

New records and ecology of *Naeviopsis carneola* in Central Europe with notes on other fungi growing on *Juncus filiformis*

MARKÉTA SUKOVÁ¹, CHRISTIAN SCHEUER² and BLANKA BURYOVÁ³

¹Mycological Department, National Museum, Václavské nám. 68, 115 79 Praha 1,
Czech Republic

²Institut für Botanik, Karl-Franzens-Universität, Holteigasse 6, 8010 Graz,
Austria

³Institute of Botany, Academy of Sciences of the Czech Republic,
252 43 Průhonice, Czech Republic

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Naeviopsis carneola (Ascomycetes, Helotiales, *Dermateaceae*), earlier known only from three localities in Sweden and Poland, is reported from further localities in the Czech Republic, Poland, Germany and Austria. The ecology of the species in Central Europe is evaluated (habitat, altitude, period of fructification, occurrence on various parts of *Juncus filiformis* shoots and presence of associated juncicolous fungi). Known localities are mapped. A description based on recent collections, a drawing and for the first time also microphotographs (TLM) are provided.

Key words: fungi on *Juncus filiformis*, *Naeviopsis carneola*, ecology, distribution, taxonomy, Central Europe, Czech Republic.

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Druh *Naeviopsis carneola* (Ascomycetes, Helotiales, *Dermateaceae*), dříve známý jen ze tří lokalit ve Švédsku a Polsku, byl nalezen na dalších lokalitách v České republice, Polsku, Německu a Rakousku. Byla studována ekologie tohoto druhu ve střední Evropě (prostředí, nadmořská výška, období fruktifikace, výskyt na různých částech prýtlů *Juncus filiformis* a ostatní juncikolní houby přítomné na studovaných prýtech). Všechny dosud známé lokality jsou vyznačeny na schematické mapce. Je uveden popis doplněný perokresbou a fotografiemi apothecií a důležitých mikroznaků.

INTRODUCTION

Hein (1976) introduced the genus *Naeviopsis* for 12 species occurring on herbs and on leaves of trees. Most of them are known only from Europe. Since that time only one more species has been described – *Naeviopsis carneola*. It was published by Hein and Nannfeldt (in Holm and Nannfeldt 1992) with a detailed description. The specimens from two localities in Sweden were distributed in *Fungi exsiccati suecici praesertim Upsalienses*. Scheuer and Chlebicki (1997) published the second record from the Tatra Mts. (Poland) together with a drawing and SEM photograph of an apothecium. The collection was later distributed in *Mycotheca Graecensis* and

Dupla Fungorum (Scheuer and Poelt 1997, Scheuer 1997). A small collection from the Niedere Tauern Mts. in Styria (Austria) previously unpublished by the second author also proved to contain this fungus. Recently *N. carneola* was found in 1999 and 2001 in the Šumava Mts. in the Czech Republic (Suková 2003). An investigation was made in the season of 2002 with the aim to find it in other localities, mainly in the Czech Republic, and to give more information about its ecology (habitat, altitude, period of fructification, occurrence on various parts of *Juncus*-shoots, presence of other juncicolous fungi on the shoots and substrate specificity).

METHODS

Localities of *Juncus filiformis* favourable for the occurrence of *Naeviopsis carneola* (especially in the Czech Republic) were systematically visited, their habitat conditions and presence of *Naeviopsis carneola* and other fungi were recorded. Both fresh (specimens PRM 896491, 900920, 900922, 900933, 900942) and dried (other specimens and associated fungi) material was studied in water and Melzer's reagent under a TLM microscope using Nomarski contrast. 1 % and 5 % solutions of KOH were also used (PRM 895088). The description is based on the first author's recent collections. Herbarium specimens are deposited in the herbaria PRM (Mycological Department, National Museum, Praha) and GZU (Institut für Botanik, Universität Graz).

RESULTS AND DISCUSSION

Naeviopsis carneola B. Hein et Nannf., in L. Holm et Nannf., *Thunbergia* 16: 12, 1992.

Description

(Figs. 1, 2, 3)

Fresh apothecia ochraceous, rounded, slightly elongated in direction of the *Juncus filiformis* shoot (stem, bract or leaf), (270-)400-820 × (230-)270-600 μm (measured at Loc. 17a, PRM 900932 and 900933), erumpent by a longitudinal slit in the surface tissues of the shoot or by 4 valves. While the apothecia are still young, the slit closes on drying, later the sides of the slit crack, forming valves which stay open in mature apothecia. Sometimes the disc may be completely exposed as the surface tissues are destroyed. Dried apothecia are mostly brownish orange, up to 450 μm in length.

Microcharacters. Unless stated otherwise, the data in this description are based on dried material examined in Melzer's reagent (MLZ). Paraphyses filiform, 2 μm wide, hyaline, smooth, septate, forked, in the upper part conspicuously enlarged to

