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Fungi of the genus *Ramularia* of the Słowiński National Park

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In the years 1996-98 and 2001, the occurrence of fungi of the genus *Ramularia* in 11 plant associations of the Słowiński National Park (north-western Poland) was investigated. The plant associations included: *Angelico-Cirsietum oleracei*, *Betulo pendulae-Quercetum roboris*, *Carici arenariae-Empetretum nigri* (*CaEn*), *Elymo-Ammophiletum* (*EA*), *Empetro nigri-Pinetum*, *Filipendulo-Geranietum*, *Helichryso-Jasionetum litoralis*, *Myrico-Salicetum auritae* (*MSa*), *Phragmitetum australis* (*Pa*), *Ribeso nigri-Alnetum*, and *Vaccinio uliginosi-Betuletum pubescentis*. A total of 37 species of *Ramularia* were found. Of them, *R. galli* was newly found in Poland, and *R. archangelicae*, *R. calcea*, *R. chamaedryos*, *R. cynarae*, *R. didymarioides*, *R. lactea*, *R. rhaetica*, *R. schulzeri*, *R. tanaceti*, and *R. triboutiana* were earlier infrequently recorded in this country. Eight *Ramularia* taxa were found on plants earlier not reported to be their hosts, i. e., *Ramularia chaerophylli* (on *Chaerophyllum temulum*), *R. lamii* var. *lamii* (*Galeopsis tetrahit*), *R. inaequale* (*Hieracium laevigatum*, *H. sabaudum* and *Hypochoeris radicata*), *R. schulzeri* (*Lotus uliginosus*), *R. grevilleana* var. *grevilleana* (*Potentilla erecta*), *R. uredinis* (*Pucciniastrum vaccinii* z *Vaccinium uliginosum*), *R. lactea* (*Viola palustris* and *V. tricolor*) and *R. veronicae* (*Veronica arvensis*). Most species of *Ramularia* occurred in the *MSa* (18), and least in *EA* (1), *CaEn* (1), and *Pa* (1).

Key words: parasitic fungi, Słowiński National Park, *Ramularia*

INTRODUCTION

Słowiński National Park (SPN) is one of the floristically richest national parks of Poland (Ostrowski and Symonides 1994). It comprises over 830 vascular plant species, among which ca. 30% have a narrow distribution range, occur in single sides or are interesting due to their ecological properties (Piotrowska 1991).

The most characteristic plant associations of SPN are *Vaccinio uliginosi-Pinetum* Kleist 1929, *Cladonio-Pinetum* Juraszek 1927, *Empetro nigri-Pinetum* (Libb. et Siss. 1939 n. n.) Wojt. 1964, *Ribeso nigri-Alnetum* Sol.-Górn. (1975) 1987, *Ericetum tetralicis* R. Tx. 1937, *Rhynchosporetum albae* Koch 1926, and *Eriophoro vaginatum-Sphagnum fallax* Hueck 1928. Only in SPN, the *Carici arenariae-Empetretum nigri* R. Tx. et

Kawamura 1975 em. Barendregt 1982 plant association occur on slopes of old dunes (Matuszkiewicz 2001).

To 1996, the knowledge of the occurrence of microscopic parasitic fungi in SPN was exceptionally poor and regarded only two species, *Vermiculariella elymi* Oudem. and *Phoma inconspicua* Speg., found by Dominik (1963). In the years 1996-2001, the author of this paper collected ca. 460 species of such fungi representing the phyla Oomycota, Ascomycota and Basidiomycota, as well as the group of anamorphic fungi. Of them, many belonged to the genus *Ramularia*.

Members of the genus *Ramularia* are anamorphic fungi, and their teleomorphs are species of the genus *Mycosphaerella* (Kirk et al. 2001). These fungi are the causal agents of spots or even necrosis of larger fragments of leaves of their plant hosts (Marcinkowska 2003). On the under, more rarely on the upper, sides of the spots, they form conidiophores with conidia. The conditions favourable to fungi of this genus are raised humidity and a moderate temperature (Marcinkowska 2003). The diagnostics of *Ramularia* spp. are mainly based on the recognition of their plant hosts and the determination of characters of conidia and conidiophores of these fungi (Braun 1998). In cultures, species of *Ramularia* rarely sporulate (Marcinkowska 2003).

The aim of this paper is to list and shortly characterize the morphological properties of the species of the genus *Ramularia* and the disease symptoms of their plant hosts found in SNP in the years 1996-98 and 2001. Additionally, the known distribution of these fungi in Poland and other regions of the world is presented.

MATERIALS AND METHODS

The samples studied were diseased fragments of above-ground parts of plants growing in eleven selected plant associations of SNP (Fig. 1). The plant associations included *Angelico-Cirsetum oleracei* R. Tx. 1937 em. Oberd. 1967, *Betulo pendulae-Quercetum roboris* R. Tx. 1930, *Carici arenariae-Empetrum nigri*, *Elymo-Ammophiletum* Br.-Bl. et De Leeuw 1936, *Empetro nigri-Pinetum*, *Filipendulo-Geranietum* W. Koch 1962, *Helichryso-Jasionetum litoralis* Libb. 1940, *Myrico-Salicetum auritae* (Allg. 1922) R. Tx. et Pass. 1961, *Phragmitetum australis* (Gams 1927) Schmale 1939, *Ribeso nigri-Alnetum*, and *Vaccinio uliginosi-Betuletum pubescentis* Libbert 1933.

The nomenclature of plant associations is according to Matuszkiewicz (2001).

In the years 1996-1998, the affected plants were sampled between 15th and 30th day of June to September, and in 2001 in each second half of May to October.

In the laboratory, the plant parts collected were first dried between sheets of filter paper, and then their species affiliation was determined according to Szafer, Kulczyński and Pawłowski (1969). The nomenclature of plants used is after Mirek et al. (1995). Fungi of the genus *Ramularia* were recognized according to Braun (1998).

The size, shape, colour, and the distribution of spots on the leaf surface, as well as the place of occurrence of conidiophores with conidia of *Ramularia* spp. were examined. To determine the characters of conidiophores and conidia of the *Ramularia* spp. found, thin cuttings from a transverse section of leaves of the plant hosting a given *Ramularia* sp. were made. They were subsequently transferred to a drop of lactic acid placed on a microscope slide and covered with a cover glass.

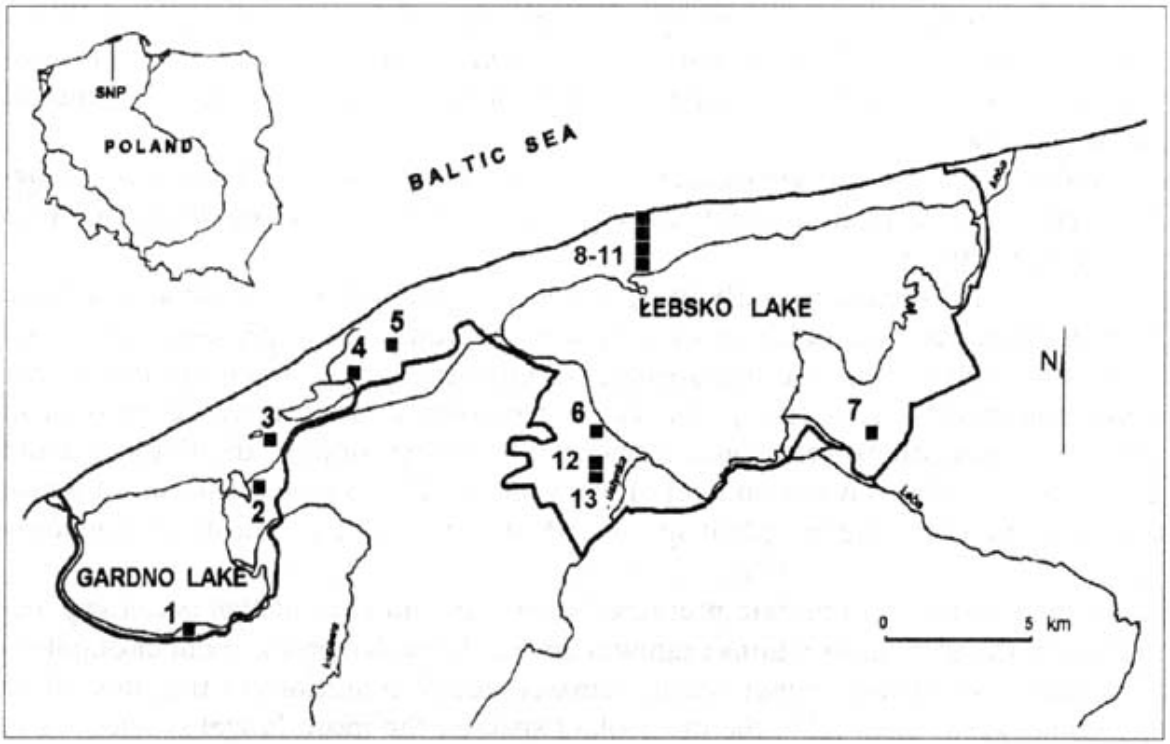

Fig 1. Permanent plots with plant associations of the Słowiński National Park: 1- *Phragmitetum australis*; 2 - *Betulo pendulae-Quercetum roboris*; 3, 12 - *Vaccinio uliginosi-Betuletum pubescentis*; 4 - *Ribeso nigri-Alnetum*; 5, 13 - *Myrico-Salicetum auritae*; 6 - *Angelico-Cirsetum oleracei*; 7 - *Filipendulo-Geranietum*; 8 - *Elymo-Ammophiletum*; 9 - *Helichryso-Jasionetum litoralis*; 10 - *Carici arenariae-Empetrum nigri*; 11 - *Empetro nigri-Pinetum*.

Microscope observations were performed using the Olympus SZX9 dissecting microscope and the Zeiss Axiolab compound microscope. Microphotographs were recorded on a Sony 3CDD DXC-390 colour video camera coupled to the Olympus BX 50 compound microscope equipped with Nomarski differential interference contrast optics.

The floral materials are deposited at the Department of Plant Pathology University of Agriculture in Szczecin.

The data of the *Ramularia* species found in the years 1996-98 have already been published (Adamska 2001; Adamska and Błaszkowski 2000; Adamska et al. 1999). However, the used names of the fungi found were as those proposed by Brandenburger (1985), of which many are out of date now. In this paper, the nomenclature of the species of *Ramularia* encountered follows that of Braun (1998).

