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BRYOLOGICAL RESEARCH OF CROATIA – A HISTORICAL OVERVIEW

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Croatia has a long history of bryological research, started in the first decades of the 19th century. However, the research activities were mostly sporadic and occasional, with only a few comprehensive works on the subject. After the peak at the end of the 19th and the beginning of the 20th century, a new wave of bryological works in the 1950s and 1960s were mostly focusing on karst rivers. Most data appeared in Pavletić's Prodromus (published in 1955) more like a summation of several previous species lists, containing relatively few new records. With regard to the current situation of Croatian bryology, renewed field research is urgently needed to assess the real status of the bryophyte flora of Croatia.

Key words: bryophytes, flora, liverworts, mosses, SE Europe

INTRODUCTION

Croatia is a southeastern European country at the crossroads of Central Europe, the Balkans and the Mediterranean. The country covers 56,594 km^2, with three main biogeographical regions: 1) Pannonian, 2) Dinaric Montane (with the highest mountains Dinara 1,831 m a.s.l., Biokovo 1,762 m a.s.l. and Velebit 1,757 m. a.s.l.) and 3) Adriatic Coastal with over 1,000 islands. The last two are characterised by a wide range of karstic phenomena and belong to the Dinaric mountain system. The Pannonian region is a lowland, mostly on Neocene alluvial deposits, stretching between the Drava and Sava rivers, containing a few low, mainly siliceous mountains, partly built of very old Palaeozoic rocks. Such a geographical, geological and climatic diversity resulted in one of the highest levels of biodiversity in Europe. With the vascular flora counting 4,275 species and 1,072 subspecies (altogether 5,347 taxa), Croatia is the third richest country regarding its flora in Europe after Slovenia and Albania (Nikolić 2001). Nevertheless, almost every year new plant species are reported from Croatia.

At present the bryophyte flora counts 474 species of mosses (Sabovljević *et al.* 2008), 153 species of liverworts and two species of hornworts (Sabovljević 2003).

However, the bryoflora is insufficiently known (cf. Sabovljević *et al.* 2011) and some recent studies based on field research will add many new species for the country.

This paper attempts to provide a historical overview of bryological research in Croatia, and it will be shown that the peak of research takes us back to the end of the 19th and beginning of the 20th century. It is also evident that new studies are of urgent importance for either the basic knowledge, nature conservation or several applied disciplines.

HISTORICAL OVERVIEW

As part of the Austro-Hungarian Monarchy, during the 19th and early 20th century Croatia had been mostly researched by bryologists from Vienna and Budapest. The Croatian coastline was especially interesting for them, where some of the early explorers spent their holidays collecting plant material. Therefore, some of the earliest findings refer just to the coastal parts. Hoppe and Hornschuh (1817–18) quote findings from Istria in the early 19th century; Host (1831) gave us the first records from the continental parts of Croatia. Early references are very sporadic, *e.g.* Petter (1832) quoted only one liverwort from the surroundings of the town of Split and Biasoletto (1841) only mentioned *Cinclidotus aquaticus* from the Krka river. Rabenhorst (1844–53) has provided data only from Istria. Sendtner (1848, 1857) broadened the area of investigation from Istria to the Quarnero islands and Dalmatia. Sardagna (1861) collected the most common bryophytes on Mt Biokovo, Unger (1866) recorded several species from the islands of Korčula and Lokrum, and Weiss (1866, 1867) published his findings from the surroundings of Pula and Dubrovnik, as well as from the island of Mljet. Klinggräff (1861) gave us the first comprehensive list from the continental part of Croatia, including that from the surrounding of Zagreb (89 mosses and 31 liverworts). He is followed by Heinz (1887, 1888) who published a longer list of mosses from the surroundings of Zagreb (97 mosses and 43 liverworts) with species descriptions, analytical keys and the first set of Croatian bryological terms. In the same era the investigation of Slavonia begun with Schulzer v. Müggenburg *et al.* (1866), Knapp (1866) and Stoizner (1870). After that period of time, almost all subsequent investigations until the end of the monarchy refer to the coastal parts of Croatia. The island of Krk was researched by Cubich (Kubić) (1874); Tommassini prepared a species list for Istria (published in Freyn 1877); Matcovich (Matković) (1877, 1879) published a bryophyte record for the town of Fiume/Rijeka. Istria and Dalmatia were further researched by Solla (1891), Kern (1896), Glowacki (1902), Loitlesberger (1905, 1909), Matouschek (1900, 1901, 1904, 1905), Hruby (1912), Janchen and Watzl (1908), Forenbacher (1911), and Latzel (1914).