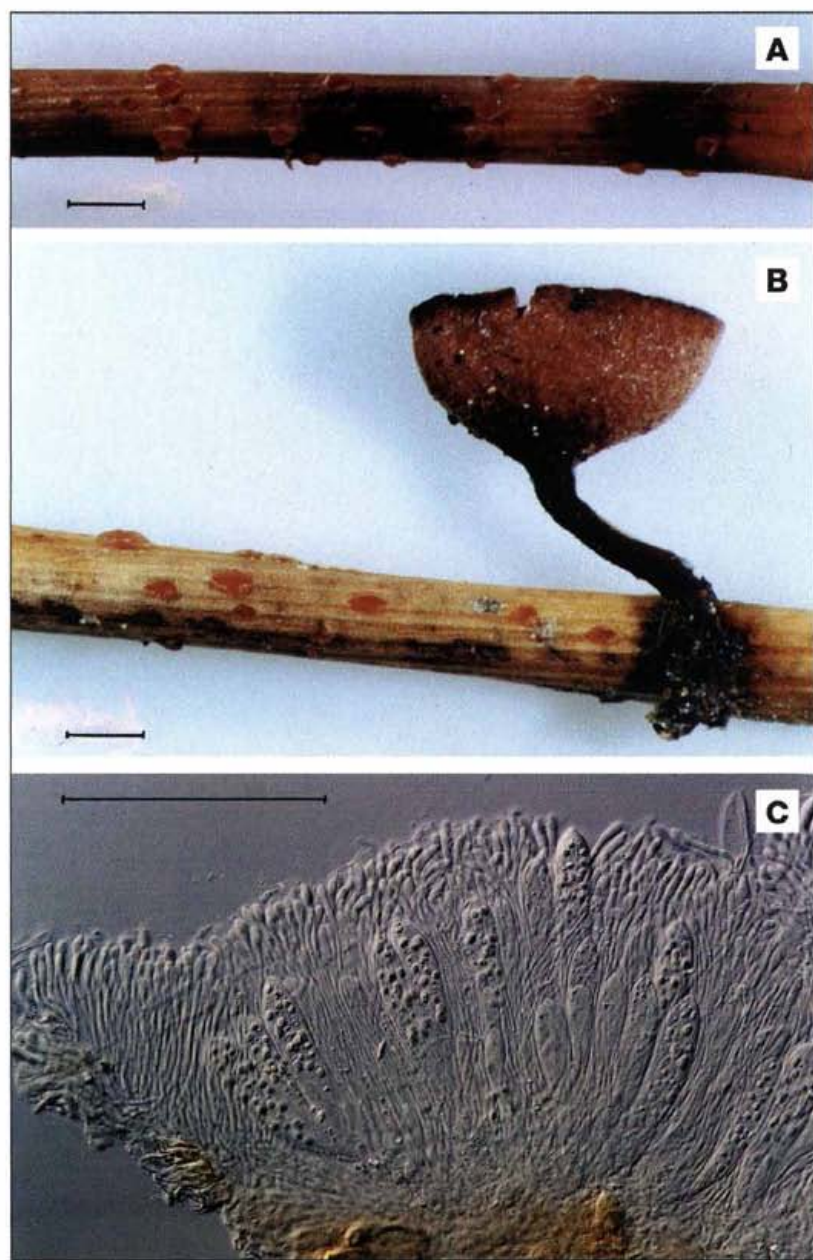


Fig. 1. *Naeviopsis carneola* B. Hein et Nannf.: A-B: apothecia on shoots of *Juncus lififormis* (in B also an apothecium of *Myriosclerotinia curreyana*), Poland, Karkonosze Mts., SW edge of cirque of Mt. Staw (PRM 900922); C: apothecium in longitudinal section, dried material (PRM 895088) studied in 1% KOH solution. Scale bars A-B: 1 mm; C: 100 µm.

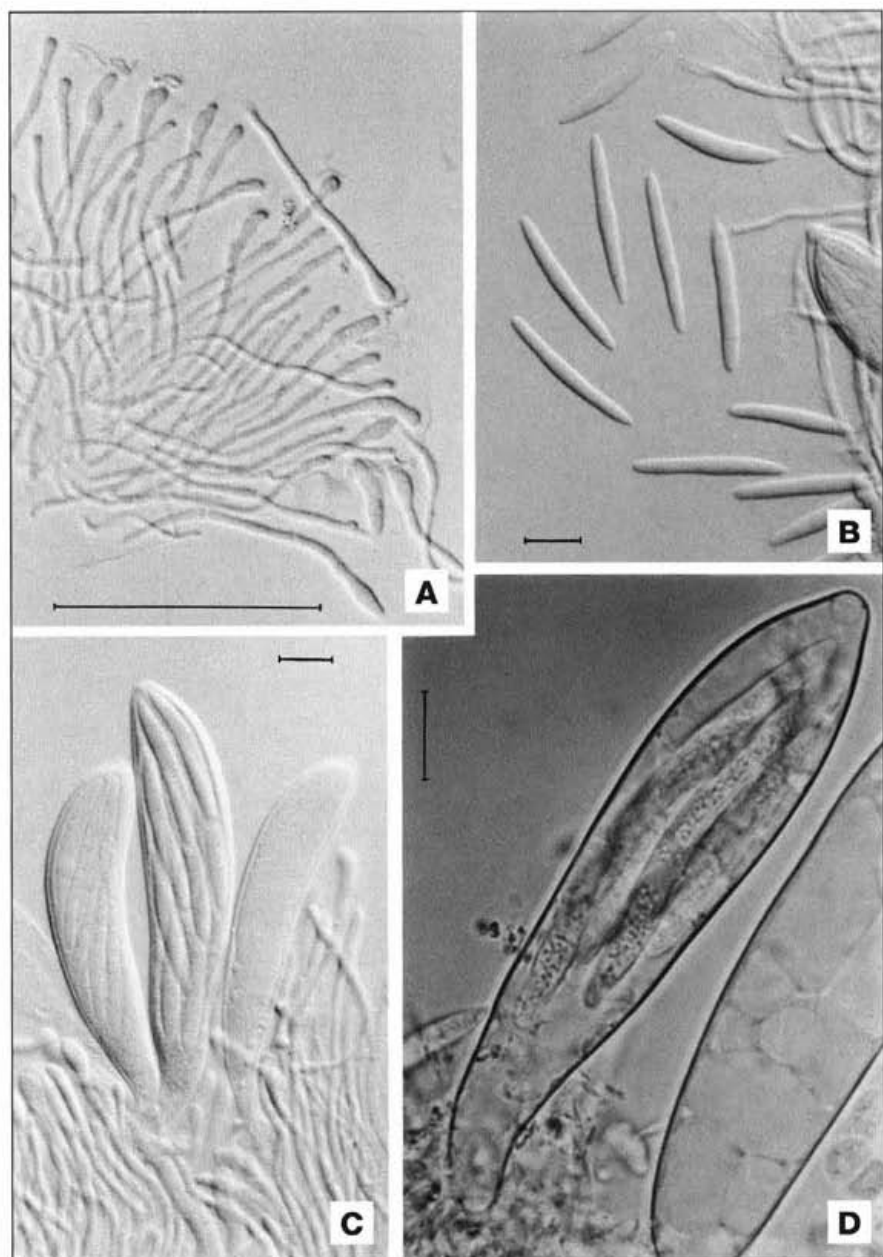


Fig. 2. *Naeviopsis carneola* B. Hein et Nannf.: A: paraphyses; B: ascospores; C: asci; D: living ascus. A-C: dried material (PRM 895088) studied in Melzer's reagent using Nomarski contrast; D: fresh material (PRM 900942) studied in water in TLM. Scale bars A: 50 μ m; B-C: 10 μ m; D: 10 μ m.

