



Distribution and national conservation status of the lichen family Lobariaceae (Peltigerales): from subtropical luxuriant forests to the alpine scrub of Nepal Himalaya

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Abstract

During 2007 - 2014, voucher specimens of Lobariaceae were collected from different geographic locations of Taplejung, Solukhumbu, Rasuwa, Gorkha, Manang, Kaski, and Myagdi districts of Nepal. Morphological characters, chemical tests and thin-layer chromatography techniques (TLC) were applied for the identification. Combining with earlier publications on Lobariaceae, this study summarized two genera *Lobaria* and *Sticta* each with seven and six species, reported from ten different districts of Nepal. The altitudinal distribution of the species varies from 1350 m to 5004 m (i.e. subtropical to alpine bioclimatic zones) above sea level, from Eastern, Central and Western parts of Nepal. *Lobaria adscripturiens* (Nyl.) Hue, *L. fuscotomentosa* Yoshim. *L. aff. quercizans* Michx. and *S. limbata* (Sm.) Ach. are new records for the lichen flora of Nepal. Major chemotypes and their distributions are presented and further work on molecular analyses of these specimens from Nepal is recommended for the understanding of their systematic position. Extensive exploration covering more geographical areas of Nepal will increase the understanding on taxonomy and ecology of this interesting lichen group. In the light of species occurrence and following IUCN criteria, we have also prepared the national conservation status of Lobariaceae species, which could provide further insights for the inclusion of species in national conservation priorities.

Key words – Checklist – *Lobaria* – *Sticta* – Taxonomy – TLC

Introduction

A lichen is a self-supporting, symbiotic organism where fungal (mycobiont) and algal or cyanobacterial cells (photobiont) partners exist and function together (Honegger 1991, Kirk et al. 2008). Recently, basidiomycetous yeasts were reported as additional components of lichens (Spribille et al. 2016), or as lichenicolous fungi (Millanes et al. 2016). Lichens are cosmopolitan and equally able to colonize a variety of terrestrial habitats including those which are inhospitable for other organisms such as rock surfaces, the coldest alpine peaks (Wirtz et al. 2003) and deserts. The primary

photobiont, (green-algal or cyanobacterial) fixes carbon for both partners (Søchting 2015). The total number of lichenized fungi is still unknown, but different researchers predicted or estimated the number between 13,500 - 28,000 species (Hawksworth et al. 1995, Kirk et al. 2008, Lücking et al. 2009). The Himalayan belt with a variety of terrestrial habitats is considered as a lichen rich landscape of Asia, comprising different forms of lichens (Upreti 1998). Lichen exploration and identification in Nepal is still poorly developed compared to higher plants, so more exploration and investigations are required to learn more about lichenized fungi (Olley & Sharma 2013, Søchting 2015). Proper understanding of the distribution and abundance of lichens will help in the preparation of a national Red list, crucial for the successful planning of nature conservation (Scheidegger & Goward 2002).

The Lobariaceae, second largest family of Ascolichens belongs to the order Peltigerales in the class Lecanoromycetes with about 14 genera and about 400 species (Kirk et al. 2008, Lumbsch & Huhndorf 2010, Moncada et al. 2013, 2014, de Lange & Galloway 2015). The scientific identification and publications on Lobariaceae from Nepal goes back to the work of the Japanese scientist Yasuhiko Asahina from National Science Museum, Tokyo, when he identified specimens collected by Japanese expedition members in Nepal Himalaya during 1952 – 1953 (Asahina 1955). Only a few publications (Asahina 1955, Awasthi 1960, 2007, Yoshimura 1971, Sharma 1979a, b, 1995, Joshi & Awasthi 1982, Baniya et al. 2010, Olley & Sharma 2013, Devkota et al. 2014) have mentioned the occurrence of Lobariaceae in Nepal.

Several ethnic uses of Lobariaceae were reported by numerous researchers around the globe, though there is not a single publication on uses of these taxa in Nepal. Some of the important uses of *Lobaria* spp. are the medical treatment of: skin diseases - Bhutan (Søchting 1999); indigestion - Yunnan (Ju et al. 2013); arthritis - Canada (Johnson 1997); sores on the leg - USA (Densmore 1939); *L. pulmonaria* in lung ailments during the early modern era - Europe (Cameron 1900, Llano 1948); cuts - Italy (Guarrera et al. 2008); coughing up blood - Canada (Turner & Efrat 1982); *L. isidiosa* to treat inflammation and burns - China (Hu et al. 1980); *L. orientalis* in lung ailments - China (Wang & Qian 2013); *L. quercizans* for the tonic effect - USA (Smith 1923); *L. retigera* and *L. yunanensis* for indigestion, burns - China (Wang & Qian 2013); *S. nylanderiana* for excessive cough - India (Sinha & Singh 2005) and *S. wrightii* for indigestion - China (Wang & Qian 2013). Recently, Devkota *et al.* (in prep. 2017) studied trade value of lichens in Nepal Himalaya and found *L. retigera* and *S. nylanderiana* for their cross-border trade value.

The main objective of this research was to explore and record the geographic distribution of Lobariaceae from different bioclimatic zones of Nepal. In addition, drawing on previously published data, we prepared an updated checklist of Lobariaceae with national conservation status for Nepal.

Materials & Methods

This study is based on the specimens collected during three major lichenological field expeditions in 2007, 2009 and 2011 - 2014 in seven different districts from the subtropical zone (1000 m - 2000 m) to the nival zone (5000 m and above) of Nepal (Fig. 1).

Louise Olley (RBGE) and her team conducted an expedition to Langtang National Park, Rasuwa district in 2007 and collected c. 1200 macro and microlichens. Afterwards, in 2009 Christoph Scheidegger and Shiva Devkota visited Langtang National Park and collected c. 508 Lobariaceae specimens. The major expeditions in Gorkha district, and Sagarmatha and Kangchenjunga areas conducted during 2011 - 2013 years by Christoph Scheidegger and his team, resulted in the collection of c. 4200 specimens of lichens in the framework of a Nepal - Swiss Collaborative Research Project. Research transects were laid out to document vascular plants, macromycetes, lichens, birds and butterflies (Scheidegger et al. 2010, Katuwal et al. 2016, Rai et al. 2016).

