

## *Gymnopus vernus* (*Omphalotaceae*, *Agaricales*) recorded in Slovakia

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*Gymnopus vernus* was recorded in Slovakia in 2008 for the first time, namely in the Jelšie Nature Reserve (Liptovská kotlina Basin, N Slovakia). After more than five years, it is still the only known Slovak locality, although with two more collections from 2009 and 2013. In this paper, description of macro- and micromorphological characters, drawings and photographs of the Slovak collections are presented. The knowledge of the occurrence, ecology and threat of the species in Europe is also summarised.

**Key words:** taxonomic description, distribution, ecology, threatened species.

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*Gymnopus vernus* bol na Slovensku nájdený prvýkrát v roku 2008, a to v prírodnej rezervácii Jelšie (Liptovská kotlina, severné Slovensko). Aj po viac ako piatich rokoch zostáva táto lokalita jediným slovenským náleziskom, i keď s dvoma ďalšími zbermi z rokov 2009 a 2013. V príspevku uvádzame opis makro- a mikromorfologických znakov, perokresby a fotografie slovenských zberov. Sumarizujeme tiež poznatky o výskyte, ekológii a ohrozenosti druhu v Európe.

### INTRODUCTION

*Gymnopus vernus* (Ryman) Antonín & Noordel. is a widely distributed but rare species in Europe. Its typical features are a pileipellis composed of thin-walled, smooth or incrustated hyphae with clavate, cylindrical to subfusoid, often irregular terminal elements, often with lateral projections, sometimes with a slightly and partially developed Dryophila-structure, the presence of cylindrical caulocystidia, the absence of well-developed cheilocystidia and pleurocystidia, and its habitat on dead wood and leaf remnants in early spring (Antonín & Noordeloos 2010). This species belongs to sect. *Vestipedes* (Fr.) Antonín, Halling

& Noordel. characterised by usually having a pileipellis in the form of a simple cutis with weakly to distinctly diverticulate or coralloid terminal elements, lack of a distinct smell, and a non-insititious stipe (Antonín & Noordeloos 2010). This section belongs in clade *Marasmiellus*, distant from the core of *Gymnopus* (Wilson & Desjardin 2005).

This early-spring species (growing mostly in March–April) is easy to overlook due its inconspicuous colouration (tints of brown) and growth among wooden remnants and fallen leaves. This could also be a reason why *G. vernus* is rarely recorded, although it is wide-spread throughout Europe.

In Slovakia, this species was recorded for the first time in 2008 in the Jelšie Nature Reserve, still the only locality in Slovakia, and refound again in 2009 and 2013.

The aim of this paper is to present a descriptions and illustrations of the macro- and micromorphological characters of the Slovak collections of *G. vernus* and provide references to its occurrence, ecology and conservation status in Europe.

#### MATERIAL AND METHODS

Three collections of *Gymnopus vernus* were studied. The macroscopic description is based on fresh basidiomata. Microscopic features are described from dried material mounted in a 3% KOH aqueous solution, Melzer's reagent and Congo red, using an Olympus BX41 light microscope with an oil immersion lens and a magnification of 1000×. Illustrations of all microscopic structures were drawn using a drawing tube at a projection scale of 2000×. Statistics of micromorphological characters are based on 30 measurements. The sizes are given as minimum, maximum (in parentheses), average ± standard deviation, and average values. The voucher specimens are deposited in the private herbarium of Pavol Tomka, with two duplicates in the SLO herbarium. The descriptive terminology is according to Vellinga (1988). The taxonomy and nomenclature of *Gymnopus vernus* follows Noordeloos & Antonín (2008) and Antonín & Noordeloos (2010). For taxonomy / syntaxonomy and nomenclature of other macromycetes we follow Bacigálová & Lizoň (1998), of vascular plants Marhold (1998), and of forest communities Jarolímek et al. (2008).

Abbreviations. SLO – herbarium of Comenius University Bratislava (Thiers on-line), L = number of lamellae reaching the stipe, l = number of lamellulae between each pair of lamellae, Q = ratio of length and width of spores.

## RESULTS

*Gymnopus vernus* (Ryman) Antonín & Noordel., Czech Mycol. 60: 25, 2008.

