub up to 2 m high; corolla grey-white. Flowering: March. Fruiting: April. Habitat: growing rarely on rocky slopes and in crevices. Status: Threatened (only three populations were observed throughout SNP, but number of individuals are varying from 1 to 4). Distribution: India (Himalayas), Nepal, Bhutan, SW China, N. Myanmar, Thailand. Specimens examined: SNP, Gorkhay to Srikhola, 19/05/2013, S. Panda 08. Ethnomedicinal use: Decoctions of leaves & twigs are used for the treatment of skin disease. Phytochemical compounds reported: Chrysin, flavonene, ladanein, negletein, sitosterol, triacontane (Husain et al. 1992; Yang et al. 1996). Pharmacological use: ethanolic root extract is being active to central nervous system (Chandel et al. 1996).

Elsholtzia Willd., Bot. Mag. 4 (11): 3. 1790.

54. ***E. fruticosa*** (D. Don) Rehd., Pl. Wilson. 3: 381. 1917; Hsi-Wen & Hedge, Fl. China 17: 251. 1994. *Perilla fruticosa* D. Don, Prodr. Fl. Nepal.: 115. 1825. Vernacular name: Sano silam, Mranja, Bhote pate (Nepalese of Gairibans) (Plate 9 E). Field characters: An erect bushy shrub up to 1 m high; corolla dull yellow. Flowering: August - September. Fruiting: September - November. Habitat: growing commonly on rocky slopes and in crevices. Status: Common. Distribution: India (E Himalayas), Nepal, Bhutan, SW China & N. Myanmar. Specimens examined: SNP, Tumling to Gairibans, 19/09/2014, S. Panda 198. Ethnomedicinal use: mature seeds (black) along with dale khorsane (round *Capsicum* sp.) & lasun (*Allium sativum*) are boiled and taken after meals to relieve digestive disorders.

Leucosceptrum Sm., Exot. Bot. 2: 113. 1805.

55. ***L. canum*** Sm., Exot. Bot. 2: 113. 1805; Hsi-Wen & Hedge, Fl. China 17: 247. 1994. Vernacular name: Ghurpis (Nepalese of Molle) (Plate 9 F). Field characters: A tall tree up to 4 m high; corolla white. Flowering: November-December. Fruiting: Dec.-Jan. Habitat: growing luxuriantly

on rocky slopes and in crevices. Status: Common. Distribution: India (E. Himalayas), Nepal, Bhutan, SW China, N. Myanmar, Thailand, Laos, Vietnam. Specimens examined: SNP, Molle, 29/11/2013, S. Panda 30. Ethnomedicinal use: decoction of fresh bark from stem of *L. canum* mixed with equal amount of fresh rhizomes & roots decoction of *Astilbe rivularis* (Buro akhoti) are mixed together and prepared as bandage for relief of bone fracture.

Notochaete Benth. in Edward's Bot. Reg. 15: t. 1289. 1829.

56. ***N. hamosa*** Benth. in Edward's Bot. Reg. 15: t. 1289. 1829; Hsi-Wen & Hedge, Fl. China 17: 141. 1994. Vernacular name: Kuro (Nepalese of Gairibans) (Plate 10 A). Field characters: An erect herb up to 2 ft high; verticillaster globose, densely flowered with hooked awned calyx; corolla white. Flowering & Fruiting: August - September. Habitat: growing rarely on rocky slopes, crevices and on rock walls. Status: Threatened (several populations with few individuals were observed throughout SNP). Distribution: India (E Himalayas), Nepal, Bhutan, SW China and N. Myanmar. Specimens examined: SNP, Gairibans, 19/09/2014, S. Panda 200. Ethnomedicinal use: decoction of leaves in the form of a 'paste' is applied to snake bite area, as well as taken internally as an antidote to treat snakebite (mainly Gurbe, hario & Kalo saps). Phytochemical compounds reported: Nortriterpenoids (notohamosin-A, B & C), β-sitosterol, shanzhiside, daucosterol, 3,5-dimethyoxy-4-hydroxybenzoic acid, pinoresinol, acteoside (Y. Luo et al. 2003).

Scutellaria L., Sp. Pl. 2: 598. 1753.

57. ***S. discolor*** Colebr. in Wall., Pl. Asiat. Rar. 1: 66. 1830; Hsi-Wen & Hedge, Fl. China 17: 86. 1994. Vernacular name: Dampate (Nepalese of Kalapokhri) (Plate 10 B). Field characters: An erect pubescent dwarf shrub up to 30 cm high; stem creeping at base; corolla purple. Flowering: August - November. Fruiting: November-January. Habitat: growing rarely on rocky slopes, crevices and on rock walls. Status: Threatened (several populations with few individuals were observed throughout SNP). Distribution: India (Himalayas), Nepal, Bhutan, SW China, N. Myanmar, Malesia. Specimens examined: SNP, Kaianata to Kalapokhri, 20/09/2014, S. Panda 201. Ethnomedicinal uses: extract of leaves & twigs are used to relieve rheumatic pain. Leaf-paste is used to relieve headaches.

Lardizabalaceae R. Br.

Holboellia Wall., Tent. Fl. Nepal. 1: 23. 1824.

58. ***H. latifolia*** Wall., Tent. Fl. Nepal. 1: 23. 1824; Dezhao & Shimizu, Fl. China 6: 447. 2001. Vernacular name: Gufla (Nepalese of Kalapokhri) (Plate 10 C). Field characters: A climbing shrub; corolla light purple-white to white; fruits pinkish-purple. Flowering: April - May. Fruiting: August - September. Habitat: growing commonly as climber on trees. Status: Common. Distribution: India (E Himalayas), Nepal, Bhutan, SW China, N. Myanmar. Specimens examined: SNP, Kaianata to Kalapokhri, 20/09/2014, S. Panda 202. Ethnomedicinal uses: white pulpy parts are eaten to get energy during long walks, as well as to relieve any types of stomach disorders. Extracts of roots are used for the treatment of rheumatic & sciatic pains.

Magnoliaceae Juss.

Alcimandra Dandy, Bull. Misc. Inform. Kew 1927: 259. 1927; Nianhe et al ., Fl. China 7: 70. 2008**.**

59. ***A. cathcartii*** (Hook. f. & Thomson) Dandy, Bull. Misc. Inform. Kew 1927: 260. 1927; Nianhe et al. Fl. China 7: 71. 2008. Vernacular name: Tite Chanp (Nepalese of Gairibans) (Plate 10 D). Field characters: A tall tree up to 7 m high; corolla grey-white, scented. Flowering: February – March. Fruiting: April - May. Habitat: growing commonly along rocky slopes and in crevices. Status: Common. Distribution: India (E Himalayas - Sikkim, Darjeeling of West Bengal, Arunachal Pradesh), Nepal, Bhutan, SW China, N. Myanmar, Vietnam. Specimens examined: SNP, Kaianata to Kalapokhri, 20/03/2014, S. Panda 61. Ethnomedicinal uses: extracts of flowers are taken to relieve nose ulcers & sinus pain.

Melastomataceae Juss.

Osbeckia L., Sp. Pl. 1: 345. 1753.

60. ***O. chinensis*** L., Sp. Pl. 1: 362. 1753; Jie & Renner, Fl. China 13: 362. 1753. Vernacular name: Chulasi (Nepalese of Gurdung) (Plate 10 E). Field characters: An erect bushy shrub up to 3 ft high; corolla purple-pink. Flowering: August - November. Fruiting: November - January. Habitat: growing luxuriantly on rocky slopes, crevices and on rock walls. Status: Common. Distribution: India (Himalayas), Nepal, Bhutan, SW China, N. Myanmar, Malaysia, S. Japan and N. Australia. Specimens examined: SNP, Sandakphu to Gurdung, 21/09/2014, S. Panda 203. Ethnomedicinal uses: extracts of leaves are used to treat fresh cuts and wounds.

Sarcopyramis Wall., Tent. Fl. Nepal.1: 32. 1824.

61. ***S. nepalensis*** Wall., Tent. Fl. Nepal. 1: 32. 1824; Jie & Renner, Fl. China 13: 388. 2007. Vernacular name: charibang (Nepalese of Gairibans) (Plate 10 F). Field characters: A weak succulent herb with tetragonous stem up to 20 cm high; corolla pink. Flowering: July - September. Fruiting: September - November. Habitat: growing rarely on rocky slopes, crevices and on rock walls. Status: Threatened (5 populations were observed throughout SNP, but number of individuals in each population varies from 5-17). Distribution: India (E. Himalaya & Khasi hills of Meghalaya), Nepal, Bhutan, SW China, N. Myanmar, Malaysia and Indonesia. Specimens examined: SNP, Gairibans, 19/09/2014, S. Panda 204. Ethnomedicinal use: Juice of stem (50 ml per day) is used in the treatment of blood dysentery.

Moraceae Gaud.

Ficus L., Sp. Pl. 2: 1059. 1753.

62. ***F. neriifolia*** Sm. in Rees, Cycl. 14: Ficus No. 21. 1810; Zhekun & Gilbert, Fl. China 5: 53. 2003. *F. nemoralis* Wall. ex Miq. Vernacular name: Dudilo (Nepalese of Gairibans). Field characters: A tall tree up to 4 m with milky latex throughout except roots; fruits dark green. Flowering: April. Fruiting: September - November. Habitat: growing rarely on rocky slopes and in crevices. Status: Threatened (total 7 trees were observed throughout SNP). Distribution: India (E. Himalaya & Khasi hills of Meghalaya, Nagaland, Manipur), Nepal, Bhutan, SW China, N. Myanmar. Specimens examined: SNP, Gairibans, 19/09/2014, S. Panda 205. Ethnomedicinal use: decoction of stem bark is given in the treatment of conjunctivitis and boils.

Oleaceae Hoffmannsegg & Link

Fraxinus L. Sp. Pl. 2: 1057. 1753.

63. ***F. floribunda*** Wall. in Roxb., Fl. Ind. 1: 150. 1820; Chang Mei-Chen et al., Fl. China 15: 276. 1996. Vernacular name: Lankuri (Nepalese of Kalapokhri). Field characters: A tall tree up to 4 m high; fruits blood red. Flowering: April - May. Fruiting: September - November. Habitat: growing rarely on rocky slopes and in crevices. Status: Extremely Threatened (only 4 plants seen throughout SNP). Distribution: India (Himalayas), Afghanistan, Pakistan, Nepal, Bhutan, SW China, N. Myanmar, Thailand, Laos, Vietnam, Japan. Specimens examined: SNP, Gairibans to Kalapokhri, 20/09/2014, S. Panda 206. Ethnomedicinal use: decoction of fresh bark is used for the treatment of arthritic pain.

Orchidaceae Juss.

Satyrium Swartz, Kongl. Vetensk. Acad. Nya Handl. 21: 214. 1800.

64. ***S. nepalense*** D. Don, Prodr. Fl. Nepal.: 26. 1825; Xinqi et al., Fl. China 25: 165. 2009. Vernacular name: Ban alu (Nepalese of Kalapokhri) (Plate 11 A). Field characters: An erect herb up to 1 ft; corolla pinkish. Flowering: September. Fruiting: November. Habitat: growing rarely on rocky slopes and in crevices. Status: Threatened (several populations were seen & documented, but all possess few individual plants). Distribution: India (Himalayas), Afghanistan, Pakistan, Nepal, Bhutan, SW China, N. Myanmar, Thailand, Laos, Vietnam, Japan. Specimens examined: SNP, Gairibans to Kalapokhri, 20/09/2014, S. Panda 207. Ethnomedicinal use: decoction of bulbs (50 g per day) is applied as paste on old wounds for quick healing.

Oxalidaceae R. Br.