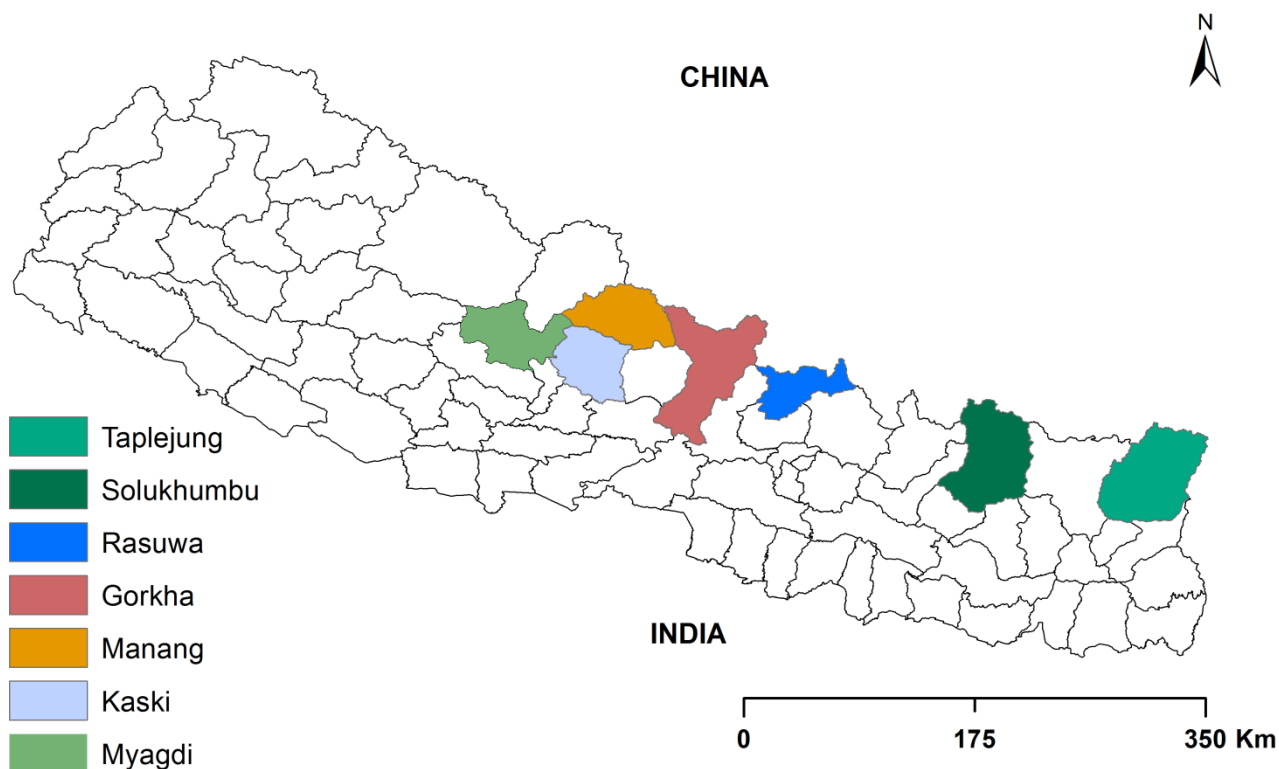


Fig. 1 - Map of Nepal showing seven study districts.

The following areas were visited for intensive specimen collecting: Olangchung Gola and Ghunsa valleys of Kangchenjunga Conservation Area, Taplejung district; Dudhkunda and Dudhkoshi valleys of Sagarmatha National Park, Solukhumbu district; Gosaikunda and Kyanjin valleys of Langtang National Park, Rasuwa district; and Nubri and Tsum valleys of Manaslu Conservation Area, Gorkha district. Manang, Myagdi and Kaski districts were visited to record the occurrence of taxa along walking trails only (Fig. 1). Kaski, Manang and Myagdi districts were visited once in 2014, Rasuwa was visited twice in 2007 and 2009. The other valleys were repeatedly visited once in a year between 2011 and 2013. Collected and dried specimens were identified by studying their morphology, anatomy, and using color spot tests with K, C, and P at the lab of Central Department of Botany, Tribhuvan University, and Kathmandu, Nepal and at the Royal Botanic Gardens, Edinburgh, Scotland.

Unidentified specimens were then brought to lab at the Swiss Federal Research Institute, WSL, Zurich, Switzerland for the identification of chemical substances with thin-layer chromatography (TLC) (Culbertson & Kristinsson 1970, Culbertson 1972). Acetone was used to extract secondary substances from 0.2 g of cleaned thallus portions for 10 minutes at 40°C. Extractions were then spotted on Merk silica gel F254 plates. Solvent C system i.e. Toluene: Acetic acid (200:30 ml) was used to elute substances for about 30-35 minutes in a closed glass cabinet. Plates were air dried for 30 minutes and then observed under short wavelength (~ 254 nm) UV light. Finally, plates were immersed carefully in a sulphuric acid bath, air dried for two to five minutes and heated in an oven at 100°C for 15 minutes. Known references were used as control substances to identify chemical substances.

A set of identified specimens from 2007 explorations are housed in the Department of Plant Resources (DPR), Ministry of Forests and Soil Conservation, Nepal and specimens from 2009 - 2014 explorations are deposited at Tribhuvan University Central Herbarium (TUCH), Kirtipur, Kathmandu, Nepal. Nomenclature of the species follows the MycoBank Database (2017; <http://www.mycobank.org/>). Conservation status of lichens for the local scale is determined following the combination of recommended guidelines for the application of IUCN criteria

(Scheidegger et al. 2000, Scheidegger & Goward 2002, Dahlberg & Mueller 2011), interpretation methods of IUCN Red List categories for cryptogams (Hodgetts 2000) and, expert opinion (Nascimbene et al. 2013). Two different terms, local and regional, were assigned to the spatial scales (Cornell & Lawton 1992). Each species was given a threat category: critically endangered (CR), endangered (EN), vulnerable (VU), least concern (LC) and data-deficient (DE) on the basis of criterion D (rarity) and criterion B (geographic range) (IUCN Standards and Petitions Subcommittee 2010, Nascimbene et al. 2013).

Critically endangered (CR): For a species known from a single locality of Nepal.

Endangered (EN): For a species known only from one to two regions of Nepal in more than one locality.

Vulnerable (VU): For a species known from three to five regions of Nepal in more than one locality.

Least concern (LC): For a species known from more than five regions of Nepal if it neither suffered serious decline nor had a restricted area of occurrence.

Data deficient (DC): For a species with insufficient data, where additional data are needed to determine the IUCN Red List status.

Secondary data were collected by consulting prior research papers on lichens of Nepal, wherever Lobariaceae species were mentioned. Their geo-reference and distribution range is noted (if available). Symbols E, C, W represent East, Central and West parts of Nepal respectively

Results & Discussion

In total, 2386 specimens were identified from seven districts of Nepal. Prior to this work, nine species of Lobariaceae (four species of *Lobaria*; five species of *Sticta*) were recorded from Nepal and with this work, the family Lobariaceae represents 13 species (seven species of *Lobaria*; six species of *Sticta*) in Nepal. During the Rasuwa visit (2007), Louise Olley and her team had listed *L. adscripturiens* (Nyl.) Hue, *L. fuscotomentosa* Yoshim. and *S. limbata* (Sm.). Similarly, Christoph Scheidegger and his team have also collected the same species including *L. aff. quercizans* Michx during their expeditions in 2009 - 2014 to different parts of Nepal. These species had not been published with ecological, chemical and morphological information till then. After comprehensive morphological and chemical studies, we confirmed the above four species as new additions to the lichen flora of Nepal.

Apart from the districts we visited, Panchthar, Dolakha, and Doti districts were also reported to harbor species of *Lobaria* and *Sticta*. Yoshimura (1971) reported *L. pseudopulmonaria* (= *L. isidiosa*) from Panchthar and Kurokawa (1967) reported *L. subretigera* from Rolwaling Himalaya, Dolakha, but according to Yoshimura (1971) this species is synonymous with *L. pseudopulmonaria*. Sharma (1979a) reported *S. platyphylloides*, *S. praetextata*, *L. discolor* and *L. retigera* from Khaptad, Doti. In summary, Lobariaceae species were recorded from ten districts mostly from the eastern part of Nepal (Fig. 2).

The TLC technique allowed to distinguish the two species pairs *L. pseudopulmonaria* / *L. isidiosa* and *Lobaria kurokawae* / *L. retigera* showing that the presence of stictic and norstictic acids are not taxonomically important but that the presence of the retigeric and retigeranic acids can discriminate between the two taxa. Both taxa include multiple ITS haplotypes which include isidiate and apotheciate specimens (Cornejo et al. 2009). A more detailed phylogenetic analysis of the cyanobacterial taxa belonging to *Lobaria* is needed for an appropriate taxonomic circumscription of these taxa. In this paper, we recognize the two chemically distinct taxa *L. isidiosa* and *L. retigera*.