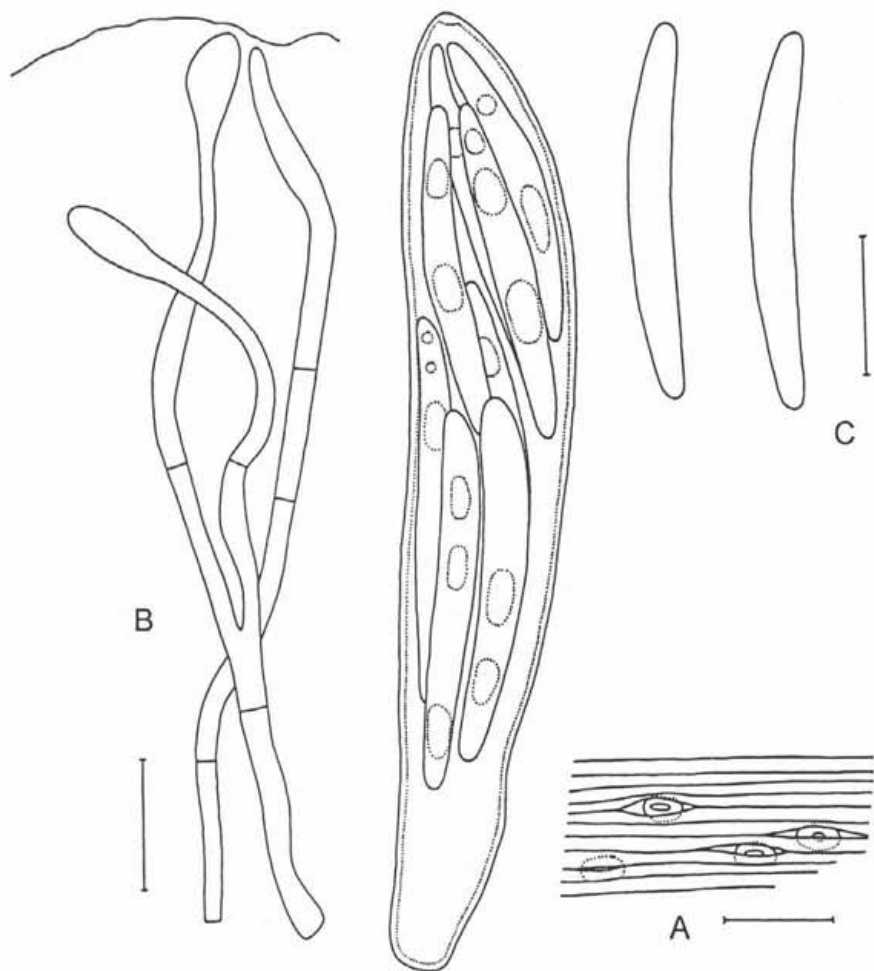


Fig. 3. *Naeviopsis carneola* B. Hein et Nannf. (PRM 895092): A: apothecia on bract of *Juncus filiformis*; B: paraphyses and ascus; C: ascospores. B-C: dried material studied in Melzer's reagent. Scale bars A: 500 μm ; B-C: 10 μm .

2.5-4.7 μm , in fresh material studied in water to (2.5-)3.5-5(-5.5) μm , embedded in a hyaline gelatinous substance. Asci inoperculate, octosporic, (57-)60-74(-78) \times (12-)13-16(-17), fresh in water 70-90(-96) \times (12.5-)14.5-18.5(-20) μm , clavate, upper part characteristically conical especially in MLZ or water (in KOH more rounded), porus not amyloid in MLZ (also after pretreatment in 5 % KOH). Ascospores mostly triseriate, one-celled, (23-)26.5-31 \times (3-)3.5-4 μm , in fresh material studied in water (30-)33-39(-43) \times (3-)4-4.5 μm , narrowly fusiform, only slightly curved, slightly gradually pointed towards each end, smooth, nearly hyaline with slight lemon tint. Rarely one or several septa in some ascospores were seen in the collections PRM 895092 (observed in a slide prepared from dried material) and PRM 900942 (observed in a slide from fresh material).

Material studied, habitat characteristics and character of localities

Localities are marked in a schematic map (Fig. 4) using numbers indicated in the following survey. Vegetation units (esp. associations), when stated, are used according to Neuhäuslová (2001) for the Šumava Mts. and according to Chytrý et al. (2001) for the other mountains of the Czech Republic. In the following survey all specimens were collected on dead overwintered shoots or parts of shoots of *Juncus filiformis*. The morphological term "shoots" means aboveground parts of plants (sheaths, leaves, stems, inflorescences and bracts); "stem" = part of shoot under inflorescence, "bract" = part of shoot above inflorescence in case of *Juncus filiformis*. We use the term "shoots" especially when it is not possible to specify, whether *Naeviopsis carneola* is located on stems, bracts or leaves. The abbreviation "not." = "notavit" (Kotlaba 1999) is used in case the material of *Naeviopsis carneola* was old or scanty, not worth to be housed in PRM, but sufficient for microscopic study and confirmation of the occurrence in the locality. Unless stated otherwise, the specimens were collected and identified by M. Suková. Bryophytes were identified by B. Buryová. The term "associated fungi" is used for fungi which were found on the same shoots as *N. carneola*, although they often occurred also on other shoots in the locality or in the tuft.

Sweden: 1) Gästrikland, Hille parish, "Tolfforskoggen", c. 200 m NW of Tolffors, on fallen last year's culms (in the specimen are fragments of shoots), 7 July 1951, leg. J. A. Nannfeldt, Fungi exsiccati suecici praesertim Upsalienses no. 3428 (isotype), PRM 877293, lit.: Holm and Nannfeldt (1992). - 2) Småland, Lidhult parish, N of "Knotsnabben", on last year's culms (in the specimen are fragments of shoots), 2 July 1929, leg. J. A. Nannfeldt, l. c. no. 3429, PRM 877346, lit.: Holm and Nannfeldt (1992). - **Poland:** 3a) Karkonosze (Krkonoše) Mts., WNW of Śnieżka (Sněžka) Mt., SW edge of cirque of "Ml. Staw" lake, open area with *Nardus stricta*, *Deschampsia cespitosa*, *Juncus filiformis*, *Sphagnum girgensohnii* and *S. capillifolium* between tourist trail and growth of *Pinus mugo*, *Vaccinium myrtillus* and *Homogyne alpina*, alt. 1390 m, 2 June 2002, PRM 900922, associated with *Arthrimum cuspidatum*, *Myriosclerotinia curreyana* and *Niptera eriophori*. - 3b) Karkonosze Mts., same locality, site with *Juncus squarrosus*, *J. filiformis* and tuft of *Molinia caerulea* in open area (mosaic of *Eriophorum vaginatum*, *E. angustifolium*, *Calluna*