RESULTS AND DISCUSSION

In the diseased plants collected in SNP, a total of 37 species of the genus *Ramularia* were found.

Most *Ramularia* species (18) occurred in the *Myrico-Salicetum auritae* plant association, i. e., a shrub association positioned ca. 7 km from the bank of the Baltic Sea and containing most plant species. Of them, 11 were hosts of *Ramularia* spp.

Other plant associations hosting a high number of *Ramularia* spp. were *Ribeso nigri-Alnetum* (12) and *Vaccinio uliginosi-Betuletum pubescentis* (10), i. e., forest associations also relatively floristically rich and not being under the direct influence of the Baltic Sea.

In the *Angelico-Cirsietum oleracei*, *Filipendulo-Geranietum*, and *Betulo pendulae-Quercetum roboris* plant associations, eight, six and five species of *Ramularia* were found, respectively.

The plant associations harbouring the lowest number of *Ramularia* spp. were *Empetro nigri-Pinetum* and *Helichryso-Jasionetum litoralis* (two species each), as well as *Elymo-Ammophiletum*, *Carici arenariae-Empetretum nigri*, and *Phragmitetum australis* (one species each). Except for the *Phragmitetum australis* plant association, all the other associations were highly influenced by strong winds of the Baltic Sea and consisted of a relatively low number of plant species. *Phragmitetum australis* is a rush association comprising few plant species. Most of them are not hosts of *Ramularia* spp.

Thus, considering the data presented above, the number of *Ramularia* spp. occurring in the plant associations examined highly depended on the number of potential plant hosts of these fungi and the environmental conditions of the sites where the plants grew. Generally, the more plant species, the more fungal species are in a site (Mułenko 1988). Strong winds shorten the length of the wetting period of leaves and, thereby, decrease the probability of their infection by most fungal pathogens (Agrios 1988). Spores of *Ramularia* spp. germinate only in the presence of water (Braun 1995).

Of the species of *Ramularia* found in SNP, 13 commonly occur in Poland and the other regions of Europe (see below). *Ramularia agrestis* var. *agrestis*, *R. didyma* var. *didyma*, *R. glechomatis*, *R. lamii* var. *lamii*, *R. lysimachiae*, *R. macrospora*, *R. moehringiae*, *R. sambucina*, *R. sphaeroidea*, *R. tricherae*, *R. ulmariae*, *R. uredinis*, and *R. veronicae* were recorded from four to six times in our country. Ten species (*R. archangelicae*, *R. calcea*, *R. chamaedryos*, *R. cynarae*, *R. didymarioides*, *R. lactea*, *R. rhaetica*, *R. schulzeri*, *R. tanaceti* and *R. triboutiana*) were observed only one to three times, and *R. galii* was for the first time revealed in Poland.

Eight *Ramularia* spp. affected plant species earlier unknown to be their hosts. The plant hosts were *Chaerophyllum temulum* (harbouring *R. chaerophylli*), *Galeopsis tetrahit* (*R. lamii* var. *lamii*), *Hieracium laevigatum* (*R. inaequale*), *H. sabaudum* (*R. inaequale*), *Hypochoeris radicata* (*R. inaequale*), *Lotus uliginosus* (*R. schulzeri*), *Potentilla erecta* (*R. grevilleana* var. *grevilleana*), *Pucciniastrum vaccinii* z *Vaccinium uliginosum* (*R. uredinis*), *Viola palustris* (*R. lactea*), *V. tricolor* var. *maritima* (*R. lactea*) and *Veronica arvensis* (*R. veronicae*).

Earlier papers (Adamska 2001; Adamska and Błaszkowski 2000; Adamska et al. 1999) inform on 26 *Ramularia* spp. found in SNP in the years 1996-98. However, according to Braun (1998), three of them now belong to the genera *Passalora*, *Phaeoramularia*, and *Spermosporina*, and *R. hieracii* (Baum.) Jaap. and *R. taraxaci* Karst. are synonyms of *R. inaequale* (Preuss.) U. Braun.

Fungi of the genus *Ramularia* found in eleven plant associations of the Słowiński National Park

The data presented below the name of a *Ramularia* sp. characterized are the plant host, the plant association, and the date of collection of the fungus and its plant host(s), respectively.

Abbreviations:

ACo - Angelico-Cirsietum oleracei
BpQr – Betulo pendulae-Quercetum roboris
CaEn - Carici arenariae-Empetretum nigri
EA - Elymo-Ammophiletum
EnP - Empetro nigri-Pinetum
FG - Filipendulo-Geranietum
HJl - Helichryso-Jasionetum litoralis
MSa - Myrico-Salicetum auritae
Pa - Phragmitetum australis
RnA - Ribeso nigri-Alnetum
VuBp - Vaccinio uliginosi-Betuletum pubescentis

Ramularia agrestis Sacc. var. ***agrestis*** (Fig.2 A-D)

Spots circular, cream-coloured, up to 4 mm diam, with a pale cream-coloured centre and a deep-red border, 1-1.5 mm wide, randomly distributed on bottom leaves, 1-2 per leaf. *Sporulation* very abundant, cream-white in colour, on the under side of the spots. *Conidia* 12-32 x 4-9 μm, 0-1-septate. On *Viola arvensis* Murray, *VuBp*, VII 1997, VIII-IX 1998.

Distribution. POLAND. On *V. arvensis*: the Bug valley (Danilkiewicz 1987), the Pieniny Mountains (Kućmierz 1976), and the Łęczyńsko-Włodawskie Lake District (Mułenko 1988). OTHER REGIONS. On *V. arvensis*: many regions of Europe (Braun 1998). Additionally, *R. agrestis* var. *agrestis* has been found affecting other species of the genus *Viola* growing in Caucasus, Europe, and North America (Braun 1998).

Remarks. Other species of *Ramularia* occurring on plants of the genus *Viola* are *R. agrestis* Sacc. var. *deflectens* (Bres.) U. Braun, *R. lactea* (Desm.) Sacc., and *R. biflorae* Magnus ex Lindau (Braun 1998).

Ramularia archangelicae Lindr.

Spots large, angular, large, 1-2 cm long, dark green to brown, without a border, randomly distributed on and sometimes covering the whole upper leaf surface. *Sporulation* abundant, pale cream-coloured, on the under side of the spots. *Conidia* 14-32 x 2-5 μm, 0-1- rarely 2-septate. On *Angelica sylvestris* L., *MSa*, X 2001.

Distribution. POLAND. On *A. sylvestris*: the Pieniny Mountains (Kućmierz 1975, 1976) and the Bug valley (Danilkiewicz 1987). OTHER REGIONS. On *A. sylvestris*: many regions of Europe (Braun 1998); on different *Angelica* spp.: Asia, Europe, and North America (Braun 1998).

Remarks. *Ramularia archangelicae* is the only species of this genus so far found affecting leaves of plants of the genus *Angelica* (Braun 1998).

Ramularia calcea Ces. (Fig. 2 E-H)

Spots angular, vain-restricted, 2-3 cm long, brown, with no border, distributed on the whole upper leaf surface, but more numerous at the leaf border, especially on the bottom leaves. *Sporulation* very abundant, pale cream-coloured, on the upper

and under sides of the spots. *Conidia* 10-22 x 2.5-6 μm, with no septa. On *Symphytum officinale* L., *RnA*, X 2001

Distribution. POLAND. On *S. officinale*: the Ojców National Park (Kućmierz 1971, 1973), Gorce (Kućmierz 1969), meadows between Nakło and Ujście (Michalski 1982). OTHER REGIONS. Caucasus and many regions of Europe (Braun 1998).

Remarks. Another species of the genus *Ramularia* affecting plants of the genus *Symphytum* is *R. cylindroides* Sacc. var. *cylindroides* (Braun 1998).

Ramularia chaerophylli Ferraris

Spots angular, brown, with no border, mainly occur at the leaf border, occasionally cover up to 50% of the leaf area. *Sporulation* abundant, white, on the under side of the spots. *Conidia* 12-68 x 2.5-5 μm. On *Anthriscus sylvestris* (L.) Hoffm., *VuBp*, VIII 1997; *Chaerophyllum temulum* L., *MSa*, X 2001.

Distribution. POLAND. On *A. sylvestris*: SNP (Adamska 2001; Adamska and Błaszkowski 2000), the Ojcowski National Park (Kućmierz 1971, 1973), the Pieniny Mountains (Kućmierz 1976), meadows between Nakło and Ujście (Michalski 1982); on *Ch. hirsutum* L.: the only earlier report of the occurrence of *R. chaerophylli* on *Ch. hirsutum* is that of Braun (1998); however, he did not mention the site of the origin of this fungus. OTHER REGIONS. On *A. sylvestris*: Asia and many regions of Europe (Braun 1998); additionally, *R. chaerophylli* has been found on different species of the genus *Myrrhis*, as well as on *Anthriscus* and *Chaerophyllum* spp., other than *A. sylvestris* and *Ch. temulum*, growing in Asia and Europe (Braun 1998).

Remarks. *Chaerophyllum temulum* is a new plant host of *R. chaerophylli* for the world (Braun 1998).

Ramularia chaerophylli is the only species of the genus *Ramularia* so far found on plants of the genera *Anthriscus* and *Chaerophyllum* (Braun 1998).

Ramularia chamaedryos (Lindr.) Gunnerb. (Fig. 3 A-D)

Spots ovoid, 1-4 mm, with cream-coloured centre and dark grey to grey-green border, randomly distributed on the upper leaf side, more frequently on older leaves. *Sporulation* abundant, pale cream in colour, mainly on the uppe side of the spots. *Conidia* 7.5-20 x 2.5-6 μm, with no septa. On *Veronica chamaedrys* L., *MSa*, V 2001.

Distribution. POLAND. On *V. chamaedrys*: the Bug valley (Danilkiewicz 1987), Łęczyńsko Włodawskie Lake District (Mułenko 1988), and SNP (Adamska 2001). OTHER REGIONS. Many countries of Europe (Braun 1998).

Remarks. Apart from *R. chamaedryos*, plant species of the genus *Veronica* have been found also affected by *R. beccabungae* Fautrey, *R. coccinea* (Fuckel) Vestergr., and *R. veronicae* Fuckel (Braun 1998).

