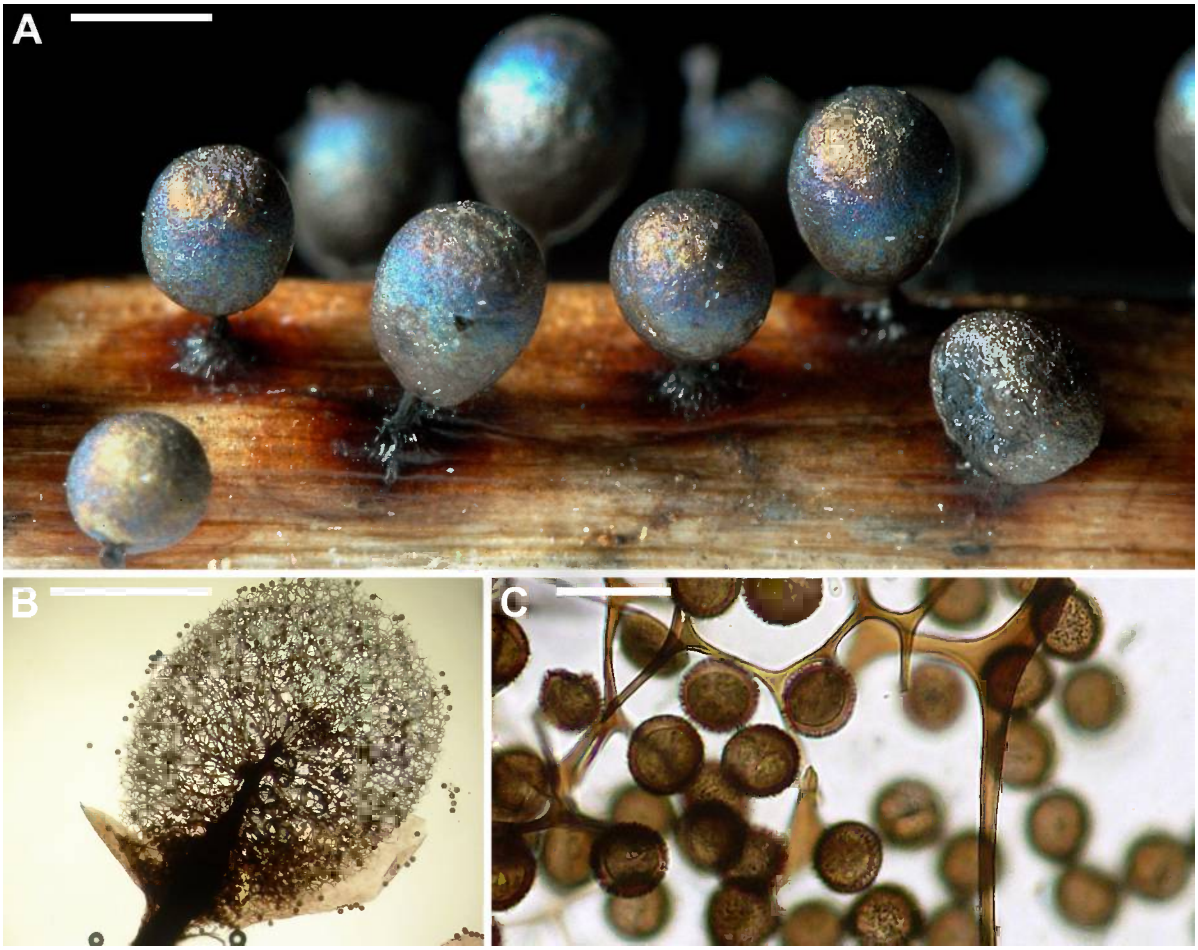
IMI Descriptions of Fungi and Bacteria No. 2218

LAMPRODERMA OVOIDEOECHINULATUM



A. Sporocarps (bar = 1 mm). **B**. Sporocarp viewed by compound microscope (bar = 500 µm). **C**. Capillitium and spores (bar = 20 µm). [Photographs: A. Michaud]

Lamproderma ovoideoechinulatum Mar. Mey. & Poulain, in M. POULAIN & M. MEYER, *Bulletin Mycologique et Botanique Dauphiné-Savoie* **45**(no. 176): 17 (2005). [*IndexFungorum* 356970; *Stemonitidaceae*, *Stemonitiida*]