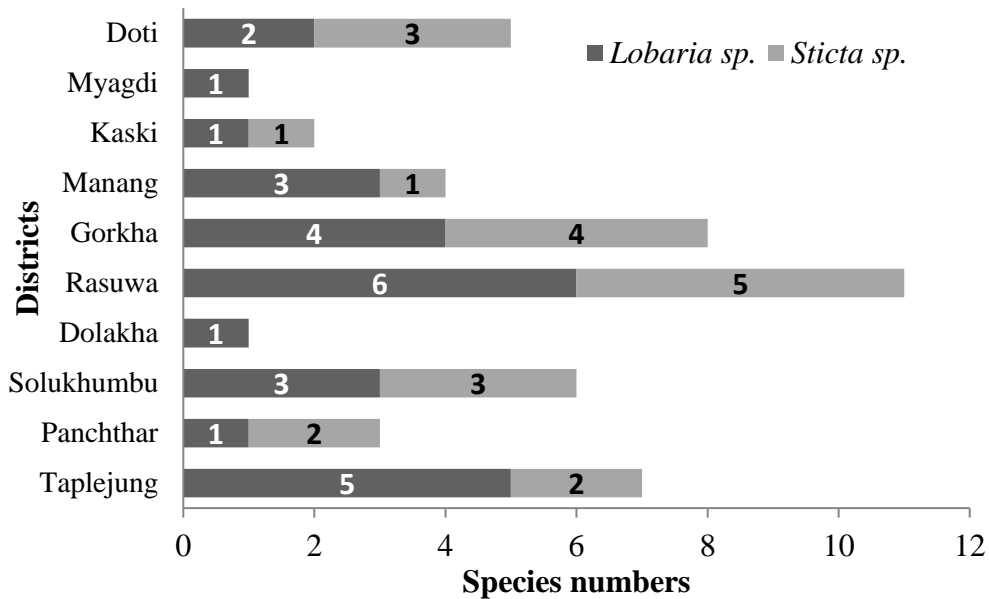


Fig. 2 - Total number of species of the genera *Lobaria* and *Sticta* from ten districts of Nepal. The order of the districts is arranged from East to West (Tablejung to Doti).

The altitudinal distribution range of the Lobariaceae of Nepal was determined on the basis of recent collections and earlier publications (Fig. 3). Most of the Lobariaceae species are distributed within the 2000 m to 4000 m altitudinal zone. This zone represents the temperate zone, where large variation in water availability occurs (Baniya et al. 2010). *Sticta weigeli* and *Lobaria discolor* are found in subtropical zone (1000 m - 2000 m), *L. retigera* and *L. pindarensis*, are found in the alpine zone (4000 m - 5000 m). Interestingly, one species, *L. isidiosa*, is found in the nival zone (above 5000 m). The remaining species are found from the temperate to subalpine zone (2000 m - 4000 m). *L. isidiosa* shows the largest altitudinal range (2662 m - 5004 m), followed by *L. retigera* (2141 m - 4200 m) and *S. praetextata* (2036 m - 3908 m). *Sticta limbata* was found only in one location, Kyanjin valley (3180 m), Langtang National Park, Rasuwa District during the Langtang expedition of 2007.

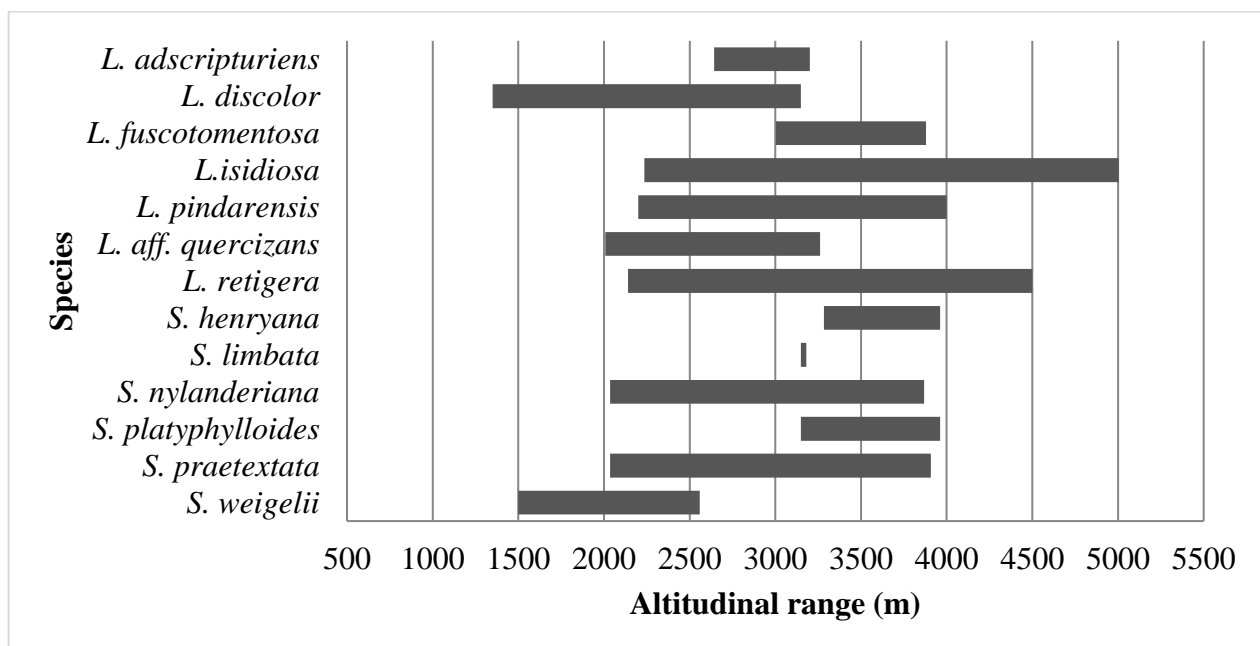


Fig. 3 - Distribution of Lobariaceae in different altitudinal levels, corresponding to bioclimatic zones.

According to Shrestha (2008) the five bioclimatic zones in Nepal include the tropical zone (< 1000 m), the sub-tropical zone (1000 m - 2000 m), the subalpine zone (3000 m - 4000 m), the alpine zone (4000 m - 5000 m) and the nival zone (>5000 m). About two-thirds of the total forest area (5.96 million ha, i.e. 40.36%) of Nepal is badly affected by grazing, tree cutting, bush cutting, looping, forest fire and other anthropogenic disturbances including bark removal from the trees (DFRS 2015). These kinds of disturbances decrease habitat quality and cause serious consequences for lichen, abundance and growth (Scheidegger & Werth 2009).

Taxonomic treatment

Identification keys to *Lobaria* and *Sticta* species in Nepal

- I. Cyphellae and pseudocyphellae on the lower side absent.....*Lobaria*
 II. Cyphellae on the lower side present, medulla white..... *Sticta*

I. Genus: *Lobaria*

- 1 Dominant photobiont a green alga.....2
 Dominant photobiont a cyanobacterium7
2. Thallus isidiate, ridged.....3
 Thallus without isidia4
3. Medulla, KC +, gyrophoric acid present..... *L. pindarensis*
4. Medulla KC +, ascospores fusiform, 1-3 septate, tomentum sparse.....*L. discolor*
 Medulla KC +, ascospores acicular, lower side dark brown to brown black.....5
5. Cortex K +, upper side wrinkled-rugose, gyrophoric and congyrophoric acid present
*L. fuscotomentosa*
 Cortex K ±, upper side smooth, medulla KC +, gyrophoric acid present.....6
6. Cortex K –, congyrophoric acid present, thallus dull greenish-brown.....*L. adscripturiens*
 Cortex K +, congyrophoric acid absent, apothecia common, thallus greenish gray.....*L. aff. quercizans*
7. Retigeranic acid present, retigeric acid absent.....*L. isidiosa*
 Retigeranic acid absent, retigeric acid present.....*L. retigera*

II. Genus: *Sticta*

1. Photobiont a green algae, moist thallus green or light in color.....2
 Photobiont blue - green algae (a cyanobacterium), moist thallus, dark.....5
2. Thallus isidiate, medulla KC + *S. praetextata*
 Thallus lacking isidia and soredia.....3
3. Medulla KC +, gyrophoric acid present..... *S. nylanderiana*
 Medulla KC –, gyrophoric acid absent, thallus dichotomously lobed at margins.....4
4. Smooth thallus on upper side, *S. henryana*
 Thallus granulose tomentose on upper side..... *S. platyphylloides*
5. Thallus lacking basal holdfast, attached by a single point, sorediate or isidiate.....6
6. Thallus with densely sorediate margins, medulla K–, *S. limbata*
 Margin with cylindrical isidia, medulla K+*S. weigelii*

A total of nine lichen substances were identified in the specimens examined by color reactions and thin layer chromatography. For species, whose specimens were not available, chemical properties were adapted from earlier publications (see details on enumeration). Gyrophoric acid, congyrophoric acid, atranorin, norstictic acid, stictic acid, constictic acid, thelophoric acid, retigeric acid, and retigeranic acid were identified from *Lobaria* and *Sticta* species (Table 1).