Ramularia cynarae Sacc. (Fig. 3 E-H)

Spots at first ovoid, then extensive and vine-restricted, grey-brown, with no border. *Sporulation* not abundant, grey-white, on the under and the upper sides of the spots. *Conidia* 12-38 x 1.5-4.5 μm, 0-3-septae (rarely 0-septate). On *Cirsium arvense* (L.) Scop., *BpQr*, VIII 1996, *RnA*, VIII-IX 1996.

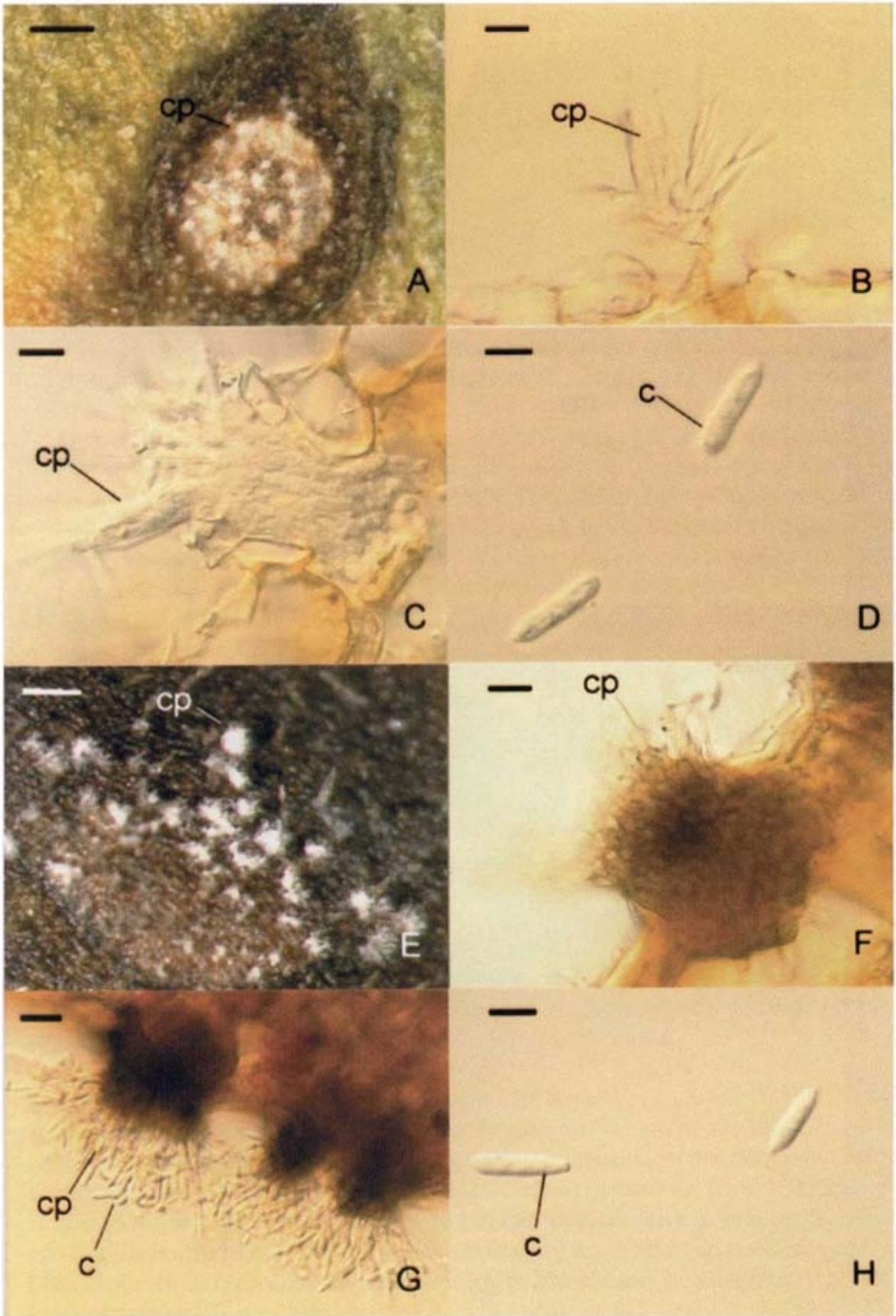

Fig. 2. *Ramularia agrestis* var. *agrestis*: conidiophores (cp) on a leaf of *Viola arvensis* (A), conidiophores (cp) and conidia (c; B-D); *Ramularia calcea*: conidiophores (cp) on a leaf of *Symphytum officinale* (E), conidiophores (cp) and conidia (c; F-H).

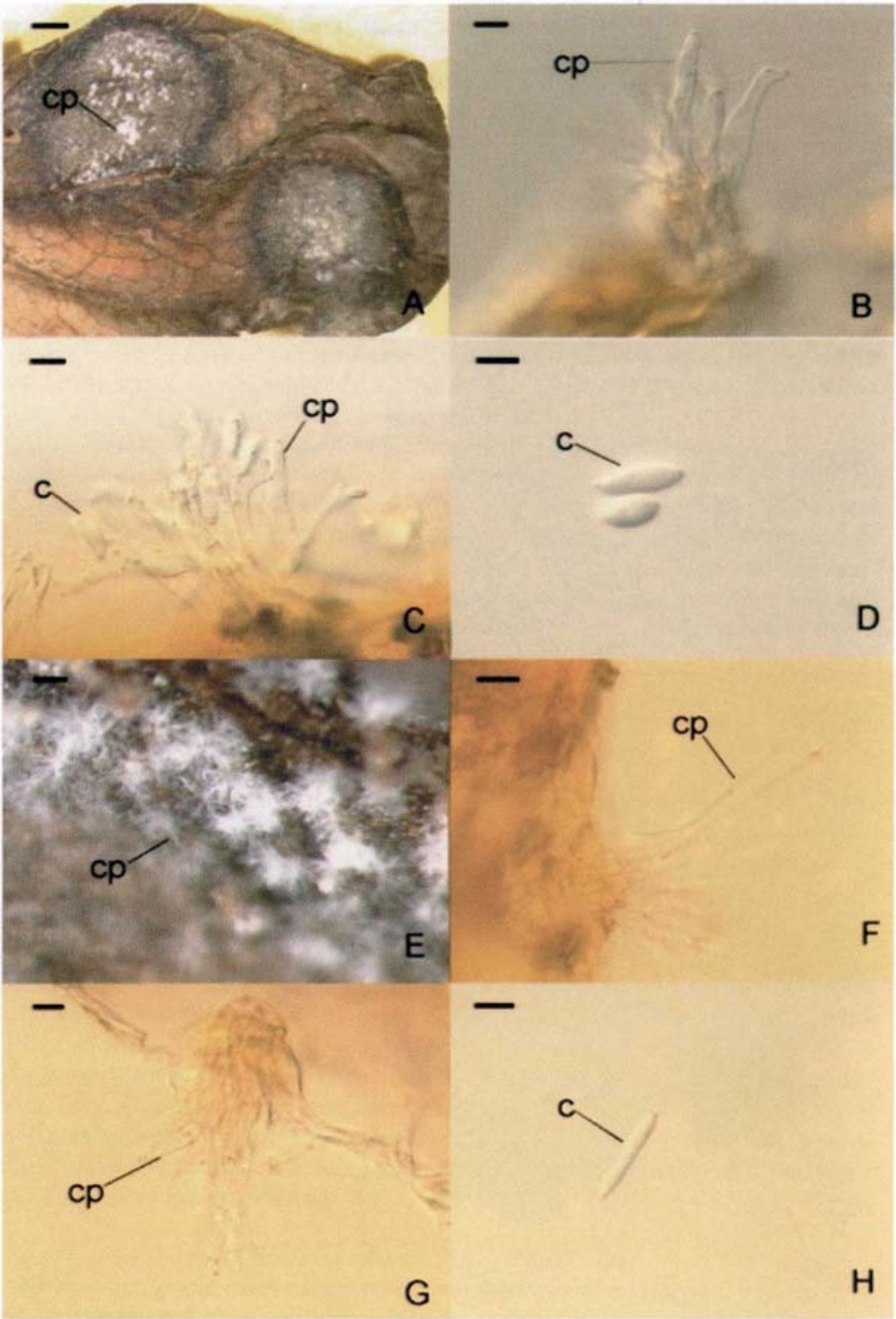

Fig. 3. *Ramularia chamaedryos*: conidiophores (cp) on spots of a leaf of *Veronica chamaedrys* (A), conidiophores (cp) and conidia (c; B-D); *Ramularia cynarae*: dense conglomerating of conidiophores (cp) on a leaf of *Cirsium arvense* (E), conidiophores (cp) and conidia (c; F-H).

Distribution. POLAND. On *C. arvensis*: the Bug valley (Danilkiewicz 1987) and SNP (Adamska 2001). OTHER REGIONS. On *C. arvensis*: Asia, many regions of Europe, and North America (Braun 1998). On different plant species of the genera *Carduus*, *Carthamus*, *Cirsium*, *Cousinia*, *Cynara*, *Echinops*, *Jurinea*, *Onopordum*, *Saussurea*, and *Silybum*: Asia, northern Africa, and North and South America (Braun 1998).

Remarks. Another fungus of the genus *Ramularia* found affecting plants of the genus *Cirsium* is *R. jubatskana* (Sacc.) U. Braun (Braun 1998).

Ramularia didyma Unger var. ***didyma***

Spots angular, small, up to 0.5 cm long, brown, without a border, present at the leaf border. *Sporulation* abundant, whitish, on the under leaf side. *Conidia* 9-34 x 2.5-5 μm, 0-1-septate. On *Ranunculus bulbosus* L., *VuBp*, VII 1997; *R. repens* L., *MSa*, X 2001.

Distribution. POLAND. On *R. bulbosus*: SNP (Adamska 2001; Adamska and Błaszkowski 2000); on *R. repens*: the Bug valley (Danilkiewicz 1987), the Łęczyńsko-Włodawskie Lake District (Mułenko 1988) and on meadows located between Nakło and Ujście (Michalski 1982), and in the Białowieża National Park (Mułenko 1996). OTHER REGIONS. On *R. bulbosus*: France and Italy (Braun 1998); on *R. repens*: New Zealand, Asia, and many regions of Europe (Braun 1998).

