

## **Lichenological studies in the western sectors of the Alps: Sesia Valley (Piedmont, Italy)**

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**Abstract** – The purpose of the survey was to study lichen diversity in uplands areas of the Alps. 191 lichen species are reported from the Sesia Valley (Piedmont, Italy). 20 of these are new to Piedmont, 53 are new to the investigated area and 3 are the second report for Italy. An annotated list, with ecological and distributional remarks, is given.

**Lichen / Biodiversity / Alps / Italy**

**Résumé** – Ce travail a eu pour objectif l'étude de la diversité des lichens dans les régions montagneuses des Alpes. 191 taxa sont présents dans la Valle Sesia (Piémont, Italie) ; 20 sont nouveaux pour le Piémont, 53 sont nouveaux pour le secteur étudié, enfin 3 sont la deuxième citation pour l'Italie. Un catalogue, avec des remarques relatives à l'écologie et à la distribution, est présenté.

**Lichen / Biodiversité / Alpes / Italie**

### **INTRODUCTION**

The known lichen flora of Piedmont consists of 930 infrageneric *taxa* (Nimis, 1993). Their distribution is heterogeneous because most reports refer to limited parts of the region (Isocrono, 1999). Over 70% of the data refer to mainly nineteenth-century flora studies conducted in the Sesia Valley (Baglietto & Carestia, 1864, 1864a, 1865, 1867, 1880; Baroni, 1892; Martel, 1910). A detailed analysis of the data referring to this valley, however, reveals that several sites in the alpine belt were unexplored.

This work is part of a research project underway at the Department of Plant Biology of the University of Turin which aims at acquiring data on lichen diversity in the western sector of the Alps. It contains the results of the exploration of poorly or non-investigated areas in the Sesia Valley.

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## STUDY AREA

The Sesia Valley is an Alpine valley located on the southern side of the Pennine Alps. It is almost rectangular in shape with an area of 670 km<sup>2</sup> and is 63 km long. It can be divided into a larger upper section, typically mountainous-alpine, between the slopes of Monte Rosa and Varallo, and a lower hilly-flat section, between Varallo and Borgosesia.

Precipitation is typically subalpine, with a main minimum in winter (December-January) and a maximum in autumn (October). Average precipitation varies between 1465 and 1780 mm/year (Biancotti *et al.*, 1998).

The Sesia Valley area is particularly rich in metamorphic rocks, with four NE-SW structural systems:

a) *south alpine* (dominant lithotypes: granulites, kinzigitic gneisses, marbles, schists, granular acidic rock, sandstones and limestone limited by Monte Fenera);

b) *austro-alpine* (kinzigitic gneisses, tabular gneisses and mica schists) separated from the first system by a fault line (Insubric Line);

c) *piedmont zone of calcareous schists with ultramafic rocks* (schists);

d) *Pennidic system* (gneisses with a predominance of micas and granets locally alternated with micaschists).

Due to the considerable differences in altitude (from 350 m at Borgosesia to 4559 m of Punta Gnifetti in the Monte Rosa Massif) and the climatic and geomorphological heterogeneity, the Sesia Valley hosts a quite complex and multifaceted vegetational situation (Bono, 1966). Altitude zoning can be recognised in all sectors. However, in the individual valleys the various species associate differently and in differing proportions. In the head areas up to a height of 1600 m with the exception of urban and industrial areas, there is extensive deciduous vegetation, mainly beech woods and mixed woods. In the upper section of the Valley the latter consist of alder [*Alnus viridis* (Chaix) DC; *A. incana* (L.) Moench; *A. glutinosa* (L.) Gaertner], maple (*Acer pseudoplatanus* L.; *A. platanoides* L.) and ash (*Fraxinus ornus* L.; *F. excelsior* L.) while in the lower part of the valley there is the presence of beech (*Fagus sylvatica* L.) and chestnut (*Castanea sativa* L.). On Varallo's Sacro Monte and on Mt. Fenera there are mixed woods of oak [*Quercus robur* L., *Q. petraea* (Mattuschka) Liebl.], chestnut, beech and birch (*Betula pendula* Roth). The physiognomy of coniferous woods varies according to the valleys; in the more open ones (e.g. Val Vogna) the xeric climate favours the presence of *Larix decidua* Miller; along steep slopes (e.g. Valle Otro) the damper and cooler climate favours the presence of *Picea excelsa* (Lam.) Link and *Abies alba* Miller (Bertolani Marchetti, 1954; Bono 1966). Above 2000 m pastureland is dominant, both still used as such and abandoned and now shrub-bearing (*Rhododendron ferrugineum* L., *R. hirsutum* L., *Vaccinium myrtillus* L., *V. uliginosum* L. and *Alnus viridis* (Chaix) DC. where conditions are moister]. In the alpine belt (head of the Val Grande, southern slopes of the Monte Rosa massif) moraines and scree slopes predominate, characterised pioneer cryptogams.

## METHODOLOGY

The studies were performed in the sections of the Sesia Valley which had not yet been studied or which are of particular lichenological interest. Furthermore, given the important role of protection and safeguarding natural heritage performed by the Parks and the almost total absence of lichenological

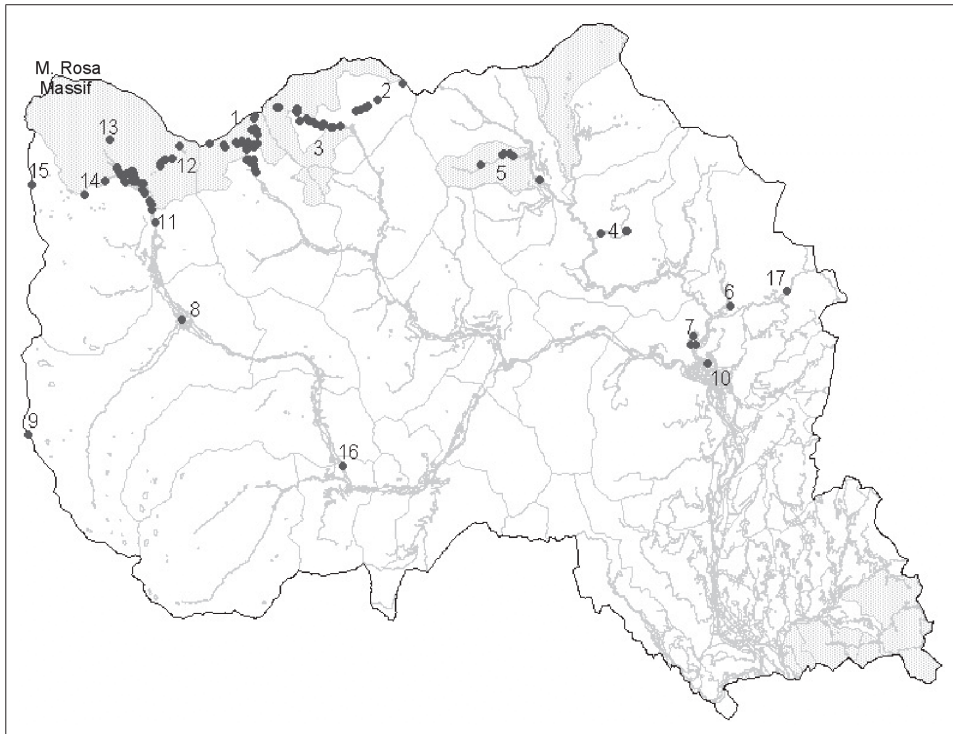


Fig. 1. Sampling sites in the Sesia Valley. Numbers refer to text. The shadowed areas show Natural Parks and Reserve.

information regarding the Upper Sesia Valley Natural Park, many samples were taken in this area. Lichenological investigations were carried out in 15 localities, covering a broad spectrum of substrata and altitudes from 400 to 3200 metres.

