

# The lichens of the plant communities in the middle reaches of the Uty River Valley

*Alena Sagalakova, Olga Zyryanova\*, Mariya Larina*

Khakas State University named after N.F. Katanov, 90 Lenin St., 655000 Abakan, Russia

**Abstract.** The article presents the data on the species communities situated in the middle reaches of the Uty river valley (Beisky District, Republic of Khakassia). The taxonomic list of lichens is represented by 51 taxa of a species rank belonging to 24 genera and 11 families. The largest number of species is characterized by the crustose life form. Mesophytes and epiphytes are predominant in the terms of ecological substrate.

## 1. Introduction

Lichens are a completely inimitable and extremely peculiar group of living organisms. They always attract attention, primarily because they grow in the places where other plants cannot grow and, therefore, they are called “pioneers” of vegetation. At the same time they remain a poorly studied group of plants [1]. Studying lichens is especially relevant as lichens are the most sensitive components of ecosystem due to the fact that even a moderate atmospheric pollution adversely affects them causing a certain reduction in species diversity and foliage projective cover up to the complete extinction of many species [2].

The Uty river is located in the Beisky District and forms the right tributary of the Abakan river. The valley vegetation is represented by bunchgrass, meadow and salt steppes, valley meadows, windbreaks and forest outliers.

According to the available literature there is no information on the studies of the species composition of lichens in the Uty river valley. In this regard, the species composition of lichens in the plant communities situated in the middle reaches of the Uty river valley has particular interest for further studies.

## 2. Material and methods

The materials for the study include the herbarium specimen of lichens collected by the authors in the middle reaches of the Uty river valley with the use of route method. The research was conducted on the southern slope of Mount Bolshaya, on the territory of the village Uty, in the floodplain of the Uty river, in the wood lines and on the different substrata. The material collection and herbarization was performed using the common method described in the second edition of Identification Guide to Lichens of the USSR "Morphology, Systematics and Geographical Distribution" [3]. Around 60 herbarium envelopes were collected and then processed in the Laboratory of the Khakas State

---

\* Corresponding author: [o\\_a\\_zyryanova@mail.ru](mailto:o_a_zyryanova@mail.ru)

University named after N.F. Katanov with the use of the microscope Mikromed-1 and binocular loupe MBS-2 with 10 % KOH solution. In order to identify the materials "Identification Guide to Lichens of the USSR" [4-7] and "Identification Guide to Lichens of Russia" [8-12] were used. The life forms and ecological groups were identified on the basis of the personal observations of the authors and according to the literary sources [13].

### 3. Results and discussion

The species diversity of lichens in the middle reaches of the Uty river valley is represented by 11 families, 24 genera, including 51 species: *Cyphelium tigillare* (Ach.) Ach., *Candelaria concolor* (Dick.) Stein., *Candelariella aurella* (Hoffm.) Zahlbr., *C. vitellina* (Hoffm.) Müll. Arg., *C. xanthostigma* (Ach.) Lettau., *Cladonia pocillum* (Ach.) Grognot., *Cl. pyxidata* (L.) Hoffm., *Aspicilia cinerea* (L) Körb. *A. maculata* (H. Magn.) Oxner., *A. transbaicalia* Oxner., *Lecanora bolcana* Pollini., *L. campestris* (Schaer.) Hue., *L. cenisia* Ach., *L. crenulata* Hook., *L. dispersa* (Pers.) Sommerf., *L. frustulosa* (Dicks.) Ach., *L. hageni* Ach., *L. subfusca* Ach., *Lecidella euphorea* (Flörke) Hertel., *Rhizoplaca chrysoleuca* (Sm.) Zopf., *Rh. melanophthalma* (DC.) Leuckert et Poelt. *Rh. peltata* (Ramond) Leuckert et Poelt., *Flavoparmelia caperata* (L.) Hale., *Flavopunctelia soledica* (Nyl.) Hale, *Melanelia tomini* (Oxner) Essl., *Parmelia cetrata* Müll. Arg., *P. olivacea* (L.) Essl., *P. sulcata* Taylor., *Parmeliopsis ambigua* (Wulfen) Nyl., *Photoparmeliopsis muralis* (Schreb.) M.Choisy., *Xanthoparmelia camtschadalis* (Ach.) Hale., *X. conspersa* (Ach.) Hale., *X. somloënsis* (Gyeln.) Hale., *Pertusaria pertusa* (Weigel) Tuck., *Buellia insignis* (Naegeli ex Hepp) Körb., *Diplotomma albostratum* (Hoffm.) Flot., *Phaeophyscia sguarrosa* Hale., *Physcia aipolia* (Ehrh. ex Humb.) Fűrmr., *Ph. albinea* (Ach.) Nyl., *Ph. caesia* (Hoffm.) Fűrmr., *Ph. leptalea* (Ach.) DC., *Physcia obscura* (Aht.) Rabenh., *Ph. stellaris* (L.) Nyl., *Ph. tenella* (Scop.) DC., *Rinodina septentrionalis* Malme., *Psora decipiens* (Hedw.) Hoffm., *Rhizocarpon disporum* (Nageli ex Hepp.) Müll. Arg., *Caloplaca ferruginea* (Huds.) Th. Fr., *C. flavorubescens* (Huds.) J. R. Laundon., *C. pellodella* (Nyl.) Hasse., *Xanthoria elegans* (Link) Th.Fr.

The average number of species in a family is approximately equal to 4.6, while 3 families have values above this indicator and considered dominant. They include Lecanoraceae Körb. (12; 23.5 %), Physciaceae Zahlbr. and Parmeliaceae Zenker (11 species; 21.5 %). Candelariaceae Hakul. и Teloschistaceae Zahlbr include 4 species (7.8 % each). There are also 3 single-species families on the studied territory which make 5.8 % of the total species number.