vulgaris, *Nardus stricta* and *Deschampsia cespitosa*) between tourist trail and growth of *Pinus mugo*, alt. 1390 m, on stems and bracts, 2 June 2002, PRM 900921, associated with *Arthrimum cuspidatum*. – 4) Tatra Mts., Tatra National Park, N-exposed slopes of the Przelęcz Liliowe pass down to the “Dolina Gąsienicowa” valley, mosaic of *Pinetum mugii*, small patches of tall herb vegetation and small boggy depressions with *Juncus filiformis* and *Eriophorum vaginatum*, alt. 1600 m, on dead stems, 9 July 1993, leg. et det. C. Scheuer (no. 3075, 3145; Mycotheca Graecensis no. 99, Dupla Fungorum 1997), GZU, lit.: Scheuer and Chlebicki (1997), associated with e.g. *Arthrimum cuspidatum*, *Brunnipila calycioides*, *Micropeltopsis nigro-annulata* var. *papillosa*. – Czech Republic: 5a) Krušné hory Mts., 7 km NE of the village of Stříbrná, nature reserve “Velké Jeřábí jezero”, bog with *Pinus x pseudopumilio*, *Vaccinium myrtillus*, *V. uliginosum*, *Empetrum nigrum*, *Oxycoccus* sp., *Eriophorum vaginatum*, *E. angustifolium*, *Calluna vulgaris*, *Polytrichum commune* and scattered *Carex nigra*, at margin of the bog are patches of *Juncus filiformis* and *Avenella flexuosa*, patches of *Molinia caerulea*, also *Trientalis europaea* and some spruces are present in the bog, the bog is surrounded by spruce forests and by a clearing at the W side, alt. 940 m, on bracts lying parallelly over *Sphagnum fallax* tufts, 24 June 2002, PRM 900943. – 5b) Krušné hory Mts., 7 km NE of the village of Stříbrná, nature reserve “Velké Jeřábí jezero”, sloping open boggy area (SSE of Loc. 5a) with growth of *Carex rostrata* and *Sphagnum flexuosum* with scattered patches of *Juncus filiformis*, *Carex nigra* and *C. canescens*, alt. 925 m, on shoots lying parallelly on *Sphagnum flexuosum* tufts, 23 June 2002, PRM 900936, associated with *Arthrimum cuspidatum*. – 6) Krušné hory Mts., “Božidarské rašeliniště” bog, 700 m SW of the village of Boží dar, moist meadows in close vicinity of the bog (*Pinus x pseudopumilio*, *Betula nana*, *Vaccinium myrtillus*, *V. uliginosum*, *V. vitis-idaea*, *Eriophorum vaginatum*, *Oxycoccus* sp.) with *Bistorta major*, *Potentilla erecta*, *Galium* sp., *Comarum palustre*, *Carex rostrata*, *C. nigra*, *C. canescens*, *Eriophorum angustifolium*, *Juncus filiformis* and *Sphagnum fallax*, alt. 1005 m, on bracts lying in tufts of *Deschampsia cespitosa*, *Molinia caerulea* or among *Sphagnum fallax* plants, 22 June 2002, PRM 900935, associated with *Arthrimum cuspidatum*, *Niptera eriophori*. – 7) Jizerské hory Mts., N of village of Josefův důl, 2.75 km WSW of settlement Smědava, nature reserve “U Posedu”, small open place among young spruces with *Juncus filiformis*, *Eriophorum vaginatum*, *Carex canescens*, *Avenella flexuosa* and *Vaccinium myrtillus*, alt. 1000 m, on stems and bracts lying among *Sphagnum girgensohnii* plants, on *Polytrichastrum formosum* tufts, on *Cephalozia bicuspidata* growths and on decaying decorticated log, 30 June 2002, leg. M. Suková et D. Novotný, rev. C. Scheuer, PRM 900940, associated with *Arthrimum cuspidatum*, *Niptera eriophori* (PRM 900941), *Mollisia* cf. *palustris*. – 8) Krkonoše Mts. (Giant Mts.), Labský důl valley, NW edge of “Harrachova jáma” cirque, small tufts of *Juncus filiformis* in open area with *Nardus stricta*, in close vicinity of rocks, snowfield and growths of *Pinus mugo*, *Vaccinium myrtillus* and *Athyrium* sp., the locality is not far above a spruce forest with birch and *Sorbus aucuparia*, alt. 1220 m, on lying stem and leaf, 31 May 2002, PRM 900920. – 9) Krkonoše Mts., NW of Luční bouda chalet, “Čertova louka” bog (*Eriophorum angustifolium*, *E. vaginatum*, *Trichophorum* sp., *Carex pauciflora*, *Andromeda polifolia*, *Pinus mugo*, *Vaccinium myrtillus*), area with *Molinia caerulea*, scattered *Juncus filiformis* and *Carex nigra*, *Sphagnum* spp., *Polytrichum commune*, *Homogyne alpina* and *Nardus stricta*, alt. 1385 m, on stem and bract among *Sphagnum* plants, 14 July 2002, not. M. Suková. – 10a) Krkonoše Mts., “Úpské rašeliniště” bog, 1 km ENE of Luční bouda chalet, mosaic of growths of *Pinus mugo* and open areas with *Eriophorum angustifolium*, *E. vaginatum*, *Trichophorum* sp. and *Andromeda polifolia*. *Juncus filiformis* grows along the tourist trail on a mesic place with moss, *Deschampsia cespitosa*, *Homogyne alpina*, *Taraxacum* sp. and *Viola* sp., alt. 1430 m, on stems and bracts, 5 June 2002, PRM 900924 (the material of *N. carneola* was relatively old), associated with *Arthrimum cuspidatum* (PRM 900925). – 10b) Krkonoše Mts., same locality and similar place with *Juncus filiformis* by the trail, 5 June 2002, PRM 900926, associated with *Arthrimum cuspidatum* and *Brunnipila calycioides*. – 11) Krkonoše Mts., “Obří důl” valley, bog 250 m N of chalet Bouda v Obřím dole, open area (surrounded by spruce forest) with *Sphagnum fallax*, *Trientalis europaea*, *Potentilla erecta*, *Vaccinium vitis-idaea*, *V. myrtillus*, *Calamagrostis* sp., *Anthoxanthum odoratum*, *Nardus stricta*, *Juncus effusus* and *J. filiformis*, alt. 920 m, on