The sampling sites are listed below and reported in Fig. 1

- 1 - Valle Sermenza: Rima (1400 m) - Alpe Vallé di Sotto (1710 m) - Rifugio Vallé [Vallé mountain hut] (2175 m) - Lago del Toro (2250 m) Colle Vallé (2625 m) - Colle del Piccolo Altare (2630 m)
- 2 - Valle Sermenza: Carcoforo (1300 m) - Rifugio Boffalora (1685 m) - Colle d'Egua (2239 m)
- 3 - Valle Sermenza: Carcoforo (1300 m) - Rifugio Massero (2082 m) - Colle della Bottiglia (2607 m)
- 4 - Valle Mastallone, Valbella, Valbella Inferiore (779 m) - Valbella Superiore (885m)
- 5 - Valle Mastallone, Vallone di Roi, Fobello (960 m) - Alpe Giavinale (1180 m) - Alpe Gumietto (1140 m)
- 6 - Valle Mastallone, Varallo - Cervarolo (708 m)
- 7 - Valle Mastallone, Varallo - Dovesio (571 m) - Arboerio (617 m)
- 8 - Val Vogna: lower section of the Valley between Riva Valdobbia and Piane (900-1100 m)
- 9 - Val Vogna: Passo Valdoppiola, near Ospizio Sottile (2480 m) - Lago Nero (2600 m) - Lago Bianco
- 10 - Val Grande: Varallo, monumental area of Sacro Monte (608 m)
- 11 - Val Grande, Monte Rosa Massif: Merletti village (1271 m) - Cappella di Sant'Antonio (1385 m) - baite d'Stigu (1500 m) - Rifugio Pastore (1575 m)

- 12 - Val Grande, Monte Rosa Massif: Rifugio Pastore (1575 m) - Colle del Turlo (2.738 m)  
 13 - Val Grande, Monte Rosa Massif: Rifugio Pastore (1575 m) - Rifugio Barba Ferrero (2.250 m)  
 14 - Val Grande, Vallone di Bors, Rifugio Pastore (1575 m) - Rifugio Calderini (1850 m) - Alpe La Balma (2207 m)  
 15 - Val Grande, Monte Rosa Massif: Passo dei Salati (2936 m) - Stolemberg (3202 m) - Punta Indren (3260 m)  
 16 - Val Grande, Valle di Rassa, Piode (750 m)  
 17 - Varallo between Roccapietra (450 m) and Corte (900 m).

All the collected samples are stored in the Lichenological section of the *Herbarium Universitatis Taurinensis* (TO). Nomenclature follows Nimis (2003).

### ANNOTATED LICHEN LIST

Distributional remarks and comparisons with past data are based on an unpublished account of literature and field data of Piedmont.

\*\* = new to Piedmont

\* = new to Sesia Valley

- Acarospora fuscata* (Nyl.) Th. Fr. - **1, 2** - in pastures and at the borders of coniferous forests, on inclined rocks (micaceous and hard gneisses, mica schists) mainly SW exposed.
- Acarospora glaucocarpa* (Ach.) Körb. - **11** - at the borders of woods, on weathering gneisses.
- Acarospora sinopica* (Wahlenb.) Körb. - **4** - on siliceous rock (exp. SE) in a meadow near Valbella village.
- Amandinea punctata* (Hoffm.) Coppins & Scheid. - **4, 1** - frequent both on broad-leaved trees (especially *Fraxinus excelsior*) in the lower part of the Valley and on coniferous trees (*Larix*) mainly W-SW exposed.
- Anaptychia ciliaris* (L.) A. Massal. - **8** - on trunks of *Fraxinus excelsior* and *Fagus*.
- Arthrorhaphis citrinella* (Ach.) Poelt - **1** - [revidit: P.L.Nimis]; **15** - on ground among rocks. This is the second record for Piedmont and the only recent one.
- Aspicilia caesiocinerea* (Malbr.) Arnold - **1, 2, 3, 4, 9** - very frequent in meadows and pastures on different types of rocks (micaceous and chloritic gneisses, granulites), irrespective of inclination and exposure.
- Aspicilia cinerea* (L.) Körb. - **3** - found on rocks in pastures, SW exposed.
- Bellemeria alpina* (Sommerf.) Clauzade & Cl. Roux - **1** - on horizontal rocks only above treeline. First recent record for Piedmont after the ones of Baglietto & Carestia (1880). Despite of the scarcity of quotations the species is widespread in Piedmont.
- \**Brodoa atrofusca* (Schaer.) Goward - **1, 11** - on inclined (45°) rocks in pastures mainly S exposed. Second record for Piedmont.
- Brodoa intestiniformis* (Vill.) Goward - **14** - on rocks in pastures N-NE exposed.
- Byronora rhypariza* (Nyl.) Poelt - **1** - on mossy rock in pasturelands. Only another old record is known from Piedmont (Baglietto & Carestia, 1880 from Sesia Valley).
- Caloplaca arenaria* (Pers.) Müll. Arg. - **9, 13** - in pasturelands on different types of rocks (chloritic gneisses and mica schists).
- Caloplaca cerina* (Hedw.) Th. Fr. - **4, 8, 16** - on barks of *Fraxinus* and *Juglans*.