Figs. 1–4

- ≡ *Collybia verna* Ryman, Bot. Notiser 131: 197, 1978.  
= *Marasmius nivalis* Luthi & Plomb, Bull. Soc. Mycol. Fr. 83: 740, 1967 (invalid); *Collybia nivalis* (Luthi & Plomb) M.M. Moser, Kl. Kryptog.-Fl. 2b/2, Ed. 4: 147, 1978 (invalid); *Gymnopus nivalis* (Luthi & Plomb) Antonín & Noordel., Mycotaxon 63: 364, 1995 (invalid).

Selected published figures and/or descriptions. Antonín & Noordeloos (1997, 2010), Breitenbach & Kränzlin (1991), Krieglsteiner (1980), Moreau (1998), Ryman (1978).

### Description

Basidiomata in groups. Pileus 30–50 mm broad, hemispherical when young, expanding to convex, plano-convex, applanate to slightly depressed at the centre with age, margin inflexed to straight, flat, entire, not translucently striate, hygrophanous, surface smooth, sometimes cracked when old and dry, glabrous, slightly greasy when wet, red brown or chestnut brown, fading when drying up (from the centre) to pale or ochraceous brown; turning dark brown in 10% KOH. Lamellae up to 5 mm wide, L = ca. 30–40, l = 3(7), ventricose, free or emarginate, pale brown, edge entire to eroded, concolorous. Stipe 30–50 × 5–15 mm, central, cylindrical, sometimes curved, subbulbous at the base, elastic, stuffed at first, then fistulose, brown, darker towards base, slightly fibrillose (under lens) to glabrous, at the base with distinct ochraceous hairs. Context in pileus whitish to light brown, in stipe somewhat darker, taste and smell slightly fungoid.

Basidiospores (5.2)6.1–7.5(8) × (3)3.5–4.2 μm, av. 6.8 × 3.9 μm, Q = (1.5)1.64–1.87(1.9), av. Q = 1.75, ellipsoid to oblong, with somewhat thickened apex of hilar appendage (in light microscope), smooth, thin-walled, hyaline, non-dextrinoid, non-amyloid. Basidia (23)26–32(35) × (5.5)6.2–7.6(8.5) μm, av. 29.1 × 6.9 μm, 4-spored, very rarely 2-spored, clavate and narrowly clavate, thin-walled, hyaline.

Hymenial cells of different types: i) clavate, narrowly clavate and narrowly cylindrical with obtuse apex, (16)23.3–38.2(45) × (3.5)4.5–7.1(8.5) μm, av. 30.7 × 5.8 μm (typical basidioles); ii) cylindrical and narrowly cylindrical with tapered apex, (20.5)23.8–32.2(37) × (3.5)4–5.5(6.5) μm, av. 28 × 4.8 μm; iii) narrowly fusiform and narrowly clavate with lateral projections, (17)20.3–30.8(35) × 4.5–7.9(9) μm, av. 25.6 × 6.2 μm; iv) clavate or (sub)cylindrical, irregular to subcoralloid, 21–38 × (3)5–9 μm (scattered and mostly on the lamella edge); all types thin-walled, hyaline, some of them resembling cystidia, but true cheilocystidia and pleurocystidia absent.

Pileipellis an ixocutis composed of cylindrical, smooth or incrustated, thin- to thick-walled, hyaline to yellowish, up to 8 μm wide hyphae with cylindrical, nar-

rowly cylindrical, clavate, narrowly clavate, utriform, narrowly utriform terminal cells (19.5)27.1–45.1(51)  $\times$  (5)5.3–10.4(16)  $\mu\text{m}$ , av.  $36.1 \times 7.8 \mu\text{m}$ , often with lateral projections, thin-walled, hyaline. Stipitipellis a cutis made up of cylindrical, smooth or incrustated, thin- to slightly thick-walled, hyaline, up to 8  $\mu\text{m}$  wide hyphae; the hyphae i) with lateral projections up to 10  $\mu\text{m}$  long, or ii) with parallel or erect, cylindrical and narrowly cylindrical terminal elements (caulocystidia), (15)19.4–39.4(59)  $\times$  (3)3.3–6.9(9)  $\mu\text{m}$ , av.  $29.4 \times 5.1 \mu\text{m}$ , with obtuse or tapered apex, sometimes furcate or with lateral projections, some terminal elements narrowly clavate with lateral projections, smooth, thin-walled, hyaline. Hairs at the base of the stipe composed of cylindrical, straight to bent, smooth, thin- to slightly thick-walled, hyaline, 3–6  $\mu\text{m}$  wide hyphae.