Table 1 - Color reactions and TLC results of the *Lobaria* and *Sticta* species.

Species	Cortex			Medulla				Lichen substances								
	K	C	KC	K	C	KC	P	Gyr	Cong	Atr	Nor	Sti	Cons	Thel	R1	R2
Lobaria (Schreb.) Hoffm.,																
<i>L. adscripturiens</i>	-	-	-	-	-	+	-	+	+	?	-	-	-	-	-	-
<i>L. discolor</i>	+	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-
<i>L. fuscotomentosa</i>	+	-	-	+	-	+	-	+	+	-	-	-	-	-	-	-
<i>L. isidiosa</i>	-	-	-	±	-	-	-	-	-	-	+	+	+	-	-	+
<i>L. pindarensis</i>	-	-	-	+	-	+	+	+	-	-	+	+	+	-	-	-
<i>L. aff. quercizans</i>	+	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-
<i>L. retigera</i>	-	-	-	±	-	-	-	-	-	-	-	-	-	+	+	-
Sticta (Schreb.) Ach.																
<i>S. henryana</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>S. limbata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>S. nylanderiana</i>	+	-	-	-	-	+	-	+	+	+	-	-	-	-	-	-
<i>S. platyphylloides</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>S. praetextata</i>	+	-	-	-	-	+	-	+	-	+	-	-	-	-	-	-
<i>S. weigelii</i>	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-

K = Potassium hydroxide (KOH); C = Aqueous solution of calcium hypochlorite (Ca(OCl)₂); P = Aqueous solution of p-phenylenediamine (C₆H₄(NH₂)₂); Gyr = gyrophoric acid; Cong = congyrophoric acid; Atr = atranorin; Nor = norstictic acid; Sti = stictic acid; Cons = constictic acid; Thel = thelophoric acid; R1=Retigeric acid; R2=Retigeranic acid

Enumeration of species

Lobaria (Schreb.) Hoffm.,

Lobaria adscripturiens (Nyl.) Hue

Etymology - Thallus 6-12 cm broad, light-yellow brown, irregular and wide lobes (0.5-1.0 cm) lobes, wave shaped and shining margins, upper surface slightly wrinkled, soredia and isidia absent, green algae - photobiont, dark-brown tomentum, dark brown rhizines, pycnidia with black ostioles, dark brown colored and disc shaped apothecia (0.5-3.5 mm) in diameter, acicular, 3 septate spores 42-45 × 5-7 μm.

Known distribution - India (Joshi & Awasthi 1982, Awasthi 2007, Singh & Sinha 2010), China, Taiwan, Philippines and Malaysia (Yoshimura 1971), South Korea (Park 1990, Ren et al. 2012).

New addition to Nepal.

Chemistry - Cortex K -, C -, KC -, P -; medulla K -, C -, KC + (rose red), P -. **TLC**: gyrophoric, congyrophoric and traces of atranorin present.

Number of specimens examined - 13

Material examined (Representative only) - **RASUWA: Thulo Syafru, Gosainkund valley.** Between Chandanbari to Gosaikund, on bark of *Abies spectabilis* 28° 07.635` N, 85° 20.905` E, alt. 3202 m, 27 September 2007, Joshi, Sharma & Olley 2007, M2; **Ghoda Tabela** on the way to *Kyanjin*, on trunk of *Quercus semecarpifolia*, 28° 11. 838` N, 85° 27. 242` E, alt. 3067 m, April 27, 2009. Scheidegger & Devkota, 2009, NE69/06a; **Lama Hotel** on the way to *Kyanjin*, on trunk of *Alnus nepalensis*, 28° 10. 166` N, 85° 26. 176` E, alt. 2642 m, April 27, 2009. Scheidegger & Devkota, 2009, NE72/08b.

Distribution range in Nepal - Temperate - subalpine zone, C, 2642 m - 3202 m. Fig. 4A

Conservation Status - Critically endangered (CR)

Notes - This species superficially resembles *L. quercizans* but is distinguished by the presence of congyrophoric acid in the medulla, and its wrinkled or rough thallus. The systematic position of the specimens from Nepal needs to be confirmed with molecular analyses.

Lobaria discolor (Bory) Hue

Known distribution - NEPAL: Mewakhola valley (1350 m), Eastern Nepal (Joshi & Awasthi 1982); Khaptad (3150m), Doti district, Seti Zone (Sharma 1979b), India (Joshi & Awasthi 1982); Philippines, Sri Lanka (Yoshimura 1971), South Korea (Ren et al. 2012).

Chemistry - Cortex K + (yellow), C -, KC -, P -; medulla K -, C -, KC + (red), P -. **TLC:** gyrophoric

Number of specimens examined - 1

Material examined - **KASKI:** *Near Australian Camp, Lumle* 28° 18. 381` N, 83° 50. 087` E, alt. 1980 m, April 27, 2014, Scheidegger, 2014. Nepal.

Distribution range in Nepal - Sub-tropical - subalpine zone, E, W, 1350 m - 3150 m. Fig. 4B

Conservation Status - Vulnerable (VU)

Notes - The systematic position of the specimens from Nepal needs to be confirmed with molecular analyses.

Lobaria fuscotomentosa Yoshim.

Etymology - Thallus foliose, 7 cm long, dark brown, lobes (6-12 mm), wrinkled surface, green algae - photobiont, dark-brown tomentum, pycnidia 0.2-0.3mm in diameter, soredia, isidia and cyphellae absent on both surfaces, dark brown colored apothecia (1.5-3.5 mm) in diameter, acicular 2- septate spores 30-42 × 3-6 µm.

Known distribution - India (Joshi & Awasthi 1982, Pandit & Sharma 2012); Bhutan (Aptroot & Feijen 2002), Japan, China (Yoshimura 1971)

New addition to Nepal.

Chemistry - Cortex K + (yellow), C -, KC -, P -; medulla K + (pale yellow), C -, KC + (reddish), P -. **TLC:** gyrophoric, congyrophoric

Number of specimens examined - 3

Material examined - **RASUWA:** *Kyanjin valley* to Ghoda Tabela, on bark of *Abies spectabilis* 28° 12.246` N, 85° 35.519` E, alt. 3879 m, September 24, 2007, Olley, Cross, Joshi & Sharma, 2007, AC11.1; **GORKHA:** *Lho, Nubri valley* on the way to Samagaun, on bark of *Abies spectabilis*, 28° 34.258 N, 84° 41.905` E, alt. 3284 m, 26 March 2011. Devkota, Sankhi & Scheidegger 2011, 14WF1/26; **TAPLEJUNG:** *Gyabla, Ghunsa valley*, on the way to Ghunsa, Kangchenjunga Conservation Area, on bark of *Quercus semicarpifolia*, 27° 37.323` N, 87° 52.548` E, alt. 3003 m, 6 April, 2012, Devkota, Chongbang & Scheidegger 2012, 63WE1/33.

Distribution range in Nepal - Subalpine zone, E, C,W, 3003 m - 3879 m. Fig. 4C

Conservation Status - Vulnerable (VU)

Notes - The systematic position of the specimens from Nepal needs to be confirmed with molecular analyses.