- Caloplaca crenularia* (With.) J. R. Laundon - **4** - on weakly inclined siliceous rocks (micaceous gneisses, granulites) in meadows.
- \*\**Caloplaca crenulatella* (Nyl.) H. Olivier - **6, 7** - on vertical rocks (diorite-gneiss, granite) exposed E-SE. New to Piedmont. Although this species is most frequent on calcareous rocks, in the Sesia Valley it has been found, as the type, on siliceous ones.
- \**Caloplaca pyracea* (Ach.) Th. Fr. - **4** - on the trunk of *Fraxinus excelsior* in a mixed hardwood forest near the river. New to Sesia Valley.
- Candelaria concolor* (Dicks.) Stein - **4, 7, 10, 16, 17** - frequent in mixed hardwood forests (on bark of *Fraxinus excelsior* and *Acer negundo*, E-SE exposed) and inside orchards (on *Pyrus communis* trunk); found once also on rock.
- \**Candelariella aurella* (Hoffm.) Zahlbr. - **1** - on base rich siliceous rocks in a stony slope. New to Sesia Valley.
- \**Candelariella reflexa* (Nyl.) Lettau - **11** - on the trunk of *Acer platanoides* in hardwood forests. New to Sesia Valley.
- Candelariella vitellina* (Hoffm.) Müll Arg - **1, 2, 4, 9, 10, 13** - very frequent on rocks (mica schists, micaceous and chloritic gneisses, diorite) mainly S-SE exposed both in natural environments and in pasturelands, on roofs in the villages, and on decaying wood.
- \**Candelariella xanthostigma* (Ach.) Lettau - **16, 17** - on isolated *Juglans* and *Fraxinus excelsior* trees. New to Sesia Valley.
- Carbonea vitellinaria* (Nyl.) Hertel - **1, 2** - a lichenicolous fungus found on epilithic samples of *Candelariella vitellina*.
- Carbonea vorticosa* (Flörke) Hertel - **3, 12** - only above treeline in a snowbed on rocks (micaceous gneisses and mica schists).
- Cetraria chlorophylla* (Willd.) Vain. - **2** - this species seem to be very rare in Piedmont. In Sesia Valley we have found it only once on *Larix* twigs with northerly exposure. This is the first recent record from Piedmont after the ones from Riva Valsesia (Baglietto & Carestia, 1880). We have collected also another one sample in Piedmont from Cuneo province near the border with Liguria (unpublished).
- Cetraria hepatizon* (Ach.) Vain. - **3, 11** - in the border area of a *Larix* forest on steeply inclined rocks (45-50°) with mainly E-SE exposed.
- Cetraria islandica* (L.) Ach. - **1, 3, 14, 15** - very common on soil and mosses from oroboreal to alpine belts. Less frequent in meadows among rocks.
- Cetraria nivalis* (L.) Ach. - **15** - on soil among rocks, SE exposed, always above 2900 m.
- \**Cladonia arbuscula* ssp. *mitis* (Sandst.) Ruoss - **1** - on soil of pastures. New to Sesia Valley.
- Cladonia bellidiflora* (Ach.) Schaer. - **1, 13** - rather frequent on soil from larch wood to pasturelands.
- Cladonia notea* (Ach.) Schaer. - **13** - on *Larix decidua* stumps in woodlands.
- Cladonia cervicornis* ssp. *verticillata* (Hoffm.) Ahti - **1** - on acid soil above treeline (exp. E).
- Cladonia coccifera* (L.) Willd. - **3** - on soil in rock fissures at the upper border of larch wood.
- Cladonia coniocraea* (Flörke) Spreng. - **3, 5, 7** - widespread on soil, mosses, *Larix* (basal parts of boles) and sometimes on rocks.
- Cladonia crispata* (Ach.) Flot. - **14** - on soil in open grasslands.
- Cladonia deformis* (L.) Hoffm. - **1** - rare, it was found only once on soil with easterly exposure.
- Cladonia gracilis* (L.) Willd. - **12** - on acid soil among rocks (exp. SE) in pastures.

- \*\**Cladonia grayi* s. str. - **3** - on weakly inclined rock covered by a thin soil coat (exp. SE). New to Piedmont.
- Cladonia macilenta* Hoffm. ssp. *macilenta* - **2, 3, 11, 12, 14** - frequent on larch trunks and stumps, present also on soil among rocks and mosses in grasslands.
- Cladonia macroceras* (Delise) Hav. - **1** - on soil in pastures and in *Rhododendron* heaths.
- Cladonia phyllophora* Hoffm. - **1** - found only once in pastures on soil among stones.
- Cladonia polydactyla* (Flörke) Spreng. - **1** - [rev: P.L.Nimis] in a stony ground among shrubs (especially *Vaccinium*).
- Cladonia pyxidata* (L.) Hoffm. - **1, 3, 12** - frequent on soil in pastures and among rocks.
- Cladonia rangiformis* Hoffm. - **1** - locally abundant on soil (exp. E) above treeline.
- Cladonia squamosa* Hoffm. v. *squamosa* (Scop.) Hoffm. - **1, 14** - on soil in pastures. It can reach the upper limit of pastures near stony slopes.
- Cladonia squamosa* v. *subsquamosa* (Leight.) Vain. - **3, 4** - on horizontal rock covered by a thin soil coat (exp. NE) and on mosses.
- Cladonia uncialis* (L.) F. H. Wigg. ssp. *uncialis* - **3, 14** - on soil and stony ground.
- \*\**Collema callopismum* A. Massal. - **6** - found only once on horizontal surface of a wall (exp. E). New to Piedmont.
- \**Collema crispum* (Huds.) F. H. Wigg. - **11** - on mossy wall. New to Sesia Valley. First recent record from Piedmont after those from XIX century (Re, 1805; Biroli, 1808, Pollini, 1824).
- Collema flaccidum* (Ach.) Ach. - **4, 7** - on epilithic mosses on walls (exp. E-SE). The last know record from Piedmont dates to 1910 (Martel, 1910).
- Collema polycarpon* Hoffm. ssp. *polycarpon* - **1** - on calcareous rocks. First punctual report for the Sesia Valley.
- Collema subflaccidum* Degel. - **8** - on bark of ash trees. Second record from Piedmont and the first recent one after that of Baglietto & Carestia (1880).
- Cornicularia normoerica* (Gunnerus) Du Rietz - **12, 13** - found on siliceous rocks (gneisses) often in *Umbilicaria* dominated communities.
- Cypselium tigillare* (Ach.) Ach. - **1** - rare on the trunk of *Larix*, NW exposed.
- Dermatocarpon miniatum* (L.) W. Mann - **2, 5, 7** - on rocks and walls from mixed forests to pastures with southerly exposure.
- \*\**Dermatocarpon rivulorum* (Arnold) Dalla Torre & Sarnth. - **3** - on gneiss partially submerged. New to Piedmont. According to Piervittori & Isocrono (1999) the record of Cengia-Sambo (1933) accepted by Nimis (1993) for the Region refers to a locality in the Aosta Valley.
- Dibaesis baeomyces* (L. f.) Rambold & Hertel - **1, 3** - [revidit: P.L. Nimis] often sterile on soil above treeline.
- Dimelaena oreina* (Ach.) Norman - **9** - on steeply inclined surfaces (70-90°) of siliceous rocks.
- \**Diploschistes actinostomus* (Ach.) Zahlbr. - **11** - on weathering rocks in larch forests with prevailing southern exposure. This record, new to Sesia Valley, is also the second for Piedmont.
- Diploschistes scruposus* (Schreb.) Norman - **1, 2** - on rocks (micaschists) in pasturelands (exp. SE and W, incl. 45°).
- Evernia divaricata* (L.) Ach. - **4** - on ash branches along the river bank in hardwood forests.
- Evernia prunastri* (L.) Ach. - **1, 2, 3, 4, 5, 8, 11, 12, 13** - very common on *Larix* boles and branches with prevailing N-NW exposure. It was also found on *Betula alba*, *Fraxinus excelsior*, *F. ornus* and *Sorbus aria*.



