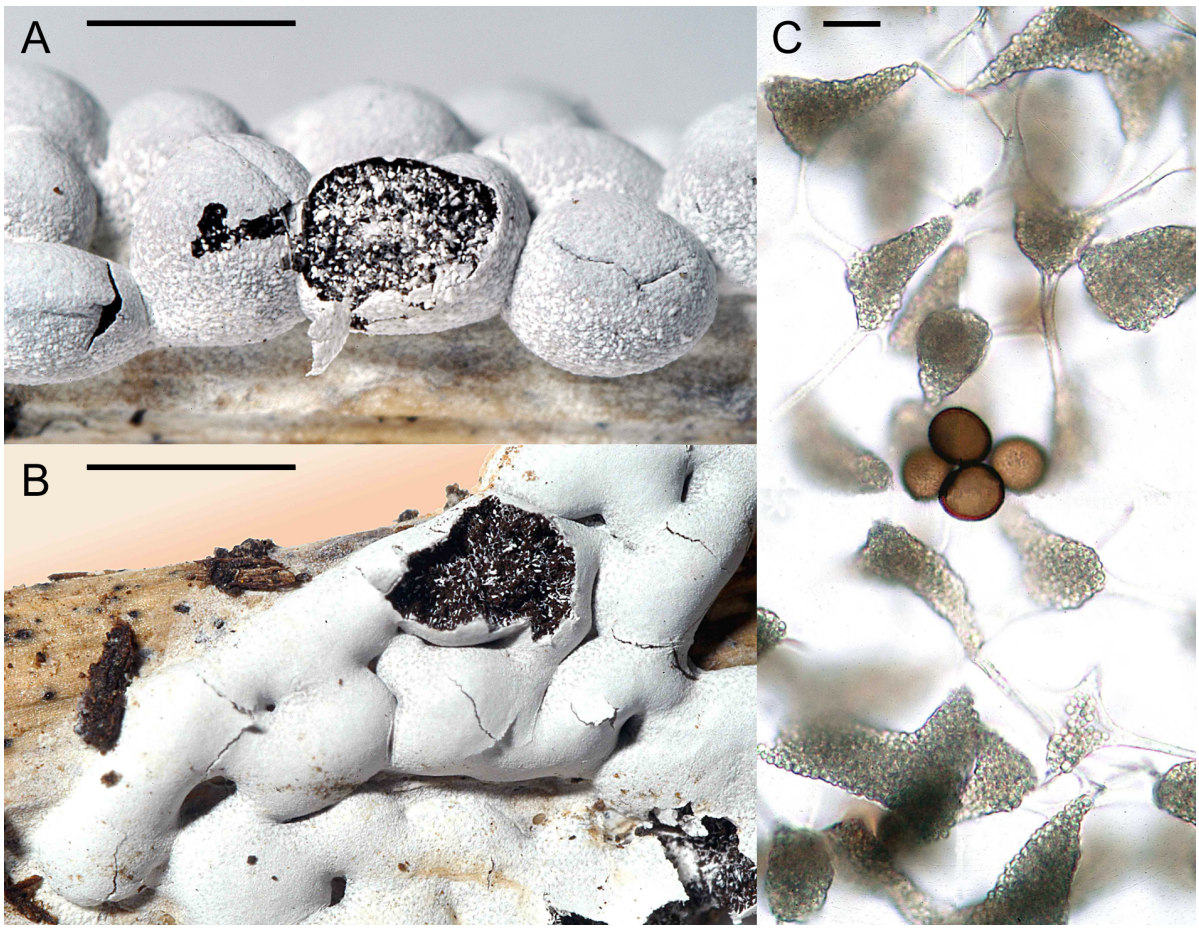

A. Sporocarps (bar = 1 mm). **B**. Plasmodiocarp (bar = 1 mm). **C**. Capillitium and spores (bar = 10 µm) [Photographs: A. Michaud].

