

## **Biogeographical complements for *Seligeria carniolica* and *S. irrigata* (Bryophyta, Seligeriaceae)**

Marc PHILIPPE<sup>a\*</sup> & Ryszard OCHYRA<sup>b</sup>

<sup>a</sup>Université Lyon 1 and CNRS – UMR5023, 7 rue Dubois,  
F-69622 Villeurbanne Cedex, France

<sup>b</sup>Department of Bryology, W. Szafer Institute of Botany,  
Polish Academy of Sciences, ul. Lubicz 46, 31-512 Kraków, Poland

**Abstract** – New distributional data from France for two European endemic species, *Seligeria carniolica* and *S. irrigata*, are provided. The latter is new to France and this discovery significantly extends its current geographical range. The former is red-listed as an endangered endemic species in Europe and for a long time it was known only from some widely distributed isolated localities but nowadays it appears to be quite well represented in eastern France. The biogeography of these two species is discussed and *S. carniolica*, formerly considered as a boreal-montane suboceanic element, could be better designated as a Perialpine species with disjunct, highly isolated occurrences in northern Europe and in the Balkan Peninsula. *Seligeria irrigata* is primarily an Alpine species with some isolated localities in the Western Carpathians of Slovakia and in the Abruzzean Apennine Mountains in Italy.

**Alps / calcicoles / distribution / endemics / Europe/ France / mosses / saxicoles**

**Résumé** – De nouvelles données chorologiques sont apportées pour la France au sujet de deux espèces endémiques européennes, *Seligeria carniolica* et *S. irrigata*. Cette dernière est nouvelle pour la France et sa découverte élargit considérablement sa distribution géographique connue. La première est listée pour l'Europe comme endémique « en danger » ; pendant longtemps elle n'a été connue de quelques localités isolées dans une aire vaste, alors que maintenant il est montré qu'elle est bien représentée dans l'Est de la France. Les biogéographies de ces deux espèces sont discutées et *S. carniolica*, auparavant considérée comme un élément boréal-montagnard subocéanique, pourrait être mieux qualifiée comme une espèce périalpine avec des localités disjointes hautement isolées en Europe du nord et dans les Balkans. *Seligeria irrigata* est principalement une espèce alpine, avec des localités isolées dans les Carpates occidentales de Slovaquie et dans les Apennins abruzzes en Italie.

**Alpes / calcicoles / distribution / endémiques / Europe / France / mousses / saxicoles**

### **INTRODUCTION**

Directed prospecting can greatly improve our understanding of the distribution of rare bryophytic taxa. For example, when applied to *Buxbaumia viridis* (Moug. ex Lam. & DC.) Brid. ex Moug. & Nestl. in France it allowed the discovery

\* Corresponding author: marc.philippe@univ-lyon1.fr

of this red-listed species (Schumacker & Martiny, 1995; Hodgetts, 2015) from five French administrative departments, in addition to the 17 in which its occurrence was documented (Philippe, 2007).

Similarly, after the fortuitous discovery of another red-listed species, *Seligeria carniolica* (Breidl. & Beck) Nyholm in the French Jura Mountains (Philippe & André, 2014), such targeted surveying was performed in the Southern Jura, which resulted in the discovery of six additional populations (Philippe & Hugonnot, 2016, and unpublished data). The species was formerly known in France only from the Jura Mountains (Dirkse *et al.*, 1990).

This paper aims to provide the floristic results of our directed prospecting in another mountainous area, the French Alps, to contribute with relevant observations on the discoveries, and to discuss the biogeographical implications for the species found.

## MATERIAL AND METHODS

Prospecting was focused searching for *Seligeria carniolica* in the French Alps, trying to document the species from as much departments as possible.

Geographically, in France the Alps are a crescent-shaped set of mountains stretching from Geneva to Nice, over eight departments, namely from the north the Haute-Savoie, southwards through the Savoie, the Isère, the Drôme, the Vaucluse, the Haute-Alpes, the Alpes-de-Haute-Provence and the Alpes-Maritimes. Biogeographically the French Alps are usually divided into the Southern Alps (Var, Durance, and Drôme watersheds) and the Northern Alps (Ozenda, 1966) by an important biogeographical line known as the “*ligne des grands cols*” (*litt.* high pass line), south of which biotas are marked by Mediterranean summer drought. Geologically, eventually, the Alps *sensu stricto* are limited westward by a large overthrust fault system. The numerous mountain ranges encountered west of this frontal fault, although geographically belonging to the Alps, are better qualified as perialpine (Pomerol, 1975).