- Graphis scripta* (L.) Ach. - **4, 7, 17** - on ash and beech trunks in hardwood forests and also on cultivated trees (*Pyrus communis*, *Juglans*, *Prunus cerasus*).
- Gyalecta jenensis* (Batsch) Zahlbr. - **10** - over bryophytes growing on sandstones. Previous reports date back to XIX century (Bellardi, 1788; Biroli, 1808; Baglietto & Carestia, 1867; 1880).
- \*\**Haematomma ochroleucum* v. *porphyrium* (Pers.) J. R. Laundon - **17** - on *Acer pseudoplatanus* near Corte village. New to Piedmont.
- Hyperphyscia adglutinata* (Flörke) H. Mayrhofer & Poelt - **17** - quite common on *Fraxinus excelsior* trunks.
- Hypocnomyce scalaris* (Lilj.) M. Choisy - **1, 2, 3, 8, 11, 12, 13** - always on *Larix* boles in woodlands.
- Hypogymnia physodes* (L.) Nyl. - **1, 2, 3, 11, 12, 13** - common on *Larix* trunks and branches mainly N exposed.
- \**Hypogymnia tubulosa* (Schaer.) Hav. - **2, 13** - on *Larix decidua* branches in woodlands. New to Sesia Valley.
- Imshaugia aleurites* (Ach.) S. Mey. - **13** - [revidit P. L. Nimis] on coniferous trunks, especially *Larix* (exp. NW). This is the first recent report for the region, it was formerly cited only once (Baglietto & Carestia, 1880, Riva in Valsesia).
- Lasallia pustulata* (L.) Mérat - **1, 12** - in coniferous forests on inclined siliceous rocks with prevailing SW-SE exposure.
- Lecania cyrtella* (Ach.) Th. Fr. - **8** - on base-rich barks of *Juglans regia*, *Fraxinus excelsior* and *Populus* spp.
- Lecania naegelii* (Hepp) Diederich & P. Boom - **17** - quite rare on *Fraxinus excelsior* trunk.
- Lecanora allophana* Nyl. - **16** - on trunks of *Juglans regia* trees.
- \**Lecanora argentata* (Ach.) Degelius - **4** - on the trunk of *Fraxinus excelsior* in hardwood forests near the river. New to Sesia Valley.
- Lecanora campestris* (Schaer.) Hue - **3** - on steeply inclined micaschists (90° exp. N) in pastures. First recent record for the Region.
- Lecanora carpinea* (L.) Vain. - **16** - on young trees of *Juglans*. Previously reported only from Sesia Valley without detailed indication of locality (Baglietto & Carestia, 1867, 1880).
- Lecanora cenisia* Ach. - **1** - on rocks (hard schists) (exp. E, incl. 90°) in coniferous forests.
- \**Lecanora chlarotera* Nyl. - **1, 3, 4, 5, 7, 12, 16, 17** - very common in coniferous and broad-leaved woodlands especially on bark and branches of *Larix*, *Fraxinus* spp., *Acer* spp., mainly E-NE exposed. New to Sesia Valley.
- Lecanora dispersoaeolata* (Schaer.) Lamy - **15** - on base rich siliceous rocks (micaceous gneisses). This is the first recent report from Piedmont region.
- Lecanora intricata* (Ach.) Ach. - **13** - on siliceous rocks (sheet silicate gneiss) above treeline.
- \**Lecanora leptyroides* (Nyl.) Degel. - **4** - on *Acer* sp. and *Fraxinus* trunk in a mixed hardwood forests. New to Sesia Valley.
- Lecanora muralis* (Schreb.) Rabenh. - **2, 4, 10** - on weekly inclined base-rich siliceous (micaschists) and calcareous (limestone) rocks in pastures, mainly S exposed. Also found on man-made substrata (Sacro Monte Sanctuary).
- \*\**Lecanora muralis* ssp. *dubyi* (Müll. Arg.) Poelt - **1, 12** - on weekly inclined micaschists near the upper border of coniferous woodlands. New to Piedmont.
- Lecanora polytropa* (Hoffm.) Rabenh. v. *polytropa* - **1, 2, 3, 10, 12, 13, 15** - very common on rocks (different gneiss types and quartzite) from coniferous forests to snow beds.

- Lecanora polytropa* v. *alpigena* (Ach.) Schaer. - **15** - on micaceous gneisses with albite sill in the alpine belt.
- Lecanora pulicaris* (Pers.) Ach. - **4** - on *Acer* and *Fraxinus* trunks in mixed forests.
- \*\**Lecanora silvae-nigrae* Wirth - **13** - on vertical faces of siliceous rock in pasturelands. New to Piedmont, third record for N-Italy; previously it was found in Aosta Valley (Piervittori *et al.*, 2004) Friuli (Tretiach & Hafellner, 2000).
- Lecanora swartzii* (Ach.) Ach. ssp. *swartzii* - **9** - on rocks (gneisses) above treeline.
- Lecidea atrobrunnea* (Lam. & DC.) Schaer. - **12** - on siliceous rocks.
- Lecidea auriculata* Th. Fr. - **12** - known only from the Alps, on siliceous rocks in pastures with prevailing southerly exposure.
- \*\**Lecidea cervinicola* de Lesd. - **12** - on gneisses in pasturelands. New to Piedmont.
- Lecidea confluens* (Weber) Ach. - **1, 2, 3, 12, 15** - frequent on rocks (hard, tabular and granets gneisses; micaschists; feldspatic and albite schists) in the alpine region, mainly SE exposed.
- Lecidea lapicida* (Ach.) Ach. v. *lapicida* - **3** - on siliceous rocks (hard gneisses, weathered gneisses with formation of Mn oxide, quartzite) in mixed forests.
- Lecidea lapicida* v. *pantherina* Ach. - **1, 15** - on granular acidic rocks and kinzigitic gneisses.
- \**Lecidella carpathica* Körb. - **1, 2, 9** - on rocks (granets gneisses, chlorite gneisses) in areas between coniferous forests and pastures. New to Sesia Valley.
- Lecidella elaeochroma* (Ach.) Haszl. - **4, 16, 17** - common on different broad-leaved trees (*Acer*, *Fraxinus*, *Juglans*) near villages or in open areas of the woods.
- Lecidoma demissum* (Rutstr.) Gotth. Schneid. & Hertel - **1** - [revidit: P.L.Nimis] on soil always above treeline. First recent record from Piedmont.
- Letharia vulpina* (L.) Hue - **2, 3, 12** - not very common on trunk and branches of *Larix*.
- Lobaria linita* (Ach.) Rabenh - **1, 14** - on saxicolous and terricolous mosses, mainly N exposed, in the alpine belt.
- \*\**Micarea adnata* Coppins - **3, 4** - mainly in woodlands on *Larix* stumps (esp. NW) and on trunks of *Fraxinus* near the river. First record from the Alps and the northernmost for Italy. Previously found only in Basilicata (Nimis & Tretiach, 1999) and Calabria (Puntillo, 1993).
- \*\**Nephroma expallidum* (Nyl.) Nyl. - **2** - [revidit: P.L.Nimis] on mosses (exp. W) in pastures. New to Piedmont. Second record for Italy after that of Nascimbene & Caniglia (2000).
- \*\**Nephroma parile* (Ach.) Ach. - **8** - on epilithic mosses in mixed wood. New to Piedmont.
- Ochrolechia alboflavescens* (Wulfen) Zahlbr. - **13** - [revidit: P.L. Nimis] on the trunk *Larix* (exp. NW) in woodlands.
- Opegrapha varia* Pers. - **17** - on isolated *Juglans regia* trees near the river.
- Ophioparma ventosa* (L.) Norman - **11** - on siliceous (gneiss) rock above treeline. First recent record from Piedmont, where however the species is frequent in the subalpine and alpine belts (unpublished data).
- Orphniospora mosigii* (Körb.) Hertel & Rambold - **4** - on siliceous rocks in pasturelands (exp. SE).
- Parmelia caperata* (L.) Ach. - **4, 5, 6, 7, 10, 11, 17** - very common from the lowlands to the montane belt on broad-leaved trees (*Acer pseudoplatanus*, *A. montanus*, *Betula alba*, *Castanea sativa*, *Fraxinus excelsior*, *Juglans regia*, *Prunus cerasus*, *Tilia cordata*) mainly E-SE exposed.
- Parmelia conspersa* (Ach.) Ach. - **1, 3, 5, 6, 7, 12** - frequent on rocks, mainly gneisses, from oroboreal to the alpine belt.