Oxalis L., Sp. Pl. 1: 433. 1753.

65. ***O. latifolia*** Humb. in Bonpl. & Kunth, Nov. Gen. & Sp.: 5: 184. 1821. Vernacular name: Thulo chari amilo (Nepalese of Kalapokhri) (Plate 11 B). Field characters: An decumbent long peduncled herb up to 20 cm high; corolla pink. Flowering: July - August. Fruiting: July - September. Habitat: growing rarely on rocky slopes, crevices and on rock walls. Status: Threatened (only 5 populations of a very few individuals

were seen throughout SNP). Distribution: Native of Central and South America. Naturalized in Europe and tropical South Asia incl. India. Specimens examined: SNP, Gairibans to Kalapokhri, 20/09/2014, S. Panda 209. Ethnomedicinal use: extract of leaves & petioles is used for the treatment of throat pain and in cases of tonsillitis.

Papaveraceae Juss.

Meconopsis Vig., Hist. Nat. Pavots Argemones.: 48. 1814.

66. ***M. aculeata*** Royle, Ill. Bot. Himal. Mts. 1: 67. 1834; Mingli et al., Fl. China 7: 272. 2008. Vernacular name: kanta (Nepalese of Kaiankata) (Plate 11 C). Field characters: An erect shrub up to 1 m high ; corolla bluish-purple. Flowering: September. Fruiting: September - October. Habitat: growing rarely on rocky slopes and in crevices. Status: Extremely Threatened (Only 2 populations seen throughout SNP). Distribution: India (Himalayas), Pakistan, Nepal, Bhutan, China, Myanmar. Specimens examined: SNP, near Kaiankanta, 20/09/2014, S. Panda 210. Ethnomedicinal use: decoctions of roots are used to treat inflammation from fractures near joint and pain of broken bones. Extract of roots is also taken internally to reduce high blood pressure.

Polygalaceae Juss.

Polygala L., Sp. Pl. 2: 701. 1753.

67. ***P. arillata*** Buch.-Ham ex D. Don, Prodr. Fl. Nepal.: 199. 1825; Shukun et al., Fl. China 11: 145. 2008. Vernacular name: Morcha (Nepalese of Gairibans) (Plate 11 D). Field characters: An erect shrub up to 2 m high; corolla yellow; fruits purple. Flowering: July. Fruiting: August - September. Habitat: growing rarely on moist rocky slopes, crevices and on wet rock walls. Status: Threatened (Several populations were seen and documented with a very few individual plants). Distribution: India (E. Himalaya, NE Indian hills and hills of Peninsular India) Nepal, Bhutan, SW China, N. Myanmar, Sri Lanka, Malesia. Specimens examined: SNP, Gairibans, 19/09/2014, S. Panda 214. Ethnomedicinal use: Extract of leaves is used to treat muscular pain. Decoction of roots is applied on forehead to relieve headache.

Ranunculaceae Juss.

Aconitum L., Sp. Pl. 1: 532. 1753.

68. ***A. heterophyllum*** Wall. ex Royle, Ill. Bot. Himal. Mts.: t. 13. 1833. Vernacular name: Atis (Nepalese of Kalapokhri) (Plate 11 E). Field characters: An erect undershrub up to 1 m high; corolla dark bluish-purple. Flowering: September. Fruiting: September - October. Habitat: growing rarely on moist rocky slopes and in crevices. Status: Extremely Threatened (3 different populations with a very few individuals were seen mixed with other *Aconitum* spp. and documented). Distribution: India (Himalayas), Nepal and Bhutan. Specimens examined: SNP, Kalapokhri, 20/09/2014, S. Panda 218. Ethnomedicinal use: powdered mature seeds are mixed with honey, then this resultant mixture is applied on throat to relieve throat pain and tonsillitis problems.

69. ***A. violaceum*** Jacq. ex Stapf, Ann. Roy. Hort. Gard. Calcutta 10 (2): 144. 1905. Vernacular name: Bikh (Nepalese of Kalapokhri) (Plate 11 F). Field characters: An erect undershrub up to 1 m high; corolla light bluish-purple. Flowering: September. Fruiting: September - October. Habitat: growing rarely on moist rocky slopes and in crevices. Status: Extremely Threatened (3 different populations with a very few individuals were seen mixed with other Aconitum spp. and documented). Distribution: India (Himalayas), Nepal and Bhutan. Specimens examined: SNP, Kalapokhri, 20/09/2014, S. Panda 219. Ethnomedicinal use: decoction of roots is applied to carbuncles for a rapid cure.

Anemone L., Sp. Pl. 1: 538. 1753.

70. ***A. vitifolia*** Buch.-Ham. ex DC., Syst. Nat. 1: 211. 1817; Wencai et al., Fl. China 6: 317. 2001. Vernacular name: Kapase (Nepalese of Kalapokhri) (Plate 12 A). Field characters: An erect herb up to 70 cm high; corolla white. Flowering: July - September. Fruiting: September - October. Habitat: growing rarely on moist rocky slopes and in crevices. Status: Threatened (a total of 5 discontinuous populations with very few individuals were seen throughout SNP). Distribution: India (Himalayas), Nepal, Bhutan, China, Myanmar. Specimens examined: SNP, near Kalapokhri, 20/09/2014, S. Panda 220. Ethnomedicinal uses: decoction of leaves & twigs is given to relieve toothache. Root-paste is applied to the scalp of head to remove lice.

Clematis L., Sp. Pl. 1: 543. 1753.

71. ***C. buchananiana*** DC., Syst. Nat. 1: 140. 1817; Wencai et al., Fl. China 6: 378. 2001. Vernacular name: Pinase lahara (Nepalese of Gurdung) (Plate 12 B). Field characters: A climber on trees & shrubs; corolla white. Flowering: July - September. Fruiting: September - October. Habitat: growing rarely on moist rocky slopes and in crevices. Status: Threatened (several populations with a very small numbers of individuals were seen throughout SNP). Distribution: India (Himalayas), Nepal, Bhutan, China, Myanmar. Specimens examined: SNP, Sandakphu to Gurdung, 21/09/2014, S. Panda 221. Ethnomedicinal use: fresh leaves are burnt and its smoke is inhaled twice daily for 3 days for the treatment of sinus pain.

Ranunculus L., Sp. Pl. 1: 548. 1753**.**

72. ***R. diffusus*** DC.**,** Prodr. 1: 38. 1824; Wencai et al., Fl. China 6: 333. 2001.

R. nepalensis DC., Prodr. 1: 39. 1824. Vernacular name: Bokua (Nepalese of Gorhay) (Plate 12 C). Field characters: A diffused perennial herb; leaves deeply 3-partite; peduncle 1-flowered; corolla bright yellow. Flowering: June – July. Fruiting: July - August. Habitat: growing rarely on moist rocky slopes, crevices and on wet rock walls. Status: Threatened (several populations with a very few individuals were seen throughout SNP). Distribution: India (Himalayas and NE India excl. Assam & Tripura), Nepal, Bhutan, SW China and N. Myanmar. Specimens examined: SNP, Phallut to Gorkhay, 30/11/2013, S. Panda 222. Ethnomedicinal use: decoction of tender leaves is used to treat skin infection.

Rosaceae Juss.

Agrimonia L., Sp. Pl. 1: 448. 1753.

73. ***A. pilosa*** Ledebour, Index Seminum Hort. Dorpat., Suppl. 1: 1823; Lingdi et al., Fl. China 9: 382. 2003. Vernacular name: Kathlange (Nepalese of Mole) (Plate 12 D). Field characters: An erect dwarf shrub up to 60 cm high; corolla bright yellow. Flowering: May - September. Fruiting: September - November. Habitat: growing rarely on moist rocky slopes, crevices and on wet rock walls. Status: Threatened (several populations with few individual plants were seen and documented throughout SNP). Distribution: India (Himalayas and NE India excl. Assam & Tripura), Nepal, Bhutan, SW China, N. Myanmar, Mongolia, Korea, Thailand, Laos, Vietnam, Japan, Russia, E Europe. Specimens examined: SNP, Phallut to Molle, 30/11/2013, S. Panda 223. Ethnomedicinal use: extract of leaves is used to treat dysentery. Decoction of roots is used to treat or as an antidote for snake bite (mainly Gurbe sap).

Cotoneaster Medik., Philos. Bot. 1: 154. 1789.

74. ***C. acuminatus*** Lindl., Trans. Linn. Soc. Bot. London 13: 101. 1822; Lingdi et al., Fl. China 9: 98. 2003. Vernacular name: Dhalke phool (Nepalese of Kalapokhri) (Plate 12 E). Field characters: A bushy much branched dwarf shrub; corolla white; fruits blood-red. Flowering: May - June. Fruiting: September - October. Habitat: growing commonly on moist rocky slopes and in crevices. Status: Threatened (several populations with few individual plants were seen and documented throughout SNP). Distribution: India (Himalayas), Nepal, Bhutan, SW China and N. Myanmar. Specimens examined: SNP, Kalapokhri, 20/09/2014, S. Panda 224. Ethnomedicinal use: mature fruits (5-6 per day for 3 days) are eaten raw to expel intestinal worms.

Potentilla L., Sp. Pl. 1: 495. 1753.

76. ***P. fulgens*** Wall. ex Hook. Bot. Mag. 53: t. 2700. 1826. Vernacular name: Chirya phal (Nepalese of Kalapokhri). Field characters: Silky decumbent herb; flowers with short pedicels; corolla 12-20 mm across, yellow. Flowering: July - September. Fruiting: August - October. Habitat: growing luxuriantly on moist rocky slopes, crevices and on wet rock walls. Status: Common. Distribution: India (Himalayas), Nepal, Bhutan, SW China and N. Myanmar. Specimens examined: SNP, Kaiankata to Kalapokhri, 29/05/2014, S. Panda 100. Ethnomedicinal uses: Extract of leaves & roots (50:50) is administered to treat diarrhoea.

Rubus L., Sp. Pl. 1: 492. 1753.

77. ***R. acuminatus*** Sm. in Rees, Cyclop. 30: n. 43. 1819; Lingdi et al., Fl. China 9: 262. 2003. Vernacular name: Sanu aselu (Nepalese of Gurdung) (Plate 13 A). Field characters: An eglandular scandent shrub

with a few curved prickles; leaves simple, ovate to ovate-lanceolate with caudate-acuminate apex; corolla white; fruits blood red. Flowering: May - July. Fruiting: June - August. Habitat: growing rarely on moist rocky slopes, crevices and on tree canopy. Status: Threatened (several populations with few individual plants were seen and documented throughout SNP). Distribution: India (Himalayas), Nepal, Bhutan, SW China and N. Myanmar. Specimen examined: SNP, Sandakphu to Gurdung, 30/05/2014, S. Panda 101. Ethnomedicinal use: Extract of roots (25g in half glass of water per day for 2 days) is given to patients suffering from diarrhoea.

78. *R. calycinus* Wall. ex D. Don Prodr. Fl. Nepal.: 235. 1825; Lingdi et al., Fl. China 9: 280. 2003. Vernacular name: Bhuin aselu (Nepalese of Gurdung) (Plate 13 B). Field characters: An eglandular creeping hirsute herb with small prickles; lamina simple orbicular-reniform isolating it from other species; corolla white. Flowering: May - July. Fruiting: June - August. Habitat: growing rarely on moist rocky slopes and in crevices. Status: Threatened (several populations with few individual plants were seen and documented throughout SNP). Distribution: India (Himalayas & Khasia Mt. in Meghalaya), Nepal, Bhutan, SW China and N. Myanmar. Specimen examined: SNP, Sandakphu to Gurdung, 30/05/2014, S. Panda 102. Ethnomedicinal use: extract of roots (50g in half glass of water per day for 2 days) is given to patients suffering from diarrhoea.