Lamproderma ovoideoechinulatum var. *microsporum* Mar. Mey. & Poulain, in M. POULAIN & M. MEYER, *Bulletin Mycologique et Botanique Dauphiné-Savoie* **45**(no. 176): 17 (2005). [*IndexFungorum* 356251]

Diagnostic features. Nivicolous; sporangia stalked, pear-shaped; peridium not mottled with brown spots; capillitium extending entire length of columella; spores dark brown, echinulate; similar to *L. ovoideum* Meyl., but spores are echinulate with long spines.

On natural substratum. *Amoebal state* no information. *Plasmodium* no information. *Hypothallus* reddish black, membranous. *Sporocarps* grouped, stalked sporangia, 1·3–2·2 mm high. *Stalk* up to 25% of total height. *Sporothecae* pear-shaped, dark, glistening with various reflected colours, particularly shades of blue, 1–1·7 × 1–1·2 mm. *Peridium* thicker at the base, often decurrent on the stalk. *Columella* up to two-thirds the height of the sporotheca, with attached capillitial threads and interconnecting branches. *Capillitium* dense, dark brown arising all along the columella and anastomosing with free tips at the periphery. *Spores* black *en masse*, individually dark brown, paler on one side, globose, 12·5–16 µm diam., echinulate, with lax irregularly distributed ornamentation.

ASSOCIATED ORGANISMS & SUBSTRATA: **Plantae**. *Alnus* sp. (branch); *Apiaceae* indet. (stem); *Athyrium filix-femina* (L.) Roth (frond, stem); *Carex* sp.; *Epilobium angustifolium* L.; *Fagus sylvatica* L. (twig); *Gramineae* indet. [also as 'grasses']; *Picea* sp. [as 'spruce'] (leaf, stem); *Plantae* indet. (branch, stem); *Rubus idaeus* L., *R. ulmifolius* Schott, *Rubus* sp.; *Salix purpurea* L. (twig); *Sasa kurilensis* (Rupr.) Makino & Shibata, *Sasa* sp.; *Vaccinium myrtillus* L. (twig). **Protista**. *Didymium dubium* Rostaf.; *Lamproderma sauteri* Rostaf., *L. zonatum* Mar. Mey. & Poulain; *Meriderma carestiae* (Ces. & De Not.) Mar. Mey. & Poulain. **Associated organism of type specimen**. None cited. **Comment**. This species occurs on dead branches, leaves, stems, and twigs of angiosperms and gymnosperms, and on dead fronds of ferns. Twigs are sometimes decorticated and resinous. It has also been observed on living branches.

INTERACTIONS & HABITATS: For a thorough introduction to myxomycete ecology, see MADELIN (1984). The dead plant material with which myxomycetes are very widely associated, while undoubtedly a platform for their sporocarps, is not necessarily a source of nutrition. Sporocarps are the only stage in myxomycete life cycles where species can be identified by morphology. The other states, as amoebae and plasmodia, have received little attention. SHCHEPIN *et al.* (2019) suggested that populations of myxomycete amoebae may inhabit much wider ecological niches than indicated by records of their sporocarps. There is no specific information about the ecology and nutrition of the amoebal state of *L. ovoideoechinulatum*. In their amoebal state, myxomycetes are known to feed on small organic particles and micro-organisms (including some fungi), but the identity of those micro-organisms is rarely, if ever, recorded. This species is nivicolous, found in spring at the edge of melting snow patches, and is thus associated with alpine and other montane ecosystems. In records from Japan, the current species has been seen with other nivicolous myxomycetes on the same substratum (YAJIMA & CHANG, 2016). Although associations with animals and fungi are known or suspected, no observations were found where the associated organism was identified to genus or species level.

GEOGRAPHICAL DISTRIBUTION: NORTH AMERICA: Canada (British Columbia). ASIA: Japan. EUROPE: Austria, France, Germany, Italy, Norway, Poland, Spain, Switzerland, Ukraine.
Elevation (m above sea level). Records up to 2300 (France), and 640 (Japan).
Comment. Native to mountainous areas of Asia, Europe and North America. More than 80% of all records are from France, a figure which probably reflects the active study of nivicolous myxomycetes there.