- \**Parmelia elegantula* (Zahlbr.) Szatala - **2** - on *Larix decidua* branches in woodlands. New to Sesia Valley.
- \**Parmelia exasperatula* Nyl. - **2, 6** - on branches of broad-leaved (*Tilia*) and coniferous (*Larix*) trees. New to Sesia Valley.
- Parmelia glabra* (Schaer.) Nyl. - **4, 16** - on *Fraxinus excelsior* trunks.
- \**Parmelia glabratula* (Lamy) Nyl. ssp. *glabratula* - **4, 5, 7, 10, 17** - both on trees (alder, ash, maple, birch) in open forests and on steeply inclined rocks. New to Sesia Valley.
- \*\**Parmelia incurva* (Pers.) Fr. - **1** - [revidit P. L. Nimis] on a vertical, E-exposed face of siliceous rock (tabular gneiss) in woodlands. New to Piedmont and to the Alps. Second record Italy after an old one from Emilia (Zanfrognini, 1902).
- \**Parmelia pastillifera* (Harm.) Schub. & Klem. - **5** - on alder trunk in hardwood forests. New to Sesia Valley. The distribution in Piedmont seems to be limited to lower montane belt (Caniglia *et al.*, 1992; Isocrono & Falletti, 1999).
- Parmelia pulla* Ach. s. lat. - **3, 4, 6, 8** - on siliceous rocks (gneisses and quartzite sill inside micaschists) from lowlands to coniferous forests with prevailing E-SE exposure.
- \*\**Parmelia revoluta* Flörke - **4** - on ash trunk at the border of a mixed hardwood forest. New to Piedmont. The record from Monte Rosa Massif (Baroni, 1892) accepted by Nimis (2003) for the Region refers to a locality in the Aosta Valley: "Valle di Gressoney, sui sassi sopra Gaby".
- Parmelia saxatilis* (L.) Ach. - **1, 2, 3, 5, 11, 13** - common both on inclined (from 45° to 90°) siliceous rocks (tabular gneiss) and on bark of *Larix* and *Betula alba* from coniferous forests to pastures above treeline.
- Parmelia somloensis* Gyeln. - **4, 10, 11** - on rocks and mosses (exp. SE) in mixed woods.
- \**Parmelia subaurifera* Nyl. - **5, 16** - on the trunk of *Larix* (exp. SW) in mixed coniferous wood and on an isolated *Juglans* near the village. New to Sesia Valley.
- \**Parmelia subrudecta* Nyl. - **6, 7, 10, 17** - on bark of broad-leaved trees (especially *Tilia cordata*, *Betula alba*, *Fraxinus excelsior*) below and in montane belt, mainly S exposed. New to Sesia Valley.
- Parmelia sulcata* Taylor - **1, 2, 4, 4, 5, 6, 11, 12, 13, 16** - very common on a wide range of trees (*Larix*, *Fraxinus* spp., *Prunus cerasus*, *Alnus* spp., *Tilia* spp., *Betula alba*, *Acer* spp., *Sorbus aria*) both on boles and branches. First detailed report from Valsesia; the previous one (Baglietto & Carestia, 1880) lacks of any geographical indications.
- Parmelia tiliacea* (Hoffm.) Ach. - **6, 16** - on trunks of *Tilia* and *Juglans* in the lower montane belt.
- \**Parmelia verruculifera* Nyl. - **4** - on rocks (diorite) in meadows. First recent record from Piedmont.
- Parmeliopsis ambigua* (Wulfen) Nyl. - **1, 2, 3, 5, 11, 12, 13** - frequent on the bases of *Larix* trunks in woodlands, mainly NW exposed.
- Peltigera canina* (L.) Willd. - **8** - [revidit: P.L. Nimis] on terricolous mosses in a mixed wood.
- \**Peltigera degenii* Gyeln. - **8** - [revidit: P.L. Nimis] on soil among mosses in a mixed wood. New to Sesia Valley. Second record from piedmont: formerly cited from the Region without indication of locality (Vitikainen, 1994).
- Peltigera didactyla* (With.) J. R. Laundon - **4** - on epilythic mosses.
- \**Peltigera elisabethae* Gyeln. - **4** - on soil. New to Sesia Valley.
- Peltigera horizontalis* (Huds.) Baumg. - **11** - on epilithic mosses (esp. SW) in a *Larix* forest.

- \*\**Peltigera membranacea* (Ach.) Nyl. - **12** - on mossy rocks in *Larix* woods. New to Piedmont. This species was rarely distinguished from *P. canina* in the earlier literature. Probably for this reason this species was not yet cited from the Region.
- Peltigera polydactyla* s. lat. - **4** - on mosses growing on horizontal surface of a wall.
- Peltigera rufescens* (Weiss) Humb. - **9** - on soil in stony meadows.
- Pertusaria albescens* (Huds.) M. Choisy & Werner - **4, 7, 8** - on trunks of broad-leaved trees, mainly *Fraxinus*, frequently found near rivers.
- \*\**Pertusaria flavida* (DC.) J. R. Laundon - **3** - rare on *Larix* trunk in open forests (exp. NW). New to Piedmont.
- \**Phaeophyscia chloantha* (Ach.) Moberg - **17** - found together with the next species on an isolated ash trees near the Corte village. New to Sesia Valley.
- Phaeophyscia orbicularis* (Neck.) Moberg - **16, 17** - common only below montane belt; on isolated *Juglans* and *Fraxinus*.
- \**Physcia adscendens* (Fr.) H. Olivier - **4, 7, 16, 17** - common on broad-leaved trees in *Xanthorion* communities. New to Sesia Valley.
- Physcia aipolia* (Humb.) Hampe - **8, 16** - on *Fraxinus* and *Juglans* trunks in mixed woods.
- Physcia albinea* (Ach.) Nyl. - **1** - certainly rare in Italy (Nimis, 2003), found only once on rocks.
- \**Physcia dubia* (Hoffm.) Lettau v. *dubia* - **6, 13** - both on rocks (schists) with eastern exposure and on lignum of *Larix*. New to Sesia Valley.
- Physconia distorta* (With.) J. R. Laundon - **8, 16, 17** - on *Fraxinus* and *Juglans*.
- Physconia muscigena* (Ach.) Poelt v. *muscigena* - **2** - on a mossy rock (exp. S, incl. 15°) in pasture.
- Placynthium nigrum* (Huds.) Gray - **10** - on made-man limestone and mortar in the Sacro Monte Monumental area.
- Polysporina simplex* (Davies) Vezda - **3** - on rock (hard gneiss) in pastures.
- Porpidia macrocarpa* (DC.) Hertel & A. J. Schwab - **3, 4, 11** - common on rocks, mainly gneisses, from *Larix* woods to pastures.
- Porpidia speirea* (Ach.) Kremp. - **1, 2, 13** - on rocks (hard gneiss, micaceous gneiss, micaschist, quartzite) from coniferous forests to pastures and stony slopes, mainly W-NW exposed.
- Protoparmelia badia* (Hoffm.) Hafellner - **1, 2, 14** - quite common on gneisses (exp. N-NW) in pastures and stony areas.
- \*\**Protoparmelia picea* auct. - **1** - on siliceous rock (gneiss). New to Piedmont. Second record from Italy where it is known only from the Alps.
- Pseudephebe pubescens* (L.) M. Choisy - **15** - on hard siliceous rocks, especially gneisses and quartz sills in the alpine belt.
- Pseudevernia furfuracea* (L.) Zopf v. *furfuracea* - **1, 5, 13** - common on *Larix* boles and branches both inside forests and on isolated trees.
- \**Pseudevernia furfuracea* v. *ceratea* (Ach.) D. Hawksw. - **1, 2, 3, 12, 13** - common on *Larix* boles and branches, mainly N exposed. New to Sesia Valley.
- Psilolechia lucida* (Ach.) M. Choisy - **4, 5, 6, 7, 8, 11, 12** - extremely common on rocks in shaded situations, on soil and tree roots.
- Ramalina farinacea* (L.) Ach. - **5** - on alder trunks in mixed woods.
- Ramalina pollinaria* (Westr.) Ach. - **4** - on steeply inclined surfaces of rocks (mica schists).
- Rhizocarpon geminatum* Körb. - **2** - on more or less horizontal rocks in pastures, mainly S exposed.
- Rhizocarpon geographicum* (L.) DC. s. lat. - **8, 9, 15** - on siliceous rocks.