Lobaria isidiosa (Müll. Arg.) Vain

Known distribution - NEPAL: Tato Pani - Marsyangdi river, Manang district (Asahina 1955); Rolwaling Himalaya, Dolakha (Kurokawa 1967); Cho-Oyu Himalaya near Debuhe 3657 - 3962 m. (Awasthi 1960); Batassy Bhuspate Dandaa - Panchthar Yoshimura (1971); Mewakhola valley (3300 m - 3450 m) Taplejung - Eastern Nepal (Joshi & Awasthi 1982); Langtang - Rasuwa (Miehe 1990), India (Joshi & Awasthi 1982, Pinokiyo et al. 2008, Molleman et al. 2011, Joshi et al. 2016), Japan, China, Bhutan, Philippines and Indonesia (Yoshimura 1971), South Korea (Ren et al. 2012), Taiwan (Lin 2013), Alaska and British Columbia (Cornejo & Scheidegger 2015)

Chemistry - Cortex K -, C -, KC -, P -; medulla K ± (yellow), C -, KC -, P -. **TLC:** norstictic, stictic, constictic and, retigeranic acid

Number of specimens examined - 119

Material examined (Representative only) - **RASUWA:** *Kyanjin valley* between Ghoda Tabela and Kyanjin, on bark of *Sorbus microphylla*, 28° 12.246` N, 85° 33.31` E, alt. 3835 m, September 24, 2007, Cross, Joshi, Sharma & Olley, 2007, AC4.2; *Tserko Ri above Kyanjin, Kyanjin valley* on dwarf scrubs, 28° 12. 787` N, 85° 36. 35` E, alt. 5004 m, April 23, 2009. Scheidegger & Devkota, 2009. NE58/a. **GORKHA:** *Samagaun, Samagaun valley*, on bark of *Betula utilis*, 28° 34.973` N,

84° 38.495` E, alt. 3501 m, March 27 2011. Devkota, Sankhi & Scheidegger 2011, 15WE1/20; **Dumje (Opposite Gho), Tsum valley**, on trunk of *Quercus semicarpifolia*, 28° 28.113` N, 85° 00.486` E, alt. 2563 m, 19 September 2012. Devkota & Scheidegger 2012, 42EF1/10. **SOLUKHUMBU: Surkey, Dudhkoshi valley** on the way to Lukla, on trunk of *Gultheria fragmentissima*, 27° 40.328` N, 86° 42.868` E, alt. 2209 m, July 04, 2012, Devkota & Scheidegger 2012, 21EF2/11. **Tongnasa, Dudhkunda valley** on the way to Dudhkunda lake, on bark of *Tsuga dumosa*, 27° 35.681` N, 86° 35.379` E, alt. 2968 m, 18 June, 2012, Devkota & Scheidegger 2012, 53WF1/5. **TAPLEJUNG: Rambuk Kharka, Ghunsa valley** above Ghunsa, on trunk of *Juniperous indica*, 27° 42.813` N, 87° 57.919` E, alt. 3850 m, Aspect 120, Slope 30, 11 April, 2012, Devkota, Chongbang & Scheidegger 2012, 65WF2/30.

Distribution range in Nepal - Temperate - nival zone, E, C, W, 2235 m - 5004 m. Fig. 4D

In our study area, it is collected from 2235 m - 3850 m. Earlier, the highest range reported by Awasthi (1960) was 3962 m from Cho-Oyu Himalaya near Debucho.

Conservation Status - Least concern (LC)

Notes - *Lobaria isidiosa* looks like *L. pindarensis*, but it has *Nostoc* as a photobiont (Awasthi 2007). Cornejo *et al.* (2009) found the presence of retigeranic acids but absence of retigeric acid in *L. isidiosa*.

Lobaria pindarensis Räsänen

Known distribution - NEPAL: Mewakhola valley (3300 m) -Taplejung, Eastern Nepal (Joshi & Awasthi 1982); Olangchung Gola - Taplejung (3400 m), Khumjung - Solukhumbu (3871m), Dumje forest - Tsum, Gorkha (3400 m) (Devkota *et al.* 2014), Bhutan (Upreti & Ranjan 1988, Upreti & Negi 1996, Aptroot & Feijen 2002), India (Joshi & Awasthi 1982, Shukla *et al.* 2015).

Number of specimens examined - 1391

Material examined (Representative only) - **RASUWA: Ghoda Tabela, Gosaikunda valley**, on branch of *Berberis* sp. near Army camp alt. 3100 m, Sept.19 2007, Joshi, Sharma & Olley, 2007, M1. **Between Gosaikunda and Chandanbari, Gosaikunda valley**, on trunk of *Abies spectabilis* 28° 05.718` N, 85° 22.523` E, alt. 3765 m, April.19 2009, Scheidegger & Devkota, 2009, NE37/02a. **Lama Hotel, Kyanjin valley** 28° 09.458` N, 85° 25.19` E, alt. 2036 m, 21 April 2009. Scheidegger & Devkota 2009, NE56/01a. **Kyanjin, Kyanjin valley** 28° 12.458` N, 85° 33.19` E, alt. 3884 m, 21 April 2007. Cross, Joshi, Sharma & Olley 2007, AC10. **GORKHA: Gaup, Nubri valley** on the way to Samagaun, on trunk of *Rhus wallichii*, 28° 31. 927` N, 84° 48. 787` E, alt. 2200 m, March 31, 2011. Devkota & Scheidegger, 2011. MP15/01a. **Samagaun, Nubri valley**, on trunk of *Abies spectabilis*, 28° 34. 406` N, 84° 40. 075` E, alt. 3570 m, March 29, 2011. Devkota & Scheidegger, 2011. MP1/20a. **Dumje (Opposite Gho), Tsum valley**, on trunk of *Rhus wallichii*, 28° 28. 28` N, 85° 00. 771` E, alt. 2600 m, September 20, 2012. Devkota & Scheidegger, 2012.M2P1/01a. **Lamjung (Opposite Chekampar) Tsum valley**, on branch of *Rosa macrophylla*, 28° 28. 514` N, 85° 03. 131` E, alt. 3800 m, September 24, 2012. Devkota & Scheidegger, 2012.M2P9/01a. **SOLUKHUMBU: Musey, Dudhkoshi valley** on branch of *Berberis* sp, 27° 41. 614` N, 86° 43. 094 E`, alt. 2569 m, April 13, 2011, Devkota & Scheidegger, 2011. 22EE1/11; Khumjung, **Dudhkoshi valley**, on trunk of *Abies spectabilis*, 27° 48. 871` N, 86° 43. 016 E`, alt. 3871 m, April 18, 2011, Devkota & Scheidegger, 2011. SP1/35a; **Phera, Dudhkunda valley** on trunk of *Pinus wallichiana*, 27° 33. 869` N, 86° 35. 590` E, alt. 2600 m, June 15 2012, Devkota & Scheidegger, 2012. 52EE2/20; **Mangem, Dudhkunda valley** on trunk of *Abies spectabilis*, 27° 39. 370` N, 86° 35. 803 E`, alt. 3795 m, June 24, 2012, Devkota & Scheidegger, 2012. 55EE2/1. **TAPLEJUNG: Gyabla, Ghunsa valley**, on *Arundinaria* sp, 27° 36. 675` N, 87° 52. 333 E`, alt. 2486 m, April 13 2012, Devkota & Scheidegger, 2012. K2P9/01a. **Rambuk Kharka, Ghunsa valley**, on trunk of *Juniperous indica* sp, 27° 42. 791` N, 87° 57. 871E`, alt. 3845 m, April 11, 2012, Devkota, Chongbang & Scheidegger, 2012. 65WE2/2. **Olangchung Gola (opposite forest), Olangchung Gola valley**, on bark of *Viburnum nervosum*, 27° 40. 306` N, 87° 46. 836 E`, alt. 3167 m, May 16, 2011, Devkota & Scheidegger, 2011. 33WF1/04. **Nearby Dinga Samba, Olangchung Gola valley**, on branch of *Rhodendron campanulatum*, 27° 43. 010` N, 87° 43. 998` E, alt. 4000 m, May 20, 2011, Devkota & Scheidegger, 2011. KP2/20a.

MANANG: Bhintang, on trunk of *Abies spectabilis*, 28° 37. 338` N, 84° 28. 091` E, alt. 3600 m, October 16, 2012, Devkota & Scheidegger, 2012. MAP1 / 21b. **Kharche, Surki Khola, below Bhintang** on trunk of *Mahonia nepalensis* alt. 2681 m, October 16, 2012, Devkota & Scheidegger, 2012. **Between Bhratang and Chame** 28° 33. 996` N, 84° 12. 663` E, alt. 2761 m, April 13, 2014, Scheidegger, 2014. CS982. **Above Pisang**, 28° 36. 453` N, 84° 08. 839` E, alt. 3461 m, April 14, 2014, Scheidegger, 2014. C99-Nepal. **MYAGDI: Ghodepani** 28° 24. 598` N, 84° 41. 907` E, alt. 2659 m, April 23, 2014, Scheidegger, 2014. K99-Nepal. **Deurali near Ghodepani** 28° 24.