ECONOMIC IMPACTS: There is experimental evidence that this species can accumulate heavy metals (KRYVOMAZ, 2015*a*, *b*; KRYVOMAZ & ANDRUSISHINA, 2015; KRYVOMAZ *et al.*, 2016, 2017). KRYVOMAZ (2017*a*) measured metal levels in samples of *L. ovoideoechinulatum*. The levels of different elements were, in descending order, as follows [µg of metal per g of myxomycete tissue]: Ca (14480), Mg (2080), Fe (1280), Si (1200), Al (960), Mn (840), Zn (144), Pb (15·6), Ni (4·8), Cu (3), Cd (1·68), Cr (0·06). Like many other nivicolous species, *L. ovoideoechinulatum* strongly accumulated the highly toxic heavy metals Cd and Pb. Heavy metal accumulating properties are likely to have significant positive economic potential (STEPHENSON & MCQUATTIE, 2000). Although nothing has yet been developed for the present species, there is considerable interest in use of fungi with similar abilities for bioremediation and other applications (GADD, 2007). No evaluation has been made of any other possible positive economic impact of this organism (e.g. as a recycler, as a source of useful products, as a provider of checks and balances within its ecosystem, etc.). No reports of negative economic impacts have been found.

INFRASPECIFIC VARIATION: One subspecific taxon has been described on the basis of slightly smaller spores. It is listed in the synonymy above.

DISPERSAL & TRANSMISSION: For a general discussion about myxomycete dispersal, see KRYVOMAZ & STEPHENSON (2017). Myxomycete spores are dispersed considerable distances by wind. Field experiments and mathematical modeling have shown that, with winds of 0·1 m/s, spores can travel up to *c.* 1·8 km, and when wind speed reaches 28 m/s, this rises to over 500 km (TESMER & SCHNITTLER, 2007). Spores and myxamoebae may be dispersed by rainwater, meltwater and water in soil. Some local dispersal may also occur by movement of myxamoebae and plasmodia. Insects and other invertebrates feed on sporophores, as probably do terrestrial vertebrates including birds, and myxomycete spores have been found in insect faeces, suggesting that animals may play a part in their dispersal. For some species (but probably very rarely or never nivicolous myxomycetes), plant debris floating in seawater may also contribute to dispersal between land masses.

CONSERVATION STATUS: The IUCN's Red Listing Criteria were originally designed for evaluation of vertebrate animals and flowering plants, and present challenges to those trying to apply them to organisms like myxomycetes which are unicellular for a significant part of their life cycle. A discussion of those challenges, particularly in respect of myxomycetes and climate change, is provided by KRYVOMAZ & STEPHENSON (2017). **Previous evaluations**. None. **Information base**. About 480 records (specimens, databases and bibliographic sources combined, excluding duplicates) from at least May 1964 to June 2018, with observations in March, April, May, June, July and August. **Estimated extent of occurrence** [calculated using *http://geocat.kew.org*]. Well over 3·1 million km^2 (Asia: 0·2 million km^2; Europe: 2·9 million km^2; North America: insufficient data). **Estimated area of occupancy** [calculated using *http://geocat.kew.org*]. Well over 500 km^2. The method for estimating area of occupancy has produced an artificially low figure. The species is likely to be under-recorded because of the small number of people with the skills to search for and identify it. Some of the plants with which it is associated are common and widespread species. **Threats**. As a nivicolous species, *L. ovoideoechinulatum* is threatened by climate change. Insufficient information to enable other threats to be identified. In particular, possible vulnerabilities of the amoebal and plasmodial states of this species are currently completely overlooked. **Population trend**. Not known. Of datable records, none are pre-1961 and *c.* 75% are post-1960 but pre-2001, and 25% post-2000. **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 Data Deficient. ***In situ* conservation actions**. None noted. ***Ex situ* conservation actions**. 3 nucleotide sequences and 3 PopSet sequences were found in a search of the NCBI GenBank database [*www.ncbi.nlm.nih.gov*, accessed 11 November 2019]. No living strains of this species are listed by the ATCC, CABI and Westerdijk Institute [formerly CBS] culture collections.