Within the French Alps our searches were focused on these perialpine massifs as there Mesozoic sediments dominated by marls and limestone largely crop out, a context similar to that of the Jura Mountains. We investigated six of these perialpine massifs: Les Bauges (Haute-Savoie and Savoie), La Chartreuse (Savoie – Isère), Le Dévoluy (Isère – Drôme – Hautes-Alpes), Le Saou (Drôme), La Blanche (Alpes-de-Haute-Provence) and the Haute-Tinée (Alpes-Maritimes).

Steep gullies cutting through Jurassic and Early Cretaceous strata and drained by permanent, but not too erosive, streams were mostly targeted taking into consideration the ecology described for *S. carniolica*. According to Dirkse *et al.* (1990), Hallingbäck *et al.* (2006) and Philippe & André (2014), it is a calcareous species growing on limestone, on inclined to subvertical rock faces that are throughout most of the year washed by a thin film of carbonated water, within a millimeter thin calcite encrusted microbial mat; other environmental factors are more variable and, at least in France, the species is also more heliophilous than most of the other congeners and hitherto it has not yet been recorded at an elevation above 1000 m a.s.l.

Seven days of field work were dedicated to this research, between February and July 2016, using a touch-and-go method, i.e. as soon that the species was found in a department further research was continued in another.

The nomenclature follows Ros *et al.* (2007) for hepatics, Ros *et al.* (2013) for mosses, Ochyra & Gos (1992) for the *Seligeria* species not included in the latter reference, and Ochyra (2013) for the genus *Torrentaria* Ochyra.

The voucher specimens are kept in the Herbiers de l'Université Claude Bernard, Lyon 1, Villeurbanne, France (LY) and in the W. Szafer Institute of Botany of the Polish Academy of Sciences, Kraków, Poland (KRAM).

## RESULTS

Six new discoveries of *Seligeria carniolica* in four French departments (Haute-Savoie, Savoie, Isère and Drôme) were obtained, belonging to three perialpine massifs: Le Saou, la Chartreuse and Les Bauges. Subsequently, a single population of *S. irrigata*, a species reported here for the first time from France, was discovered in the department des Hautes-Alpes, région Provence-Alpes-Côte d'Azur.

### *Seligeria carniolica* (Breidl. & Beck) Nyholm

#### Région Auvergne-Rhône-Alpes

Département de Haute-Savoie, commune de Giez, Nant du Contial, 617 m a.s.l., 45°44'51.2"N, 6°14'30.1"E, on Lower Oxfordian pelitic limestone splashed with the water of a torrent, in a steep shady gully, embedded in a bacterial mat encrusted by calcite crystals, 15.07.2016, *Philippe s.n.* (LY0006756); about one hundred sporophytes.

Département de Savoie, commune de Montagnole, Nant du Gorgeat, 805 m a.s.l., 45°30'31.8"N, 5°53'21.1"E, on Upper Berriasian marly limestone of an oozing rocky bank, embedded in a bacterial mat encrusted by calcite crystals, 14.07.2016, *Philippe s.n.* (LY0006754); no sporophytes; commune de Saint-Cassin, Nant du Gorgeat, 845 m a.s.l., 45°30'27.9"N, 5°53'28.7"E, on Upper Berriasian limestone of a steep bank, splashed with water, half-shaded, embedded in a bacterial mat encrusted by calcite crystals, 14.07.2016, *Philippe s.n.* (LY0006752), about ten sporophytes; commune d'Apremont, Nant du Rousselet, 908 m a.s.l., 45°30'1.8"N, 5°54'49.4"E, on an oozing bank cut through Middle Berriasian marls, half-shaded, embedded in a bacterial mat encrusted by calcite crystals, 14.07.2016, *Philippe s.n.* (LY0006753); about ten sporophytes.

Département de l'Isère, commune de Chapareillan, Nant de Sale Froide, 940 m a.s.l., 45°26'18.4"N, 5°57'23.4"E, on a boulder of Lower Berriasian pelitic limestone splashed with water, along a small stream in a beech forest, embedded in a bacterial mat encrusted by calcite crystals, 14.07.2016, *Philippe s.n.* (LY0006755); about one hundred sporophytes.

Département de la Drôme, commune d'Espenel, ravin de Combe Crose, 555 m a.s.l., 44°40'27.5"N, 5°15'7.9"E, on oozing Oxfordian marly limestones in a steep gully, along a small temporary stream in an oak forest, embedded in a bacterial mat encrusted by calcite crystals, 17.02.2016, *Philippe s.n.* (LY0006751); about one hundred sporophytes. Somewhat upstream, about 50 m higher, *S. carniolica* was found again, with about ten sporophytes, associated with *S. trifaria* var. *longifolia* (Lindb. ex Broth.) Ochyra & L.Gos.