The high position in the flora composition of Lecanoraceae Körb., Teloschistaceae Zahlbr. families is characteristic of the arid regions flora in the Holarctic [14]. At the same time a significant content of Parmeliaceae Zenker. and Physciaceae Zahlbr families makes it similar to the boreal floras of the Holarctic.

The detailed layout of lichenoflora can be inferred by the spectrum of the most-represented genera in the terms of species.

The average number of species in genus is 2.17. There are 7 dominant genera exceeding this value and accounting for 68.6 % of the total species number. The largest number of species belongs to the genus of *Lecanora* (Ach.) Th. Fr. with 8 species which make 15.6 %. The representatives of these species typically include the steppe species, as, for example, *Lecanora crenulata* and *L. frustulosa*. The next genus in terms of number is *Physcia* (Schreb.) Michx. having 7 species which make 13.7 %. The typical representatives are *Physcia stellaris* and *Ph. tenella* located on the bodies of the deciduous trees, especially on birches.

The genera *Aspicilia* A. Massal., *Rhizoplaca* Zopf, *Parmelia* Ach., *Caloplaca* Th. Fr. and *Xanthoparmelia* (Vain.) Hale have 3 species which make 29.4 % of the total species

number. The predominance of the mentioned genera indicates that the studied area is located in the steppe belt.

There are 13 (24.7 %) single-species genera within the territory of the Uty river valley.

The biomorphological analysis has shown that the most species of lichens have a crustose form of thallus. They are 26 in number which is 51% of the total species number.

This number includes such species as *Candelariella aurella*, *Protoparmeliopsis muralis*, *Lecanora crenulata* and others. The number of species having a foliose form of thallus within the studied area is 22, which is 43.1 %. This number includes such species as *Xanthoparmelia somloënsis*, *Physcia stellaris*, *Parmeliopsis ambigua*, *Xanthoparmelia conspersa* and others. The lichens having a fruticose form of thallus are represented by 3 species which makes 5.9 % from the total number of the collected species. *Aspicilia transbaicalica* have a dwarf-fruticose form, but nevertheless the authors classified it as fruticose type.

In view of the fact that crustose lichens hold the dominant position, according to the classification by A.N. Oksner [3], in addition to the three main types one can distinguish their biomorphs characterized as more fractional. They include areolate-crustose, granular-crustose and scaly-crustose lichens. The largest number of lichens among crustose type found in the middle reaches of the Uty river valley has the areolate (areolate-crustose) type of thallus and they are mainly confined to the stony substrate of the steppe and forest-steppe zones.

To characterize the ecological structure of lichens the authors used the data on the lichens tolerance to humidity, thermal regime, and snow cover thickness according to the work of N.V. Sedelnikova [13]. As a result, all collected lichens were divided into 3 ecological groups. The ecological group of mesophytes includes 29 species which is 57 % of the total number. These are all species of the genus *Physcia*, as well as species such as *Rhizocarpon disporum*, *Pertusaria pertusa*, *Lecidella euphorea* and others. The group of xerophytes includes 18 species which is 35.3 % and comprises such species as *Aspicilia maculata*, *Lecanora campestris*, *Lecanora subfusca* and others. The smallest number is represented by the group of xerocryophytes of 4 species which is 7.8 %. This group includes species from the genus *Rhizoplaca* and *Melanelia tomini*.

According to the substrate analysis it is established that lichens located within the studied area prefer a stony (26.5 %) and woody (21.4 %) types of substrate. Only 4 species grow on the soil which is 7.8 % of the total species number. The largest number of epilithic and epiphytic lichens is characteristic of the studied area since the steppe type of vegetation with wood lines, planted with poplars is considered predominant. Besides, a dominant group of epiphytic lichens can be found right there. There are also stony steppes serving a substrate for epilithic lichens.

## 5. Conclusion

The territory under study belongs to the steppe zone, where fruticose lichens are not large in number. This fact for its part confirms our analysis on the life forms of lichens.

The studies were supported by the RFBR projects 18-04-00633 and 18-44-190007 p\_a.

## References

1. T.N. Pystina. *Botany problems at a boundary 20-21 cent.*, **2** (St. Petersburg, 1998)
2. A.V. Altyunnikova, V.V. Reutskaya, *Actual problems of environmental protection and environmental management* (Stavropol, 2014)

3. A.N. Oksner. *Identification Guide to Lichens of the USSR*, **2** (Science, Leningrad, 1974)
4. *Identification Guide to Lichens of the USSR*, **1** (Science, Leningrad, 1971)
5. *Identification Guide to Lichens of the USSR*, **3** (Science, Leningrad, 1975)
6. *Identification Guide to Lichens of the USSR*, **4** (Science, Leningrad, 1977)
7. *Identification Guide to Lichens of the USSR*, **5** (Science, Leningrad, 1978)
8. *Identification Guide to Lichens of Russia*, **6** (Science, St. Petersburg, 1996)
9. *Identification Guide to Lichens of Russia*, **7** (Science, St. Petersburg, 1998)
10. *Identification Guide to Lichens of Russia*, **8** (Science, St. Petersburg, 2003)
11. *Identification Guide to Lichens of Russia*, **9** (Science, St. Petersburg, 2004)
12. *Identification Guide to Lichens of Russia*, **10** (Science, St. Petersburg, 2008)
13. N.V. Sedelnikova, *Lichens of Altai and Kuznetsk highlands: Summary of flora* (Science, Novosibirsk, 1990)
14. N.S. Golubkova, *Analysis of lichen flora of Mongolia* (L., Science, 1983)