NOTES: Molecular techniques are now being developed to detect myxomycetes in soil, and this may make it possible to identify species in their amoebal state. *Lamproderma ovoideoechinulatum* was included in one such pioneering study (HOPPE & SCHNITTLER, 2015). Radiation levels in this and several other nivicolous myxomycetes were monitored by KRYVOMAZ (2015*b*), and found not to exceed acceptable levels.

LITERATURE & OTHER SOURCE MATERIAL: GADD, G.M. Geomycology: biogeochemical transformations of rocks, minerals, metals and radionuclides by fungi, bioweathering and bioremediation. *Mycological Research* **111**(1): 3-49 (2007). GALLINARI, A. & FERRARI, P. Contributo alla conoscenza dei myxomiceti nivicoli della provincia di Brescia. *Natura Bresciana* **38**: 57-69 (2013). HOPPE, T. & SCHNITTLER, M. Characterization of myxomycetes in two different soils by TRFLP-analysis of partial 18S rRNA gene sequences. *Mycosphere* **6**(2): 216-227 (2015). KELLER, H.W. & EVERHART, S.E. Importance of myxomycetes in biological research and teaching. *Fungi* **3**(1): 13-27 (2010). KRYVOMAZ, T.I. The assessment of heavy metal accumulation by myxomycetes. *Motrol* Lublin **17**(8): 157-164 (2015*a*). KRYVOMAZ, T.I. [as КРИВОМАЗ, T.I.] Радіаційний контроль нівальних міксоміцетів Карпат [Radiation monitoring of Carpathian nivicolous myxomycetes]. *Екологічна Безпека та Природокористування* [*Environmental Safety and Natural Resources*] **2**(12): 72-79 (2015*b*) [text in Ukrainian]. KRYVOMAZ, T.I. [as КРИВОМАЗ, T.I.]. *Наукові Основи Моніторингу Забруднення*