Remarks. In Poland, the fungal species of the genus *Ramularia* observed on plants of the genus *Ranunculus* have also been *R. acris* Lindr., *R. didyma* var. *exigua* (U. Braun) U. Braun, and *R. simplex* Pass. (Braun 1998).

Ramularia didymarioides Briosi & Sacc. (Fig. 4 A-D)

Spots at first ovoid, later angular, vein-restricted, large, 2-3 cm long, dark green to brown, with no border, randomly distributed on the upper leaf side. *Sporulation* not abundant, grey-cream in colour, on the under leaf side. *Conidia* 9-37 x 5-9 μm, 0-2(-3)-septate. On *Melandrium rubrum* (Weigel) Garcke, *RnA*, X 2001.

Distribution. POLAND. On *M. rubrum*: the Tatra National Park (Mułenko et al. 1995). OTHER REGIONS. On *M. rubrum*: many countries of Europe; on different plant species of the genera *Lychnis*, *Melandrium*, and *Viscaria* (Braun 1998).

Remarks. Other fungi of the genus *Ramularia* affecting plants of the genus *Melandrium* also are *R. lychnicola* Cooke and *R. silenicola* C. Massal. (Braun 1998).

Ramularia galii Chevassut

Spots angular, covering large fragments of leaves, brown at the border and the base of leaves. *Sporulation* very low, pale cream-coloured, on the under side of the spots. *Conidia* 10-16 x 2-3 μm, 1-septate. On *Galium aparine* L., *RnA*, VII 2001.

Distribution. No earlier report existed of the occurrence of *R. galii* on *G. aparine* growing in both Poland and the other regions of the world. To date, *R. galii* has been observed only on *G. mollugo* L. growing in France and Sweden (Braun 1998). *Galium aparine* is a new plant host of *R. galii* for the world.

Remarks. *Ramularia galii* is the only member of the genus *Ramularia* found to attack plants of the genus *Galium* (Braun 1998).

Ramularia gei (A.G. Eliasson) Lindr.

Spots circular, small, up to 0.5 cm diam, drying with age, pale brown to brown, with no border, distributed on the whole upper leaf surface, but usually more numerous in their centre. *Sporulation* rather abundant, white-grey, on the under leaf side. *Conidia* 6-24 x 2.5-5 μm, 0-1-septate. On *Geum urbanum* L., *MSa*, VII 1996, VII 1997, *RnA*, X 2001.

Distribution. POLAND. On *G. urbanum*: the Łęczyńsko-Włodawskie Lake District (Mułenko 1988), the Pieniny Mountains (Kućmierz 1976), the Bug valley (Danilkiewicz 1987), and the Słowiński National Park (Adamska 2001; Adamska and Błaszkowski 2000; Adamska et al. 1999). OTHER REGIONS. On *G. urbanum*: Central Asia and different regions of Europe (Braun 1998); on different *Geum* spp.: Asia, Europe, and North America (Braun 1998).

Remarks. *Ramularia gei* is the only species of *Ramularia* so far found on plants of the genus *Geum* (Braun 1998).

Ramularia geranii Fuckel var. ***geranii***

Spots irregular, rarery ovoid, brown, with no border, present at the leaf border, mainly on the oldest leaves; dried leaves with a tucked up border. *Sporulation* very abundant, white, on the under side of the spots. *Conidia* 15-45 x 2.5-5 μm, 0-3-septate. On *Geranium dissectum* L., *VuBp*, VIII 1997, VIII-IX 1998; *G. molle* L., *BpQr*, IX 1997; *G. pusillum* Burm. f. ex L., *FG*, VII 1997; *G. robertianum* L., *FG*, VII 1997.

Distribution. POLAND. On *G. dissectum*, *G. mole*, and *G. robertianum*: SNP (Adamska 2001; Adamska and Błaszkowski 2000); on *G. pusillum*: the Chmielinne reserve (Danilkiewicz 1982), the Bug valley (Danilkiewicz 1987), SNP (Adamska 2001; Adamska and Błaszkowski 2000; Adamska et al. 1999). OTHER REGIONS. On *G. dissectum* and *G. molle*: different countries of Europe; on *G. pusillum*: central regions of Asia and many countries of Europe; on *G. robertianum*: Great Britain (Braun 1998).

Remarks. Plants of the genus *Geranium* are also attacked by *R. pseudogeranii* U. Braun (Braun 1998).

Ramularia glechomatis U. Braun (Fig. 4 E-H)

Spots at first ovoid, later angular, vein-restricted, dark green with a cream-coloured centre, usually with no border, occasionally with deep-red-brown border, present at the border of the oldest leaves. *Sporulation* low, whitish, on the under side of the spots. *Conidia* 7.5-27.5 x 2.5-5 μm. On *Glechoma hederacea* L., *RnA*, X 2001.

Distribution. POLAND. On *G. hederacea*: the Pieniny Mountains (Kućmierz 1976), the Bug valley (Danilkiewicz 1987), the Łęczyńsko-Włodawskie Lake District (Mułenko 1988), and on meadows between Nakło and Ujście (Michalski 1982). OTHER REGIONS. On *G. hederacea*: commonly in the whole Asia and Europe (Braun 1998); on different *Glechoma* spp.: Asia and Europe (Braun 1998).

Ramularia grevilleana (Tul. et C. Tul.) Jørst. var. ***grevilleana***

Spots ovoid, 1 x 5 mm, with a cream-coloured centre and deep-red, 1-2 mm wide border, randomly distributed on the upper side of the oldest bottom leaves. *Sporulation* very low, cream-coloured, on the under side of the spots. *Conidia* 12-48 x 2.5-5 μm. On *Potentilla erecta* (L.) Raeusch., *MSa*, X 2001.

Distribution. POLAND. On *P. erecta*: the *MSa* plant association of SNP is the first site of Poland in which *R. grevilleana* var. *grevilleana* was found to be hosted by *P. erecta*. OTHER REGIONS. On *P. erecta*: Russia, Austria, Germany, and Finland (Braun 1998).

According to Braun (1998), *R. grevilleana* var. *grevilleana* affects different plant species of the genera *Duchesnea*, *Fragaria*, *Horkelia*, *Potentilla*, and *Waldsteinia* wherever they grow in the world.

Remarks. *Ramularia grevilleana* var. *grevilleana* is the only species of *Ramularia* occurring on plants of the genus *Potentilla* (Braun 1998). The teleomorph of *R. grevilleana* var. *grevilleana* is *Mycosphaerella fragariae* (Tul.) Lindau (Braun 1998).

Ramularia heraclei (Oudem.) Sacc.

Spots irregular, brown, with no border, occupying large fragments of the upper side of bottom leaves. *Sporulation* low, grey-white, occurring on the under side, rarely on the uper side of the spots. *Conidia* 7.5-38 x 2-5 μm, 0-3-septate. On *Heracleum sphondylium* L., *ACo*, VII 1997, *FG*, VII 1998.

Distribution. POLAND. On *H. sphondylium*: the Pieniny Mountains (Kućmierz 1975, 1976), the Bug valley (Danilkiewicz 1987), the Ojców National Park (Kućmierz 1971, 1973), and SPN (Adamska et al. 1999).

According to Braun (1998), *R. heraclei* has been found affecting different plant species of the genera *Apium*, *Heracleum* (including *H. sphondylium*), and *Pastinaca* growing in New Zealand, Asia, Europe, Africa, and North America.

Remarks. Another species of *Ramularia* found on *H. sphondylium* is *R. butomi* (Braun 1998).

Ramularia inaequale (Preuss) U. Braun

Spots ovoid, 0.5 x 1-2 cm, at first dark green, then brown, with no border, distributed on the whole upper leaf side, but more numerous at the leaf border. *Sporulation* low, grey-white, on the under side, rarely on the upper side of the spots. *Conidia* 7.5-38 x 2-5 μm, 0-3-septate. On *Hieracium laevigatum* Willd., *BpQr*, VIII-IX 1996; *H. sabaudum* L., *VuBp*, IX 1998; *H. umbellatum* L., *EA*, X 2001, *CaEn*, IX 2001; *Hypochoeris radicata* L., *EA*, VI-VII 2001, *HJl*, VI-VIII 2001, *CaEn*, VI-VII 2001, *EnP*, VIII 2001.

Distribution. POLAND. On *H. laevigatum* and *H. sabaudum*: only SPN (Adamska 2001; Adamska and Błaszkowski 2000); on *H. umbellatum*: the Bug valley (Danilkiewicz 1987), the Łęczyńsko-Włodawskie Lake District (Mułenko 1988). OTHER REGIONS. On *H. laevigatum*: Czech Republic and Germany; on *H. sabaudum*: Czech Republic, Romania, and Germany; on *H. umbellatum*: Asia and many regions of Europe; on *H. radicata*: Romania, Germany, Great Britain, and France (Braun 1998).

Remarks. *Ramularia inaequale* is the only species of *Ramularia* so far found affecting plants of the genera *Hieracium* and *Hypochoeris* (Braun 1998). There is no earlier report of *R. inaequale* hosted by *H. radicata* in Poland.

The teleomorph of *R. inaequale* is *Mycosphaerella hieracii* (Sacc. et Briard) Jaap (Braun 1998).

Ramularia lactea (Desm.) Sacc.

Spots irregular, *ca*. 0.5-1 cm long, brown, without a border, mostly on the oldest bottom leaves. *Sporulation* rather low, cream-coloured, on the upper and under sides of the spots. *Conida* 6-22 x 2.5-5 μm, 0-1-septate. On *Viola palustris* L., *ACo*, IX 1997; *V. tricolor* L.s.s., *VuBp*, VIII 1998; *V. tricolor* var. *maritima* Schweigg. ex G. Hagen, *HJl*, IX-X 2001.

Distribution. POLAND. On *V. tricolor*: near Bydgoszcz (Michalski 1965), Szczecin (Dominik 1963), and SNP (Adamska 2001; Adamska and Błaszkowski 2000); on *V. palustris*: SPN (Adamska 2001; Adamska and Błaszkowski 2000). OTHER REGIONS. On *V. palustris*: France and Russia (Braun 1998). There is no earlier report of the occurrence of *R. lactea* on *V. tricolor* subsp. *maritima*. Apart from the species of the genus *Viola* listed above, *R. lactea* affected many other *Viola* spp. growing in Asia, Europe, North Africa, and North America (Braun 1998).