- \**Rhizocarpon macrosporum* Räsänen - **2, 4, 12** - on horizontal siliceous rocks (exp. S) in pastures and in open areas of the forests. New to Sesia Valley. Second record from Piedmont after that of Runemarh (1956).
- Rhizocarpon polycarpum* (Hepp) Th.Fr. - **12** - on tabular gneiss in pastures. Second record for Piedmont and the first recent one.
- \**Rhizocarpon saanaense* Räsänen - **1, 2** - on rocks in pasturelands. New to Sesia Valley. Second record for Piedmont after that of Runemarh (1956).
- \*\**Rhizocarpon tinei* (Tornab.) Runemarh - **13** - on hard siliceous rock (quartzite) in coniferous forests. New to Piedmont.
- Rhizoplaca chrysoeluca* (Sm.) Zopf. - **2, 9** - on rocks and pebbles.
- Rinodina pyrina* (Ach.) Arnold - **4, 16** - on *Acer* and *Juglans* trunk near the border of a hardwood mixed forest.
- \**Sarcogyne privigna* (Ach.) A. Massal. - **14** - on mortar (exp. N-NE) of ski-lift ruins. New to Sesia Valley, first recent record for the Region.
- Schaereria fuscocinerea* (Nyl.) Clauzade & Cl. Roux - **1** - [revidit: P.L.Nimis] on rocks (quartzite) among *Rhododendron* in the alpine belt. First recent record from Piedmont after that of Stizenberger (1882) and Martel (1910).
- Solorina crocea* (L.) Ach. - **1, 9** - on soil among rocks (exp. W and N) in sites with a long snow-lie.
- Sporastatia testudinea* (Ach.) A. Massal. - **9, 12** - frequent on steeply inclined rocks (gneisses).
- Stereocaulon alpinum* Laurer - **12, 15** - on soil among rocks in the alpine belt.
- \*\**Strangospora moriformis* (Ach.) Stein - **13** - [revidit P.L. Nimis] found only once on bark of *Larix* (exp. NW). Apparently this species is rapidly declining over its entire range (Nimis, 1993). New to Piedmont.
- Tephromela atra* (Huds.) Hafellner v. *atra* - **1** - on steeply inclined rocks (tabular gneiss) (exp. E) in coniferous forests.
- Thamnolia vermicularis* (Sw.) Schaer. v. *vermicularis* - **10, 15** - on soil and in rock fissures.
- Trapeliopsis gelatinosa* (Flörke) Coppins & P. James - **12** - [revidit: P.L.Nimis] on soil in meadows above treeline. Second record for Piedmont and the first recent one.
- Trapeliopsis granulosa* (Hoffm.) Lumbsch - **5** - [revidit: P.L.Nimis] on acid soil in pastures.
- Tremolecia atrata* (Ach.) Hertel - **1, 13** - on rocks (gneiss, micaschist) from meadows to stony slopes.
- Umbilicaria crustulosa* (Ach.) Frey ssp. *crustulosa* v. *crustulosa* - **13** - on rocks, NW exposed.
- \**Umbilicaria crustulosa* ssp. *crustulosa* v. *badiofusca* Frey - **11** - on steeply inclined (90°) rocks (exp. SE) in mixed forests. New to Sesia Valley. Previously reported for the whole Region without indication of locality (Nimis, 1993).
- Umbilicaria cylindrica* (L.) Duby - **1, 2, 12 15** - common from the montane to alpine habitats on slightly inclined (5-40°) rocks.
- \**Umbilicaria cylindrica* v. *tornata* (Ach.) Nyl. - **3, 11 15** - on inclined rocks (from 45° to 90°) above treeline. New to Sesia Valley.
- Umbilicaria decussata* (Vill.) Zahlbr. - **15** - on rocks (micaceous gneiss with quartz).
- Umbilicaria deusta* (L.) Baumg. - **1, 2, 3, 11, 12** - very common on rocks (micaceous and hard gneiss) in different ecological situations from coniferous woods to scree areas.
- Umbilicaria hirsuta* (Westr.) Hoffm. - **11** - on almost vertical surfaces inside forests.

- \**Umbilicaria nylanderiana* (Zahlbr.) H. Magn. - **15** - found only once, on rocks at 3100 m. New to Sesia Valley. Second record for Piedmont after that from Susa Valley (Montacchini *et al.*, 1982).
- Umbilicaria torrefacta* (Lightf.) Schrad. - **15** - on rocks at 3100 m.
- \**Umbilicaria virginis* Schaer. - **2, 3** - This species, according to Nimis (2000) is strictly limited to the nival belt of the Alps. In the Sesia Valley it was found on siliceous rocks, mainly SE exposed, always above treeline. New to Sesia Valley. Second record from Piedmont after that from Susa Valley (Montacchini *et al.*, 1982).
- Verrucaria nigrescens* Pers. - **12, 13** - both in natural habitats (on calcareous rocks in pastures) and on man-made substrata (on marble handrail of Varallo Sacro Monte Church). First recent record from Piedmont.
- Vulpicida pinastri* (Scop.) Mattson & M. J. Lai - **1, 2, 3, 11, 13** - very common on bark and lignum of *Larix* both in open and closed forests, mainly N-NW exposed.
- Xanthoria elegans* Th.Fr. v. *elegans* - **11, 13, 14** - rather common on rocks (chlorite-schist) in pastures mainly S exposed.
- Xanthoria fallax* (Hepp) Arnold - **5, 8, 16, 17** - on trunks of deciduous trees, more frequent in the lower part of the Valley.
- Xanthoria parietina* (L.) Th. Fr. - **8, 6, 16, 17** - widespread on broad-leaved trees in the lower Valley.
- \*\**Xanthoria soreliata* (Vain.) Poelt - **13** - on rocks and on mountain hut walls (exp. SE). New to Piedmont.
- Xanthoria ulophyllodes* Räsänen - **16, 17** - on broad-leaved trees (esp. *Fraxinus* and *Juglans*) in the lower section of the Valley.