Pileus and stipe trama similar, made up of cylindrical, straight, bent to somewhat flexuous hyphae, sometimes branched or with lateral projections, smooth or with some incrustation, thin- to slightly thick-walled, hyaline, 3–20(30)  $\mu\text{m}$  wide, some cells with globose to oblong droplet(s) or granular content. Clamp connections present in all tissues.

#### Specimens examined

Slovakia. Liptovská kotlina Basin, NE of the village of Pavčina Lehota, Jelšie Nature Reserve, 49°2'19.69" N, 19°34'19.38" E, alluvial ash–alder forest (tree layer dominated by *Alnus glutinosa* with admixed *Padus avium* and *Fraxinus excelsior*), on dead alder branches among mosses under *Alnus glutinosa*, 670 m a.s.l., 6 Apr. 2008, leg. P. Tomka (herbarium P. Tomka 102224; SLO 796); *ibid.*, 49°2'16.32" N, 19°34'6.78" E, on rotting alder branches buried in soil covered by mosses, *Oxalis acetosella* and *Anemone nemorosa* under *Alnus glutinosa*, 18 Apr. 2009, leg. P. Tomka (herbarium P. Tomka 149576; SLO 797); *ibid.*, 49°2'22.42" N, 19°34'16.51" E, on rotting alder branches buried in soil under *Alnus glutinosa*, 21 Apr. 2013, leg. P. Tomka (herbarium P. Tomka 380515).

#### Occurrence and ecology in Slovakia

In Slovakia, *Gymnopus vernus* is known from Jelšie Nature Reserve (Jelšie NR). It was designated a nature reserve in 1973 to protect preserved ash–alder alluvial forests. With an area of 26.10 ha and an elevation range of 670–690 m a.s.l., it is situated on the talus cone of the Demänovka Stream formed from silica material. As for soils, Fluvis Gleysols dominate. Jelšie NR has a moderately cold to cold basin climate; the mean annual precipitation is 600–900 mm, mean temperature in January ranges from  $-3.5$  to  $-6$  °C, in July from 20 to 23 °C (Anonymus online, Kontriš 1981).