Remarks. Other species of *Ramularia* attacking plants of the genus *Viola* are *R. agrestis* var. *agrestis*, *R. agrestis* var. *deflectens* (Bres.) U. Braun, and *R. biflorae* Magnus ex Lindau (Braun 1998). There is no earlier report of *R. lactea* hosted by *V. tricolor* var. *maritima* in Poland.

The teleomorph of *R. lactea* is *Mycosphaerella violae* Potebnja (Braun 1998).

Ramularia lamii Fuckel var. ***lamii***

Spots at first circular, later angular, small, ca. 0.5 cm long, brown, with no border, occurring at the border and at the base of leaves. *Sporulation* low, white-cream in colour, on the under side of the spots. *Conidia* 12-37.5 x 2.5-8 μm, 0-1-septate. On *Galeopsis speciosa* Mill., *MSa*, V 2001; *G. tetrahit* L., *RnA*, VIII 1996, IX 1997.

Distribution. POLAND. On *G. speciosa*: this species was not earlier reported to be the host plant of this fungus; on *G. tetrahit*: only in SPN (Adamska 2001; Adamska and Błaszkowski 2000). OTHER REGIONS. On *G. speciosa* only in Poland (Braun 1998). *Ramularia lamii* var. *lamii* has also affected other plant species of the family *Lamiaceae* (e. g., *Lamium*, *Mentha*, *Salvia* and *Stachys*; Braun 1998).

Remarks. *Ramularia lamii* var. *lamii* is the only species so far found on plants of the genus *Galeopsis* (Braun 1998).

Ramularia lampsanae (Desm.) Sacc.

Spots irregular, large, up to ca. 3-4 cm long, brown to brown-black, with no border. *Sporulation* very abundant, white, on the under side of the spots. *Conidia* 4-20 x 2-5 μm, 0-1-septate. On *Lapsana communis* L.s.s., *VuBp*, VII 1996.

Distribution. POLAND. On *L. communis*: in SPN (Adamska 2001; Adamska and Błaszkowski 2000), the Chmielinne reserve (Danilkiewicz 1982), the Bug valley (Danilkiewicz 1987); Gorce (Kućmierz 1969), the Ojców National Park (Kućmierz 1971, 1973), the Pieniny Mountains (Kućmierz 1976); Szczecin (Madej 1972); meadows near Nakło and Ujście (Michalski 1982); the Łęczyńsko-Włodawskie Lake District (Mułenko 1988), the Białowieża National Park (Mułenko 1994, 1996; Mułenko and Chlebicki 1992). OTHER REGIONS. On *L. communis*: New Zealand, Europe, North America (Braun 1998). Apart from *L. communis*, *R. lampsanae* also attacked other *Lapsana* spp. in New Zealand, Europe, and North America (Braun 1998).

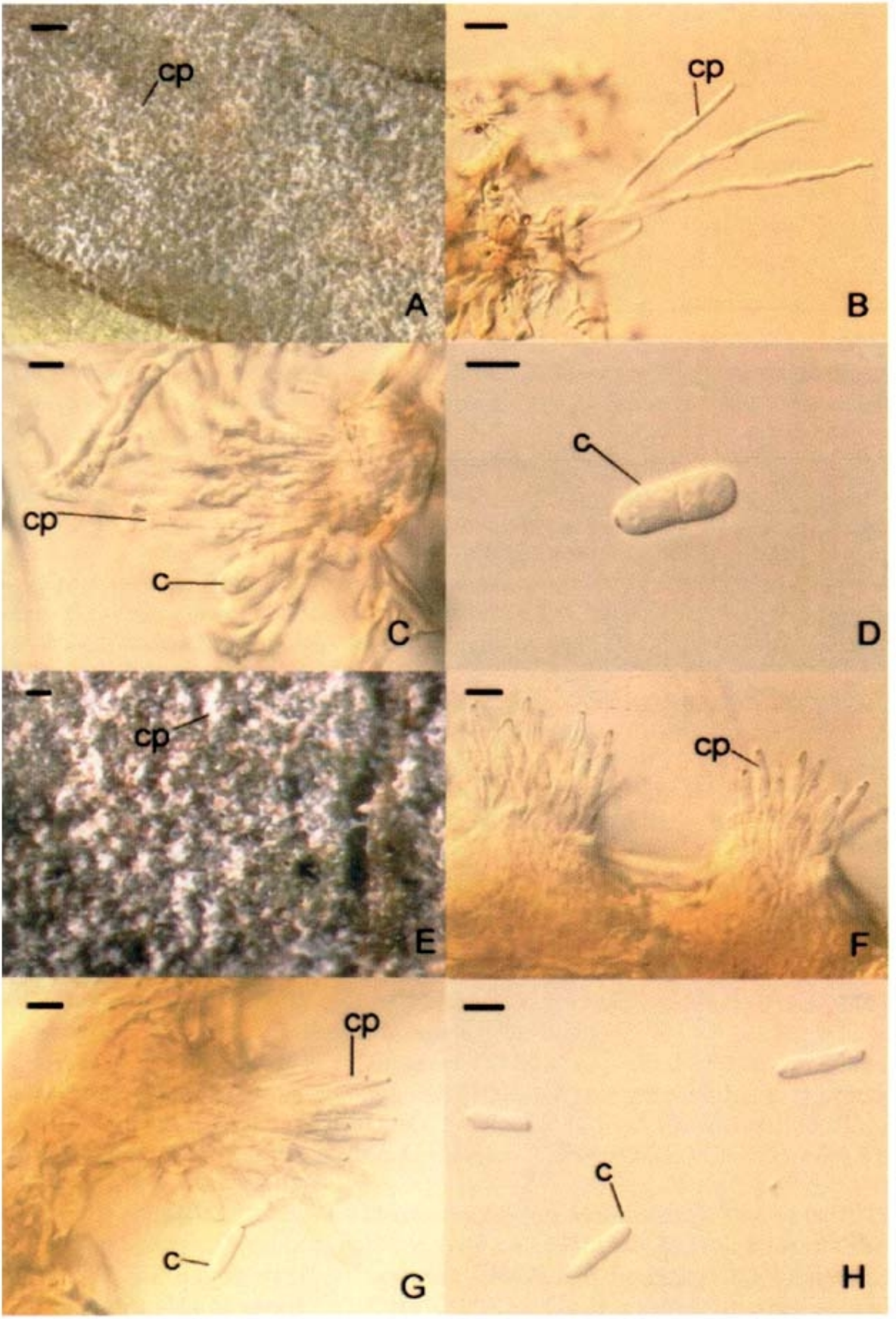

Fig. 4. *Ramularia didymarioides*: conidiophores (cp) on a leaf of *Melandrium rubrum* (A), conidiophores (cp) and conidia (c; B-D); *Ramularia glechomatis*: dense conglomerating of conidiophores (cp) on a leaf of *Glechoma hederacea* (E) conidiophores (cp) and conidia (c; F-H).

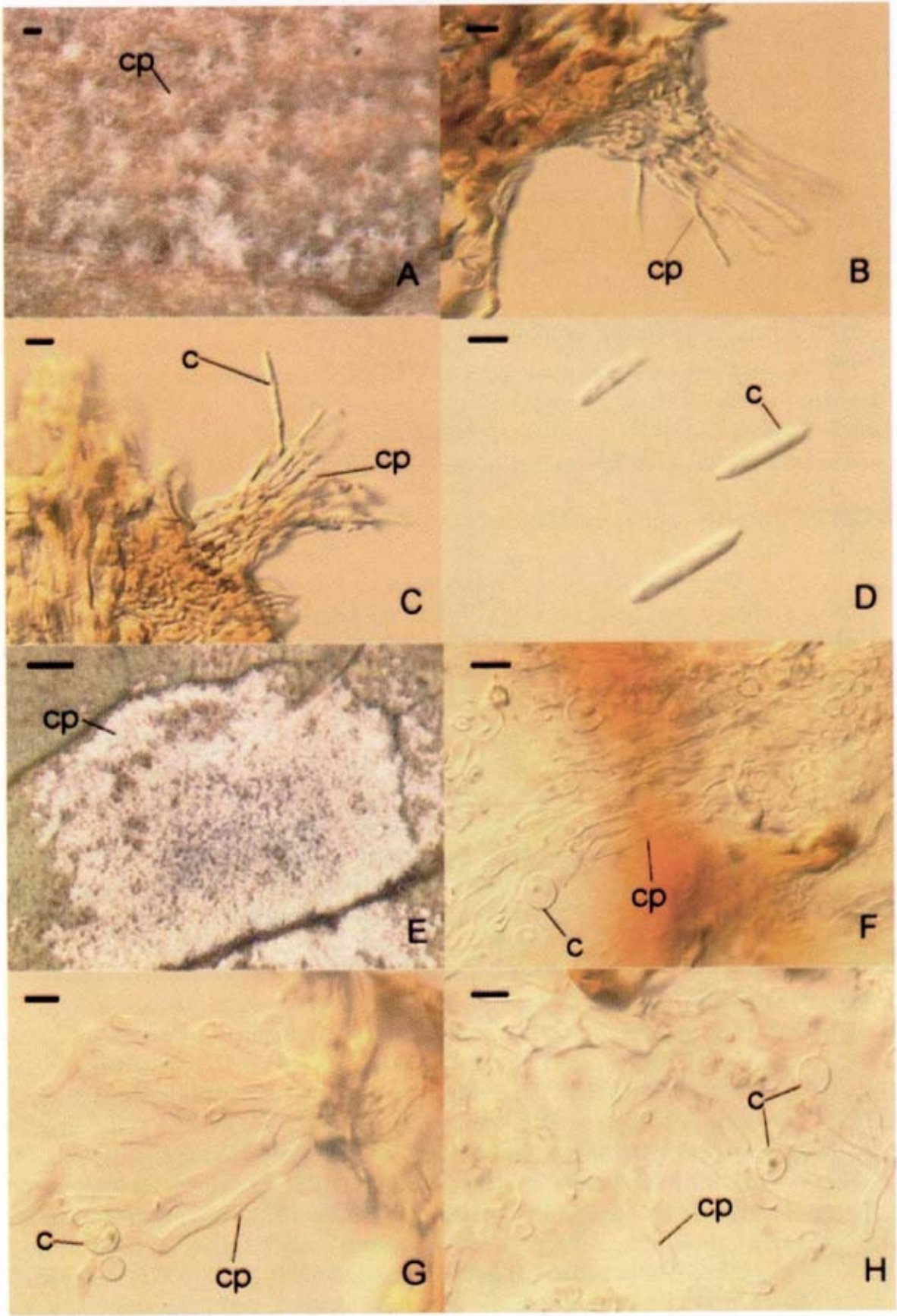

Fig. 5. *Ramularia lysimachiae*: dense conglomerating of conidiophores (cp) on a leaf of *Lysimachia vulgaris* (A), conidiophores (cp) and conidia (c; B-D); *Ramularia sphaeroidea*: conidiophores (cp) on a leaf of *Lotus uliginosus* (E), conidiophores (cp) and conidia (c; F-H).