languid (flattened, not terete) stems, bracts and leaves lying among *Sphagnum fallax* plants, 4 June 2002, PRM 900923, associated with *Arthrimum cuspidatum* and *Niptera eriophori*. – **12**) Krkonoše Mts., nature reserve "Černohorské rašeliniště" bog (*Pinus mugo*, *Vaccinium myrtillus*, *V. uliginosum*, *Eriophorum vaginatum*, *Trichophorum cespitosum* and *Andromeda polifolia*), WNW margin of the reserve (spruce forest with *Vaccinium myrtillus*, *V. vitis-idaea* and *Trientalis europaea*, and open areas with *Vaccinium uliginosum*, *Eriophorum vaginatum* and *Oxycoccus* sp.); *Juncus filiformis* grows by a drainage ditch (*Sphagnum fallax*, *S. cuspidatum*, *S. russowii* and *Polytrichum commune*) along a tourist trail, alt. 1180–1190 m, on shoots lying parallelly over tufts of peat-mosses (*Sphagnum* spp.), 6 June 2002, PRM 900927, associated with *Arthrimum cuspidatum* and *Brunnipila calycioides*. – **13a**) Hrubý Jeseník Mts., Mt. "Velký Jezerník", nature reserve Slatě, in saddle between the peaks of Velký Jezerník and Malý Děd, bog (*Eriophorum vaginatum*, *Vaccinium uliginosum*, *V. vitis-idaea*, *V. myrtillus*, *Oxycoccus* sp., *Andromeda polifolia*, *Sphagnum* spp., *Polytrichum commune*, *Empetrum nigrum*, *Calluna vulgaris*, also *Melampyrum pratense*, *Avenella flexuosa* and *Trientalis europaea*) surrounded by spruce forest (*Sphagno-Piceetum*) with peat-mosses (*Sphagnum* spp.); *Juncus filiformis* grows sporadically in the bog and more frequent along a wooden pathway where also *Deschampsia cespitosa*, *Nardus stricta*, *Anthoxanthum* sp., *Carex canescens* and *C. echinata* occur, alt. 1300 m, on stems and bracts lying among dead *Nardus* shoots or lying on wood of the path, 5 July 2002, PRM 900942, associated with *Arthrimum cuspidatum* and *Niptera eriophori*. – **13b**) Hrubý Jeseník Mts., same locality, small site with *Juncus filiformis*, brownish green coloured peat-moss and *Polytrichum commune* (surrounded by *Nardus stricta*, *Deschampsia cespitosa*, *Molinia caerulea*, *Juncus effusus* and *Homogyne alpina*) between the wooden pathway and the spruce forest, alt. 1300 m, on shoots lying on tufts and among plants of *Sphagnum* sp. and *Polytrichum commune*, 20 May 2003, PRM 900919, associated with *Arthrimum cuspidatum*, *Brunnipila calycioides* and *Mycosphaerella perexigua* var. *minima*. – **14**) Šumava Mts. (Bohemian Forest), 2.5 km N of the village of Kvilda, "Jezerní slat" bog, *Sphagno-Pinetum mugii* with *Pinus* × *pseudopumilio*, *Betula nana*, *Calluna vulgaris*, *Vaccinium myrtillus*, *V. uliginosum*, *V. vitis-idaea*, *Eriophorum vaginatum*, *E. angustifolium*, *Carex nigra*, *C. canescens* and *C. rostrata*; *Juncus filiformis* occurs only in a small area between *Pinus* × *pseudopumilio* and a wooden pathway with *Polytrichum commune*, *Sphagnum flexuosum*, *Nardus stricta*, *Melampyrum pratense*, *Eriophorum angustifolium* and *Carex nigra*, alt. 1075 m, 49° 02' 30" N, 13° 34' 40" E, on bracts and leaves lying among *Sphagnum flexuosum* plants and among *Polytrichum commune* stems, 12 June 2002, rev. C. Scheuer, PRM 896488, associated with *Arthrimum cuspidatum* (PRM 896490), *Brunnipila calycioides*, *Mycosphaerella perexigua* var. *minima* and *Niptera eriophori*. – **15**) Šumava Mts., 2.75 km NE of the site Březník, "Ptačí nádrž", at left bank of Ptačí potok brook, open area with *Carex rostrata*, *Juncus filiformis*, *Sphagnum fallax*, *Polytrichum commune* and less frequent *Carex nigra*, at the margin of the area near a spruce forest also occur *Vaccinium myrtillus*, *Trientalis europaea* and *Calamagrostis* sp., alt. 1130 m, on dead bracts lying on tufts and among plants of *Sphagnum fallax*, 13 June 2002, PRM 896498, associated with *Arthrimum cuspidatum* and *Brunnipila calycioides* (PRM 896499). – **16**) Šumava Mts., S of Modrava village, "Luzenské údolí" valley (with bogs surrounded by uniform spruce forest), c. 1 km S of Březník, on left side of the road Hraniční louka – Březník, by drainage ditch (*Juncus filiformis*, *Carex nigra*, *C. canescens*, *Sphagnum fallax*, *Polytrichum commune* and *Deschampsia cespitosa*) between road and bog (mosaic of *Pinus* × *pseudopumilio* and *Eriophorum vaginatum*, *Vaccinium uliginosum*, *Trichophorum cespitosum*, *Oxycoccus* sp. and *Andromeda polifolia*), alt. 1147 m, on stems, bracts and leaves lying among *Sphagnum fallax* plants or lying parallelly on lying decorticated fragment of spruce trunk, 7 June 2001, rev. C. Scheuer, PRM 895088, lit.: Suková (2003), associated with *Arthrimum cuspidatum*, *Brunnipila calycioides*, *Mycosphaerella perexigua* var. *minima* and *Phyllachora therophila*. – **17a**) Šumava Mts., ESE bank of "Plešné jezero" lake, vegetation with *Juncus filiformis* and *Sphagnum girgensohnii* between bank and spruce forest (*Dryopterido dilatatae-Piceetum*) with *Sorbus aucuparia*, *Vaccinium myrtillus*, *V. vitis-idaea* and *Dryopteris dilatata* (sporadically *Betula*, *Pinus* × *pseudopumilio* and *Salix* sp. by the bank), alt. 1090 m, on stems and especially on bracts lying parallelly on root of a tree, on leaves of birch, on tufts