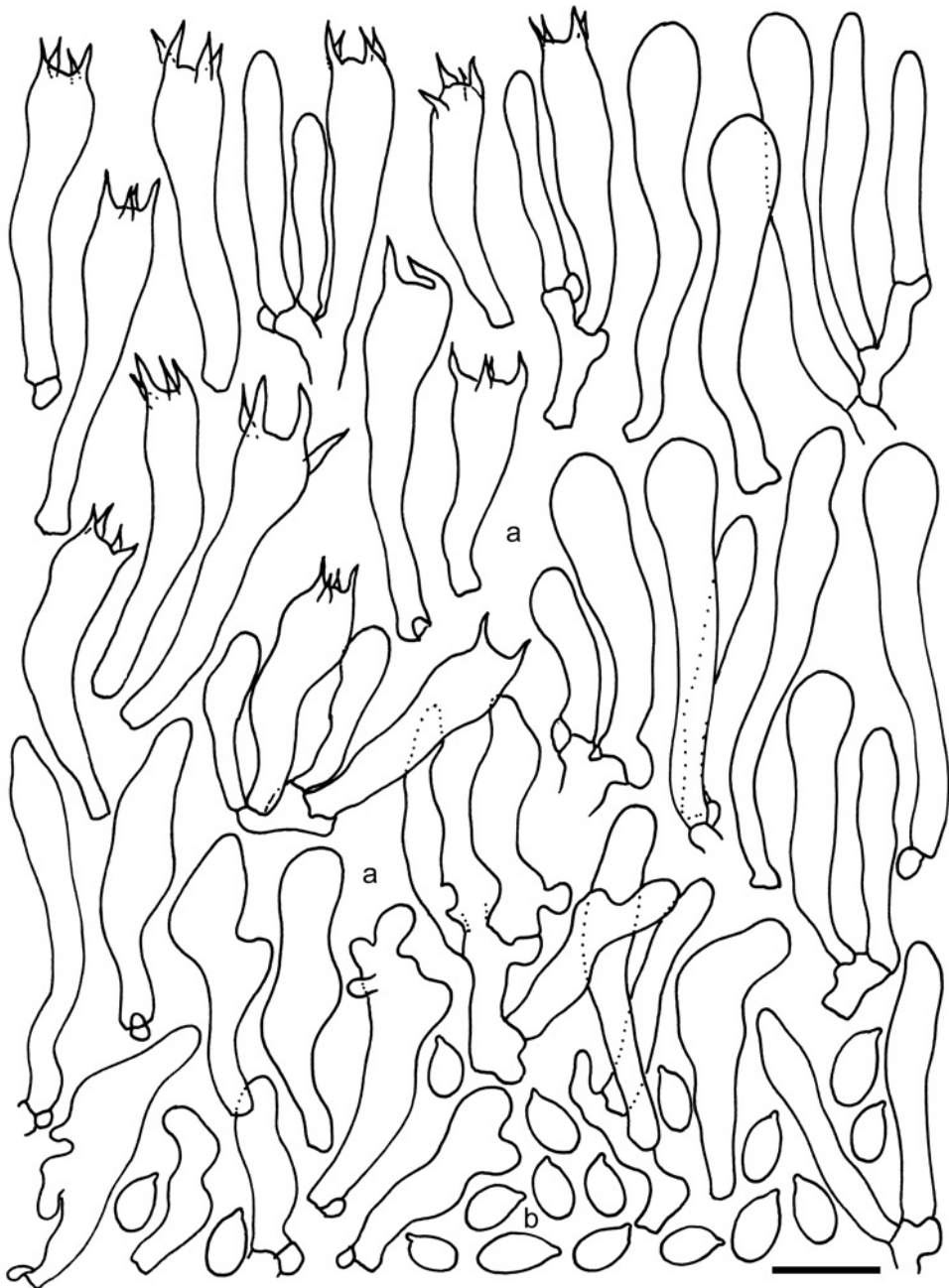
Jelšie NR is primarily covered by alluvial ash–alder forests of the sub-alliance *Alnenion glutinoso-incanae*. The tree layer is dominated by *Alnus glutinosa* with admixed *Padus avium* and *Fraxinus excelsior*. The locally well-developed shrub layer consists mostly of rejuvenates of the main woody species, especially of

**Fig. 2.** *Gymnopus vernus*: basidiomata (Jelšie Nature Reserve, Liptovská kotlina Basin, Slovakia, 6 April 2008, herbarium P. Tomka 102224; SLO 796). Photo P. Tomka. ►

