

Diderma nigrum, a synonym of *Diderma asteroides* (Myxomycetes)

G. MORENO

H. SINGER

C. ILLANA

Dpto. de Biología Vegetal (Botánica)

Universidad de Alcalá

E-28871 Alcalá de Henares, Madrid, Spain

M. LIZÁRRAGA

Programa de Biología, Dpto. de Ciencias Básicas

Instituto de Ciencias Biomédicas, Universidad Autónoma de Ciudad Juárez

Anillo Envolvente y Estocolmo s/n.

C.P. 32300 Ciudad Juárez, Chihuahua, México

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Abstract: The type of *Diderma nigrum* has been studied and compared with collections of *Diderma asteroides*, applying electron microscopy. Due to similarity of the macroscopical habit and microscopical characters such as spore ornamentation synonymy is proposed.

Zusammenfassung: Der Typus von *Diderma nigrum* wurde untersucht und mit Aufsammlungen von *Diderma asteroides* verglichen, unter Anwendung der Elektronenmikroskopie. Aufgrund der Ähnlichkeit des makroskopischen Habitus und mikroskopischer Merkmale, wie z. B. die Sporen-Ornamentation, wird eine Synonymie vorgeschlagen.

Nivicolous Myxomycetes appear when snow is melting in spring and summer along the margins of snow banks at high elevations in the mountains. This group of organisms, namely several species of the genera *Comatricha*, *Diacheopsis*, *Diderma*, *Didymium*, *Lamproderma*, *Lepidoderma* and *Physarum*, present a distinct ecological adaptation. One essential requirement for their development seems to be a permanent snow-layer for at least three months, below of which their spores rest and, in the course of the thaw, are induced to germinate.

Some species have led to taxonomic confusion, as they appear both in lowlands and after the melting of the snow in the mountains. In agreement with STEPHENSON & STEMPEN (1994), the fruiting bodies of snow-bank species tend to be more robust than those of other Myxomycetes, and alpine fruitings of those species that also occur in lowland habitats have somewhat larger spores. But also a considerable variability in regard to morphological characters, especially spore ornamentation, can be observed. Thus, species have been described as new, which in reality fall within the variability of already described lowland species. This is the case of *Trichia synspora*, which was recently synonymised by the authors of this work with *Trichia varia* (SINGER & al. 2003).

Materials and methods

The material studied originates from collections made in Austria and Spain, in both nivicolous and Mediterranean areas. The type material of *Diderma nigrum* was loaned from the herbarium BPI.

The material was studied with a binocular microscope, mounted in Hoyer's medium and examined with a Nikon (Optiphot) microscope. Scanning electron microscopy (SEM) micrographs were made with a Zeiss DSM-950. SEM-preparation was made as described in MORENO & al. (2002).

Diderma nigrum KOWALSKI, Mycologia 60: 601. 1968. (Colour fig. IV, Figs. 5-8)

Diagnosis original: Sporangii dissipatis, sessilibus, hemisphaericis, atrobrunneis vel nigris, 1-2 mm diam; hypothallo inconspicuo; peridio triplici, pariete externo cartilaginoso, dehiscente stellate, pariete medio calcareo, saepe ad externum connato, pariete interno membranaceo, saepe ad medium connato; columella nulla vel increbra praesentium pulvinata, cervina vel aliquando alba; capillitio moderate abundant, filamentis brunneis ad extremum pallidis; sporis globosis, brunneis, minute verrucosis, 12-14 μm diam.; plasmodio ignoto.