Table 1. Current distribution of *Seligeria carniolica* in France

| <i>Municipality (commune)</i> | <i>Department</i> | <i>Natural region</i> | <i>Literature source</i>             |
|-------------------------------|-------------------|-----------------------|--------------------------------------|
| Ornans                        | Doubs             | Jura Mountains        | Dirkse <i>et al.</i> (1990)          |
| Vuillafans                    | Doubs             | Jura Mountains        | Philippe & André (2014)              |
| Nans-sous-Ste-Anne            | Doubs             | Jura Mountains        | Philippe & André (2014)              |
| Saint-Claude                  | Jura              | Jura Mountains        | Philippe & André (2014)              |
| Argis                         | Ain               | Jura Mountains        | Philippe & Hugonnot (2016)           |
| Arrandas                      | Ain               | Jura Mountains        | Philippe & Hugonnot (2016)           |
| Innimont                      | Ain               | Jura Mountains        | Philippe & Hugonnot (2016)           |
| St-Rambert-en-Bugey           | Ain               | Jura Mountains        | Philippe & Hugonnot (2016)           |
| Amans                         | Ain               | Jura Mountains        | Philippe & Hugonnot (2016)           |
| Desvres                       | Pas-de-Calais     | Boulonnais            | Anonymous (2015), Chruslinski (2015) |
| Espenel                       | Drôme             | Le Saou               | This paper; LY0006751                |
| Saint-Cassin                  | Savoie            | La Chartreuse         | This paper; LY0006752                |
| Apremont                      | Savoie            | La Chartreuse         | This paper; LY0006753                |
| Montagnole                    | Savoie            | La Chartreuse         | This paper; LY0006754                |
| Chapareillan                  | Isère             | La Chartreuse         | This paper; LY0006755                |
| Giez                          | Haute-Savoie      | Les Bauges            | This paper; LY0006756                |

Despite the same observation emphasis (about 3.5 days of field work), *S. carniolica* was not found in the Southern Alps in France during this prospecting. The current distribution of the species in France is summarized in Table 1.

### *Seligeria irrigata* (H.Paul) Ochyra & L.Gos

#### Région Provence-Alpes-Côte d'Azur

Département des Hautes-Alpes, canton de Saint-Bonnet-en-Champsaur, commune de Le Noyer; Pisse Sainte-Catherine waterfall in massif of Dévoluy between Gap and Grenoble, 1400 m a.s.l., 44°40'17.7"N, 6°00'13.4"E, on Upper Jurassic (Oxfordian-Kimmeridgian) pelitic marly limestone splashed with water, at the foot of a waterfall, embedded in a bacterial mat filled with 10-12 µm calcite crystals, 25.07.2016, *Philippe s.n.*, conf. R. Ochyra (KRAM B-227165; LY0006757) (Fig. 1).

These north-facing cliffs are sprayed by a permanent 40 m high waterfall (Figs 2-3), the flow of which is quite variable. After the first 5-10 m cascade the water hits a cliff projection. From there, at least during the summer, the water flows as a film on the pelitic marly limestone. The stone is a hard micritic limestone with some clay content but without dolomitization. Probably because of much more intense washing during the spring and autumn, the cliffs bear only scant vegetation. This is limited to a few isolated stems of *Jungermannia atrovirens* Dumort., dwarf *Eucladium verticillatum* (With.) Bruch & Schimp., and clumps with some shoots of *Torrentaria riparioides* (Hedw.) Ochyra. In somewhat sheltered cracks, only two taxa of *Seligeria* were found, namely *S. irrigata* and *S. trifaria* var. *longifolia*.

The last both taxa of *Seligeria* are morphologically very similar, the latter being somewhat larger and having markedly falcate-secund leaves which, in the former, are nearly straight (Ochyra & Gos, 1992). However, microscopic examination shows that these species are unmistakable and are easily separated by leaf areolation