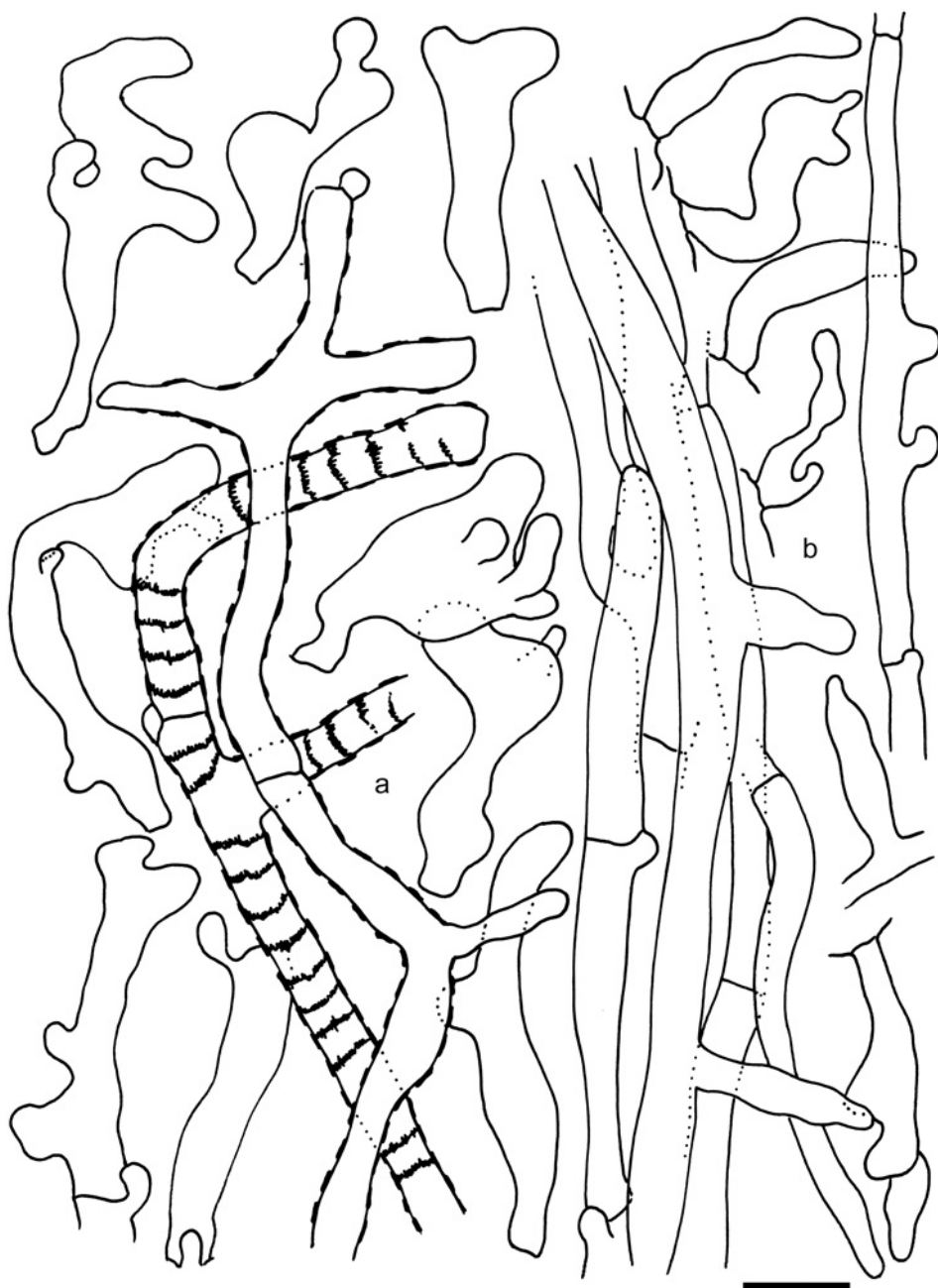


**Fig. 1.** *Gymnopus vernus*: basidiomata (Jelšie Nature Reserve, Liptovská kotlina Basin, Slovakia, 18 April 2009, herbarium P. Tomka 149576; SLO 797). Photo P. Tomka.





**Fig. 3.** *Gymnopus vernus*: **a** – basidia and other hymenial cells, **b** – spores (Jelšie Nature Reserve, Liptovská kotlina Basin, Slovakia, 6 April 2008, herbarium P. Tomka 102224; SLO 796). Scale bar = 10  $\mu$ m. Del. S. Jančovičová.



**Fig. 4.** *Gymnopus vernus*: **a** – hyphae and terminal cells in the pileipellis, **b** – hyphae and terminal cells in the stipitipellis (Jelšie Nature Reserve, Liptovská kotlina Basin, Slovakia, 6 April 2008, herbarium P. Tomka 102224; SLO 796). Scale bar = 10  $\mu$ m. Del. S. Jančovičová.

*Padus avium*, with locally admixed *Lonicera xylosteum* and *Crataegus monogyna* shrubs. The herb layer is composed of mesophilous to hygrophilous species, such as *Chaerophyllum hirsutum*, *Caltha palustris*, *Geum rivale*, *Filipendula ulmaria*, *Aegopodium podagraria*, *Asarum europaeum*, *Oxalis acetosella*, *Glechoma hederacea*. The herb layer further includes ferns such as *Athyrium filix-femina* and *Dryopteris carthusiana*, and spring species, e.g. *Carex remota*, *Cardamine amara* and *Valeriana dioica* (Slezák, pers. comm.).