Remarks. *Ramularia lampsanae* attacks only plant species of the genus *Lapsana* (Braun 1998).

Ramularia lysimachiae Thüm. (fig. 5 A-D)

Spots irregular, large, up to ca. 2-3 cm long, cream-green- to cream-coloured, with no border, at first present at the leaf border, then connect with each other to occasionally occupy the whole leaf area. *Sporulation* from low to very abundant, whitish, on the under side of the spots. *Conidia* 5-20 x 2.5-5 μm, 0-1-septae. On *Lysimachia vulgaris* L., *MSa*, VII 2001.

Distribution. POLAND. On *L. vulgaris*: the Białowieża National Park (Mułenko 1996), the Łęczyńsko-Włodawskie Lake District (Mułenko 1988), the Bug valley (Danilkiewicz 1987), and the Masurian Lakes (Durska 1974). OTHER REGIONS. On *L. vulgaris*: Asia and many regions of Europa (Braun 1998). Additionally, *R. lysimachiae* has been found on other *Lysimachia* spp. growing in Asia, Europe, and North America (Braun 1998).

Remarks. The teleomorph of *R. lysimachiae* is *Mycosphaerella lysimachiae* Höhn. (Braun 1998).

Ramularia macrospora Fresen.

Spots angular, extensive, up to 3-4 cm long, with no border, sometimes occupy almost the whole area of bottom leaves. *Sporulation* low, grey-white, on the under side of the spots. *Conidia* 12-38 x 4-7.5 μm, 0-3-septate. On *Campanula rapunculoides* L., *MSa*, VII 1998.

Distribution. POLAND. On *C. rapunculoides*: near Kłodzko (Starmachowa and Kućmierz 1967), the Pieniny Mountains (Kućmierz 1976), on meadows between Nakło and Ujście (Michalski 1982), and in SPN (Adamska 2001). OTHER REGIONS. On *C. rapunculoides*: Asia and many countries of Europe (Braun 1998). *Ramularia macrospora* has also occurred on plant species of the genera *Adenophora*, *Asyneuma*, *Campanula* (other than *C. rapunculoides*), *Gadellia*, *Legousia*, and *Phyteuma* in Asia, Europe, and North America (Braun 1998).

Remarks. Other species of *Ramularia* attacking plants of the genus *Campanula* are *R. campanulae-latifoliae* Allesch. and *R. campanulae-barbatae* Jaap et Lindau (Braun 1998).

Ramularia moehringiae Lindr.

Spots ovoid, 2-3 x 7-9 mm, cream-green- to cream-coloured, with an occasional grey-cream-coloured border, 1-2 mm wide; only one spot per leaf that may occupy even 80% of its area. *Sporulation* low, cream-coloured, on the under side of the spots. *Conidia* 5-22 x 2-4, 0-1-septate. On *Moehringia trinervia* (L.) Clairv., *VuBp*, VII 2001, *RnA*, VII, IX-X 2001.

Distribution. POLAND. On *M. trinervia*: the Pieniny Mountains (Kućmierz 1975, 1976), the Białowieża National Park (Mułenko 1994, 1996; Mułenko and Chlebicki 1992), the Bug valley (Danilkiewicz 1987), and the Łęczyńsko-Włodawskie Lake District (Mułenko 1988). OTHER REGIONS. On *M. trinervia*: in some regions of Europe (Braun 1998). *Ramularia moehringiae* has also been revealed on plant species of the genus *Arenaria* and *Moehringia* spp. other than *M. trinerva* growing in Europe (Braun 1998).

Remarks. *Ramularia moehringiae* is the only species of *Ramularia* occurring on plants of the genus *Moehringia* (Braun 1998).

Ramularia plantaginis Ellis et G. Martin

Spots ovoid, extensive, up to 2 cm long, with a cream-coloured centre and a deep-red border, randomly distributed on the upper eaf side, more numerous on older leaves. *Sporulation* low, grey-white, on the under side of the spots. *Conidia* 8-32 x 2.5-5 μm, 0-3-septate. On *Plantago lanceolata* L., *ACo*, IX 1998; *P. major* L., *ACo*, VII, IX 1997, *FG*, VII, IX 1996.

Distribution. POLAND: SNP (Adamska 2001; Adamska and Błaszkowski 2000); on *P. major*: very frequently in different regions (Adamska 2001; Adamska and Błaszkowski 2000; Danilkiewicz 1982, 1987; Kućmierz 1969, 1971, 1973, 1976; Madej 1969; Mułenko 1988; Mułenko et al. 1995). OTHER REGIONS. On *P. lanceolata*: no report exists of the occurrence of *R. plantaginis* on *P. lanceolata* outside Poland; on *P. major*: Asia, many regions of Europe, and North America (Braun 1998).

Remarks. Another species of *Ramularia* affecting plants of the genus *Plantago* is *R. rhabdospora* (Berk. & Broome) Nannf. (Braun 1998).

Ramularia pratensis Sacc. var. ***pratensis***

Spots ovoid, small, 0.3-0.8 x 0.4-1 cm, with a cream-coloured centre and a deep-red border, widely distributed on the upper leaf side, usually more numerous at the leaf border. *Sporulation* abundant, cream-coloured, on the under and the upper sides of the spots. *Conidia* 10-24 x 2.5-4 μm, 0-3-septate. On *Rumex acetosa* L., *ACo*, VII-IX 1996, VII-IX 1997, *VuBp*, VIII 1998, *MSa*, VI 2001; *R. acetosella* L., *VuBp*, VII, IX 1996, VII 1977, IX 1998.

Distribution. POLAND. On *R. acetosa*: near Bydgoszcz (Michalski 1965), Przelewice near Szczecin (Madej 1969), the Łęczyńsko-Włodawskie Lake District (Mułenko 1988), and SNP (Adamska 2001; Adamska and Błaszkowski 2000); on *R. acetosella*: near Szczecin (Madej 1972), SNP (Adamska 2001; Adamska and Błaszkowski 2000). OTHER REGIONS. On *R. acetosa*: Asia and many regions of Europe; on *R. acetosella*: many countries of Europe (Braun 1998).

Remarks. Other *Ramularia* spp. affecting plants of the genus *Rumex* growing in Poland are *R. rubella* (Bonord.) Nannf. and *R. rumicis* Kalchbr. et Cooke (Braun 1998).

Ramularia rhaetica (Sacc. et G. Winter) Jaap

Spots irregular, up to ca. 0.5-1.5 cm long, brown, with no border, present at the leaf tops. *Sporulation* rather not abundant, grey-white, on the under leaf side. *Conidia* 12-48 x 2.5-5 μm, 1-4-septate (4-septate rarely occur). On *Peucedanum palustre* (L.) Moench, *VuBp*, VII 2001.

Distribution. POLAND. On *P. palustre*: the Łęczyńsko-Włodawskie Lake District (Mułenko 1988). No report exists of the occurrence of *R. rhaetica* on *P. palustre* in other regions of the world.

Remarks. Another species of *Ramularia* attacking plant species of the genus *Peucedaum* is *R. peucedani* Holos (Braun 1998).

Ramularia rubella (Bonord.) Nannf.

Spots ovoid, 0.5-1 x 1-2 cm, with a cream-coloured centre and a deep-red border, randomly distributed on the upper leaf surface, usually more numerous at the leaf border. *Sporulation* usually low, abundant after rains, cream-coloured, on the under side of the spots. *Conidia* 12-30 6-10 μm, 0-septate. On *Rumex conglomeratus* Murray, *RnA*, VII 1996, *ACo*, VII 1996, VII-VIII 1997, VII 1998; *R. crispus* L., *MSa*, VIII 1996, IX 1998; *R. obtusifolius* L., *FG*, VIII-IX 1996, VII-IX 1997, *MSa*, VI 2001.

Distribution. POLAND. On *R. conglomeratus*: on meadows between Nakło and Ujście (Michalski 1982); on *R. crispus*: in different regions (Kućmierz 1969, 1971, 1973, 1976; Madej 1963; Michalski 1965, 1982); on *R. obtusifolius*: rather frequently in different regions (Danilkiewicz 1987; Kućmierz 1969, 1971, 1973, 1976; Madej 1963, 1969, 1972; Michalski 1959, 1982; Mułenko 1988; Sałata et al. 1984). In SNP, *R. rubella* has been hosted by all the three plant species mentioned above (Adamska 2001; Adamska and Błaszkowski 2000; Adamska et al. 1999). OTHER REGIONS. On *R. conglomeratus*: New Zealand, Germany, Great Britain, Spain, and Italy; on *R. cirsius*: New Zealand, Asia, Europe, North and South Americas; on *R. obtusifolius*: New Zealand, Asia, many regions of Europe, and North America (Braun 1998). *Ramularia rubella* has also been found on different plant species of the genus *Polygonum* and *Rumex* spp. other than those listed above (Braun 1998).

Remarks. In the sites of SNP investigated, two other species of *Ramularia* were also found on plants of the genus *Rumex*, i. e., *R. rumicis* Kalchbr & Cooke and *R. pratensis* Sacc. var. *pratensis* (Braun 1998).