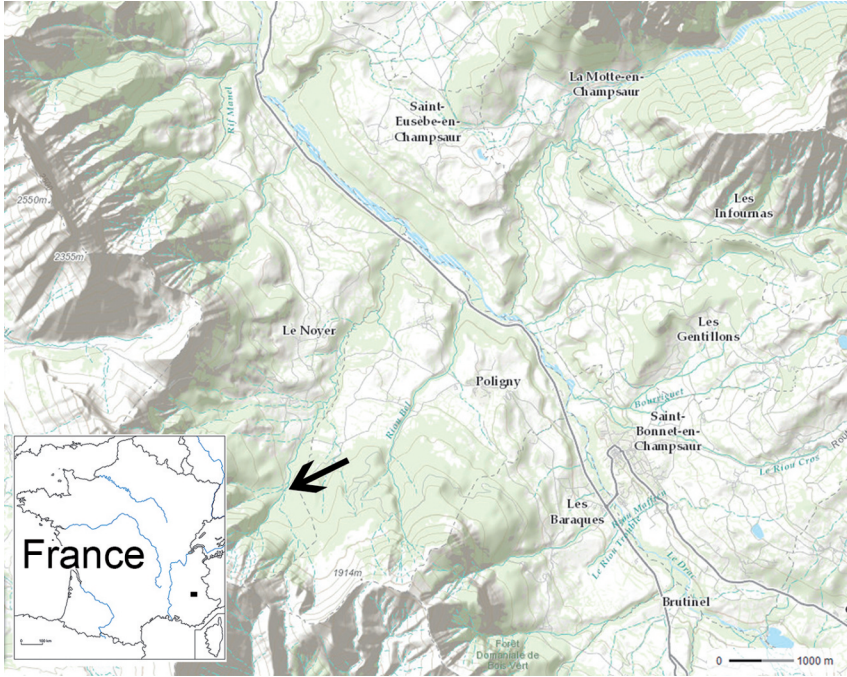


Fig. 1. Geographical situation of the French locality of *Seligeria irrigata* in the Région Provence-Alpes-Côte d'Azur, département des Hautes-Alpes, canton de Saint-Bonnet-en-Champsaur, commune de Le Noyer. The locality is pointed by the tip of the arrow. Map background © IGN.



Figs 2-3. *Seligeria irrigata* habitat in the commune de Le Noyer, France. 2. General view of the Pisse Sainte-Catherine waterfall in massif du Dévoluy, ca. 40 m high. 3. Close-up with the crack (arrow) where *S. irrigata* and *S. trifaria* var. *longifolia* were observed.

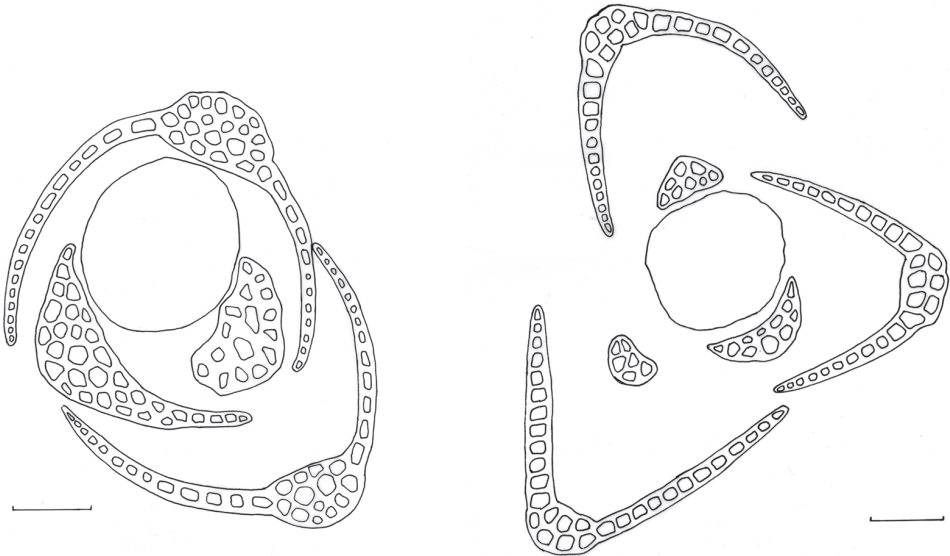


Fig. 4. Leafy shoots cross-sections of *Seligeria irrigata* (left; from LY0006757) and *S. trifaria* var. *longifolia* (right; from LY0006758). Note that these superficially similar looking species display obvious differences with *S. irrigata* having 4(5)-stratified nerve while *S. trifaria* nerve is bistratose. Scale bars = 100  $\mu$ m.

and costal anatomy, *S. irrigata* having more elongate leaf cells and a 4-5-stratose costa (Ochyra & Gos, 1992; Fig. 4). In sterile state both taxa turn look superficially similar to *S. carniolica* in having elongated dark-green to brownish leaves caught within the oozing substrate, within a mineralized biofilm. However *S. carniolica* is clearly larger and with even more falcate-secund leaves than *S. irrigata*.

An updated list of currently known records of *S. irrigata* is presented in Table 2.