of *Sphagnum girgensohnii* and *Polytrichum commune*, 10 June 2002, PRM 900932 and 900933, associated with *Arthrimum cuspidatum*, *Brunnipila calycioides*, *Cistella fugiens* (base of stem among *Sphagnum* plants, PRM 900934) and *Lachnum diminutum*. – **17b**) Šumava Mts., SW bank of "Plešné jezero" lake, vegetation with *Calamagrostis* sp., *Carex rostrata*, *Sphagnum girgensohnii* and *Polytrichum commune*, alt. 1090 m, on stems, bracts and leaves lying on tufts and among plants of *Sphagnum girgensohnii*, 30 June 1999, det. C. Scheuer, PRM 895092. – **18a**) Šumava Mts., 450 m W of Mt. Plechý, "Rakouská louka" bog, central part of the bog (*Eriophorum vaginatum*, *Vaccinium uliginosum*, *Melampyrum pratense*, *Andromeda polifolia*, *Oxycoccus* sp.), alt. 1345 m, on a few separate shoots lying among *Sphagnum russowii* plants, 26 June 2002, not. M. Suková. – **18b**) Šumava Mts., 450 m W of Mt. Plechý, "Rakouská louka" bog, margin (*Sphagno-Piceetum* with *Vaccinium myrtillus*, *Molinia caerulea*, *Eriophorum vaginatum*, *Polytrichum commune*, *Sphagnum fallax*) of the bog near spruce forest, alt. 1345 m, on separate shoots lying on tufts and among plants of *Sphagnum fallax*, 26 June 2002, PRM 896491, associated with *Arthrimum cuspidatum* and *Brunnipila calycioides*. – **18c**) Šumava Mts., 400 m WSW of Mt. Plechý, SSE of "Rakouská louka" bog, open area between spruce forest and tourist trail Plechý – Trojmezí, *Juncus filiformis* areas (with *Carex nigra* and *C. canescens*) in stands of *Nardus stricta*, alt. 1345 m, 26 June 2002, PRM 900938, associated with *Arthrimum cuspidatum* and *Brunnipila calycioides*. – **19**) Novohradské hory Mts., 800 m SE of Pohořský rybník pond, N of nature reserve "Pohořské rašeliniště" (bog with *Pinus x pseudopumilio*, *Vaccinium myrtillus*, *V. uliginosum*, *Eriophorum vaginatum*), open area (*Eriophorum angustifolium*, *E. vaginatum*, *Carex rostrata*, *C. nigra*, *C. canescens*, *Juncus filiformis*, *Avenella flexuosa*, *Nardus stricta*, *Potentilla erecta*, *Sphagnum* spp. and *Polytrichum commune*) between the reserve, spruce forest and road, alt. 888 m, on stems and bracts lying among plants of *Sphagnum fallax* and *S. girgensohnii* or lying parallelly over *Polytrichum commune* tufts, 9 June 2002, not. M. Suková, associated with *Arthrimum cuspidatum* (PRM 900929), *Brunnipila calycioides* (PRM 900930) and *Niptera eriophori* (PRM 900931). – **Germany: 20**) Bayern, Bayerischer Wald Mts., "Rachelsee" (Roklanské jezero) lake, site with *Warnstorfia exannulata*, *Sphagnum fallax*, *Polytrichum* sp., fallen leaves of *Fagus*, *Juncus filiformis*, *Carex canescens*, *C. rostrata* and *C. echinata* at waterside near dike, alt. 1072 m, on bracts lying on *Warnstorfia exannulata* growths or among *Sphagnum fallax* plants, 27 June 2002, PRM 900939. – **Austria: 21**) Oberösterreich, Bayerischer Wald Mts., 400 m SWW of Plöckenstein (Plechý) Mt., SSE of "Rakouská louka" bog, growth of *Juncus filiformis*, *Avenella flexuosa*, *Nardus stricta* and *Polytrichum* sp. between tourist trail and spruce forest (*Calamagrostis villosae-Piceetum*), alt. 1345 m, on shoots lying parallelly on soil and on *Dicranella heteromalla*, 26 June 2002, PRM 900937, associated with *Arthrimum cuspidatum* and *Brunnipila calycioides*. – **22**) Steiermark, Niedere Tauern Mts., Wölzer Tauern Mts., c. 19 km SSW of the town of Liezen, 9 km SE of the village of Donnersbach, SSW above the resort Planneralm, in a boggy area named "Plannerkessel", close to the small lake Kothüttensee, along the path to the peak Karlspitze, small depression in *Pinus mugo* bog (characteristic plants in the bog: *Carex magellanica*, *C. echinata*, *Eriophorum vaginatum*, *Andromeda polifolia*; in wetter places in the depressions also *Carex limosa*, *C. canescens*, *Juncus filiformis*, *Trichophorum cespitosum*), alt. c. 1800 m, 47° 23' N, 14° 11' E, 25 August 1981, leg. et det. C. Scheuer (Nr. 917), GZU.

Ecology

Habitat of *Juncus filiformis* shoots. *Naeviopsis carneola* was usually found on terete *Juncus* shoots lying among brownish green (*Sphagnum* sect. *Cuspidata* – *S. fallax*, *S. flexuosum*) or green coloured peat-mosses (*S. girgensohnii*), less frequently in *Polytrichum commune*. It was seldom found on or among other bryophytes (*Cephalozia bicuspidata*, *Warnstorfia exannulata*, *Polytrichastrum formosum*) or in tufts of grasses. *Naeviopsis carneola* occurred also on shoots lying

over mosses or other materials (wood, roots of trees, fallen leaves), e.g. in a rich growth of *Juncus filiformis* at the ESE side of Plešné jezero lake (Loc. 17a, locality with high air humidity). It was also found on shoots lying on decorticated prostrate trunks in Luzenské údolí valley (Loc. 16) in the Šumava Mts. and in the Jizerské hory Mts. (Loc. 7).

Changes during the vegetation season were studied in Hrubý Jeseník (Loc. 13a-b) and at the ESE side of Plešné jezero lake (Loc. 17a). The shoots of *J. filiformis* are first (in the beginning of the season) situated above the peat-mosses and of light colour. After that the peat-mosses (similarly in case of *Polytrichum commune*) grow and the shoots become more and more lodged. Subsequently they are enclosed by *Sphagnum* cushions and sometimes the surface tissues of the plants can gradually be destroyed (e.g. collection PRM 895092, Loc. 17b). Fructification of *Naeviopsis* begins at Plešné jezero already on shoots above the *Sphagnum* tufts (e.g. collections PRM 900932-3 from 10 June 2002, Loc. 17a), later (investigated on 26 June 2002) – when lying within *Sphagnum* cushions – only *Lachnum diminutum* was found frequently. In Hrubý Jeseník fructification begins when the shoots are lying partly on and partly among the peat-mosses. Parts of shoots lying in *Sphagnum* are frequently more or less brown-coloured thanks to the water, other, not so moist parts are light-coloured. The brown colour disappears soon after drying. Apothecia of the *Naeviopsis* are usually more frequent on the brown parts (observed during the collecting of specimen PRM 900919, Loc. 13b). Brown-coloured parts of shoots with apothecia were seen also in localities 4, 5a and 8.

Other fungi found on the same shoots as *Naeviopsis carneola*: *Arthrinium cuspidatum* (Cooke et Harkn.) Höhn.; *Brunnipila calycioides* (Rehm) Baral; *Cistella fugiens* (Buckn.) Matheis; *Lachnum diminutum* (Roberge) Rehm; *Micropeltopsis nigro-annulata* (Webster) Spooner et Kirk var. *papillosa* (Scheuer) Magnes et Hafellner; *Mollisia* cf. *palustris* (Roberge ex Desm.) P. Karst. – species with grey-brown apothecia and one-celled ascospores slightly attenuated towards one end; *Mycosphaerella perexigua* (P. Karst.) Johans. var. *minima* Johans. – identified according to Tomilin (1979) and Scheuer (1988); *Myriosclerotinia curreyana* (Berk.) N. F. Buchw.; *Niptera eriophori* (L. A. Kirchn.) Rehm; *Phyllachora therophila* (Desm.) Arx et E. Müll.