79. *R. cordifolius* D. Don, Prodr. Fl. Nepal.: 223. 1825. Vernacular name: Thulo ainselu (Nepalese of Kalapokhri) (Plate 13 C). Field characters: A scandent semi-erect shrub with spreading flexuous hairs with stout and hooked prickles; leaves cordate; corolla pinkish-white. Flowering: May - July. Fruiting: June - August. Habitat: growing rarely on moist rocky slopes and in crevices. Status: Threatened (several populations with small number of individual plants were seen and documented throughout SNP). Distribution: India (Himalayas), Nepal, Bhutan, SW China, N. Myanmar. Specimens examined: SNP, Kaiankata to Kalapokhri, 20/09/2014, S. Panda 225. Ethnomedicinal use: Extract of roots is used for the treatment of diarrhoea.

Sorbus L., Sp. Pl. 1: 477. 1753.

80. *S. cuspidata* (Spach) Hedlund, Kongl. Svenska Vetenskapsakad. Handl. 35: 89. 1901; Lingdi et al., Fl. China 9: 163. 2003. *Crataegus cuspidata* Spach, Hist. Veg. Phan. 2: 106. 1834. Vernacular name: Tenga (Nepalese of Gairibans). (Plate 12 F). Field characters: A tall shrub up to 4 m high; fruits oval-round, yellowish green. Flowering: May - July. Fruiting: September - October. Habitat: growing rarely on moist rocky slopes and in crevices. Status: Threatened (only 5 discrete populations with a very small number of individuals were seen throughout SNP). Distribution: India (E Himalayas), Nepal, Bhutan, SW China, N. Myanmar. Specimens examined: SNP, Tumling to Gairibans, 19/09/2014, S. Panda 227. Ethnomedicinal use: Mature fruits are eaten raw to expel intestinal worms.

Rubiaceae Juss.

Rubia L., Sp. Pl. 1: 109. 1753.

81. *R. manjith* Roxb. ex Flemming, Asiat. Res. 11: 177. 1810; Chen Tao et al., Fl. China 19: 313. 2011. *Rubia mungith* Roxb. ex Desv. in J. de B. Desv. 2: 207. 1814. *R. munjista* Roxb., Fl. Ind. 1: 383. 1820. *Rubia cordifolia* L. var. *mungista* (Roxb.) Miq. in Ann. Mus. B. Lugd.-Bat. 3: 111. 1867. *Rubia cordifolia* auct. non L.: D. Don, Prodr. Fl. Nepal.: 133. 1825. *R. cordifolia* L. var. *khasiana* Watt, Dict. Econ. Prod. Ind. 6(1): 572. 1892. Vernacular name: Majito (Nepalese of Gairibans) (Plate 13 D). Field characters: A profusely branched scandent and trailing shrub; corolla dull yellow. Flowering: July - October. Fruiting: August - December. Habitat: growing luxuriantly on moist rocky slopes, crevices and on wet rock walls. Status: Common. Distribution: India (E. Himalaya and NE India excl. Assam & Tripura), Nepal, Bhutan, SW China and N. Myanmar. Specimen examined: SNP, Tumling to Gairibans, 19/09/2014, S. Panda 228. Ethnomedicinal use: Extract of roots is used for the treatment of skin irritation & other diseases related to skin.

Rutaceae Juss.

Boenninghausenia Reichb. ex Meisn., Pl. Vasc. Gen. 1: 60. 1837.

82. *B. albiflora* (Hook.) Reichb. ex Meisn., Pl. Vasc. Gen. 2: 44. 1837; Dianxiang et al., Fl. China 11: 73. 2008. *Ruta albiflora* Hook., Exot. Fl. 1: t. 79. 1823. Vernacular name: Gwame jhar (Nepalese of Gairibans) (Plate 13 D). Field characters: An erect shrub up to 1 m high; corolla white. Flowering: May - September. Fruiting: August - December. Habitat: growing rarely on moist rocky slopes and in crevices. Status: Threatened (several populations with few individuals seen). Distribution: India (Himalayas and NE India excl. Assam & Tripura), Pakistan, Nepal, Bhutan, SW China, N. Myanmar, Thailand, Vietnam, Laos, Philippines. Specimen examined: SNP, Tumling to Gairibans, 19/09/2014, S. Panda 229. Ethnomedicinal use: Extract of leaves is used for treatment of old wounds. Decoction of roots is used as an antidote for the treatment of snake bites (Gurbe sap).

Zanthoxylum L., Sp. Pl. 1: 270. 1753.

83. *Z. acanthopodium* DC., Prodr. 1: 727. 1824; Dianxiang et al., Fl. China 11: 63. 2008. Vernacular name: Boke timbur (Nepalese of Gairibans) (Plate 13 F). Field characters: An erect shrub up to 2 m high; corolla dark brown; fruits dark green. Flowering: May - June. Fruiting: August - December. Habitat: growing rarely on moist rocky slopes and in crevices. Status: Extremely Threatened (only 5 discrete populations with 2 to 5 individuals were seen). Distribution: India (Himalayas and NE India excl. Assam & Tripura), Nepal, Bhutan, SW China, N. Myanmar, Thailand, Vietnam, Laos, Indonesia. Specimen examined: SNP, Tumling to Gairibans, 19/09/2014, S. Panda 230. Ethnomedicinal uses: Extract of leaves & twigs is used externally to relieve abdominal pain. Fruits are eaten after meals to relieve indigestion problems.

Saxifragaceae Juss.

Astilbe Buch.-Ham. ex D. Don, Prodr. Fl. Nepal.: 210. 1825.

84. *A. rivularis* Buch.-Ham. ex D. Don, Prodr. Fl. Nepal.: 211. 1825; Jintag & Ohba, Fl. China 8: 276. 2001. Vernacular Name: Buro akoti, Pan supari (Nepalese of Gurdung). Field characters: An pendant dwarf shrub with perennial creeping root stock; corolla greenish-yellow. Flowering: July - August. Fruiting: August - December. Habitat: growing rarely on moist rocky slopes, crevices and on wet rock walls. Status: Threatened (Several populations with very few individuals were seen). Distribution: India (E. Himalaya), Nepal, Bhutan, SW China, N. Myanmar and Thailand. Specimen examined: SNP, Gurdung, 21/09/2014, S. Panda 231. Ethnomedicinal use: decoction of roots is used as bandage in case of bone fracture & joint inflammation. Extract of roots & leaves is used for the treatment of diarrhoea & dysentery.

Bergenia Moench, Methodus.: 664. 1794; Jintag & Ohba, Fl. China 8: 278. 2001.

85. *B. ciliata* (Haw.) Stenberg, Rev. Saxifr. Suppl. 2: 2. 1831. *Megasea ciliata* Haw., Saxifr. Enum.: 7. 1821. *Saxifraga ligulata* Wall., Asiat. Res. 13: 398. 1820. *Bergenia ligulata* (Wall.) Engl. in Bot. Zeit. 26: 841. 1868. Vernacular Name: Pakhanbet (Nepalese of Gairibans) (Plate 14 A). Field characters: An pendant dwarf shrub; lamina obovate to suborbicular; corolla light pink to white. Flowering: July - August. Fruiting: August - December. Habitat: growing rarely on moist rocky slopes, crevices and on wet rock walls. Status: Threatened (populations were plenty throughout SNP, but all are going to be threatened due to mass collection). Distribution: India (Himalayas & Meghalaya), Nepal, Bhutan, SW China. Specimen examined: SNP, Gairibans, 19/09/2014, S. Panda 232. Ethnomedicinal use: Dried rhizomatous stems are made into powdery dust and mixed with rice dust and ghee. This resultant mixture is boiled for 15 minutes and cooled, then served to the women to relieve labour pain a few days after child birth.

Scrophulariaceae Juss.

Hemiphragma Wall., Trans. Linn. Soc. London 13: 611. 1822.

86. *H. heterophyllum* Wall., Trans. Linn. Soc. London 13: 612. 1822; Deyuan et al., Fl. China 18: 55. 1998. Vernacular name: Nash jhar (Nepalese of Kalapokhri) (Plate 14 B). Field characters: A procumbent herb with dimorphic leaves; corolla light pink; fruits blood red. Flowering: July. Fruiting: July - December. Habitat: growing luxuriantly on moist rocky slopes, crevices and on wet rock walls. Status: Common. Distribution: India (Himalayas & NE India excl. Assam & Tripura), Nepal, Bhutan, SW China and N. Myanmar, Taiwan and Philippines. Specimen examined: SNP, on the way to Kalapokhri from Gairibans, 20/09/2014, S. Panda 233. Ethnomedicinal use: Red fruits are eaten raw to treat colds, coughs, throat pain & tonsillitis.

Smilacaceae Vent.

Smilax L., Sp. Pl. 2: 1028. 1753.

87. *S. bracteata* C. Presl., Reliq. Haenk. 1: 131. 1827; Chen Xinqi et al., Fl. China 24: 112. 2000. Vernacular name: kukur dyne (Nepalese of Kalapokhri) (Plate 14 C). Field characters: A climbing shrub with prickles; corolla greenish-white; fruits green. Flowering: July - September. Fruiting: September - December. Habitat: growing rarely on moist rocky slopes and in crevices. Status: Threatened (Several populations with very few of individuals were seen). Distribution: India (Himalayas & NE India excl. Assam & Tripura), Nepal, Bhutan, SW China, N. Myanmar, Thailand, Cambodia, Laos, Vietnam, Malaysia, Japan, Philippines. Specimen examined: SNP, on the way to Kalapokhri from Gairibans, 20/09/2014, S. Panda 234. Ethnomedicinal use: Extract of roots mixed with mustard oil (50g: 50 ml) is used as massage oil to relieve rheumatic pain.

Taxaceae S. F. Gray

Taxus L., Sp. Pl. 2: 1040. 1753.

88. *T. wallichiana* Zucc., Abh. Math.-Phys. Cl. Konigl. Bayer. Akad. Wiss. 3: 803. 1843; Fu Liguo et al., Fl. China 4: 90. 1999. Vernacular name: Dhangre salla (Nepalese of Gurdung) (Plate 15 A). Field characters: A tall tree up to 20 m tall. Habitat: growing rarely on moist rocky slopes and in crevices. Status: Threatened (Several populations few individuals were seen). Distribution: India (Himalayas & NE India excl. Assam & Tripura), Nepal, Bhutan, SW China and N. Myanmar, Thailand, Vietnam, Laos. Specimen examined: SNP, on the way to Gurdung from Sandakphu, 21/09/2014, S. Panda 235. Ethnomedicinal use: decoction of leaves is used for the treatment of cough, cold, bronchitis and asthma. Extract of leaves & bark is used for the treatment of cancer.

Thymelaeaceae Juss.

Daphne L., Sp. Pl. 1: 356. 1753.

89. *D. bholua* Buch.-Ham. ex D. Don, Prodr. Fl. Nepal.: 68. 1825; Wang Yinzheng et al., Fl. China 13: 244. 2007. Vernacular name: Argayle, Lokote (Nepalese of Kalapokhri) (Plate 14 F). Field characters: A tall shrub; corolla white. Flowering: May - June. Fruiting: July - September. Habitat: growing commonly on moist rocky slopes and in crevices. Status: Threatened (Several populations few individuals were seen). Distribution: India (Himalayas), Nepal, Bhutan, Bangladesh, SW China and N. Myanmar. Specimen examined: SNP, on the way to Kalapokhri from Gairibans, 20/09/2014, S. Panda 236. Ethnomedicinal uses: decoction of fresh bark is used to treat fever. Powdered seeds (25g) are mixed with half a glass of water, taken after dinner (for at least 2 days) to expel intestinal worms.