Three collections of *Gymnopus vernus* are available from Jelšie NR; all of them come from the month of April. The species was found in wet and shaded places under *Alnus glutinosa* trees, usually associated with *Oxalis acetosella* and *Anemone nemorosa*. The basidiomata grew out of rooting alder branches which were about 5–20 mm in diameter, always grouped and crossed, more or less buried in soil, often overgrown by pale mycelium and mosses, also covered in mud.

## DISCUSSION

### Identity of *Gymnopus vernus*

Comparing our observations of *Gymnopus vernus* with the most comprehensive description in the monograph by Antonín & Noordeloos (2010), we have not found any distinct differences in macro- and micromorphological characters. Only the spores are somewhat smaller in our material [(5.2)6.1–7.5(8) × (3)3.5–4.2 μm, Q = 1.6–1.9] than in the monograph [(5.8)6.3–8.3(8.9) × (3.5)3.8–5.1 μm, Q = 1.8–1.9]. We consider such differences however to fall within the species variability, because a similar size of basidiospores was also found in collections from some other European localities (e.g. Antonín 1995).

The pileipellis reaction (and also the reaction of the pileipellis pigment incrustation) with KOH seems to be controversial. Moreau (1998) mentioned it to be light green, but it is dark brown in our material. It seems that this reaction is not present only in subsect. *Alkaliviventes* Antonín & Noordel. of sect. *Levipedes* (Fr.) Halling (Antonín & Noordeloos 2010), but also in some other species not belonging to this subsection (Antonín, not published). Therefore, the stability and taxonomic value of this character should be confirmed by comprehensive macro- and micromorphological studies supported by DNA studies.



## Distribution and ecology of *Gymnopus vernus* in Europe

As a new species for science, based on material from Switzerland, *Gymnopus vernus* was published under the name *Marasmius nivalis* by Luthi & Plomb (1967). However, the name is invalid because the authors did not mention the holotype specimen in the original description. That material was collected on dead branches and leaves under *Corylus avellana*, in March and April, at an altitude of 1200 m a.s.l. Besides this material, some more Swiss collections of *G. vernus* were included in the works by Krieglsteiner (1980, as *Collybia nivalis*, 2 collections / 2 localities), Antonín & Noordeloos (1997, as *Gymnopus nivalis*, 2010, as *G. vernus*, 3 collections / 2 localities) and Usuelli (1997, as *Collybia nivalis*, on decaying remnants of *Alnus incana*, under snow pack, in May, at an altitude of 1300 m a.s.l., 1 collection). General information on the occurrence of *G. vernus* in Switzerland is also provided by Breitenbach & Kränzlin (1991, as *Collybia nivalis*) – on buried wood and fallen leaves, under *Alnus*, *Acer* and *Corylus*, from March to May.

As *Collybia verna*, it was described by Ryman (1978) based on material from Sweden; just as the type, this material was collected on fallen half-buried twigs and branches of deciduous trees in April and May (8 collections / 3 localities).

General information on the occurrence of *G. vernus* in the Nordic countries, namely Sweden, Finland and Norway, is also mentioned by Noordeloos (2012) – among litter in deciduous forests in spring. One Finnish collection is included in the works by Antonín & Noordeloos (1997, 2010).

From Austria, *G. vernus* (as *Gymnopus nivalis* var. *nivalis*) was reported for the first time by Hausknecht & Krisai-Greilhuber (2000) – always on lying or buried branches and twigs of *Fraxinus*, in an *Alnus incana*, *Fraxinus excelsior*, *Acer pseudoplatanus*, *Corylus avellana* and *Picea abies* stand along a stream, at an altitude of 670–790 m a.s.l. (2 localities / 5 collections); later, the occurrence of the species in the country was mentioned by e.g. Gröger (2006, as *Gymnopus nivalis*).

In the Czech Republic, altogether 5 collections from 3 localities are recently known. The species was reported for the first time by Antonín (1995, as *Gymnopus nivalis*) – on twigs of *Fraxinus*, in March (1 collection); from another locality by Kotlaba & Pouzar (2004, as *Collybia verna*) – on fallen rotten branches and wooden remnants of *Acer pseudoplatanus*, in March and April (3 collections); one new unpublished collection is also known by J. Musil and M. Kříž (BRNM 714660) – in litter under *Aesculus hippocastanum*, in March.