Physarum vernum Sommerf., in FRIES, *Systema Mycologicum* **3**(1): 146 (1829). [*Index Fungorum* 146303]

Badhamia verna (Sommerf.) Rostaf., *Śluzowce (Mycetozoa) Monografia* Paris: 145 (1874, publ. 1875). [*Index Fungorum* 148192]

Physarum vernum f. *badhamioides* Meyl., *Bulletin de la Société Vaudoise des Sciences Naturelles* **50**: 5 (1914). [*Index Fungorum* 539493]

Physarum vernum var. *iridescens* G. Lister, *Guide to British Mycetozoa* Edn 4: 25 (1919). [*Index Fungorum* 146617]

Badhamia panicea var. *nivalis* Meyl., *Bulletin de la Société Vaudoise des Sciences Naturelles* **56**: 66 (1925). [*Index Fungorum* 273471]

Physarum styriacum Gottsb., *Nova Hedwigia* **12**: 245 (1966). [*Index Fungorum* 336973]

Physarum vernum f. *parvisporum* H. Singer, G. Moreno & Illana, *Österreichische Zeitschrift für Pilzkunde* **13**: 88 (2004). [*Index Fungorum* 366975]

Diagnostic features. Facultatively nivicolous. Superficially similar in general appearance to *Badhamia* and *Diderma* species and to *Didymium dubium* (see *IMI Descriptions* **1833**), but sometimes possible to

distinguish in the field by the texture of the peridium which is not egg-shell-like. The presence of nodules in the capillitium, and the characteristic shape of those nodules (microscopic examination needed) help to distinguish this species.

Sporocarps greyish white, rugulose, usually densely covered with coarse, closely-set calcareous globules, rarely nearly limeless, often crowded, sessile, as individual globose sporangia, (0·3–)0·5–0·8(–1) mm diam., or as plasmodiocarps and then usually short and simple or branched. *Peridium* single-layered, membranous. *Capillitium* of large, angular, branching, lime nodes connected by short, hyaline tubules, the nodes sometimes massed in the centre to form a columella-like structure ('pseudocolumella'). *Spores* in mass black, individually dark purplish brown, globose, warted, (9–)10–12 µm diam. *Plasmodium* white.

ASSOCIATED ORGANISMS & SUBSTRATA: **Plantae**. *Achyranthes aspera* L.; *Agave schottii* Engelm. (leaf); *Ailanthus altissima* (Mill.) Swingle (branch); *Coffea arabica* L.; *Cynodon dactylon* (L.) Pers., *Cynodon* sp.; *Cytisus oromediterraneus* Rivas Mart., T.E. Díaz, Fern. Prieto, Loidi & Penas; *Daucus carota* L.; *Fagus sylvatica* L. (wood); *Fraxinus excelsior* L. (bark); *Gerbera* sp.; *Gramineae* indet.; *Hedera helix* L.; *Lolium perenne* L.; *Medicago sativa* L.; *Melicytus ramiflorus* J.R. Forst. & G. Forst.; *Muscopsida* indet.; *Phoenix canariensis* Hort. ex Chabaud (stem); *Pinus uncinata* Raymond ex DC.; *Plantae* indet. (bark, debris, leaf, litter, stem, twig); *Populus tremula* L. (leaf); *Quercus ilex* L.; *Ulex europaeus* L. (wood). **Protozoa**. *Lamproderma ovoideum* Meyl. **Other substrata**. Artefact (raffia basket, railway track); rock; soil.

INTERACTIONS & HABITATS: The ecological rôle played by myxomycetes (see Notes below) remains poorly understood. In general, these organisms are thought to be mainly saprobic, feeding only during their vegetative (also called 'plasmodial') state, and not feeding when in their fruiting state. They may be encountered on living plant material (e.g. leaves and twigs) in both vegetative and fruiting states, but in such cases the plant material is only a substratum, not a source of nutrition. When myxomycetes are found in their vegetative state specifically on dead plant material, that material may be both a substratum and a source of nutrition. It is also possible that, in their vegetative state, myxomycetes feed on dead animal remains, living and dead bacteria, fungal hyphae and spores, and other organic material. Nothing is known about interactions between the present species and other organisms, but its associated organisms, ecological preferences and geographical distribution suggest that, in interactions, it is similar to this general picture. *Physarum vernum* is cosmopolitan, but uncommon in both lowland and alpine conditions (between 720 and 2600 m above mean sea level). It has also been recorded from desert steppe and from the Mexican part of the Sonoran Desert. It is facultatively one of the so-called 'nivicolous' or snowline myxomycetes, found on both living and dead plant material next to melting snow patches in mountainous habitats, typically where there is high insolation in spring. In the 'nivicolous' habitat, snow cover prevents abrupt soil temperature changes between night and day, provides free water and a ground-level microclimate beneath or near the melting snow favourable for development of vegetative and fruiting stages. RONIKIER & RONIKIER (2009), reviewing this ecological group, found they were typically montane, i.e. upland forest zone, in distribution rather than subalpine or alpine.