Chemistry - Cortex K -, C -, KC -, P -; medulla K + (yellow) C -, KC + (red), P + (yellow). **TLC**: gyrophoric, norstictic, stictic and constictic

Distribution range in Nepal - Temperate - Subalpine zone, E, C, W, 2036 m - 4000 m. Fig. 4E

Conservation status - Vulnerable (VU)

Notes - *Lobaria pindarensis* is associated with the green algal photobiont *Symbiochloris reticulata* (Skaloud et al. 2016). This species has been described from different geographical locations of the Himalayas. Yoshimura (1969) treated this species under *L. meridionalis*, but the later one is distinguished by the absence of gyrophoric acid and it is likely that he made a misidentification. Similarly, Joshi & Awasthi (1982) reported *L. meridionalis* from Mewakhola valley (3300m), Taplejung Nepal but it is likely that they made a wrong identification of *L. pindarensis*.

Miehe (1990) reported *Lobaria pulmonaria* from the Langtang territory of Nepal, but that could be *Lobaria pindarensis*. During 2007 and 2009 explorations, we observed several localities with a large population of *L. pindarensis*. Similar unconfirmed reports of *L. pulmonaria* were made by Smith (1931) from Darjeeling, and Singh (1981) from Manipur, India (Awasthi 2007).

Lobaria aff. quercizans Michx.

Etymology - Thallus corticolous, 7-12 cm across, pale brown, lobes (5-11 mm), plane surface and often wrinkled in older parts, greener when wet, green algae - photobiont, soredia and isidia absent, diffuse type tomentum, reddish-brown colored apothecia (3-5 mm) in diameter, acicular 3- septate spores 30-75 × 4.5-7.5 µm.

Known distribution - India (Joshi & Awasthi 1982); Bhutan (Aptroot & Feijen 2002); Taiwan (Lin 2013), Japan, Russia - Sakhalin (Yoshimura 1971), Canada (Edman et al. 2008), South Korea (Ren et al. 2012).

New addition to Nepal.

Chemistry - Cortex K + (yellow), C -, KC -, P -; medulla K -, C -, KC + (pink), P -. **TLC**: gyrophoric

Number of specimens examined - 7

Material examined (Representative only) - **RASUWA: Thulo Syafru, Gosainkunda valley on the way to Gosainkunda**, on branch of *Sorbus microphylla*, 28° 07. 174` N, 85° 20. 435` E, alt. 3319 m, April 20, 2009. Scheidegger & Devkota, 2009. NE48 / 01a; **Lama Hotel, Kyanjin valley**, on the way to Kyanjin, on trunk of *Abies spectabilis*, 28° 09. 314` N, 85° 23. 850` E, alt. 2007 m, April 21, 2009. Scheidegger & Devkota, 2009. NE55 / 01b.

Distribution range in Nepal - Temperate - Subalpine zone, C, 2007 m - 3262 m. Fig. 4A

Conservation status - Data deficient (DC)

Notes - The systematic position of the specimens from Nepal needs to be confirmed with molecular analyses.

Lobaria retigera (Bory) Trevis.

Known distribution - NEPAL: Laskya La (4200m) and Tolo Gompa Khola (4100m) - Manaslu (Asahina 1955); Bilbatay Bhanjyang, Tapethok - Helok, Bayoya - Helok, Khimty, Taplejung (Yoshimura 1971); On the way to Khaptad near herbal farm (3150 m), Doti (Sharma 1979b); Rakshe - Ethung, Taplejung (2250 m), Mewakhola valley, Tankhu village, Topkegola - Thaglabhangang, Taplejung (2250 m - 4500 m) Eastern Nepal (Joshi & Awasthi 1982), Langtang - Rasuwa (Miehe 1990). Bhutan (Upreti & Ranjan 1988, Söchting 1999, Aptroot & Feijen 2002), India (Joshi & Awasthi 1982, Pinokiyo et al. 2008, Shukla et al. 2015, Joshi et al. 2016), Japan, China, Vietnam,

Thailand, Philippines, New Guinea (Yoshimura 1971), Taiwan (Lin 2013), Alaska (Jordan 1973, Geiser et al. 1994)

Chemistry - Cortex K -, C -, KC -, P -; medulla K ±, C -, KC -, P -. **TLC**: thelophoric, triterpenoid and, retigeric acid.

Number of specimens examined - 397

Material examined (Representative only) - **RASUWA**: *Kyanjin*, on rock, 28° 12. 217` N, 85° 33. 417` E, alt. 3869 m, April 24, 2009. Joshi, Sharma & Olley, 2007. M2.3. **GORKHA**: *Gaup, Nubri valley* on the way to Samagaun, on trunk of *Machelus* sp, 28° 32. 132` N, 84° 48. 117` E, alt. 2147 m, March 20, 2011. Devkota, Sankhi & Scheidegger, 2011. 11WF1/09; *Samagaun, Nubri valley* on mossy rock, 28° 34. 420` N, 84° 39. 672` E, alt. 3570 m, March 29, 2011. Devkota, & Scheidegger, 2011. MP1/09a. *Lokpa, Tsum valley*, on mossy rock, 28° 26. 352` N, 84° 54. 799` E, alt. 2179 m, September 13, 2012, Devkota & Scheidegger, 2012. 41EE1/01. *Chekampar, Tsum valley*, on trunk of *Abies spectabilis*, 28° 28. 793` N, 85° 02. 974` E, alt. 3400 m, September 24, 2012, Devkota & Scheidegger, 2012. M2P7/01b. **TAPLEJUNG**: *Olangchung Gola* on branch of *Berberis* sp, 27° 40. 399` N, 87° 46. 771` E, alt. 3157 m, May 16, 2011, Devkota & Scheidegger, 2011. 33WM1/08. *Near Dinga Samba, Olangchung valley*, on branch of *Betula utilis*, 27° 43. 012` N, 87° 43. 913` E, alt. 4000 m, May 20, 2011, Devkota & Scheidegger, 2011. K2P2/02b. *Sekathum, Ghunsa valley*, on mossy rock, 27° 32. 156` N, 87° 48. 956` E, alt. 2184 m, April 04, 2012, Devkota, Chongbang & Scheidegger, 2012. 61EE1/16. *Rambuk Kharka, Ghunsa valley*, on branch of *Salix* sp, 27° 42. 550` N, 87° 57. 797` E, alt. 3791 m, April 11, 2012, Devkota, Chongbang & Scheidegger, 2012. 65WE1/16. **SOLUKHUMBU**: *Khumjung, Dudhkoshi valley*, on trunk of *Rhododendron campanulatum*, 27° 48. 952` N, 86° 42. 912` E, alt. 3824 m, July 11, 2012, Devkota & Scheidegger, 2012. 25WE2/5; *Musey, Dudhkoshi valley*, on trunk of *Quercus semicarpifolia*, 27° 40. 903` N, 86° 42. 756` E, alt. 2212m, July 14, 2011, Devkota, Sankhi & Scheidegger, 2011. 22EF1/18. *Boldok, Dudhkunda valley*, on rock, 27° 31. 130` N, 86° 34. 442` E, alt. 2176 m, June 10, 2012, Devkota & Scheidegger, 2012. 51WM2/01. *Simidanda, opposite of Phera, Dudhkunda valley*, on branch of *Viburnum erubescense*, 27° 35. 395` N, 86° 35. 877` E, alt. 2800 m, June 16, 2012, Devkota & Scheidegger, 2012. S2P2/24b. **MANANG**: *Bhimtang*, on trunk of *Abies spectabilis*, 28° 37. 338` N, 84° 28. 091` E, alt. 3600 m, October 16, 2012, Devkota & Scheidegger, 2012. MAP1 / 21b.