Ramularia rumicis Kalchbr & Cooke

Spots ovoid, 0.3-1 x 0.5-2 cm, with a cream-coloured centre and a deep-red border, up to 2 mm wide, randomly distributed on the upper leaf surface, but more numerous at the leaf border. *Sporulation* rather abundant, cream-coloured, on the under side of the spots. *Conidia* 12-36 x 4-6 μm, 0-3-septate. On *Rumex conglomeratus* Murray, *MSa*, VII 2001; *R. hydrolapathum* Huds., *Pa*, VIII 1996, VIII 1997, VII 1998; *R. obtusifolius* L., *MSa*, V-X 2001.

Distribution. POLAND. On *R. conglomeratus*: Gorce (Kućmierz 1969); on *R. hydrolapathum*: the Chmielinne reserve (Danilkiewicz 1982), the Bug valley (Danilkiewicz 1987), and SNP (Adamska 2001; Adamska and Błaszkowski 2000); on *R. obtusifolius*: the Białowieża National Park (Mułenko 1994, 1996). OTHER REGIONS. On *R. conglomeratus*: Central Asia and some regions of Europe; on *R. hydrolapathum*: Lithuania and Romania; on *R. obtusifolius*: southern regions of Africa, some countries of Europe, and South America (Braun 1998).

Ramularia sambucina Sacc.

Spots irregular, up to 3-4 cm long, pale brown to brown, with no border, at first present at the leaf border, then on the whole upper leaf side. *Sporulation* very low, on the under side of the spots, mainly at their border. *Conidia* 10-30 x 4-8 μm, 0-1-septate. On *Sambucus nigra* L., *ACo*, VII 1996, IX 1998, *RnA*, X 2001.

Distribution. POLAND. On *S. nigra*: the Bug valley (Danilkiewicz 1987), the Pieniny Mountains (Kućmierz 1976), near Szczecin (Madej 1965, 1968, 1972), Bydgoszcz (Michalski 1965), and SNP (Adamska 2001; Adamska and

Błaszkowski 2000). OTHER REGIONS. On *S. nigra*: Asia and many countries of Europe (Braun 1998). Additionally, apart from *S. nigra*, *R. sambucina* has been hosted by other *Sambucus* spp. growing in Asia, Europe, and North America (Braun 1998).

Remarks. The teleomorph of *R. sambucina* is *Mycosphaerella ebulina* Petr. *Ramularia sambucina* is the only species of *Ramularia* occurring on plants of the genus *Sambucus* (Braun 1998).

Ramularia schulzeri Bäumler

Spots at first ovoid, 0.5-1 x 0.6-1 cm, then angular, vein-restricted, with a grey centre and a dark green border; only one spot per leaf, never on the youngest leaves. *Sporulation* abundant, cream-coloured, on the under side of the spots. *Conidia* 10-22 x 3-5 μm, 0-1-septate. On *Lotus uliginosus* Schkuhr, *MSa*, X 2001.

Distribution. POLAND. On *L. uliginosus*: there is no earlier report of *R. schulzeri* hosted by *L. uliginosus* in Poland. However, this fungus has been observed on *L. corniculatus* L. growing on the Łęczyńsko-Włodawskie Lake District (Mułenko 1988). OTHER REGIONS. On *L. uliginosus*: only Germany (Braun 1998). On other *Lotus* spp., *R. schulzeri* has been recorded in Central Asia, Europe, and North America (Braun 1998).

Remarks. In Poland, another species of *Ramularia* attacking plants of the genus *Lotus* is *R. sphaeroidea* Sacc. (Braun 1998), a species found on *L. uliginosus* in SNP (Adamska 2001; Adamska and Błaszkowski 2000).

Ramularia simplex Pass.

Spots angular, small, 0.5-1 cm long, brown, with no border, present at the border of the upper leaf side. *Sporulation* abundant, white-cream in colour, on the under side of the spots. *Conidia* 12-36 x 4-10 μm, 0-1-septate. On *Ranunculus repens* L., *MSa*, VII 2001.

Distribution. POLAND. On *R. repens*: in some regions (Danilkiewicz 1987; Kućmierz 1969, 1971, 1973, 1976; Michalski 1982; Mułenko 1988, 1996), including SNP (Adamska 2001; Adamska and Błaszkowski 2000). OTHER REGIONS. On *R. repens*: Asia, many countries of Europe, and North America (Braun 1998). Additionally, *R. simplex* has occurred on different plant species of the genera *Anemone*, *Pulsatilla*, and *Trollius*, as well as on *Ranunculus* spp. other than *R. repens* in Asia, Europe, and North America (Braun 1998).

Remarks. In the MSa plant association of SNP, *R. repens* hosted both *R. simplex* and *R. didyma* var. *didyma*.

Ramularia sphaeroidea Sacc. (fig. 5 E-H)

Spots ovoid, 0.4-0.8 x 0.5-1 cm, at first cream-coloured, later pale yellow, with no border, randomly distributed on the upper leaf surface. *Sporulation* very abundant, cream-grey in colour, on the under side of the spots. *Conidia* 8-16 x 6-12 μm, 0-septate. On *Lotus uliginosus* Schkuhr, *MSa*, VI 2001.

Distribution. POLAND. On *L. uliginosus*: on meadows between Nakło and Ujście (Michalski 1982), the Łęczyńsko-Włodawskie Lake District (Mułenko 1988), and SNP (Adamska 2001; Adamska and Błaszkowski 2000). OTHER REGIONS. On *L. uliginosus*: Australia and many regions of Europe (Braun 1998). *Ramulara*

sphaeroidea has also affected different plant species of the genera *Chesneya*, *Glycyrrhiza*, *Trifolium* an *Vicia*, as well as *Lotus* spp. other than *L. uliginosus* in Australia, New Zealand, Central Asia, Europe, and both Americas (Braun 1998).

Remarks. The disease symptoms produced by *R. sphaeroidea* were very similar to those caused by *Peronospora lotorum* H.Syd., a species sometimes co-occurring with *R. schulzeri* on *L. uliginosus*.

Ramularia tanaceti Lind (fig. 6 A-D)

Spots irregular, brown, with no border, sometimes on the whole surface of bottom leaves. *Sporulation* low, pale cream-coloured, at the border of the under side of the spots. *Conida* 12-32 x 2.5-5 μm, 0-3-septate. On *Tanacetum vulgare* L., *FG*, IX 1998.

Distribution. POLAND. On *T. vulgare*: the Łęczyńsko-Włodawskie Lake District (Mułenko 1988) and SNP (Adamska 2001; Adamska and Błaszkowski 2000). OTHER REGIONS. On *T. vulgare*: Central Asia and some regions of Europe (Braun 1998). *Ramularia tanaceti* also attacks plant species of the genus *Leucanthemum* and *Tanacetum* spp. other than *T. vulgare* (Braun 1998).

Remarks. Plant species of the genus *Tanacetum* are also affected by *R. bellunensis* Speg. (Braun 1998).

Ramularia triboutiana (Sacc. & Letendre) Nannf.

Spots irregular, extensive, dark brown, with no border, even on 60% of the upper side of bottom leaves. *Sporulation* low, olive, on the under side of the spots. *Conidia* 14-38 x 2-5 μm, 0-3-septate. On *Centaurea scabiosa* L., *ACo*, IX 1998.

Distribution. POLAND. On *C. scabiosa*: only SNP (Adamska 2001; Adamska and Błaszkowski 2000). OTHER REGIONS. On *C. scabiosa*: Central Asia and many regions of Europe (Braun 1998). Apart from other plant species of the genus *Centaurea*, *R. triboutiana* has also been found on plants of the genera *Acroptilon* and *Leuzea* growing in Asia and Europe (Braun 1998).

Remarks. Another *Ramularia* species found to attack *C. scabiosa* is *R. centaurea-scabiosae* (Braun 1998). This fungus has not been observed in SPN to date.

Ramularia tricherae Lindr.

Spots ovoid, 0.3-0.6 x 0.8-1 cm, with a pale cream-coloured centre and a deep-red border, up to 23- mm wide, randomly distributed on the upper leaf surface. *Sporulation* low, white-grey, on the under side of the spots. *Conidia* 5-18 x 2-4 μm, 0-1-septate. On *Knautia arvensis* (L.) J.M. Coult., *RnA*, VII 1996, *MSa*, VIII-IX 1997.

Distribution. POLAND. On *K. arvensis*: in some regions [the Bug valley (Danilkiewicz 1987), Gorce (Kućmierz 1969), the Ojców National Park (Kućmierz 1971, 1973), near Żegiestów-Zdrój (Michalski 1959); the Łęczyńsko-Włodawskie Lake District (Mułenko 1988)], including SNP (Adamska 2001; Adamska et al. 1999). OTHER REGIONS. On *K. arvensis*: in many regions of Europe (Braun 1998). *Ramularia tricherae* has also been recorded on other *Knautia* spp. growing in Caucasus and Europe (Braun 1998).

Remarks. *Ramularia tricherae* is the only species of *Ramularia* occurring on plants of the genus *Knautia*. Its teleomorph is *Sphaerella silvatica* Sacc. et Speg. (Braun 1998).

Ramularia ulmariae Cooke

Spots irregular, exensive, 0.5-3 cm long, brown, sometimes vein-restricted, distributed along the leaf border. *Sporulation* low, white-grey, on the under side of the spots. *Conidia* 12-34 x 3-6 μm, 0-1-septate. On *Filipendula vulgaris* Moench, *BpQr*, VIII 1996.

Distribution. POLAND. On *F. vulgaris*: the Bug valley (Danilkiewicz 1987), the Pieniny Mountains (Kućmierz 1975, 1976), the Małopolska Upland (Romaszewska-Sałata 1981), and SNP (Adamska 2001; Adamska and Błaszkowski 2000). OTHER REGIONS. On *F. vulgaris*: Central Asia and some regions of Europe (Braun 1998). Additionally, *R. ulmariae* has also affected other plant species of the genus *Filipendula* in Asia and Europe (Braun 1998).

Remarks. *Ramularia ulmariae* is the only species of *Ramularia* affecting plants of the genus *Filipendula*. The teleomorph of this fungus is *Mycosphaerella filipendulae-denudatae* Kamilov (Braun 1998).

Ramularia uredinis (W. Voss) Sacc.

Coatings ovoid, up to 4 mm long, whitish, on uredinia of *P. vaccini*; no spots on leaves of the host plant. *Sporulation* low, pale cream in colour, on uredinia of *P. vaccini* formed on the under leaf side. *Conidia* 6-12 x 2-3 μm, 0-1-septate. On *Puccinia-strum vaccinii* (Wint) Jørst. on *Vaccinium uliginosum* L., *EnP*, X 2001.