Edgeworthia Meisn., Pl. Vasc. Gen. 1: 330. 1841.

90. *E. gardneri* (Wall.) Meisn., Denkschr. Regensburg. Bot. Ges. 3: 280. 1841; Wang Yinzheng & Gilbert, Fl. China 13: 247. 2007. Vernacular name: Kagate (Nepalese of Kalapokhri) (Plate 14 E). Field characters: A tall shrub up to 3 m high; corolla light yellow to dull yellow, mild scented. Flowering: May - June. Fruiting: July - August. Habitat: growing rarely on moist rocky slopes and in crevices. Status: Extremely Threatened (a total of 7 populations with very few individuals were seen). Distribution: India (E Himalayas), Nepal, Bhutan, SW China and N. Myanmar. Specimen examined: SNP, Kaiankata, 29/05/2014, S. Panda 103. Ethnomedicinal use: Extract of flowers is taken through the nose to treat nose ulcers & nose blockage due to cold.

Violaceae Juss.

Viola L., Sp. Pl. 2: 933. 1753.

91. *V. canescens* Wall. ex Roxb. in Roxb., Fl. Ind. 2: 450. 1824. Vernacular name: Sire jhar (Nepalese of Gurdung) (Plate 14 D). Field characters: A small herb with long runners horizontally along soil surface; corolla light purple. Flowering: May - July. Fruiting: June - September. Habitat: growing commonly in moist rocky slopes, crevices and on wet rock walls. Status: Threatened (several populations few individuals were seen). Distribution: India (Himalayas), Pakistan, Nepal, Bhutan. Specimen examined: SNP, Gairibans, 19/09/2014, S. Panda 180. Ethnomedicinal use: Extract of roots (poisonous) is used topically for the treatment of post snake bite swelling & infection. Extract of leaves is used to treat coughs & colds.

Zingiberaceae Juss.

Hedychium J. Konig in Retz., Observ. Bot. 3: 73. 1783.

92. *H. spicatum* Sm. In Rees, Cycl. 17: Hedychium no. 3. 1811; Delin & Larsen, Fl. China 24: 373. 2000. Vernacular name: Kyaro (Nepalese of Srikhola). Field characters: An erect scented herb with 3-4-flowered bracts; flowers scented, white. Flowering: July - August. Fruiting: September - November. Habitat: growing luxuriantly on moist rocky slopes, crevices and on wet rock walls. Status: Common. Distribution: India (E Himalayas & NE India excl. Assam & Tripura), Nepal, Bhutan, SW China, N Myanmar, Sri Lanka and Malesia. Specimen examined: SNP, Gurdung to Srikhola, 21/09/2014, S. Panda 241. Ethnomedicinal use: decoction of rhizomes is used for the treatment of chronic indigestion.

Conclusion

This work embodies 92 threatened ethnomedicinal species from 74 genera and 44 families from different parts of Singalila National Park, Darjeeling Himalaya, West Bengal State, mainly based on extensive field surveys followed by oral interviews with experienced members of the Nepalese community, to some extent other communities like Sherpas, Tibetans & Buddhists were also interviewed about 92 threatened ethnomedicinal Plants. More than 50 chronic diseases, ailments and maladies are treated by using different parts of these documented 92 ethnomedicinal plants including their dosimetry based on tribal information on ITK, as well as new discoveries of rich ethnomedicinal alkaloids from more than 50 species (from the 92 spp.) for treating various human ailments based on first-hand information collected during visits to these ethnic villages.

This work reports 1 endemic, 17 critically endangered and 75 other threatened ethnomedicinal species based on extensive field survey, as well as the first screening of the phytochemical data of *Gaultheria akaensis* Panda & Sanjappa, a Critically Endangered, endemic and promising ethnomedicinal plant based on HPTLC work. Each species is provided with nomenclatural citation(s), vernacular name(s) and live or herbarium photos (where available), description based on field and herbarium data for correct identification, distribution, habitat, present status based on population sampling during field visits (list Quadrat Method) and ethnic uses based on ethnic ITK. Besides the study of specimens in different Indian herbaria, studies were conducted to observe the plants in their natural habitats, to record the colour of flowers, fragrance and indumentum, the range of variations, presence of nectaries, altitude, and to assess the conservation status. Finally, conservation measures proposed at two places by putting Name plate boards (figs. 1-2) and 4 awareness programmes conducted at Tumling, Gairibans, Kalapokhri & Gurdung for effective conservation purpose.

Contribution to society

92 species with ethnomedicinal potentialities, from 74 genera and 44 families collected from different parts of Singalila National Park are documented, with a brief field description, distribution, habitat, present status and ethnic uses (where information is available) to our society. All 92 species possess more or less rich ethnomedically known/new unknown alkaloids which have traditionally been used to treat various human

ailments including sciatica, arthritis, asthma, blood dysentery, diarrhoea, snake bite, insect bites, throat pain, various skin diseases, scabies, nose ulcers, nose blockages, tonsillitis, sinusitis, headaches, kidney stone dissolution, urinary problems, coughs & colds, diabetes mellitus, toothache, gastritis, stomach ulcers, indigestion, abdominal pain, chronic constipation, piles, vomiting, scurvy, chronic bronchitis, carbuncles, jaundice, fresh cuts & old wounds, intestinal worms, gout, bleeding of internal organs, sore throats, lung infections, as narcotic drugs, as appetite inducers, for chest pain, heart problems, typhoid, leucoderma, viral fever, cholera, earache, bone fractures, joint inflammation, conjunctivitis, boils, high blood pressure, muscular pain, menstruation cycle irregularities etc. since time immemorial by the Nepalese. These plants will open new doors for India in the international market for future herbal medicine if proper drug research is carried out. The present work identifies these ethnomedicinal plants based on first-hand information collected during field visit to ethnic villages.

Conservation and Awareness Programs

Origin: Conservation measures were taken for some extremely threatened ethnomedicinal plants which exist just outside the Park. Singalila National Park begins just after Tumling toward Gairibans, and so the existence of threatened medicinal plants outside this park is extremely vulnerable. The plant diversity of Tonglu (a once rich area as described by Sir J. D. Hooker in his famous Himalayan Journal) is dwindling day by day due to the porous international boundary between India & Nepal. Currently, the entire Tonglu including its ridges looks like barren land due to mass collection of ethnomedicinal plants by the local herbalists as well as herbalists from Nepal due to the porous border! The authorities of the West Bengal Biodiversity Board have visited the area twice along with the author of the present paper, and the entire Tonglu was been declared as a "Biodiversity Heritage Site" in 2017 to improve conservation.
Vulnerable area with rich medicinal plants still existing: After an extensive survey throughout SNP from December 2011 to October 2016, this work demands that Maneybhanjang-Chitray, Lamedura, Meghma and Tonglu must be included into Singalila National Park area for better conservation.
Conservation measures taken by the author: The present author put Name Boards near the extremely threatened ethnomedicinal plants - 1. Near Chitray-Lamedura roadside for conservation of a single, individual plant, *Agapetes smithiana* which is the only plant of its kind throughout the SNP area; 2. Near Lamedura road side for conservation of an endemic, threatened & ethnomedicinal plant, *Gaultheria akaensis* Panda & Sanjappa Darjeeling Race, which is represented by two discontinuous populations throughout SNP (Gairibans-Kaiankata roadside hilly slope & Kaiankata-Kalapokhri roadside hilly slope) and 1 population outside the SNP area (Lamedura roadside hilly slope).
Awareness programmes conducted among local people: Awareness programmes were conducted at Lamedura, Tumling, Gairibans and Gurdum for effective conservation purposes during May 2014 and September 2014 (Plate 15).

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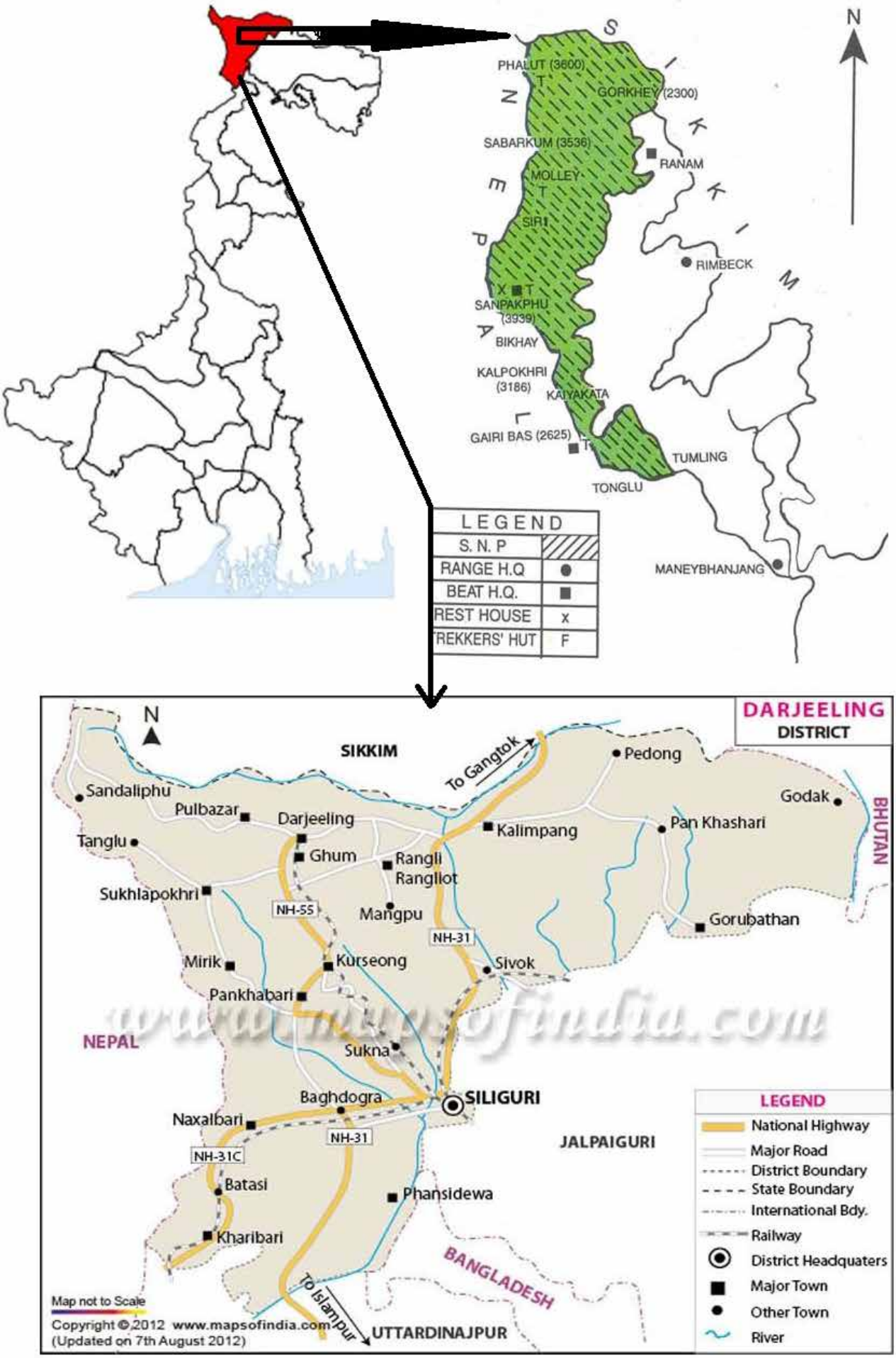
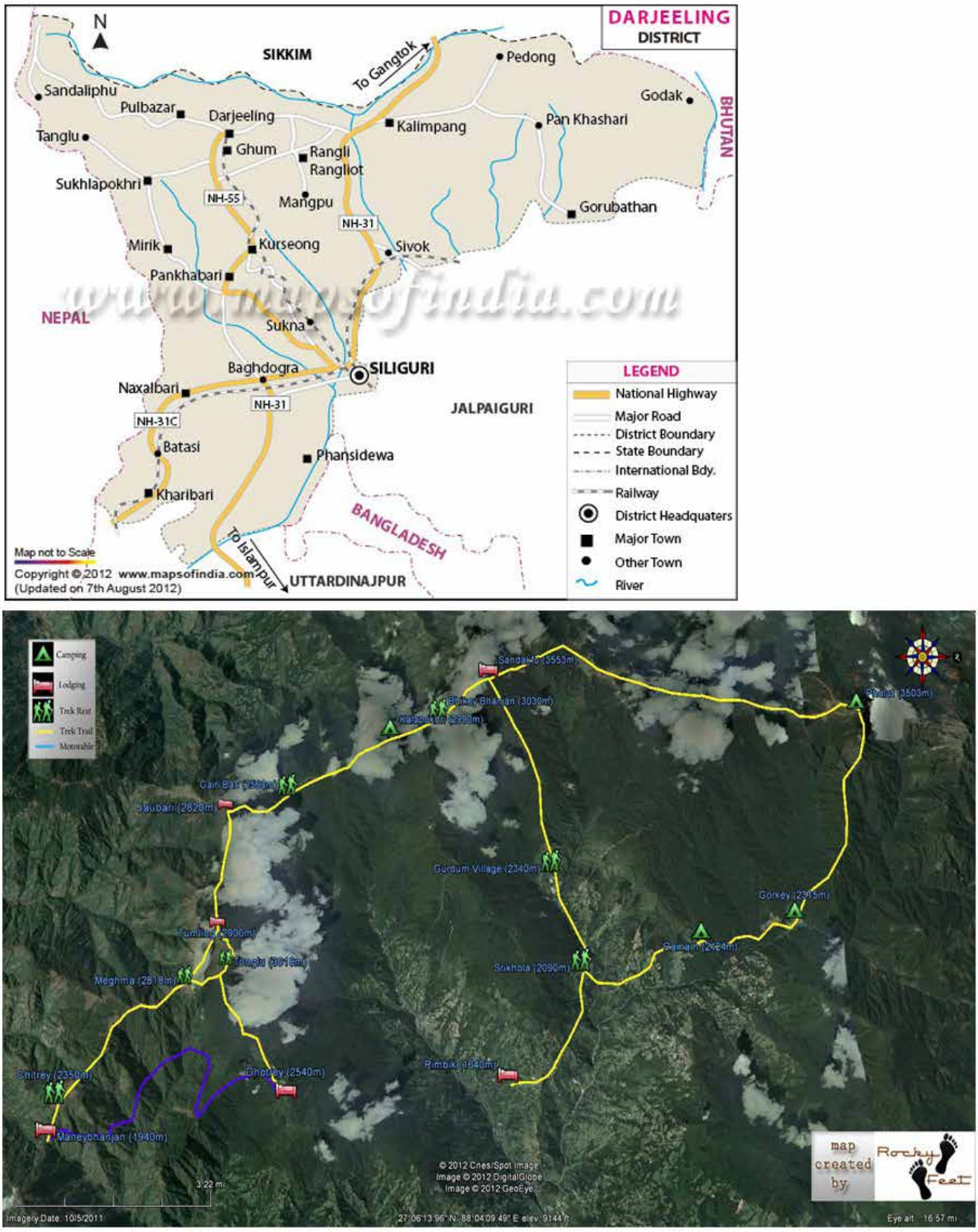