However, the most important researchers of that period were Baumgartner and Schiffner. Schiffner worked on hepatics and published the first records in 1897, followed by another in 1902. In 1906 he lists 38 additional species (Schiffner 1906), among them 18 as being new for this region and two newly described: *Riccia levieri* and *Cephaloziella baumgartneri*. Schiffner succeeded with his publications in 1909*a* (44 species from Istria and Dalmatia), 1910, 1914, and 1915*a*, *b* (island of Rab and islands of southern Dalmatia). The most comprehensive papers are those from 1909*b* and 1916*a* (Hepaticae Latzelianae I and II) and from 1916*b*, *c*, and 1918 (Hepaticae Baumgartnerianae I, II and III). In Hepaticae Latzelianae he cites 69 species from Dalmatia (until 1906 only 20 species were known from that region); and 13 species were listed in Hepaticae Baumgartnerianae I from the Dalmatian mountains (Dinara, Troglav, Biokovo, Mosor, Svilaja and some others), whereas 39 species in Part II from the islands of southern Dalmatia and 27 species in Part III from the surroundings of the town of Zadar. Moreover, he edited a list of 80 hepatics in Degen's Flora Velebitica (Degen 1938).

On the other side Baumgartner amassed a large collection from all parts of the Croatian coast (Istria, Mt Učka, Quarnero with the islands, Mt Velebit, the Dalmatian mountains and islands), but he published only a small part of his findings, mostly as contributions to publications of other authors. Some of his most important findings were published in Ginzberger (1915), Degen (1938, where he listed over 350 species for the Mt Velebit), Onno (1948), and others.

During the intensive research of the coastal parts of Croatia, the continental areas were mostly neglected. Mágocsy-Dietz (1908) published 14 hepatics and 75 mosses from the towns of Karlovac, Zagreb, Samobor, Ogulin, Lokve and Rijeka. In 1913 Košćec published his findings from the Čazma river (Košćec 1913) and Rossi from the Plješevica Mt (Rossi 1913). These parts were more intensively researched between the two world wars. Pevalek (1925*a*) published an overview on the bogs in Croatia and (Pevalek 1925*b*) on the mechanisms of tufa formation at Lakes Plitvice induced also by mosses. Pichler (1928, 1931) made comprehensive lists of peat mosses, and a list of hepatics on decaying wood (Pichler 1939). Very important is the comprehensive work of Horvat (1932), a result of 13-year work. He gave us the first bryogeography of Croatia, the first attempt of the description of the bryophyte vegetation alongside a list of 81 liverworts and 247 mosses with localities from all parts of Croatia. Boros (1924) quotes a few species from the Drava (river) valley, Szepesfalvi (1931) from southern Dalmatia, Latzel (1934) from the Baranja region; Kušan (1938) reported some epiphytic species, and Soklić (1943) published seven species from the sandy habitats in the Podravina region.

Between the two world wars the researches of the coastal parts of Croatia were continued. Morton (1914, 1929, 1930) cited a dozen species of mosses for

the island of Cres. Very important is the comprehensive publication of Latzel (1931), in which all previous data on liverworts of Dalmatia was summarised with literature citations, and many newly discovered species were added with a total of 308 species listed. Podpěra (1942–51) published data concerning the distribution of *Bryum* species, mostly in littoral Croatia, based on herbarium collections of various sources.

In 1955 Pavletić published the until now most comprehensive work on the bryophytes of Croatia (i.e. former Yugoslavia). In his "Prodromus flore briofita Jugoslavije" (Pavletić 1955*a*) he summarised all published data about the bryophytes and their distribution with author citations. In the following year Pavletić (1956*a*) published the bryoflora of the town of Karlovac based on Rossi's collection and a series of papers concerning the bryophytes in karst rivers (Pavletić 1955*b*, 1956*b*, *c*, *d*, *e*, 1957*a*, *b*, 1959, 1960*a*, *b*, Pavletić and Grom 1958, Pavletić and Matoničkin 1961, Matoničkin and Pavletić 1959*a*, *b*, 1962, 1963*a*, *b*, 1964). In 1968 he published "Flora mahovina Jugoslavije", a flora of Yugoslav bryophytes with determination keys (Pavletić 1968). Boros (1968) published a short list of species found on specific siliceous habitats in Samoborsko gorje (mountain) with two hepatics new for Croatia. After that only a few general species lists appeared based on published records, and containing no (or only a small amount of) new data (Martinčič 1968, Düll *et al.* 1999, Sabovljević 2003, Sabovljević and Natcheva 2006, Sabovljević *et al.* 2008). The only one exception is the paper of Bischler and Jovet-Ast (1973) dealing with hepatics of coastal parts of Croatia (Istria, Dalmatian coast and some islands). One of the newest contributions (Papp and Sabovljević 2009) deals with the revision of herbarium material deposited in the Bryophyte Collection of the Hungarian Natural History Museum (BP). Recently, the Croatian bryoflora was elevated to general analyses in the context of the Balkan Peninsula and Europe (Sabovljević *et al.* 2011); very recently, two new species were reported (Alegro *et al.* 2012, Modrić Surina *et al.* 2012).

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