Table 2. Chronological list of currently known records of *Seligeria irrigata*

| State/Region                                  | Country  | Literature source                |
|---|----------|----------------------------------|
| Upper Austria                                 | Austria  | Ochyra & Gos (1992)              |
| Bavaria                                       | Germany  | Ochyra & Gos (1992)              |
| Žilina  | Slovakia | Ochyra & Gos (1992)              |
| Carinthia, Salzburg, Styria and Upper Austria | Austria  | Grims (1999)                     |
| Upper Austria                                 | Austria  | Schlüsslmayr (2005)              |
| Bavaria                                       | Germany  | Meinunger & Schröder (2007)      |
| Carinthia                                     | Austria  | Köckinger <i>et al.</i> (2008)   |
| Trentino-Alto Adige                           | Italy    | Ellis <i>et al.</i> (2011)       |
| Lower Austria                                 | Austria  | Zechmeister <i>et al.</i> (2013) |
| Abruzzo                                       | Italy    | Ellis <i>et al.</i> (2014a)      |
| Provence-Alpes-Côte d'Azur                    | France   | This paper                       |

## DISCUSSION

Distribution of *Seligeria* species in France was reappraised by Boudier & Pierrot (1992; 1993). However, they did not consider *S. carniolica*, because it was placed in the separate genus *Trochobryum* Breidl. & Beck, nor *S. irrigata* which was then still a completely overlooked taxon (Ochyra & Gos, 1992). At present *S. carniolica* has been recorded in France from sixteen sites, six of which are reported herein for the first time. This is the highest number of populations of *S. carniolica* which have been controlled in the present century and this number sharply contrasts with the three small populations verified recently elsewhere in Europe, including Roxburgshire in Scotland, Northumberland in England and Öland in Sweden (Porley, 2013).

All the species of *Seligeria* sect. *Trochobryum* (Breidl. & Beck) Nyholm, namely *S. carniolica*, *S. irrigata* and *S. oelandica* C.E.O.Jensen & Medelius (Nyholm, 1987; Ochyra & Gos, 1992), have a distribution pattern covering the Alps; *S. carniolica* and *S. oelandica*, are also known from Scandinavia and the north of Britain (Hallingbäck *et al.*, 2006). The latter species has a wider geographical range, which covers Europe (Ochyra, 1991), Alaska, the Yukon, Northwest Territories and Québec in North America (Vitt, 1976; Faubert, 2013) as well as Chukotka in Arctic Asia (Afonina, 2004) and the Krasnoyarsk Territory in Siberia, also in Asia (Ellis *et al.*, 2014b). In contrast, *S. carniolica* is a European endemic (Hallingbäck *et al.*, 2006). Although the ranges of the species of sect. *Trochobryum* somewhat overlap, *S. carniolica* and *S. irrigata* are definitely more southerly species than *S. oelandica*.

*Seligeria carniolica*, described from Slovenia (Breidler & Beck, 1885) and later reported from Serbia (Wettstein, 1890), the Zurich region in the Alps of Switzerland (Culmann, 1901), and Allgäu in Germany (Poelt, 1950), was considered as an endemic of the Alps (Wettstein, 1890; Herzog, 1926; Poelt, 1950). Subsequently it was discovered in Britain (Warburg, 1949; Loble, 1965; Long, 1976) and Scandinavia (Pettersson, 1950; Coker, 1983) which led to be considered as a species with a disjunct distribution (Gams, 1951). More recently it was found in Karwendel, Austria (Dirkse *et al.*, 1990), and branded as a boreo-montane sub-oceanic element (Smith, 2004; Porley, 2013). The discovery of the numerous new localities of the species in the French Alps, at several of which were found large populations with numerous mature sporophytes, indicates that *S. carniolica* has an optimum occurrence in the perialpine massifs with Mesozoic carbonated rocks, at relatively low altitudes. Although associated with semi-aquatic habitats, the species is not particularly oceanic and thrives under clearly continental (Karwendel, Austria) or sub-mediterranean (Drôme, France) climate. Although prospecting emphasis is still limited, *S. carniolica* is not yet reported south of the “*ligne des grands cols*”. It might thus avoid areas under the influence of Mediterranean climates. The recent discovery of the species at a low altitude (below 100 m a.s.l.) in northern France (Anonymous, 2015; Chruslinski, 2015) shows it is not restricted to mountains.

The new localities in the Alps suggest that *Seligeria carniolica* should be better considered as a Perialpine species, with some disjunct localities in Northern Europe, especially on the Baltic islands and in the British Isles (Dahl, 1998). A number of disjunct thermophilic species occur on these islands and they are better interpreted as relicts from Early-Mid Holocene warmer periods, rather than late glacial relicts (Dahl, 1998). These biogeographical considerations have important implications for the conservation status of this red-listed European endemic. France clearly has much responsibility in ensuring the conservation of the species. None of the populations observed in the French Alps seemed to be threatened in the short term.

Likewise, the discovery of a new population of *S. irrigata* in the French Alps forces the reconsideration of its biogeography. Originally, it was described from a narrow area in the Berchtesgadener Alps in south-eastern Bavaria, Germany (Ochyra & Gos, 1992). Now this species is documented to occur across the Alps with some isolated occurrences in the Western Carpathians of Slovakia and the Central Apennines in Italy (Table 2). It is interpreted as an Alpine species.