From France, the species was published by Delavennat (1998, as *Collybia verna*) – under *Corylus avellana*, *Alnus* and *Buxus*, at the edge of a creek, from February to March, after the snowmelt, at altitudes of 308, 560 and 650 m a.s.l. (3 collections / exact locality in the Centre-Est region is not mentioned), and by

Moreau (1998, as *Collybia verna*) – on decaying twigs of *Buxus sempervirens*, in March, at an altitude of 550 m a.s.l. (1 collection).

From Germany, the first find of *G. vernus* was published by Krieglsteiner (1980) – on pieces of wood (*Fraxinus* and *Corylus avellana*) and on fallen leaves from the year before, in March. It was in an *Alnetum incanae* stand formed by *Fraxinus*, *Acer pseudoplatanus*, *Alnus incana* and *Corylus avellana*, in the undergrowth with *Pulmonaria officinalis*, *Leucojum vernum*, *Arum* and *Anemone*, at an altitude of 453 m a.s.l. (1 collection). Since then, other collections in Germany have been recorded and presented by e.g. Gminder & Krieglsteiner (2001, as *Collybia nivalis*) – on wet fallen twigs and leaves in windscreen hedge formed by *Acer pseudoplatanus* and *Fraxinus excelsior*, in April, at an altitude of 450 m a.s.l., and on fallen branches and twigs in stands with *Acer pseudoplatanus* or *Corylus avellana*, in March and April, at altitudes of 490, 620 and 780 m a.s.l. (4 collections / 4 localities).

As new for Spain, *G. vernus* was reported by Vila (1999, as *Collybia nivalis*) – on litter or around remnants of inflorescences of *Corylus avellana*, shortly after snowmelt in May, at an altitude of 1475 m a.s.l. (1 collection).

Summarising the above-mentioned ecological and phenological data, *G. vernus* is a saprotrophic species producing basidiomata on branches, twigs, other woody remnants and last year's fallen leaves of *Acer pseudoplatanus*, *Alnus glutinosa*, *A. incana*, *Buxus sempervirens*, *Corylus avellana* and *Fraxinus* sp. It is known as a spring fungus, occurring from February to May, often just after the snowmelt. Its lowest reported altitude is 308 m a.s.l., the highest 1475 m a.s.l. So far, it has been recorded in ten European countries: Austria, the Czech Republic, France, Finland, Germany, Norway, Slovakia, Spain, Sweden and Switzerland.

### **Threat and conservation status of *Gymnopus vernus* in Slovakia and in Europe**

Although rather widely distributed in Europe, *G. vernus* seems to be a rare species (about 30 voucher specimens are deposited in the herbaria). The limited number of finds of *G. vernus* can also be caused by its early-spring growth in habitats not frequently visited by mycologists in this time of year.

*Gymnopus vernus* is included in the red lists of the Czech Republic (as critically endangered, Holec & Beran 2006), Finland (as near threatened, Rassi 2001), Germany (as vulnerable, Benkert et al. 1992), Latvia (as data deficient, Andrušaitis 1996), and Norway (as declining, Anonymus 1999). In Slovakia, we also recognise its threat and consider conservation. Although Jelšie Nature Reserve has the highest Fifth Level of Protection (i.e. no human intervention), we have noticed some human activities here, such as collecting dry wood and path shortening through the Reserve (no educational or tourist trail leads across it). Situated near an inhabited

area, Jelšie NR is also influenced by other human activities, e.g. rubbish dumping and tree felling can be seen at the Reserve borders. However, we assume that maintaining the management in the Reserve and its vicinity will guarantee that the ecosystem resists this anthropogenic stress. The mycological importance of Jelšie NR was emphasised by Kautmanová (2004), who recorded some rare species associated with *Alnus* here, e.g. *Lactarius obscuratus*, *L. omphaliformis* and *Paxillus filamentosus*, as well two red-listed species in Slovakia: *Amanita friabilis* (as vulnerable) and *Russula alnetorum* (as near threatened, Lizoň 2001). *Amanita friabilis*, moreover, is on the list of 33 threatened fungi in Europe (Dahlberg & Croneborg 2003). Because of the limited number of collections from the only one Slovak locality, we propose to include *G. vernus* into the category of data deficient species in the Slovak red list in the future.

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