Map 1. West Bengal Map showing Darjeeling District and Singalila National Park maps magnified (Source: www.mapsofindia.com).



Map 2. Darjeeling District map with Satellite imagery map showing important localities in Singalila National Park.

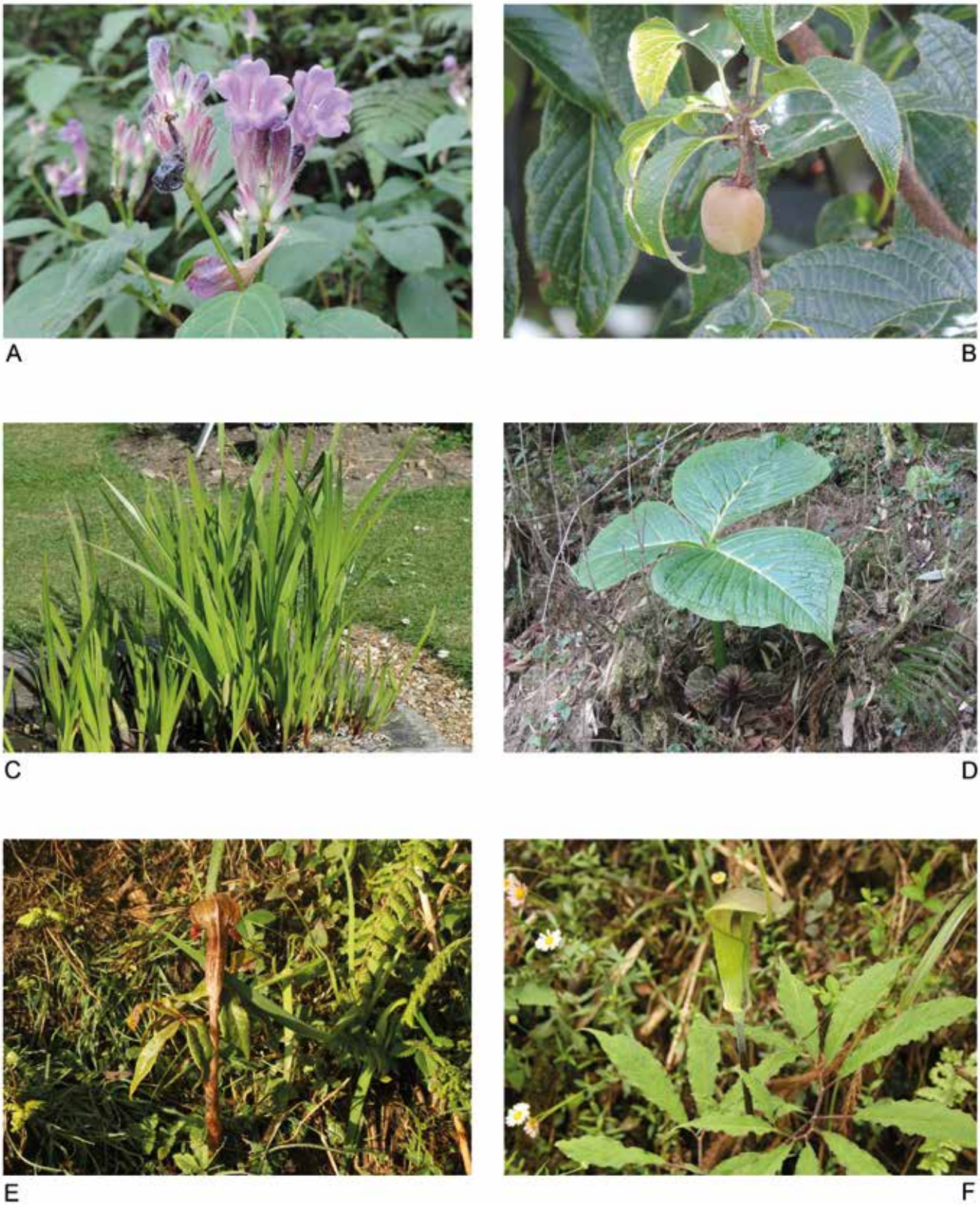


Plate 1. A. *Strobilanthes discolor* (Nees) T.Anders., B. *Actinidia callosa* Lindl., C. *Acorus calamus* L., D. *Arisaema speciosum* (Wall.)Schott & *Endl*. E. *Arisaema nepenthoides* (Wall.)Schott & Endl., F. *Arisaema tortuosum* (Wall.) Schott

Plate 2: A. *Macropanax undulatus* (G.Don) Seemann, B. *Duhaldea cappa* (D.Don) Pruski & Anderb., C. *Siegesbeckia orientalis* L., D. *Sonchus arvensis* L., E. *Impatiens arguta* Hook.f. & Thomson, F. *Impatiens falcifer* Hook.f.

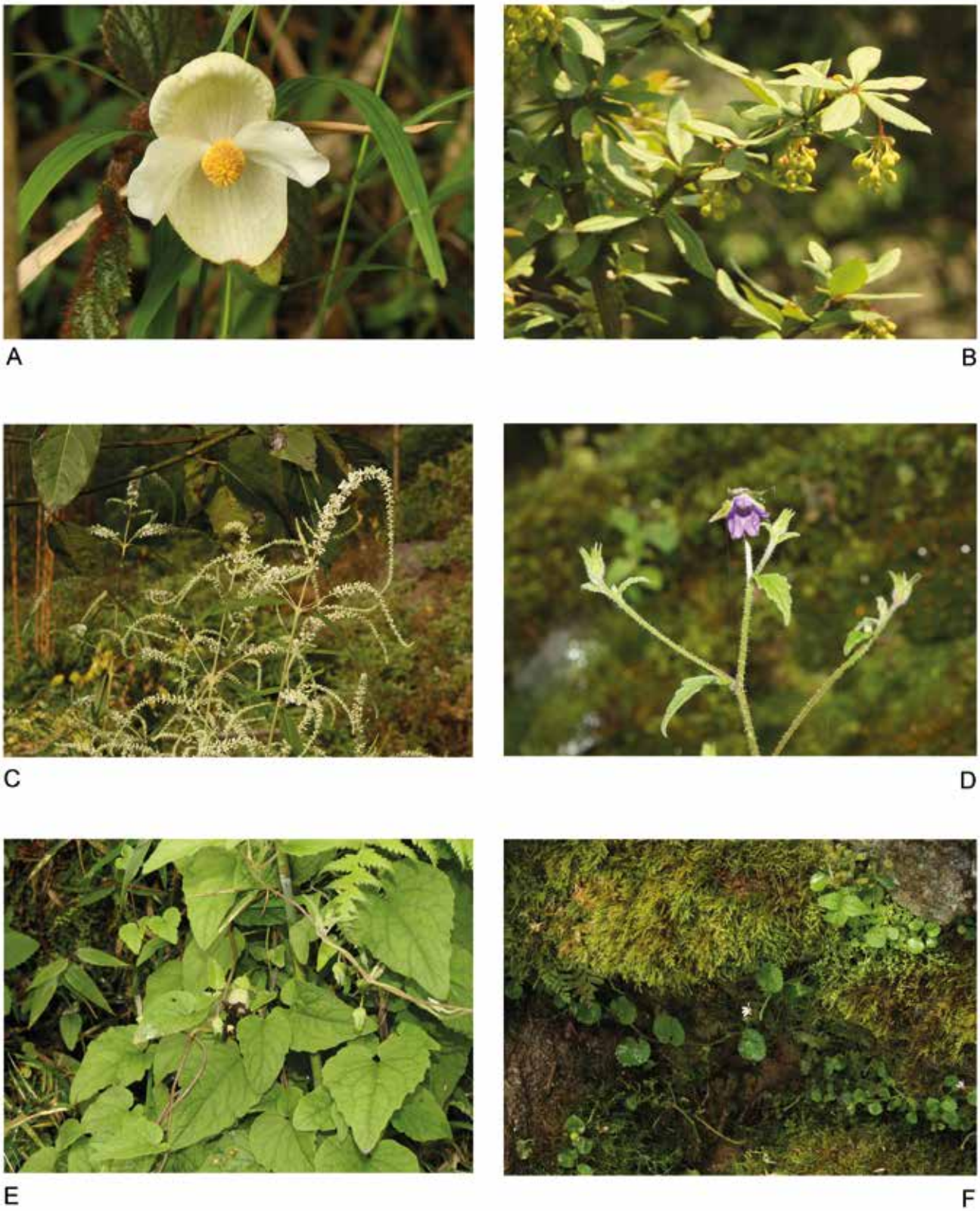


Plate 3: A. *Begonia josephii* A.DC., B. *Berberis asiatica* DC., C. *Buddleja asiatica* Lour., D. *Campanula pallida* Wall., E. *Codonopsis purpurea* Wall., F. *Lobelia nummularia* Lamk.