Naeviopsis carneola was most frequently observed together with *Arthrinium cuspidatum* and *Brunnipila calycioides*. *Arthrinium cuspidatum* was located at the bases and lower parts of shoots, *Naeviopsis carneola* on stems near inflorescences and especially on bracts (except of their tips), only rarely on leaves. *Brunnipila calycioides* was relatively often found in upper parts of bracts and leaves. Also other fungi were relatively frequent – *Mycosphaerella perexigua* var. *minima* occurring on various parts of shoots, *Niptera eriophori* on stems and especially on bracts (in many cases alternating with *Naeviopsis carneola*) and *Mollisia* cf.

palustris located usually on inflorescences and adjacent parts of stems and bracts. Clusters of perithecia of *Phyllachora therophila* and the superficial catathecia of *Micropeltopsis nigro-annulata* var. *papillosa* (Loc. 4) were scattered over various parts of the shoots. *Cistella fugiens* was recorded only once, on the base of a stem. This species occurs rather on bases of not so old shoots standing or less frequently lying in conditions different from those favourable for *Naeviopsis carneola*. It is more common on sheaths and basal parts of stems of *Juncus effusus*. Apothecia of *Myriosclerotinia curreyana* were found on various parts of stems only at Ml. Staw lake (Loc. 3a). Sclerotia (probably of *M. curreyana*) occurred at Černohorské rašeliníště bog (Loc. 12) on *Juncus filiformis* stems without *Naeviopsis carneola*. *Lachnum diminutum* occurs on various parts of shoots later in the season, so it was not often found together with *Naeviopsis carneola*.

Period of fructification of *Naeviopsis carneola* and associated fungi in the Czech Republic and close vicinity (border mountains). *Naeviopsis carneola* can be found mature from the last week of May to the first half of June, depending on altitude, local climatic conditions and habitat of *Juncus filiformis* shoots. After that period, in the second half of June, it is more or less old, but it can be recognised by more or less open slits or valves, and by mature asci at least present in some apothecia. The latest collections containing mature apothecia in good condition were made at the beginning of July in the Hrubý Jeseník Mts. (Loc. 13a).

Arthrimum cuspidatum sporulates on *Juncus filiformis* at the same time as *Naeviopsis carneola*. Apothecia of *Brunnipila calycioides* are present longer and are usually found young or mature together with mature *Naeviopsis carneola*. The pseudothecia of *Mycosphaerella perezigua* var. *minima* are mature at the end of May and in the first half of June. *Phyllachora therophila* is usually old in June. Apothecia of *Niptera phaea* and *Mollisia* cf. *palustris* usually mature in June (recent finds on *Juncus filiformis*) and later (according to experience from the Czech Republic and other *Juncaceae*, it is known also from summer and autumn). *Lachnum diminutum* appears already in the first half of June, but it is more frequent later (Plešné jezero lake, Loc. 17a). *Myriosclerotinia curreyana* (see also Suková and Svrček 2001) matures on *Juncus filiformis* in the subalpine belt in the first half of June.

Substrate specificity. *Naeviopsis carneola* is strictly specific to *Juncus filiformis* whereas other fungi found on *J. filiformis* (*Arthrimum cuspidatum*, *Brunnipila calycioides*, *Lachnum diminutum*, *Mycosphaerella perezigua* var. *minima*, *Myriosclerotinia curreyana*) occur also on other species of *Juncus*. *Niptera eriophori* is known also from other graminaceous marsh plants from the families *Juncaceae* and *Cyperaceae*. *Micropeltopsis nigro-annulata* var. *papillosa* is probably rather unspecific, but apparently has a preference for such substrata. *Mollisia palustris*

is given from various graminaceous plants in the literature, but our identifications are still tentative.

Altitude. *Naeviopsis carneola* occurs in open areas in the supramontane (Hejný and Slavík 1988) and subalpine belt in Central Europe. In the subalpine belt it was found in the Krkonoše Mts. (Mt. Staw, Čertova louka, Úpské rašeliniště, altitudes 1385–1430 m), and Tatra Mts. (Dolina Gašienicowa, alt. 1550–1650 m), and in the Eastern Alps (Niedere Tauern, alt. 1800 m). Other recently studied localities are in the supramontane belt (altitude 888–1005 m in Krušné hory, Jizerské hory, Novohradské hory; 1070–1150 m in the Šumava Mts.; (920-)1180–1345 m in Krkonoše and Hrubý Jeseník). The species does not occur at lower altitudes characterised by *Juncus filiformis* growing in communities with *Comarum palustre*, peat-mosses (*Sphagnum* spp.) and various other marsh plants. Such localities were investigated in the Novohradské hory Mts. (Mlýnský rybník pond, alt. 760 m and Huťský rybník dam lake, alt. 800 m) and in the Žďárské vrchy hills (Velké Dářko pond, alt. 615 m). *Comarum palustre* (species typical of submontane and lower altitudes) has been found together with *Naeviopsis carneola* at the only one studied locality (Božídarské rašeliniště, Loc. 6).

Concerning associated fungi, *Arthrimum cuspidatum*, *Brunnipila calycioides* (see also Chlebicki 1990), and *Micropeltopsis nigro-annulata* var. *papillosa* are distributed in the montane (sensu lato), subalpine and alpine belt (where they occur on *Juncus trifidus*). *Myriosclerotinia curreyana* has been reported from subalpine (on *Juncus filiformis*), montane and lower altitudes (on *J. effusus*) in the Czech Republic (Suková and Svrček 2001). *Mollisia* cf. *palustris* occurs in montane and lower altitudes. *Niptera eriophori* and *Cistella fugiens* are common fungi at various altitudes. *Lachnum diminutum* is known from montane and especially lower altitudes.

Types of localities. *Naeviopsis carneola* was found in various types of localities:

a) Glacial cirques. The cirque of Plešné jezero lake (Loc. 17a-b) in the Šumava Mts. (Bohemian Forest) is considered the most natural locality of *N. carneola* in the Czech Republic. According to Neuhäuslová (2001), its moraine is covered mostly by natural spruce forest on siliceous substrate, particularly *Dryopterido dilatatae-Piceetum* SE of the lake and *Athyrio alpestris-Piceetum* on slopes SW of the lake. *Juncus filiformis* forms a stand with *Sphagnum girgensohnii* at ESE side (Loc. 17a) and a stand with *Calamagrostis* sp., *Carex rostrata*, *Sphagnum girgensohnii* and *Polytrichum commune* (Loc. 17b) in a relatively large horizontal area by the SW bank of the lake. *Carex rostrata* is more frequent in an adjacent wetter area by the water. Only fragmentary occurrence of *Juncus filiformis* with *Naeviopsis carneola* was found in the cirque of Rachelsee lake (Loc. 20) on the

German side of the mountain range (Bayerischer Wald) on a rather man-influenced stand between a path and the bank near the dike.