Навколишнього Середовища Токсичними Елементами з Використанням Міксоміцетів [*Scientific Basis for Monitoring Environmental Pollution by Toxic Elements using Myxomycetes*]. Дис. д-ра техн. наук [Thesis (DSc) Technical Science] 21.06.01 (Київ: Київ Національний Університет Будівництва і Архітектури [Kyiv: Kyiv National Construction and Architecture University]): 349 pp. (2017*a*) [text in Ukrainian]. KRYVOMAZ, T.I. Accumulation of toxic metals and other elements by myxomycetes. In: *Abstracts of 9th International Congress on the Systematics and Ecology of Myxomycetes* Tanabe, Japan, 18-23 August 2017: 38 (2017*b*). KRYVOMAZ, T.I. & ANDRUSISHINA, I.M. [as КРИВОМАЗ, Т.І. & АНДРУСИШИНА, І.М.]. Перший аналіз вмісту важких металів та інших елементів в плодових тілах нівальних міксоміцетів Карпат [The first analysis of heavy metals and other elements in the fruit bodies of nivicolous myxomycetes in Carpathians]. *Екологічна Безпека та Природокористування* [*Environmental Safety and Natural Resources*] **4**(20): 20-31 (2015) [text in Ukrainian]. KRYVOMAZ, T.I. & STEPHENSON, S.L. Preliminary evaluation of the possible impact of climate change on myxomycetes. *Nova Hedwigia* **104**(1-3): 5-30 (2017). KRYVOMAZ, T.I., VOLOSHKINA, O., MAXIMENKO, D.V. & ZHUKOVA, O.G. [as КРИВОМАЗ, Т.І., ВОЛОШКІНА, О.С., МАКСИМЕНКО, Д.В. & ЖУКОВА, О.Г.]. Регресійні моделі переходу елементів в міксоміцетах в залежності від параметрів навколишнього середовища [Regression models for the transition of elements in myxomycetes depending on the environmental parameters]. *Екологічна Безпека та Збалансоване Ресурсокористування* [*Environmental Safety and Sustainable Resources Management*] **1**(15): 97-104 (2017) [text in Ukrainian]. KRYVOMAZ, T.I., VOLOSHKINA, O.S., MICHAUD, A. & ANDRUSISHINA, I.M. The analysis of metals biotransformation by alpine nivicolous myxomycetes from substrates. *Eastern-European Journal of Enterprise Technologies* **5/10**(83): 50-57 (2016). LAVOISE, C., BELLIDO-BERMEJO, F., MATEOS-MORENO, M. & PAZ, A. Myxomycetes nivícolas de la Comunidad de Cantabria. *YESCA* Revista de Micología **27**: 99-126 (2015). MADELIN, M.F. Myxomycete data of ecological significance. *Transactions of the British Mycological Society* **83**(1): 1-19 (1984). NEUBERT, H., NOWOTNY, W. & BAUMANN, K. *Die Myxomyceten Deutschlands und des angrenzenden Alpenraumes unter besonderer Berücksichtigung Österreichs* **3**: *Stemonitales* (Gomaringen, Germany: Karlheinz Baumann Verlag): 391 pp. (2000). POULAIN, M., MEYER, M. & BOZONNET, J. *Les Myxomycètes* (Sevrier, France: Fédération Mycologique et Botanique Dauphiné-Savoie): **2** vols, 568 pp. + 544 plates (2011). RONIKIER, A. & RONIKIER, M. How 'alpine' are nivicolous myxomycetes? A worldwide assessment of altitudinal distribution. *Mycologia* **101**(1): 1-16 (2009). RONIKIER, A., RONIKIER, M. & DROZDOWICZ, A. Diversity of nivicolous myxomycetes in the Gorce mountains – a low-altitude massif of the western Carpathians. *Mycotaxon* **103**: 337-352 (2008). SHCHEPIN, O.N., SCHNITTLER, M., ERASTOVA, D.A., PRIKHODKO, I.S., DAHL, M.B., AZAROV, D.V., CHERNYAEVA, E.N. & NOVOZHILOV, Y.K. Community of dark-spored myxomycetes in ground litter and soil of taiga forest (Nizhne-Svirskiy Reserve, Russia) revealed by DNA metabarcoding. *Fungal Ecology* **39**(1): 80-93 (2019). STEPHENSON, S.L. & MCQUATTIE, C.J. Assessing the potential use of myxomycetes as biomonitors of heavy metals in the environment. *Proceedings of the West Virginia Academy of Science* **72**: 32-33 (2000). TESMER, J. & SCHNITTLER, M. Sedimentation velocity of myxomycete spores. *Mycological Progress* **6**(4): 229-234 (2007). YAJIMA, Y. & CHANG, Y.C. [Nivicolous myxomycetes of Iburi and Shiribeshi Subprefectures, Hokkaido, Japan]. *Memoirs of the Muroran Institute of Technology* **66**(1-2): 3-9 (2016) [text in Japanese]. YAJIMA, Y., UCHIDA, A. & KONDO, N. List of the nivicolous myxomycetes in Shiretoko Peninsula, Eastern Hokkaido. *Bulletin of the Shiretoko Museum* **30**: 3-5 (2009).

Sources additional to those already cited from literature and the internet.

- *Biodiversity Heritage Library* [*www.biodiversitylibrary.org*].
- *Checklist of Fungi of the British Isles* [*https://basidiochecklist.science.kew.org/BritishFungi/FRDBI/FRDBI.asp*].
- *Cybertruffle* [*www.cybertruffle.org.uk*].
- *Discover Life (myxomycete pages)* [*www.discoverlife.org/mp/20q?guide=Myxomycetes*].
- *Fungal Records Database of Britain and Ireland* [*www.frdbi.info*]
- *Fungus Conservation Trust CATE2 Database* [*www.abfg.org*].

- *GBIF* [*www.gbif.org*].
- *Google* [*www.google.co.uk*].
- *Landcare Research New Zealand* [*http://nzfungi2.landcareresearch.co.nz*].
- *Mycoportal* [*www.mycoportal.org*].
- *Mycotaxon Regional Checklists in Downloadable Format* [*www.mycotaxon.com/mycobiota*].
- *National Center for Biotechnology Information* [*www.ncbi.nlm.nih.gov*].
- *Nomen.mycetozoa.com - an online nomenclatural information system of Eumycetozoa* [*http://eumycetozoa.com*].
- *USDA Fungal Databases* [*https://nt.ars-grin.gov/fungaldatabases*].

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