## DISCUSSION AND CONCLUSION

The list includes 191 infrageneric *taxa* from a total of 590 examined samples. The genera with greater specific richness are *Cladonia* (18) *Parmelia* (17) *Lecanora* (14) *Umbilicaria* (10) *Peltigera* (8) and *Rizocarpon* (7). Fifty-three (28.3% of the total) are new to the Sesia Valley; 20 of these (10.5% of the total) are also new to Piedmont, among which the finding of *Strangospora moriformis* was of particular interest. This species, collected in only one sample on the trunk of a larch tree in the upper Sesia Valley (1690 m), is considered as highly endangered because it reacts negatively to human activities (Nimis, 1993). The findings of *Nephroma expallidum*, *Parmelia incurva* and *Protoparmelia picea* confirm the presence of these species in Italy. Interesting was also to find in the Alps, *Micarea adnata*, a species that has recently been reported from the mountainous areas of Calabria (Puntillo, 1993) and Basilicata (Nimis & Tretiach, 1999). The investigation confirms the presence in Piedmont of 35 *taxa* which until now had only been known from old reports, mostly dating back to the second half of the XIX century. Twenty-fifth of these are also the second record for the Region. Among the *taxa* new to the Sesia Valley there is *Pseudevernia furfacea* v. *ceratea* which, despite being widespread, had not been previously distinguished.

The most common growth-forms are crustose (43%) followed by foliouse (39%) and fruticose (18%) lichens. Although most of the field work was carried

out in typically alpine environments, where the stress conditions should be more marked and selective, the flora encountered does not present the typical distinguishing features of pioneerism with a net dominance of crustose forms. The balance between the various growth forms could be determined by the area's climatic features (in particular high precipitation) which are more favourable to the development of lichen flora.

Correlating the distribution of lichens with the main substrata, it emerges that saxicolous lichens (47.3%) prevail over corticolous (27.5%), terricolous (23%) and lignicolous (1.6%). In particular rocky surfaces are the ideal substratum for the majority of species. In fact all growth forms are found on such surfaces. Particularly visible is the colonisation on trunks and branches of trees while epiphytic flora of shrubs proved to be less diversified. The development of terricolous and muscicolous forms is mainly due to the massive presence of species of the *Cladonia* both in larch woods and on stabilised moraines. In pasturelands terricolous lichens are poorly developed due to the high competition from phanerogamic species and to grazing, which is still practised in the area. The low number of lignicolous species could be correlated to the lack of suitable surfaces, which are reduced to a few stumps of *Larix* in the peripheral areas of woods.

In agreement with the climatic and geomorphological features of the study area, its lichen flora has a high incidence of hygrophilous and photophilous species (ecological indicator values as stated by Nimis, 2003). The high incidence of anitrophilous species indicates that the whole of the survey area has maintained its natural condition. Human activities and tourism would seem to have little impact on the environment as nitrophilous species are mostly present in environments with greater human pressure (Varallo and Valle Mastallone in the villages of Dovesio, Arboerio, Cervarolo, Valbella Inferiore and Valbella Superiore).

Finally the integration of field data with critically selected bibliographical information allows us to propose a synthetic picture of the altitudinal distribution of the individual *taxa* in the Sesia Valley (Fig. 2). The lichen flora generally follows the altitude zonation of the phanerogamic vegetation: each altitudinal belt is characterised by a group of species which are absent or scarcely represented in the others. In the montane belt characteristic epiphytic species are frequent, belonging to the genera *Parmelia* and *Physcia* plus species such as *Lecidella elaeochroma*, *Graphis scripta*, *Lecanora argentata* and *Rinodina pyrina*. The coniferous forests belt is characterised by species belonging to the genera *Hypogymnia*, *Parmeliopsis*, *Vulpicida* and *Pseudevernia*. There is a scarce presence of *Letharia vulpina* and *Usnea* sp. of which only small thalli were found. Terricolous populations of *Cladonia* are frequent in undergrowth as well as epilithic populations of *Umbilicaria*. Finally there is a number of species (8.1%) with alpine and nival characteristics such as *Cetraria nivalis*, *Thamnolia vermicularis*, *Solorina crocea*, *Stereocaulon alpinum* and *Lecidoma demissum* which were found exclusively on high altitude pasturelands and *Lecanora polytropa* v. *alpigena*, *L. dispersoareolata*, *L. swartzii* ssp. *swartzii*, *Lecidea confluens*, *Pseudephebe pubescens*, *Umbilicaria decussata*, *U. nylanderiana* and *U. torrefacta* the presence of which is particularly marked on rock outcrops.

The survey has enabled to consistently increase the degree of lichenological exploration of the Sesia Valley although the level of floristic knowledge still remains extremely variable (from zones with less than 10 reports to those with over 150). The areas which need further investigation are mainly located in the lower and middle valley (Fig. 3).



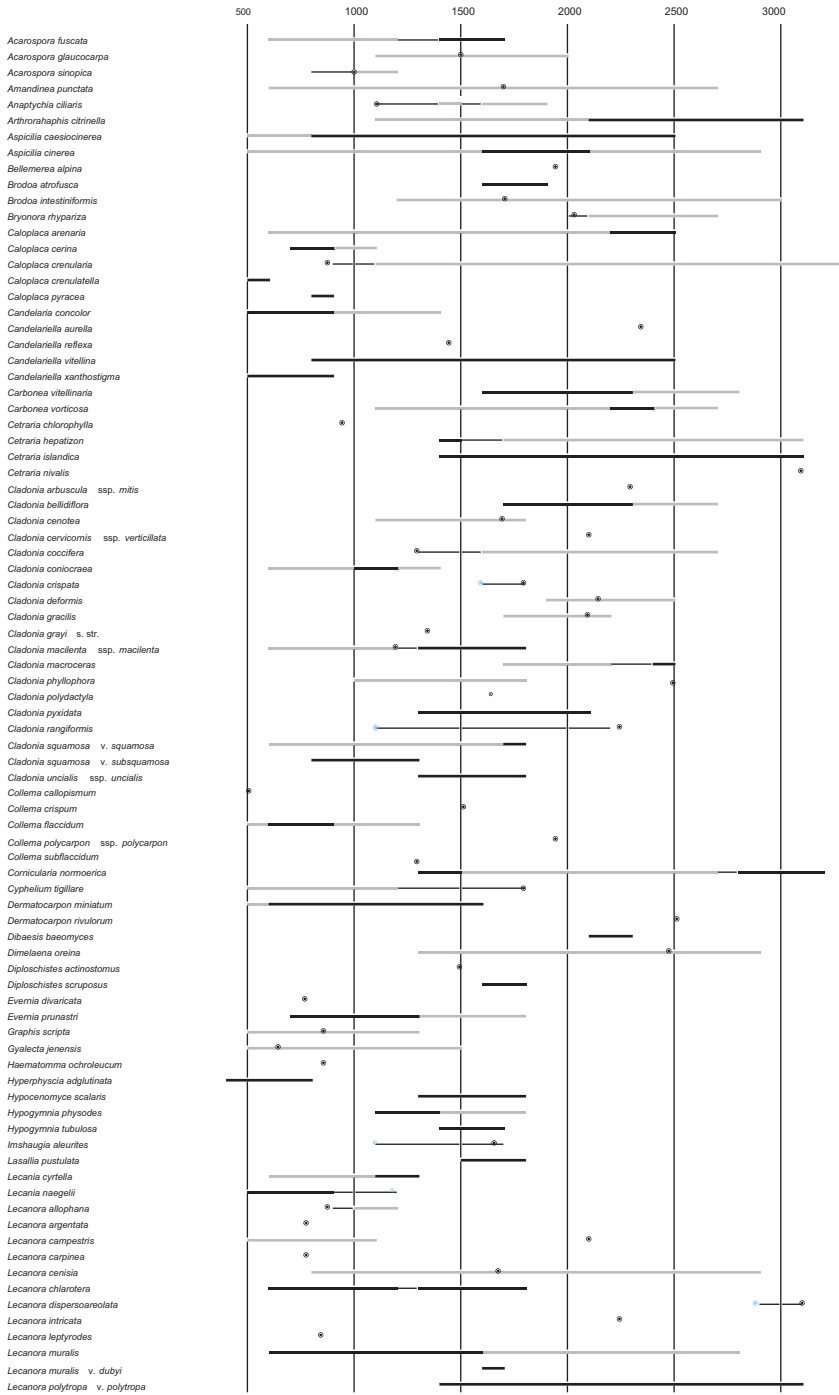


Fig. 2. Vertical distribution of lichen species collected in the Sesia Valley. The grey line shows literature data, black line field data.