Plate 4: A. *Sambucus hookeri* Rehd., B. *Viburnum nervosum* D.Don, C. *Dioscorea deltoidea* Griseb., D. *Dipsacus inermis* Wall., E. *Agapetes hookeri* (C.B. Clarke) Sleumer, F. *Agapetes serpens* (Wight) Sleumer

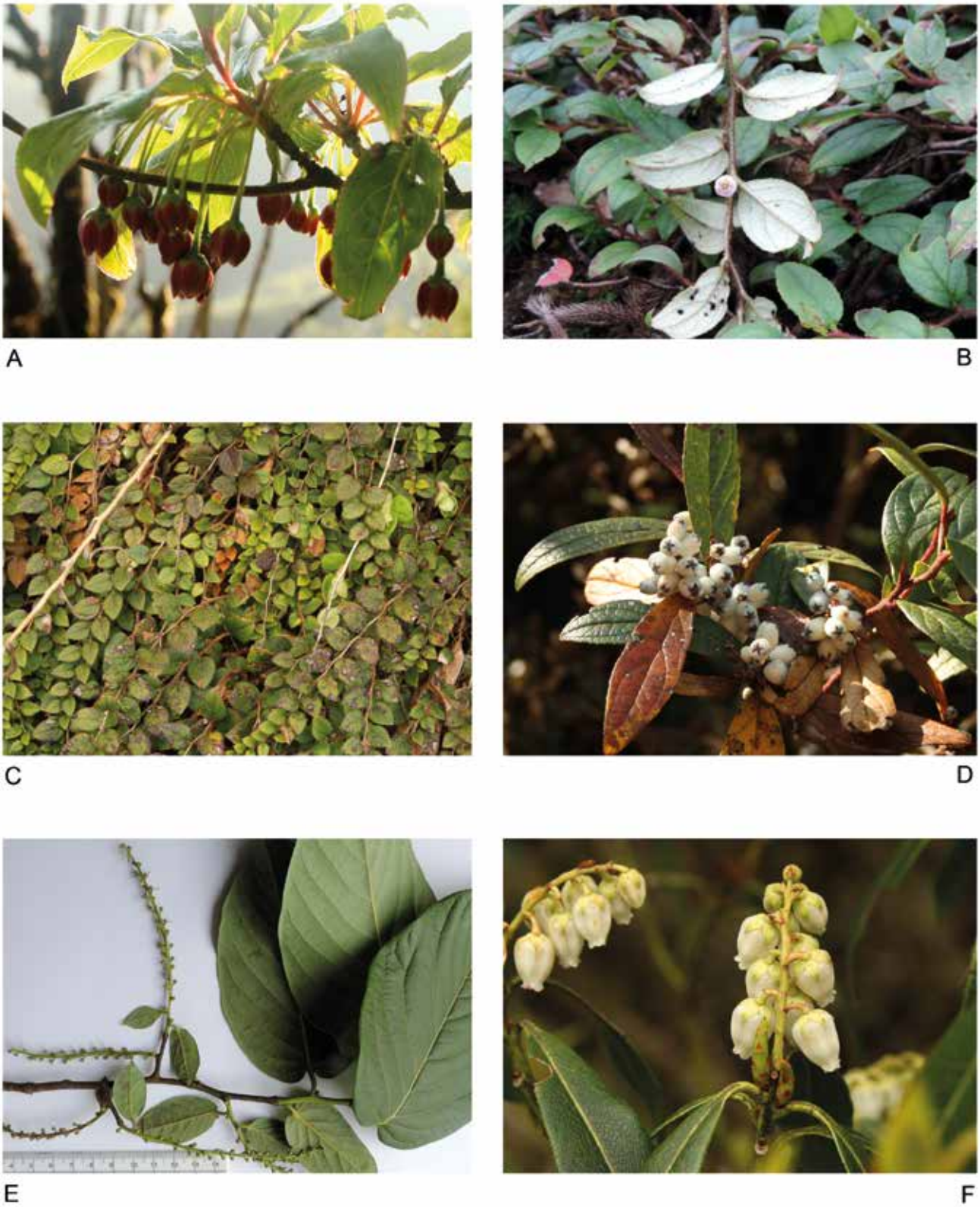


Plate 5: A. *Enkianthus deflexus* (Griff.) C.K.Schneid., B. *Gaultheria akaensis* Panda & Sanjappa, C. *Gaultheria nummularioides* D.Don, D. *Gaultheria stapfiana* Airy Shaw, E. *Lyonia ovalifolia* (Wall.) Drude, F. *Pieris formosa* (Wall.) D.Don

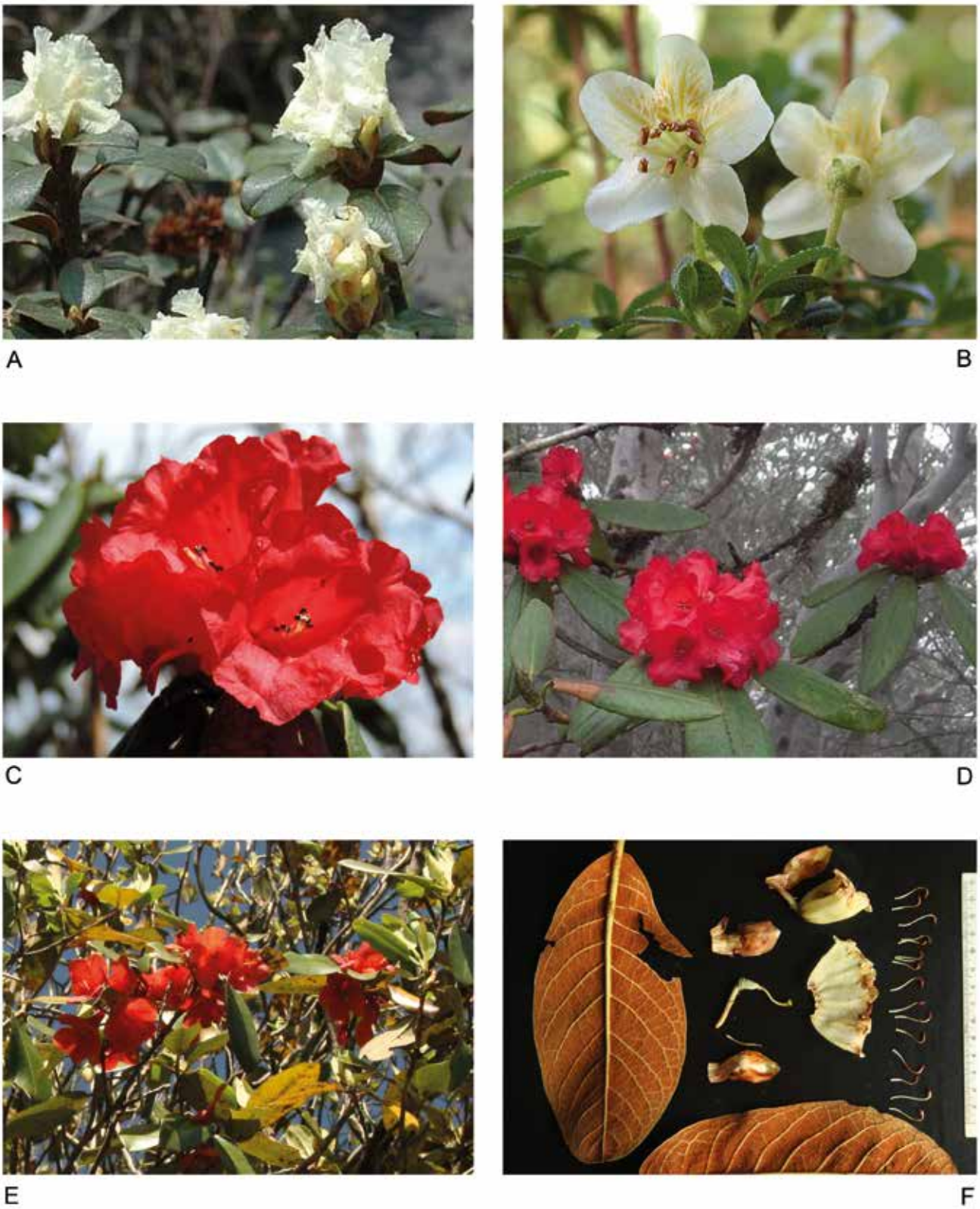


Plate 6: A. *Rhododendron anthopogon* D.Don, B. *Rhododendron lepidotum* G.Don, C. *Rhododendron barbatum* G.Don, D. *Rhododendron fulgens* Hook.f., E. *Rhododendron cinnabarinum* Hook,f., F. *Rhododendron falconeri* Hook.f.

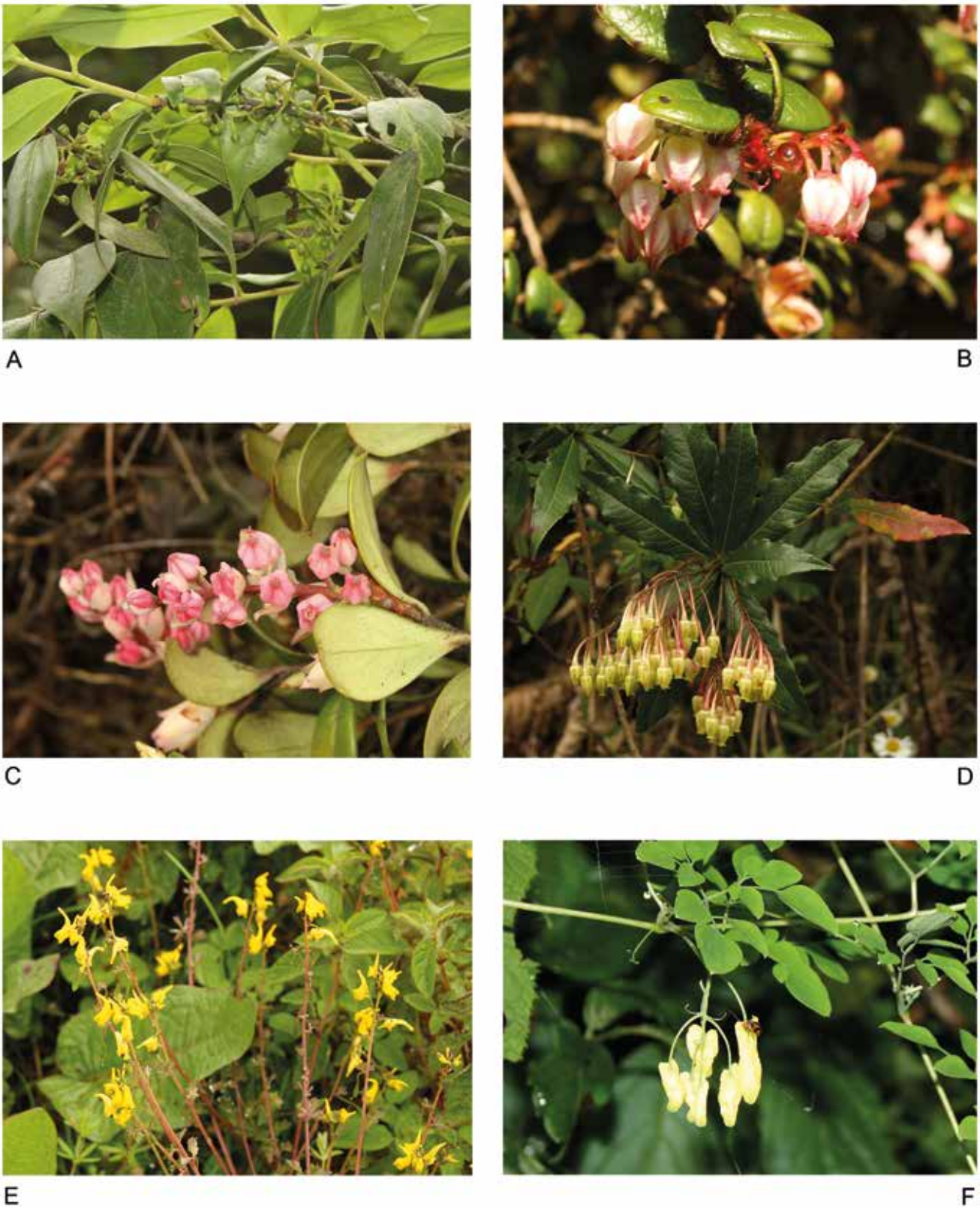


Plate 7: A. *Vaccinium dunalianum* Wight, B. *Vaccinium nummularia* C.B.Clarke, C. *Vaccinium retusum* (Griff.) C.B.Clarke, D. *Vaccinium vacciniaceum* (Roxb.) Sleumer, E. *Corydalis flaccida* Hook.f. & Thomson, F. *Dactylicapnos scandens* (D.Don) Hutch.