b) Subalpine bogs with *Pinus mugo* or mosaics of *Pinus mugo* growths, boggy places with typical plants and more mesic open places with prevailing *Nardus stricta* (Locs. 3a-b, 4, 8, 9, 10a-b, 22). Only few small tufts of *Juncus filiformis* were found in the open area with *Nardus stricta* among growths of *Pinus mugo* in Harrachova jáma cirque in Labský důl valley (Loc. 8). The occurrence of *Naeviopsis carneola* there seems to be peripheral and we suppose that *Juncus filiformis* and *Naeviopsis carneola* are more frequent on Pančavská louka bog and adjacent bogs on a plateau W above Labský důl valley.

c) Supramontane bogs (Locs. 5a, 12, 13a-b, 14, 16, 18a-b) often with *Pinus mugo* or *Pinus ×pseudopumilio* (lacking e.g. at Loc. 13a-b), with *Eriophorum vaginatum*, other typical plants (for details see "Material studied and character of localities") and mostly with red coloured peat-mosses. Separate shoots of *Juncus filiformis* among "red coloured" *Sphagnum russowii* in the centre of a bog has been found only once (Loc. 18a). *Juncus filiformis* occurs regularly in wetter places in marginal parts of the bogs, in slightly depressed places along wooden pathways and near drainage ditches e.g. along the roads. Brownish green coloured peat-mosses (e.g. *Sphagnum fallax*, *S. flexuosum*) are often present together with *Juncus filiformis* on such places.

d) Sloping (Locs. 5b, 15) or horizontal (Loc. 11) open boggy areas surrounded by spruce forests in the supramontane belt. Large growths of brownish green coloured peat-mosses (e.g. *Sphagnum fallax*, *S. flexuosum*) prevail there together with *Carex rostrata* and/or *Calamagrostis* sp. scattered regularly over the whole area of the growth. *Juncus filiformis*, *Carex nigra* and *Polytrichum commune* are usually also present.

e) Mostly uniform, large stand of *Juncus filiformis* on a man-influenced stand (Loc. 21, alt. 1345 m) in open area along a tourist trail surrounded by spruce forests. *Naeviopsis carneola* was present only in some parts of the stand where shoots are lying under wet conditions.

Various *Juncus filiformis* stands without occurrence of *Naeviopsis carneola* have been studied too. *Arthrimum cuspidatum* prevails on whole shoots in less humid or mesic localities in the supramontane and subalpine belt (e.g. locality at "Nad Malým kotlem" crossroad, in saddle between Mt. Velký Máj and Mt. Jelení hřbet in the Hrubý Jeseník Mts., Czech Republic, dried up boggy place with *Eriophorum vaginatum* and *Carex* spp., alt. 1330 m). *Arthrimum cuspidatum* has been collected also on several *Juncus filiformis* shoots in a stand affected by human activities (e.g. open area between road and clearing in cultivated spruce forest E of nature reserve Labský důl valley in the Krkonoše Mts., alt. 1170 m).

Distribution

(Fig. 4)

According to the present state of knowledge, *Naeviopsis carneola* is distributed in Scandinavia and in mountains of Central Europe. In Scandinavia it is known from Sweden (Holm and Nannfeldt 1992) and its occurrence in Norway is expected (the first author observed old material of the species in the National Parks Rondane and Ormtjernkampen in August 2002). In Central Europe it is known from the Western Sudetes (Jizerské hory Mts., Krkonoše Mts.), Eastern Sudetes (Hrubý Jeseník Mts.), Carpathians (Tatra Mts.), mountains of the Hercynian phytogeographical subprovince (Krušné hory Mts., Šumava Mts., Novohradské hory Mts.) and from the central range of the Eastern Alps (Niedere Tauern). *Naeviopsis carneola* is considered to be a species with a boreal-montane distribution with a tendency to occur in the subalpine belt.

In the Czech Republic, *N. carneola* is distributed in protected areas in border mountains. Altogether 16 localities were found and some further localities can be expected – e.g. Modravské slatě bogs in the Šumava Mts. and Pančavská louka bog in the Krkonoše Mts. Šumava (the richest locality is Plešné jezero lake, Loc. 17a-b) and Krkonoše (the richest locality is Černohorské rašeliniště bog, Loc. 12) are the most important centres of occurrence of the species in the Czech Republic. In the other Czech mountains only few localities of *N. carneola* have been found, mostly in isolated nature reserves. The richest of them is Velké Jeřábí jezero bog (Loc. 5a) in the Krušné hory Mts. The locality Malení on Mt. Smrk (alt. 1125 m) in Rychlebské hory Mts. (Eastern Sudetes) seemed to be favourable for the occurrence of *N. carneola*. However, the area of the bog is too small and the substrate (*Juncus filiformis*) is lacking and consequently, the species was not found there.

The Slovak part of the Tatra Mts. has not yet been investigated. The presence of the species in this territory and probably also in some other Slovak mountains (belonging to the Carpathians) is expected.

CONCLUSIONS

Naeviopsis carneola is considered to be a species with a boreal-montane distribution with a tendency to occur in the subalpine belt. At present it is known from Scandinavia and from mountains of Central Europe. In the Czech Republic, *N. carneola* is related to protected areas in the supramontane and subalpine belt, with centres of occurrence in the National Parks of Šumava Mts. and Krkonoše Mts. *Naeviopsis carneola* is strictly specific to *Juncus filiformis*.

The ecology of the species was investigated mainly in the Czech Republic and its close vicinity (border mountains). Habitat conditions most important for the occurrence of *N. carneola* seem to be high humidity (1), cold climate (2) and subsequently nativeness of vegetation (3). (1) Most frequently it occurs on



Fig. 4. Known localities of *Naeviopsis carneola* B. Hein et Nannf., for localities 1-22 see "Material studied and character of localities".

shoots lying within *Sphagnum* sect. *Cuspidata*, *S. girgensohnii* and less frequently *Polytrichum commune* tufts. (2) It is lacking in localities at lower altitudes even if the plant cover is similar – composed of the same species of plants as in some localities of *Naeviopsis carneola*. (3) In addition to localities with natural vegetation it is known also from man-influenced localities, however, these localities are regularly not far from those with natural vegetation. On shoots of *Juncus filiformis*, *Naeviopsis carneola* was most frequently observed together with *Arthrimum cuspidatum* and *Brunnipila calycioides*. *Arthrimum cuspidatum* was located in lower parts of shoots, *Naeviopsis carneola* on stems near inflorescences and especially on bracts (except of their tips, where *B. calycioides* often occurred). The period of fructification is relatively short (from the last week of May to the first half of June, rarely to the beginning of July) in comparison with most other fungi found on *Juncus filiformis*.

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