Distribution range in Nepal - Temperate - alpine zone, E, C, W, 2141 m - 4500 m. Fig. 4F

In our study area, it is collected from 2141 m - 4000 m. An earlier report by Joshi & Awasthi (1982) was from 2700 m - 4500 m from Thanglabhangang, Taplejung, Eastern Nepal.

Conservation status - Least concern (LC)

Notes - Cornejo *et al.* (2009) found the presence of retigeric acids and absence of retigeranic acids in *L. retigera*.

Sticta (Schreb.) Ach.

The species listed under the genus *Sticta* need a careful taxonomic revision. We assume that a detailed revision will lead to a substantial reorganization of the species complex around *S. nylanderiana*.

Sticta henryana Müll. Arg.

Known distribution - NEPAL: Near Debuche (3657 - 3962 m) Cho-Oyu Himalaya - Solukhumbu (Awasthi 1960). India (Joshi & Awasthi 1982, Awasthi 2007, Singh & Sinha 2010), Bhutan (Upreti & Ranjan 1988, Aptroot & Feijen 2002), China (Li et al. 1991).

Chemistry - Cortex K -, C -, KC -, P -; medulla K -, C -, KC -, P -. **TLC**: No lichen products present.

Number of specimens examined - 1

Material examined - **GORKHA**: *Lho, Nubri valley*, on bark of *Abies spectabilis*, 28° 34.258` N, 84°41.905` E, alt. 3284 m, 26 March 2011. Devkota, Sankhi & Scheidegger 2011, 14WF1/25.

Distribution range in Nepal - Subalpine zone, C, W, 3284 m - 3962 m. Fig. 5A

In our study area, it is collected from 3284 m. Earlier highest range was reported by Awasthi (1960) from Cho-Oyu Himalaya area (3962 m).

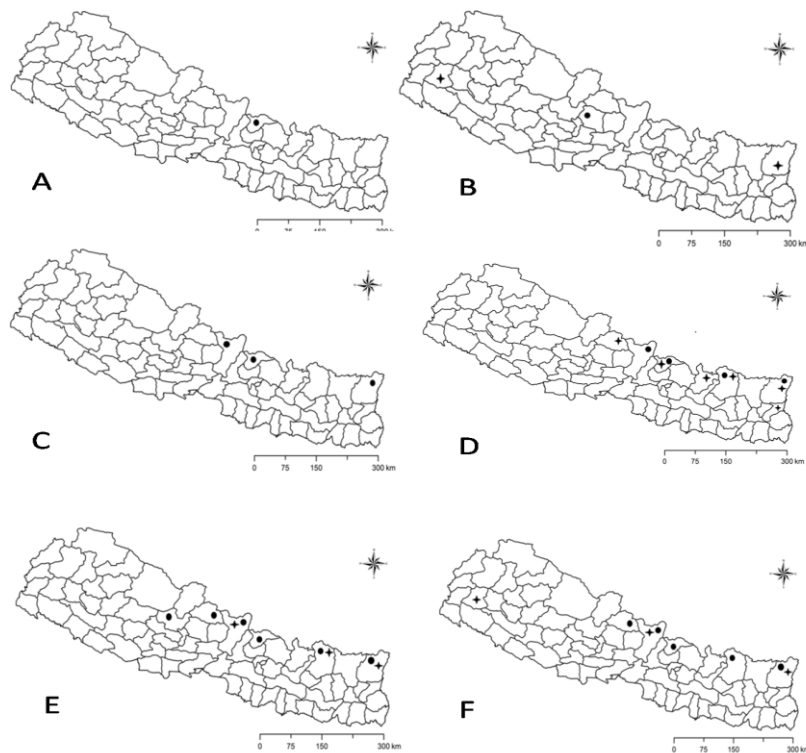


Fig. 4 - Distribution of *Lobaria* species in Nepal: **A** (*L. adscripturiens* and *Lobaria* aff. *quercizans*), **B** (*L. discolor*), **C** (*L. fuscotomentosa*), **D** (*L. isidiosa*), **E** (*L. pindarensis*), **F** (*L. retigera*). Symbols (●) and (+) represent recently collected districts by the authors and previously reported districts respectively.

Conservation status - Endangered (EN)

Notes - The systematic position of the specimens from Nepal needs to be confirmed with molecular analyses.

Sticta limbata (Sm.) Ach.

Etymology - Thallus foliose, monophyllous, 5 cm long, yellowish grey, loosely attached at one point, lobes 0.5-2.5 cm in diameter and irregular, smooth and shining surface, marginally erose - soralia, without isidia, blue green algae - photobiont, lower surface - grayish brown, densely and wooly tomentum, apothecia not seen.

Known distribution - Bhutan (Aptroot & Feijen 2002), British Columbia, Canada (Radies et al. 2009), Chile (Galloway 1994), India (Joshi & Awasthi 1982, Awasthi 2007, Singh & Sinha 2010), New Zealand (Oliver 1912), South Korea (Park 1990, Jayalal et al. 2014), UK (Ellis & Hope 2012), USA (Neitlich & Mccune 1997, McDonald et al. 2003), China (Wei 1991, Jinong & Huajie 2012).
New addition to Nepal.

Chemistry - No lichen substances. **TLC**: No lichen products present.

Number of specimens examined - 1

Material examined - **RASUWA**: *Ghoda Tabela to Langtang village, Kyanjin valley*, on hard rock, 28° 12. 477` N, 85° 28. 658` E, alt. 3180 m, September 19, 2009. Joshi, Sharma & Olley, 2007. M3.1

Distribution range in Nepal - Subalpine zone, C, 3180 m. Fig. 5B

Conservation status - Critically endangered (CR)

Sticta nylanderiana Zahlbr.

Known distribution - NEPAL: Southern Mountain range of Annapurna 2500 m -3000 m, Kaski district (Asahina 1955); On way to Sahastraling, Khaptad near herbal farm - Doti (3015 m) (Sharma

1979b), India (Awasthi 1965, 2007, Joshi & Awasthi 1982, Singh & Sinha 2010, Joshi et al. 2016), Bhutan (Upreti & Ranjan 1988, Aptroot & Feijen 2002), South Korea (Kim 1981, Jayalal et al. 2014). **Chemistry** - Cortex K + (yellow), C -, KC -, P -; medulla K -, C -, KC + (pink), P -. **TLC**: gyrophoric, congryphoric, atranorin

Number of specimens examined - 289

Material examined (Representative only) - RASUWA: *Gosaikunda*, on trunk of *Tsuga dumosa*, 28° 00. 550` N, 85° 29. 983` E, alt. 3319 m, April 16, 2009. Scheidegger & Devkota, 2009. NE15 / 01b; *Kyanjin*, on trunk of *Alnus nepalense*, 28° 10. 165` N, 85° 26. 175` E, alt. 2642 m, April 27, 2009. Scheidegger & Devkota, 2009. NE72 / 03K; **GORKHA:** *Sho, Nubri valley*, on the way to Samagaun, on branch of *Tsuga dumosa*, 28° 34. 109` N, 84° 43. 301` E, alt. 2989 m, March 24, 2011. Devkota, Sankhi & Scheidegger, 2011. 13WF1/24; *Chekampar, Tsum valley*, on trunk of *Abies spectabilis*, 28° 28. 9835` N, 85° 02.817` E, alt. 3060 m, September 23, 2012, Devkota & Scheidegger, 2012. 43EE1/02. **TAPLEJUNG:** *Near Dinga Samba, Olangchung valley*, on branch of *Berberis aristata*, 27° 41. 592` N, 87° 45. 674` E, alt. 3406 m, August 21, 2011, Devkota & Scheidegger, 2011. 34EM2 / 28. *Rambuk Kharka, Ghunsa valley*, on branch of *Rhododendron campanulatum*, 27° 42. 486` N, 87° 57. 889` E, alt. 3813 m, April 12, 2012, Devkota, Chongbang & Scheidegger, 2011. 34EM2 / 28. **SOLUKHUMBU:** *Opposite of Musae, Dudhkoshi valley*, on branch of *Viburnu* sp, 27° 40. 498`N, 86° 41. 949E`, alt. 2806 m, April 23, 2011, Devkota & Scheidegger, 2011. SP7 / 02a; Khumjung, Dudhkoshi valley, on trunk of *Rhododendron campanulatum* 27° 48. 952`N, 86° 42. 912E`, alt. 3824 m, July 11, 2012, Devkota & Scheidegger, 2012. 25WE2/4. *Tongnasa, Dudhkunda valley*, on bark of *Tsuga dumosa* 27° 35. 681`N, 86° 35. 379E`, alt. 2968 m, June 18, 2012, Devkota & Scheidegger, 2012. 55WF1/4. *Sasarbeni, Dudhkunda valley*, on branch of *Juniperous* sp., 27° 39. 373`N, 86° 35. 605E`, alt. 3777 m, June 23, 2012, Devkota & Scheidegger, 2012. 55WF2/3. **MANANG:** *Bhimtang*, on trunk of *Abies spectabilis*, 28° 37. 338` N, 84° 28. 091` E, alt. 3600 m, October 16, 2012, Devkota & Scheidegger, 2012. MAP1 / 05a.