**Acknowledgements.** We are much indebted to Prof. Dr. Rodney D. Seppelt, Arundel, Australia, for kindly improving the English text and valuable suggestions and to H el ene Chruslinki and Jean-Michel Lecron for sharing information. Thanks are due to Vincent Hugonnot, an anonymous referee, as well as editor Dr. Rosa Mar a Ros for valuable suggestions. The work of the second author was supported through the statutory fund of the W. Szafer Institute of Botany of the Polish Academy of Sciences.

## REFERENCES

- AFONINA O.M., 2004 — *Moss flora of Chukotka*. Sankt-Peterburg, Rossiyskaya Akademiya Nauk, Botanicheskiy Institut im. V. L. Komarova, 260 p. (in Russian).
- ANONYMOUS, 2015 — La For t de Desvres n'avait pas encore livr  tous ses secrets... *Nos actualit s, conservatoire botanique national de Bailleul*, available at <http://www.cbnbl.org/le-cbnbl/nos-actualites/article/La-For-et-de-Desvres-n-avait-pas>, downloaded on 24 October 2016.
- BOUDIER P. & PIERROT R.-B., 1992 — Contribution   l' tude des esp ces europ ennes du genre *Seligeria* B. S. & G. (Musci), part I. *Bulletin de la soci t  botanique du Centre-Ouest* 23: 479-490.
- BOUDIER P. & PIERROT R.-B., 1993 — Contribution   l' tude des esp ces europ ennes du genre *Seligeria* B. S. & G. (Musci), part II. *Bulletin de la soci t  botanique du Centre-Ouest* 24: 515-529.
- BREIDLER J. & BECK G., 1885 — *Trochobryum novum* genus Seligeriacearum. *Verhandlungen der kaiserlich-k niglichen zoologische-botanischen Gesellschaft in Wien* 34: 105-106 + pl. iii.
- CHRUSLINSKI H., 2015 — *Contribution   l'inventaire des bryophytes aquatiques et hydrophiles de la r gion nord - Pas-de-Calais. Etude des communaut s bryophytiques li es aux sources et ruisseaux infraforestiers*. M moire pr sent  en vue de l'obtention du Master 1 Ecologie op rationnelle, Les Facult s de l'Universit  catholique de Lille, 48 p. + 20 p. (10 annexes). Available at <http://digitale.cbnbl.org/documents/CRP1087.pdf>, downloaded on 24 October 2016.
- COKER P.D., 1983 — *Seligeria carniolica* (Breidl. & Beck) Nyh. and *S. oelandica* C. Jens. & Med.; two mosses new to Norway. *Lindbergia* 9: 81-85.
- CULMANN P., 1901 — Verzeichnis der Laubmoose des Kantons Z rich. *Mitteilungen der naturwissenschaftlichen Gesellschaft in Winterthur* 3: 3-79.
- DAHL E., 1998 — *The phytogeography of northern Europe*. Cambridge, New York, Cambridge University Press, xii + 297 p.
- DIRKSE G., RUTJES J.J., SIEBEL H. & ZIELMAN R., 1990 — *Trochobryum carniolicum* Breidler & Beck (Musci, Seligeriace s), nouveau pour la France et l'Autriche. *Cryptogamie, Bryologie, Lich nologie* 11(4): 385-389.
- ELLIS L.T., AKHOONDI DARZIKOLAEI S., SHIRZADIAN S., BAKALIN V.A., BEDNAREK-OCHYRA H., OCHYRA R., CLARO D., DULIN M.V., ECKEL P.M., ERZBERGER P., EZIZ R., SULAYMAN M., GARCIA C., S RGIO C., STOW S., HEDDERSON T., HEDEN S L., K RSCHNER H., LI W., NEBEL M., NIEUWKOOP J., PHILIPPOV D.A., PL SEK V., SAWICKI J., SCH FER-VERWIMP A., S TEF NU  S. & V NA J., 2011 — New national and regional bryophyte records, 29. *Journal of bryology* 33(4): 316-323.
- ELLIS L.T., ALEFFI M., TACCHI R., ALEGRO A., ALONSO M., ASTHANA A.K., SAHU V., BIASUSO A.B., CALLAGHAN D.A., EZER T., KARA R., GARILLETI R., GIL-L PEZ M.J., GWYNNNE-EVANS D., HEDDERSON T.A., KIEBACHER T., LARRA N J., LONG D., L TH M., MALCOLM B., MAMONTOV Y.S., NEWSHAM K.K., NOBIS M., NOWAK A., OCHYRA R., PAWLKOWSKI P., PL SEK V.,  HAL L., POTEKIN A.D., PUCHE F., RIOS D., GALLEGU M.T., GUERRA J., SAWICKI J., SCH FER-VERWIMP A., SEGARRA-MORAGUES J.G., S GOTA V., SOFRONOVA E.V., S TEF NU  S., SZ CS P.,