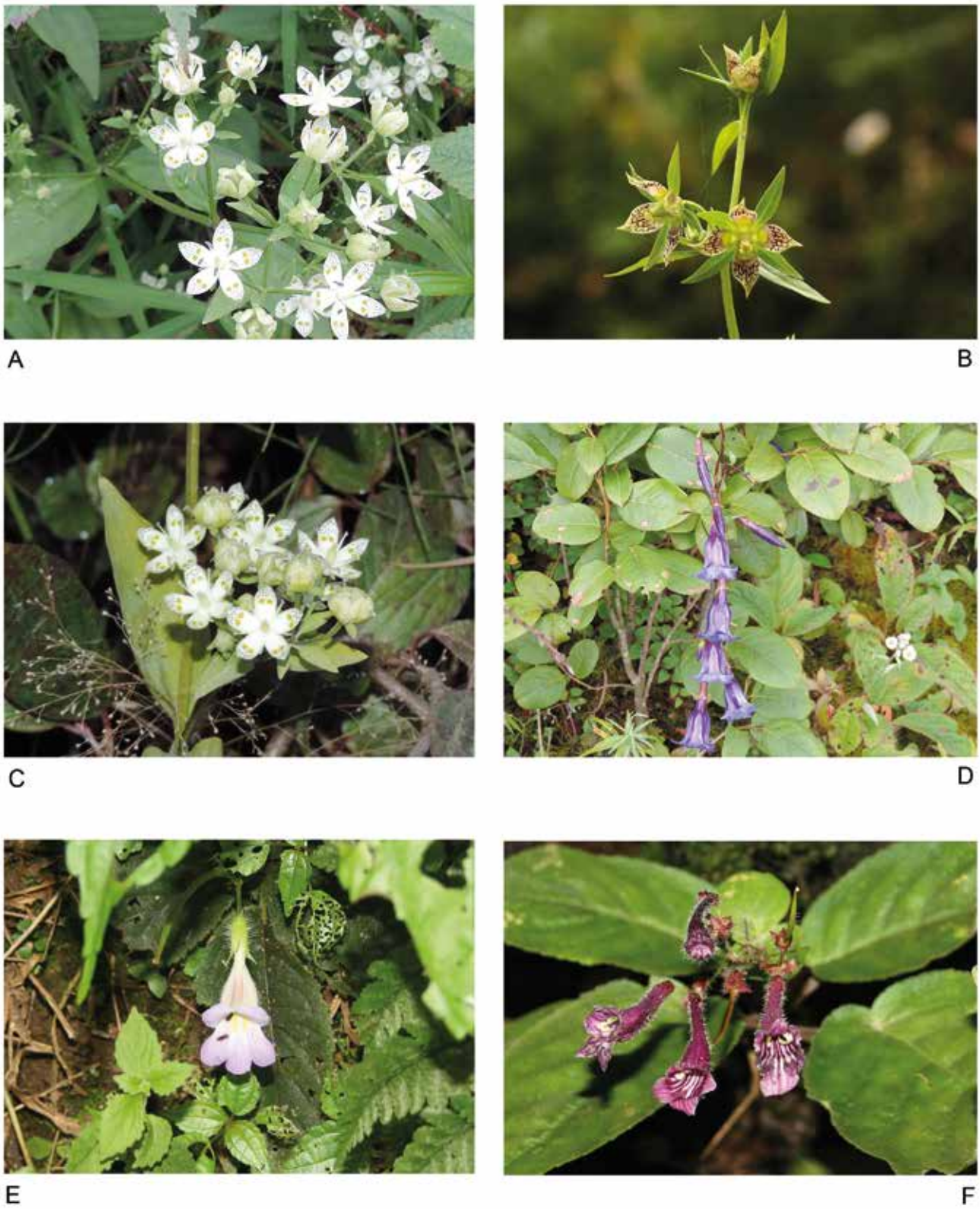


Plate 8: A. *Swertia bimaculata* (Sieb.&Zucc.) C.B.Clarke, B. *Swertia chirayita* (Roxb. ex Fleming) H.Karst., C. *Swertia paniculata* Wall., D. *Tripterospermum volubile* (D.Don) Hara, E. *Chirita pumila* D.Don, F. *Didymocarpus villosus* D.Don

Plate 9: A. *Helwingia himalaica* C.B. Clarke, B. *Hypericum elodeoides* Choisy, C. *Allium wallichii* Kunth, D. *Colebrookea oppositifolia* Sm., E. *Elsholtzia fruticosa* (D.Don) Rehd., F. *Leucosceptrum canum* Sm.

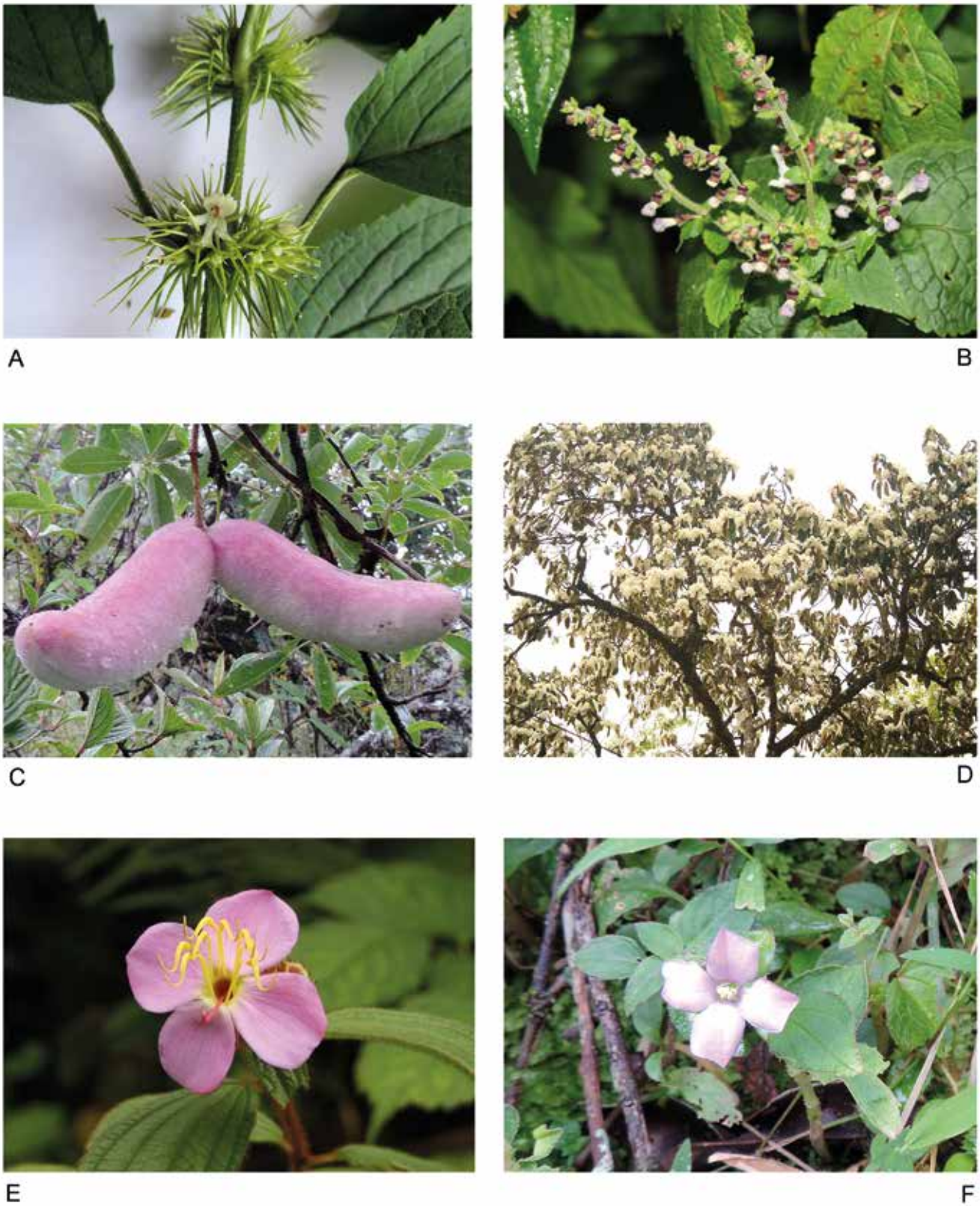


Plate 10: A. *Notochaete hamosa* Benth., B. *Scutellaria discolor* Colebr. C. *Holboellia latifolia* Wall., D. *Alcimandra cathcartii* (Hook.f. & Thomson) Dandy, E. *Osbeckia chinensis* L., F. *Sarcopyramis nepalensis* Wall.