Distribution range in Nepal - Temperate - subalpine zone, E, C, W, 2036 m - 3868 m. Fig. 5C

Conservation status - Least concern (LC)

Sticta platyphylloides Nyl.

Known distribution - NEPAL: Khaptad near herbal farm (3150 m) - Doti (Sharma 1979b), Near Debuche (3657 - 3962 m) Cho-Oyu Himalaya - Solukhumbu Awasthi (1960), India (Joshi & Awasthi 1982, Awasthi 2007, Singh & Sinha 2010, Joshi et al. 2016), Bhutan (Upreti & Ranjan 1988, Söchting 1999, Aptroot & Feijen 2002).

Chemistry - Cortex K -, C -, KC -, P -; medulla K -, C -, KC -, P -. **TLC**: None

Number of specimens examined - 19

Material examined (Representative only) - RASUWA: *Chandanbari, Gosaikunda valley*, on trunk of *Abies spectabilis*, 28° 07. 670` N, 85° 20. 582` E, alt. 3868m, April 19, 2009. Scheidegger & Devkota, 2009. NE36 / 01i; *Thulo Syafru*, on trunk of *Abies spectabilis*, 28° 07. 659` N, 85° 20. 870` E, alt. 3175 m, April 20, 2009. Scheidegger & Devkota, 2009. NE49 / 01q.

Distribution range in Nepal - Subalpine zone, E, C, W, 3150 m - 3962 m. Fig. 5D

In our study area, it is collected from 3175 m - 3868 m. Earlier, the lowest range was reported by Sharma (1979a) from Khaptad Doti (3150 m) and the highest range was reported by Awasthi (1960) from Cho- Oyu Himalaya area (3962 m).

Conservation status - Vulnerable (VU)

Sticta praetextata (Räsänen) D.D.Awasthi

Known distribution - NEPAL: On way to Khaptad (2100 m) and near herbal farm (3150 m), Doti (Sharma 1979b), India (Joshi & Awasthi 1982, Awasthi 2007, Singh & Sinha 2010, Joshi et al. 2016), Bhutan (Söchting 1999; Aptroot & Feijen 2002).

Chemistry - Thallus K + (yellow), C -, KC -, P -; medulla K -, C -, KC + (pink), P -. **TLC**: Gyrophoric, atranorin and unknown substances

Number of specimens examined - 57

Material examined (Representative only) - RASUWA: *Kyanjin*, on trunk of *Betula utilis*, 28° 12. 210'N, 85° 33. 800E, alt. 3908 m, September 21, 2007. Cross, Joshi, Sharma & Olley, 2007. AC16. ***Kyanjin***, on bark of *Betula utilis*, 28° 12. 254'N, 85° 33. 452E, alt. 3832 m, April 25, 2009. Scheidegger & Devkota, 2009. NE64 / 01K; Ghoda Tabela. **GORKHA: Samagaun, Nubri valley**, trunk of *Abies spectabilis*, 28° 34. 246' N, 84° 43. 005' E, alt. 3570 m, March 29, 2011. Devkota & Scheidegger, 2011. MP1/02b; **Gaup, Nubri valley**, on the way to Samagaun, on branch of *Betula utilis*, 27° 48. 871' N, 86° 43. 016' E, alt. 2400 m, March 31, 2011. Devkota, Sankhi & Scheidegger, 2011. MP14/16f; **Chekampar, Tsum valley**, on trunk of *Tsuga dumosa*, 28° 28. 983' N, 85° 02. 817' E, alt. 3060 m, September 23, 2012, Devkota & Scheidegger, 2012. 43EE1/03. **TAPLEJUNG Gyabla, Ghunsa valley**, on trunk of *Quercus semicarpifolia*, 27° 37. 331' N, 87° 52. 639' E, alt. 3034 m, April 06, 2012, Devkota, Chongbang & Scheidegger, 2012. 63WF1/01.

Distribution range in Nepal - Temperate - Subalpine zone, E, C, W, 2036 m - 3908 m. Fig. 5E

Conservation status - Least concerned (LC)

***Sticta weigelii* (Ach.) Vain.**

Known distribution - NEPAL: Mewakhola valley, near Shyamba village (1500 m), Taplejung, Eastern Nepal (Joshi & Awasthi 1982), Bhutan (Aptroot & Feijen 2002), India (Joshi & Awasthi 1982), South Korea (Jayalal et al. 2014), Alaska (Geiser et al. 1994), Argentina and Chile (Galloway 1994), Malaysia (Din et al. 2008).

Chemistry - Thallus K – C –, KC –, P –; medulla K+ (yellow), C –, KC –, P –. **TLC**: Unknown substances

Number of specimens examined - 2

Material examined - RASUWA: **Thulo Syafru, Gosaikunda valley**, on the way to Gosaikunda, on rock, 28° 8. 434'N, 85° 22. 239 E, alt. 2000 m, September 16, 2007. Olley, Joshi and Sharma 2007. L18. **TAPLEJUNG: Sotlima, Ghunsa valley**, Mathillo Tal, on the way to Ghunsa, on trunk of *Quercus laminosa*, 27° 32. 502' N, 87° 50.391' E, alt. 2559 m, 16 April, 2012, Devkota, Chongbang & Scheidegger 2012, 62EF1/08.

Distribution range in Nepal - Sub-tropical - temperate zone, E, C. 1500 m - 2559 m. Fig. 5F

In our study area, it is collected from 2000 m - 2559 m. Earlier, lowest range was reported by Joshi & Awasthi (1982) from Mewakhola valley (1500 m).

Conservation status - Endangered (EN)

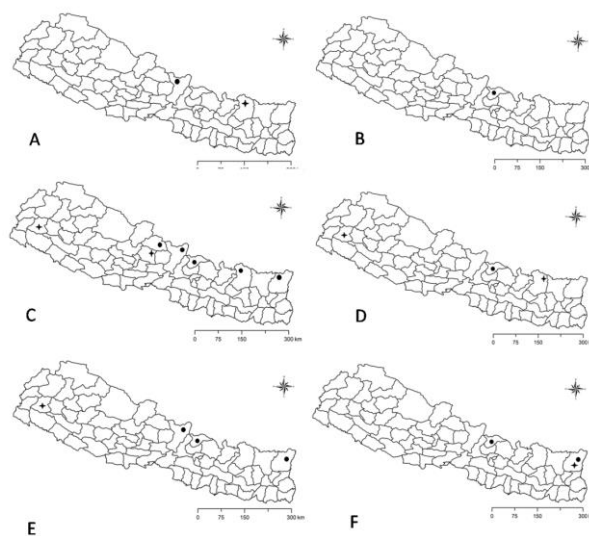


Fig. 5 - Distribution of *Sticta* species in Nepal: **A** (*Sticta henryana*), **B** (*S. limbata*), **C** (*S. nylanderiana*), **D** (*S. platyphylloides*), **E** (*S. praetextata*), **F** (*Sticta weigelii*). Symbols (●) and (+) represent recently collected districts by the authors and previously reported districts, respectively.

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