- BIDLÓ A., PAPP B., SZURDOKI E., TAN B.C., VÁŇA J., VIGALONDO B., DRAPER I., LARA F., YOON Y.-J., SUN B.-Y. & NISHIMURA N., 2014a — New national and regional bryophyte records, 41. *Journal of bryology* 36(4): 306-324.
- ELLIS L.T., AFONINA O.M., ASTHANA A.K., GUPTA R., SAHU V., NATH V., BATAN N., BEDNAREK-OCHYRA H., BENITEZ A., ERZBERGER P., FEDOSOV V.E., GÓRSKI P., GRADSTEIN S.R., GREMMEN N., HALLINGBÄCK T., HAGSTRÖM M., KÖCKINGER H., LÉBOUVIER M., MEINUNGER L., NEMETH C., NOBIS M., NOWAK A., ÖZDEMİR T., PANTOVIĆ J., SABOVLJEVIĆ A., SABOVLJEVIĆ M.S., PAWLIKOWSKI P., PLÁŠEK V., ČIHAL L., SAWICKI J., SÉRGIO C., MINISTRO P., GARCIA C.A., SMITH V.R., ŞTEFĂNUŢ S., STOW S., SUAREZ G.M., FLORES J.R., THOUVENOT L., VÁŇA J., VAN ROOY J. & ZANDER R.H., 2014b — New national and regional bryophyte records, 39. *Journal of bryology* 35(2): 134-151.
- FAUBERT J., 2013 — *Flore des bryophytes du Québec-Labrador*. Volume 2: Mousses, première partie. Saint-Valérien, Société québécoise de bryologie, xiv + 400 p.
- GAMS H., 1951 — Zur Verbreitungsgeschichte von *Trochobryum carniolicum*. *Botaniska notiser* 104: 47-49.
- GRIMS F., 1999 — *Die Laubmoose Österreichs. Catalogus Florae Austriae, II. Teil, Bryophyten (Moose). Heft 1, Musci (Laubmoose)*. Wien, Österreichische Akademie der Wissenschaften, vii + 418 p.
- HALLINGBÄCK T., LÖNNELL N., WEIBULL H. & HEDENÄS L. 2006 — *Nationalnyckeln till Sveriges flora och fauna. Bladmossor: Sköldmossor – blåmossor. Bryophyta: Buxbaumia – Leucobryum*. Uppsala, ArtDatabanken, Sveriges lantbruksuniversitet, 416 p.
- HERZOG T., 1926 — *Geographie der Moose*. Jena, Verlag von Gustav Fischer, 440 p. + Taf. 8.
- HODGETTS N.G., 2015 — *Checklist and country status of European bryophytes: towards a new Red List for Europe*. Irish Wildlife Manuals, 84. Ireland, National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, 215 p.
- KÖCKINGER H., SUANJAK M., SCHRIEBL A., SCHRÖCK C., 2008 — *Die Moose Kärntens. Sonderreihe Natur Kärnten, 4. Klagenfurt, Naturwissenschaftlichen Vereins für Kärnten*, 320 p.
- LOBLEY E.M., 1965 — *Trochobryum carniolicum* Breidl. & Beck in England. *Transactions of the British bryological society* 4: 828-830.
- LONG D.G., 1976 — Natural history observations during 1976. *History of the Berwickshire naturalists* 40(3): 197.
- MEINUNGER L. & SCHRÖDER W., 2007 — *Verbreitungsatlas der Moose Deutschlands. 2, Akrokarpe Laubmoose: Andreaeaceae bis Splachnaceae*. Regensburg, Regensburgische Botanische Gesellschaft, 699 p.
- NYHOLM E.C., 1987 — *Illustrated flora of Nordic mosses*. Fasc 1. Fissidentaceae – Seligeriaceae. Copenhagen – Lund, Nordic Bryological Society, 72 p.
- OCHYRA R., 1991 — *Seligeria oelandica*, a phytogeographically interesting moss newly recorded from Central Europe. *Folia geobotanica et phytotaxonomica* 26: 181-191.
- OCHYRA R. & GOS L., 1992 — A new species of *Seligeria* (Musci, Seligeriaceae) from Central Europe. *Fragmenta floristica et geobotanica* 37(2): 371-378.
- OCHYRA R., 2013 — The new generic name *Torrentaria*, a nomenclatural consequence of the legitimacy of *Platyhypnum* and the illegitimacy of *Platyhypnidium* (Bryophyta). *Nova Hedwigia* 96: 205-212.
- OZENDA P., 1966 — Perspectives nouvelles pour l'étude phytogéographique des Alpes du Sud. *Documents pour la carte de la végétation des Alpes* 4: 7-198.
- PETTERSON B., 1950 — *Trochobryum carniolicum*: eine seltene Laubmoosart mit disjunkter Verbreitung in Schweden gefunden. *Botaniska notiser* 103: 61-68.
- PHILIPPE M., 2007 — Actualisation des données sur la distribution de la mousse *Buxbaumia viridis* (Moug. ex Lam. et DC) Brid. ex Moug. & Nestl. en France. *Journal de botanique* 38: 3-10.
- PHILIPPE M. & ANDRÉ M., 2014 — *Seligeria carniolica* (Breidl. & Beck) Nyholm, nouvelles localités jurassiennes. *Nouvelles archives de la flore jurassienne et du nord-est de la France* 12: 62-67.
- PHILIPPE M. & HUGONNOT V., 2016 — Deux espèces de *Seligeria* (Seligeriaceae, Muscinées) nouvelles pour le département de l'Ain (France). *Bulletin mensuel de la société linnéenne de Lyon* 85(3-4): 93-98.
- POELT J., 1950 — *Trochobryum carniolicum* in Südbayern. *Bericht der naturforschenden Gesellschaft Augsburg* 1950: 55-56.
- POMEROL C., 1975 — *Ere Mésozoïque, stratigraphie et paléogéographie*. Paris, Douin, 383 p.
- PORLEY R.D., 2013 — *England's rare mosses and liverworts*. Princeton, Princeton University Press, 224 p.