Distribution. POLAND. On *P. vaccini*: no earlier report exists of the occurrence of *R. uredinis* on this fungus; on *Puccinia aegopodii* (Schum.) Röhl. parasitizing on *Aegopodium podagraria* L., Szczecin (Dominik 1963); on *Melampsora larici-pentandrae* Kleb. associated with *Salix pentandra* L.: the Łęczyńsko-Włodawskie Lake District (Mułenko 1988); on *Melampsoridium betulinum* Kleb. affecting *Betula humilis* Schrank: the Łęczyńsko-Włodawskie Lake District (Mułenko 1988); according to Braun (1998), *R. uredinis* has been found on *Pucciniastrum* sp. developing on *Vaccinium vitis-idaea* L. growing in Poland. OTHER REGIONS. On different species of *Cronartium*, *Melampsoridium*, and *Pucciniastrum* in Asia and Europe (Braun 1998).

Remarks. Other species of the genus *Ramularia* being hyperparasites of fungi of the order Uredinales are *R. coleosporii* Sacc. and *R. uredinearum* Hulen (Braun 1998). None of them has been found in Poland to date.

Ramularia urticae Ces.

Spots ovoid, depressed, large, 0.5-4 cm long, at first dark green, then brown, quickly drying, randomly distributed on the upper leaf surface, except for the leaf border where they occur rarely. *Sporulation* very abundant, white, on the under side of the spots. *Conidia* 8-32 x 3-9 μm, 0-1(-2)-septate. On *Urtica dioica* L., *FG*, VII 1998, *MSa*, VII 1996, VI, IX-X 2001, *RnA*, VIII 1997, VI-X 2001; *U. urens* L., *FG*, IX 1998.

Distribution. POLAND. On *U. dioica*: commonly in the whole country (Adamska 2001; Danilkiewicz 1982, 1987; Kućmierz 1969, 1971, 1973, 1976; Madej 1963, 1969, 1972; Michalski 1982; Mułenko 1988, 1994, 1996; Mułenko and Chlebicki 1992); on *U. urens*: only near Szczecin (Madej 1963) and in SNP (Adamska 2001). OTHER REGIONS. On *U. dioica*: Asia, the whole Europe, and North America; on *U. urens*: Asia, Russia, Latvia, Austria, and Germany (Braun 1998).

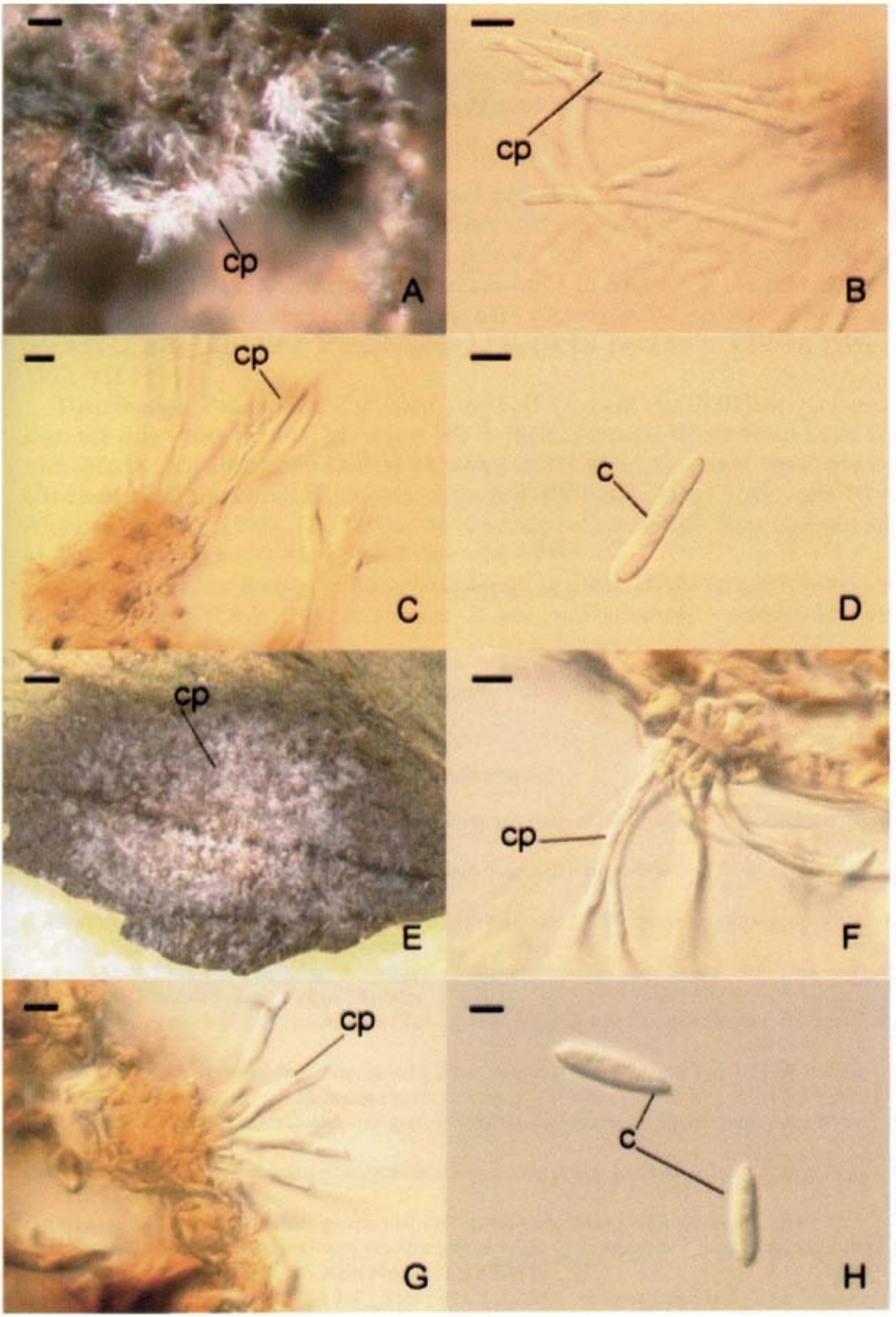

Fig. 6. *Ramularia tanaceti*: conidiophores (cp) on a leaf of *Tanacetum vulgare* (A), conidiophores (cp) and conidium (C; B-D); *Ramularia veronicae*: dense conglomerating of conidiophores (cp) on a leaf of *Veronica arvensis* (E), conidiophores (cp) and conidia (c; F-H).

Additionally, *R. urticae* has been observed on other *Urtica* spp. in Asia, Europe, and both Americas (Braun 1998).

Remarks. *Ramularia urticae* is the only species affecting plants of the genus *Urtica*. The teleomorph of this fungus is *Mycosphaerella superflua* (Auersw.) Petr. (Braun 1998).

Ramularia veronicae Fuck. (Fig. 6 E-H)

Spots ovoid, up to 1-1.5 cm long, greyish, with no border, on the upper side of bottom leaves; only one spot per leaf is formed that occasionally occupies almost 80% of the leaf area. *Sporulation* low, cream-white in colour, on the under side of the spots, rarely on the upper one. *Conidia* 6-18 x 2.5-6 μm, 0-1-septate. On *Veronica arvensis* L., *ACo*, VIII 1997; *V. chamaedrys* L., *BpQr*, IX 1996, *MSa*, VIII-IX 1996, IX 1997, VII 1998.

Distribution. POLAND. On *V. arvensis*: only SNP (Adamska 2001); on *V. chamaedrys*: the Bug valley (Danilkiewicz 1987), the Łęczyńsko-Włodawskie Lake District (Mułenko 1988), and SNP (Adamska 2001). OTHER REGIONS. On *V. arvensis*: Caucasus, Estonia, Latvia, Romania, Germany, Denmark, Italy, Spain, and North America (Braun 1998). This fungus has also been recorded on other *Veronica* spp. in Asia, Europe, and North America (Braun 1998).

Remarks. Other species of *Ramularia* affecting plants of the genus *Veronica* are *R. chamaedryos* (Lindr.) Gunnerb. and *R. coccinea* (Fuckel) Vestergr. (Braun 1998).

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Grzyby z rodzaju *Ramularia* Słowińskiego Parku Narodowego

Streszczenie

W latach 1996-1998 i 2001 badano występowanie grzybów z rodzaju *Ramularia* w 11 zespołach roślinnych Słowińskiego Parku Narodowego. Zespołami tymi były: *Angelico-Cirsietum oleracei*, *Betulo pendulae-Quercetum roboris*, *Carici arenariae-Empetretum nigri* (*CaEn*), *Elymo-Ammophiletum* (*EA*), *Empetro nigri-Pinetum*, *Filipendulo-Geranietum*, *Helichryso-Jasionetum litoralis*, *Myrico-Salicetum auritae* (*MSa*), *Phragmitetum australis* (*Pa*), *Ribeso nigri-Alnetum*, and *Vaccinio uliginosi-Betuletum pubescentis*. Łącznie znaleziono 37 gatunków grzybów z rodzaju *Ramularia*. Spośród nich, *R. galii* jest grzybem nowym dla Polski, a *R. archangelicae*, *R. calcea*, *R. chamaedryos*, *R. cynarae*, *R. didymarioides*, *R. lactea*, *R. rhaetica*, *R. schulzeri*, *R. tanaceti* i *R. triboutiana* znajdywano wcześniej rzadko. Osiem gatunków znaleziono na nowych żywicielach, tj. *Ramularia chaerophylli* (na *Chaerophyllum temulum*), *R. lamii* var. *lamii* (*Galeopsis tetrahit*), *R. inaequale* (*Hieracium laevigatum*, *H. sabaudum* i *Hypochoeris radicata*), *R. schulzeri* (*Lotus uliginosus*), *R. grevilleana* var. *grevilleana* (*Potentilla erecta*), *R. uredinis* (*Pucciniastrum vaccinii* z *Vaccinium uliginosum*), *R. lactea* (*Viola palustris* i *V. tricolor*) and *R. veronicae* (*Veronica arvensis*). Największą liczbę gatunków tych znaleziono w zespole *MSa* (18), a najmniejszą w *EA* (1), *CaEn* (1) i *Pa* (1).