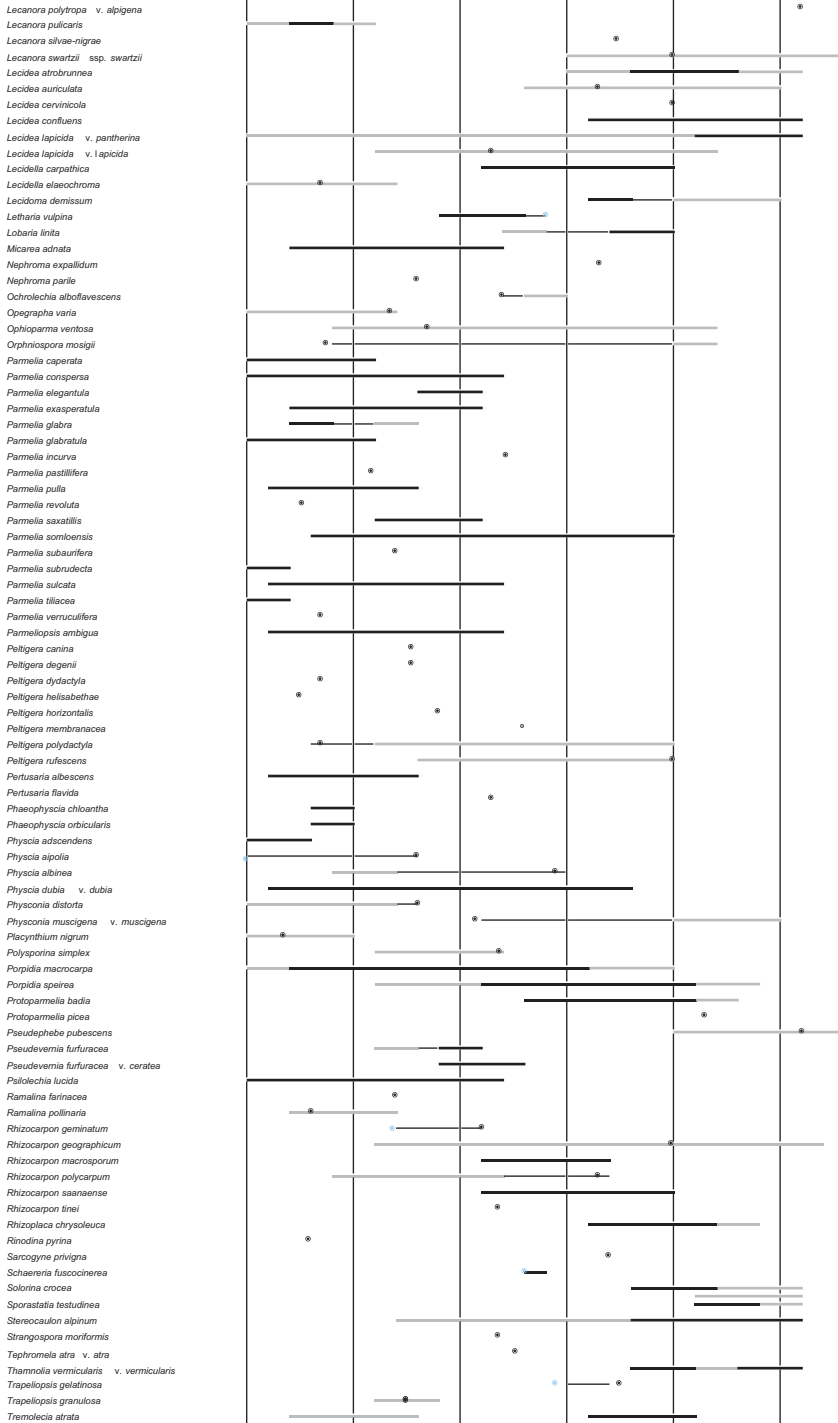


Fig. 2. Vertical distribution of lichen species collected in the Sesia Valley. The grey line shows literature data, black line field data. (Continued)

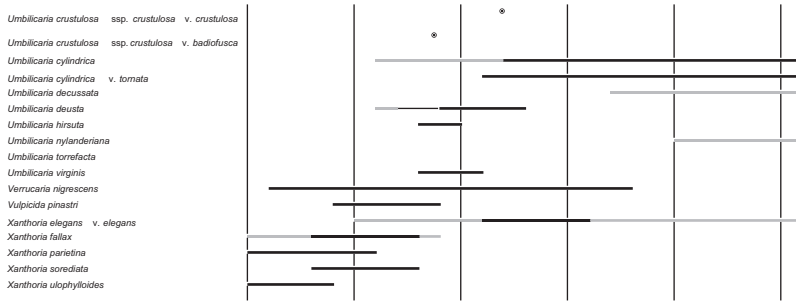


Fig. 2. Vertical distribution of lichen species collected in the Sesia Valley. The grey line shows literature data, black line field data. (Continued)

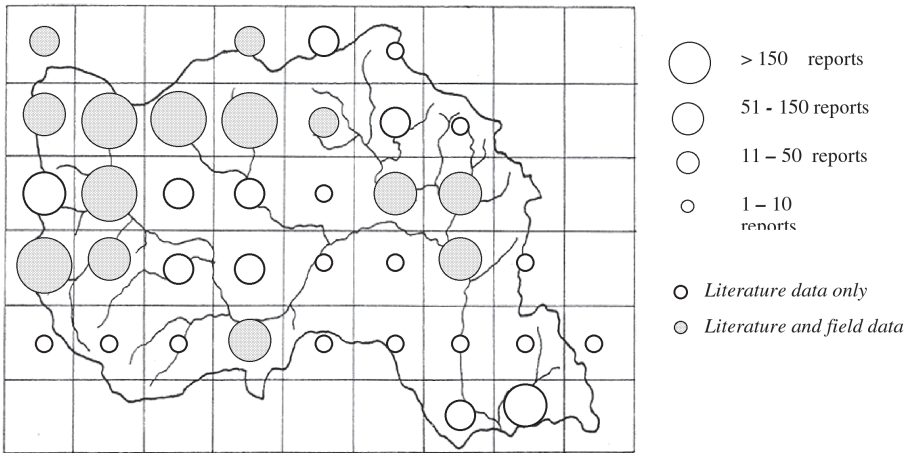


Fig. 3. Map of the exploration degree in the Sesia Valley (on the basis of 10 × 10 km squares).

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