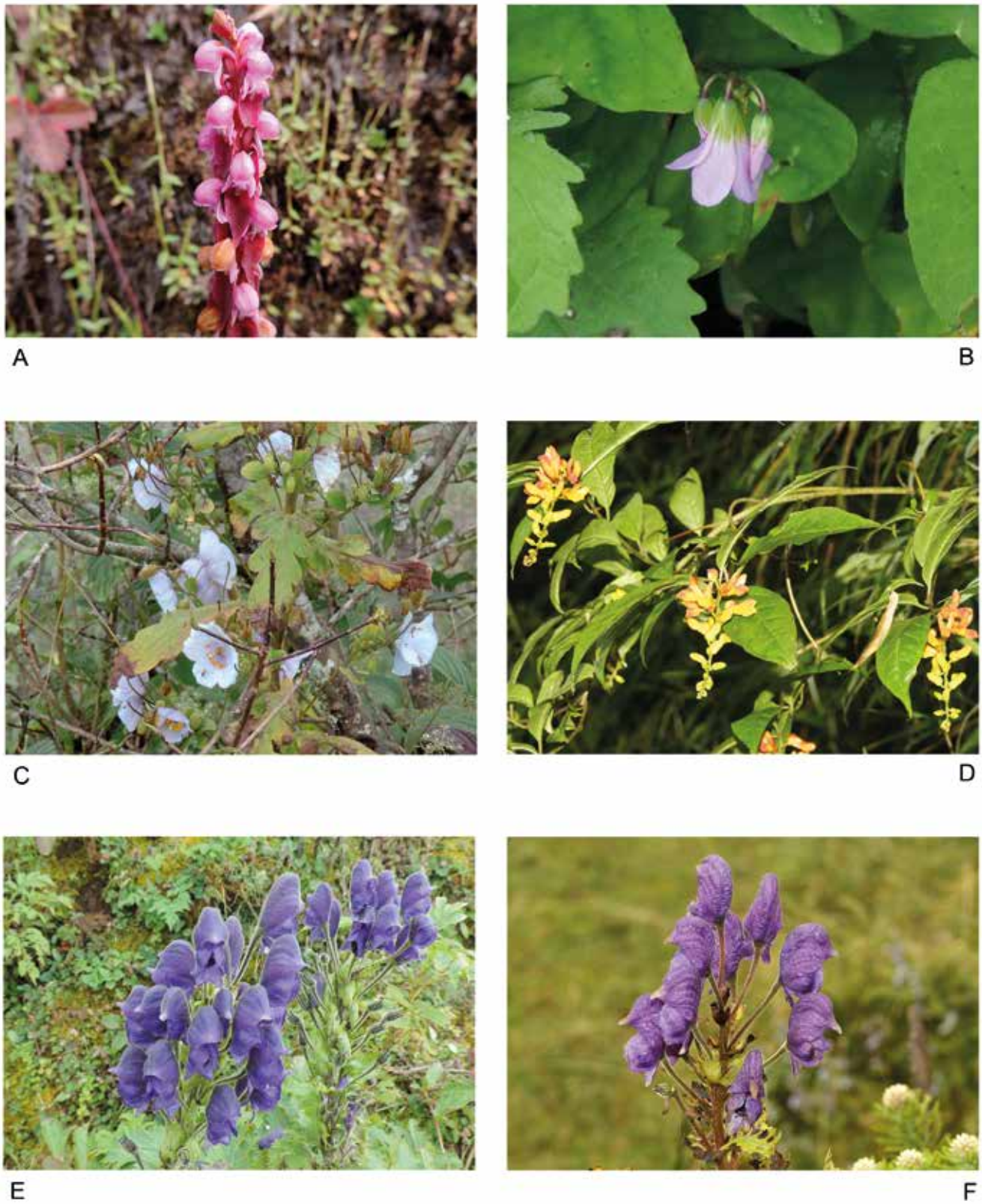


Plate 11: A. *Satyrium nepalensis* D.Don, B. *Oxalis latifolia* Humb., C. *Meconopsis aculeata* Royle, D. *Polygala arillata* D.Don, E. *Aconitum heterophyllum* Royle, F. *Aconitum violaceum* Stapf

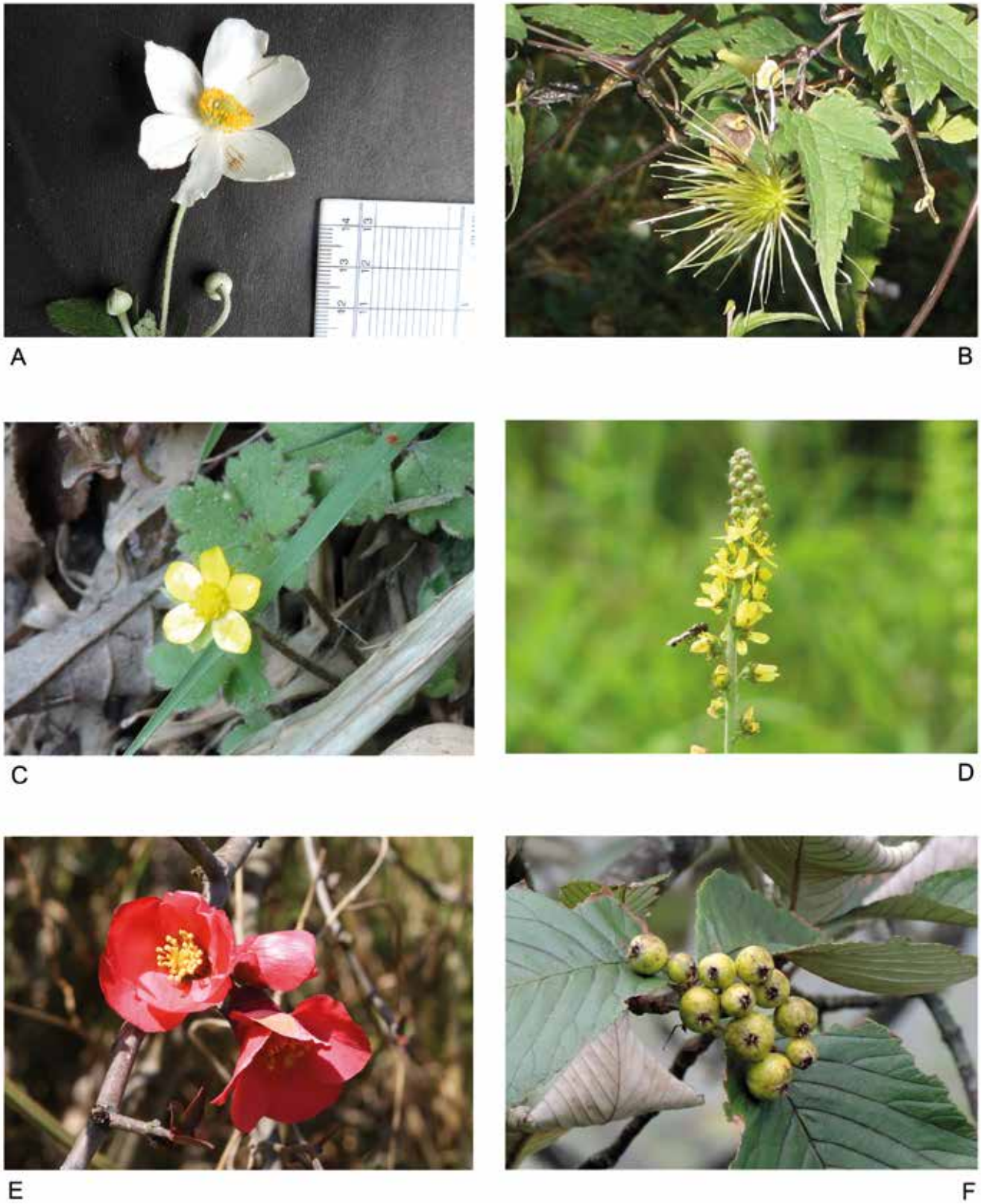


Plate 12: A. *Anemone vitifolia* DC., B. *Clematis buchananiana* DC., C. *Ranunculus diffusus* DC., D. *Agrimonia pilosa* Ledebour, E. *Cotoneaster acuminatus* Lindl., F. *Sorbus cuspidatus* (Spach) Hedlund

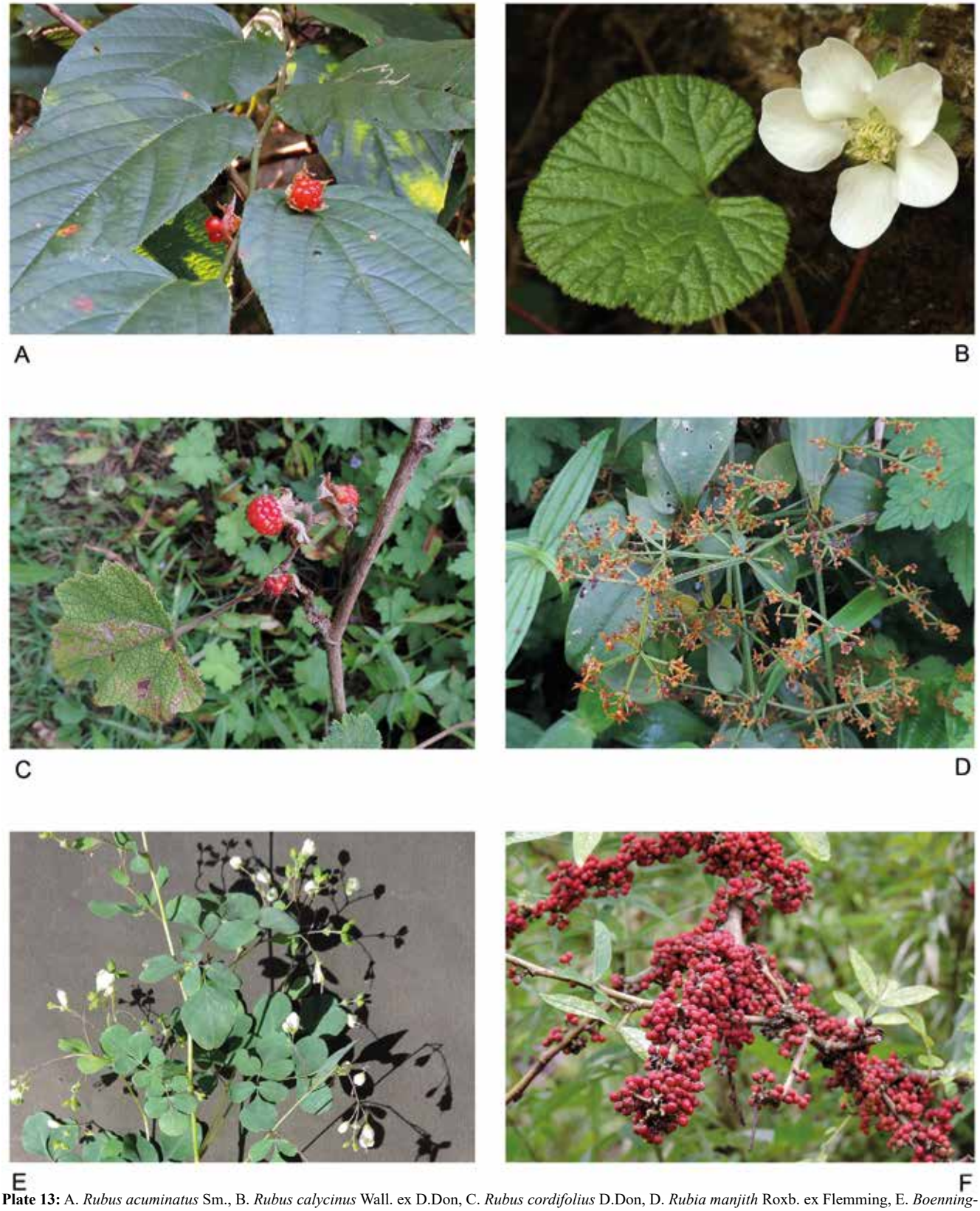


Plate 13: A. *Rubus acuminatus* Sm., B. *Rubus calycinus* Wall. ex D.Don, C. *Rubus cordifolius* D.Don, D. *Rubia manjith* Roxb. ex Flemming, E. *Boenninghausenia albiflora* (Hook.) Meisn., F. *Zanthoxylum acanthopodium* DC.

Plate 14: A. *Bergenia ciliata* (Haw.) Stenberg, B. *Hemiphragma heterophyllum* Wall., C. *Smilax bracteata* C.Presl., D. *Viola canescens* Wall. ex Roxb., E. *Edgeworthia gardneri* (Wall.) Meisn., F. *Daphne bholua* D.Don

Plate 15: A. *Taxus wallichiana* Zucc., B. *Gaultheria akaensis* Panda & Sanjappa,, C. *Agapetes smithiana,* D. uses of *Tropaeolum majus* shown by an old lady near Srikhola, E. Creating awarness among local people for conservation of critically endangered ethnomedicinal plants near Chitray-Lamedura road in Sept. 2014; Creating awarness among local people at Gairibans in May, 2014.