GEOGRAPHICAL DISTRIBUTION: AFRICA: Angola, Kenya, Malawi, Morocco, Namibia, South Africa, Zimbabwe. NORTH AMERICA: Mexico, USA (Arizona, California, Colorado, Kansas, Louisiana, Maine, Massachusetts, New Hampshire, New York, Oregon, Pennsylvania, Tennessee, Washington, West Virginia). CENTRAL AMERICA: Costa Rica. SOUTH AMERICA: Argentina, Brazil (Bahia), Chile, Ecuador, Venezuela. ASIA: China (Fujian, Hebei, Jilin, Nei Mongol, Shanxi), India, Japan, Kazakhstan (Zapadno-Kazakhstanskaya oblast), Russia (Krasnoyarskyi krai, Sverdlovskaya oblast), Taiwan. AUSTRALASIA: Australia (South Australia, Western Australia), New Zealand. CARIBBEAN: Cuba. EUROPE: Austria, Belgium, Eire, France, Germany, Italy, Luxembourg, Netherlands, Norway, Russia (Astrakhanskaya oblast, Pskov oblast, Tverskaya oblast, Volgograd oblast), Spain, Sweden, Switzerland, Turkey, UK, Ukraine. PACIFIC OCEAN: USA (Hawaii).

ECONOMIC IMPACTS: Lack of information makes it impossible to place a monetary value on the ecological rôle of this species. There are no reports of it causing economic damage to crops or other organisms of value to humans, or of its use by humans. Each year, a few field meetings are organized in Europe

devoted to the study of nivicolous myxomycetes, which therefore collectively generate low levels of nature tourism.

INFRASPECIFIC VARIATION: Several subspecific taxa have been distinguished. *Physarum vernum* f. *vernum* is characterised by dark brown and densely spiny spores. *Physarum vernum* f. *parvisporum* has a more lax spore ornamentation, the spores are often smaller and the colour of the spore mass is primarily pale brown. *Physarum vernum* f. *badhamioides* and *P. vernum* var. *iridescens* are doubtfully distinct.

DISPERSAL & TRANSMISSION: By spores. Insects may play a significant rôle in dispersal, as myxomycete spores are regularly found in their faeces. Other forms of spore dispersal probably include wind and melt water.

CONSERVATION STATUS: **Information base**. Over 500 records from August 1829 to 2009. The species has been recorded in February, March, April, May, July, August, September, October, November, December. **Threats**. This species is threatened by climate change. The strong association between 'nivicolous' myxomycetes and melting snow patches suggests that their distribution is likely to be strongly and negatively affected by global warming as winter snow cover diminishes in mountain regions. This is likely to result in these species gradually moving to higher altitudes and then becoming isolated at the tops of high mountains with no opportunity to move to higher latitudes. **Evaluation**. Using IUCN criteria (IUCN SPECIES SURVIVAL COMMISSION. *2006 IUCN Red List of Threatened Species*, *www.iucnredlist.org*. Downloaded on 15 May 2006), the species is assessed globally as near threatened. **In situ**. There are no known conservation plans or activities specifically prepared for this species. **Ex situ**. No preserved living strains of this species are listed by the *World Federation of Culture Collections* (*http//wdcm.nig.ac.jp/wfcc/datacenter.html*).

NOTES: *Physarum vernum* is a myxomycete, i.e. a member of the protozoan phylum *Mycetozoa*. Although not strictly fungi, myxomycetes (also known as 'slime moulds') have been studied traditionally by mycologists. This is one of the most conspicuous species in early spring at the edge of melting snow in the Alps. It is most likely to be confused with *P. cinereum* but it more often forms long plasmodiocarps, is much limier and has larger and darker spores. There is no obvious difference between the lowland and alpine forms (ING, 1999).

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- **On-line databases**. *Cybertruffle*, *www.cybertruffle.org.uk/robigalia*, 13 records.
  Fungal Records Database for the British Isles, *http://194.203.77.76/fieldmycology/*, 20 records.
  Global Biodiversity Information Facility, *http://data.gbif.org*, 690 records.
  Landcare Research New Zealand, *http://nzfungi.landcareresearch.co.nz/html/mycology.asp*, 7 records.
  USDA Fungal Database, *http://nt.ars-grin.gov/fungaldatabases/index.cfm*, 5 records.
- **Personal communication**. M. Meyer.
- **Reference collections**. **IMI**, 6 items.

See also the following internet pages:

- *http://eumycetozoa.com*;
- *http://slimemold.uark.edu*;
- *www.discoverlife.org/mp/20m?kind=Physarum+vernum*.

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The UK Darwin Initiative is thanked for support in producing this work.

Issued by CABI, Bakeham Lane, Egham, Surrey, TW20 9TY, UK