- ROS R.M., MAZIMPAKA V., ABOU-SALAMA U., ALEFFI D M., BLOCKEEL T.L., BRUGUÉS M., CANO M.J., CROS R.M., DIA M.G., DRAPER I., EL-SAADAWI W., ERDAĞ A., GANEVA A., GONZÁLEZ-MANCEBO J.M., HERRNSTADT I., KHALIL K., KÜRSCHNER H., LANFRANCO E., LOSADA-LIMA A., REFAI M.S., RODRÍGUEZ-NUÑEZ S., SABOVLJEVIĆ M., SÉRGIO C., SHABBARA H.M., SIM-SIM M. & SÖDERSTRÖM L., 2007 — Hepatics and Anthocerotales of the Mediterranean, an annotated checklist. *Cryptogamie, Bryologie* 28: 351-437.
- ROS R.M., MAZIMPAKA V., ABOU-SALAMA U., ALEFFI D M., BLOCKEEL T.L., BRUGUÉS M., CROS R.M., DIA M.G., DIRKSE G.M., DRAPER I., EL-SAADAWI W., ERDAĞ A., GANEVA A., GABRIEL R., GONZÁLEZ-MANCEBO J.M., GRANGER C., HERRNSTADT I., HUGONNOT V., KHALIL K., KÜRSCHNER H., LOSADA-LIMA A., LUÍS L., MIFSUD S., PRIVITERA M., PUGLISI M., SABOVLJEVIĆ M., SÉRGIO C., SHABBARA H.M., SIM-SIM M., SOTIAUX A., TACCHI R., VANDERPOORTEN A. & WERNER O., 2013 — Mosses of the Mediterranean, an annotated checklist. *Cryptogamie, Bryologie* 34: 99-283.
- SCHLÜSSLMAYR G., 2005 — Soziologische Moosflora des südöstlichen Oberösterreich. *Stapfia* 84: 1-695.
- SCHUMACKER R. & MARTINY P., 1995 — Red Data Book of European bryophytes. Part 2: Threatened bryophytes in Europe including Macaronesia. In: The European Committee for Conservation of Bryophytes (ed.), *Red Data Book of European bryophytes*. Trondheim, The European Committee for Conservation of Bryophytes, pp. 29-193.
- SMITH A.J.E., 2004 — *The moss flora of Britain and Ireland*, Ed. 2. Cambridge, Cambridge University Press, 1012 p.
- VITT D.H., 1976 — The genus *Seligeria* in North America. *Lindbergia* 3(3-4): 241-275.
- WARBURG E.F., 1949 — *Trochobryum carniolicum* new to British Isles. *Transactions of the British bryological society* 1(3): 199-201.
- WETTSTEIN R. 1890 — Über das Vorkommen von *Trochobryum carniolicum* in Südserbien. *Österreichische botanische Zeitschrift* 40(4): 170-171.
- ZECHMEISTER H., HAGEL H., GENDO A., OSVALDIK V., PATEK M., PRINZ M., SCHRÖCK C., KÖCKINGER H., 2013 — Rote Liste der Moose Niederösterreichs. *Wissenschaftlichen Mitteilungen des niederösterreichischen Landesmuseum* 24: 7-126.