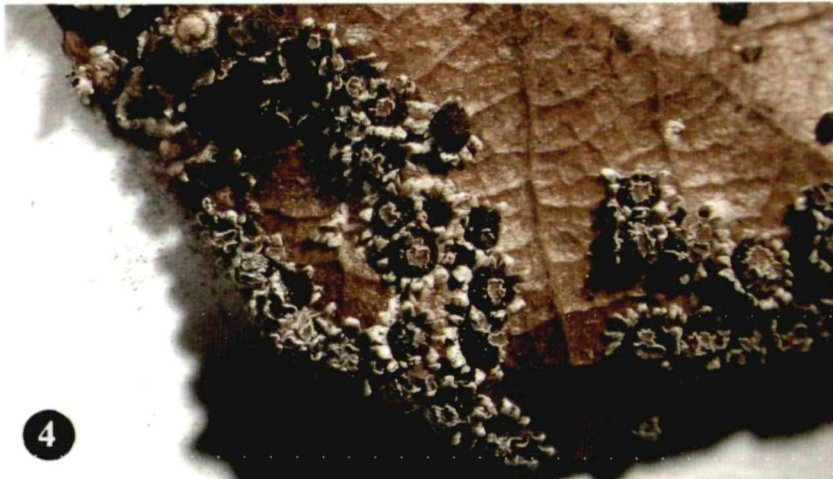
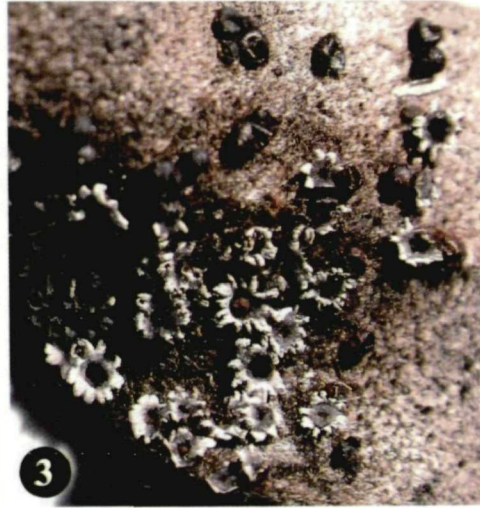
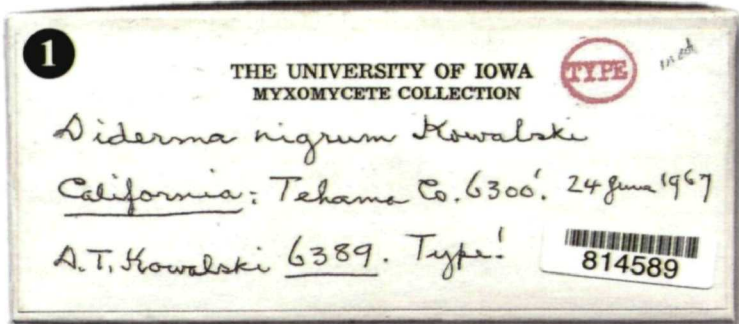
Characters:

The type is distributed in two boxes. One consists of four pieces of coniferous wood with numerous sporocarps, opened in its typical stellate fashion, with scanty capillitium. The other box contains two microscope slides, one of which seems to be made by the author, the other is more recent and contains a limeless sporocarp mounted in Amman's medium (as indicated on the label).

Sporocarps scattered to loosely clustered, sessile, hemispherical to pulvinate, seated on a broad base, 1-2 mm in diam., sometimes subplasmodiocarpous and then up to 3 mm long, dark-brown to black. Hypothallus inconspicuous, membranous, colourless. Peridium triple, persistent; inner layer thin, transparent, membranous, occasionally merged with middle-layer; middle-layer thick, white, calcareous, non-crystalline; outer layer cartilaginous, containing dark granules which gives it a mottled appearance under the microscope, usually appressed to the middle layer; star-like dehiscence of the two outer layers. Columella reduced to a thick, yellowish brown or sometimes white mound at the base of the sporocarp to hemispherical, 0.5 mm in diam., calcareous, sometimes absent; the colour of the columella extending to all the base and reaching the lower part of the inner surface of the middle peridial layer. Capillitium moderately abundant, consisting of long, filiform threads, 0.5-1 μm in diam., sparsely branching and rarely anastomosing, threads dark brown except at the hyaline extremities, sometimes with warts or spines. Spores purple-brown in mass, violet-brown by transmitted light, minutely warted, the warts often arranged in a highly irregular pattern, 12-14 μm in diam.

Specimens examined: *Diderma nigrum*: USA: California, Well's Cabin Campground, 6300 ft. elev., Tehama Co., on dead coniferous twigs, 24. 6. 1967, leg. D. T. KOWALSKI, DTK #6389 (Type).

Diderma asteroides: Spain: Badajoz, on leaf of *Quercus ilex* L., Peraleda del Zaucejo, 12. 11. 1994, leg. J. R. GARCÍA, AH 16716. Burgos, Fresneda de la Sierra, on *Fagus sylvatica* L., 7. 11. 1992, leg. A. CASTILLO, AH 15373, AH 15374. Cáceres, Guadalupe, on leaves of *Eucalyptus camaldulensis* DENH., 24. 11. 1994, leg. A. ALTÉS, G. MORENO and C. ILLANA, AH 21166. Ciudad Real, National Park of Cabañeros, on leaves of *Quercus pyrenaica* WILD., 21. 3. 2003, leg. A. CASTILLO and G. MORENO, AH 19696.



Colour fig. IV. 1. Label of the type of *Didyma nigrum*. 2. Sporocarps of *D. nigrum* type DTK 6389. 3-4. Sporocarps of *D. asteroides* AH 19696.

Austria: Gramais (1328 m s. m.), on trunk of *Picea* spec., under hollow snow layer, 26. 4. 2000, leg. H. SINGER, AH 19621.

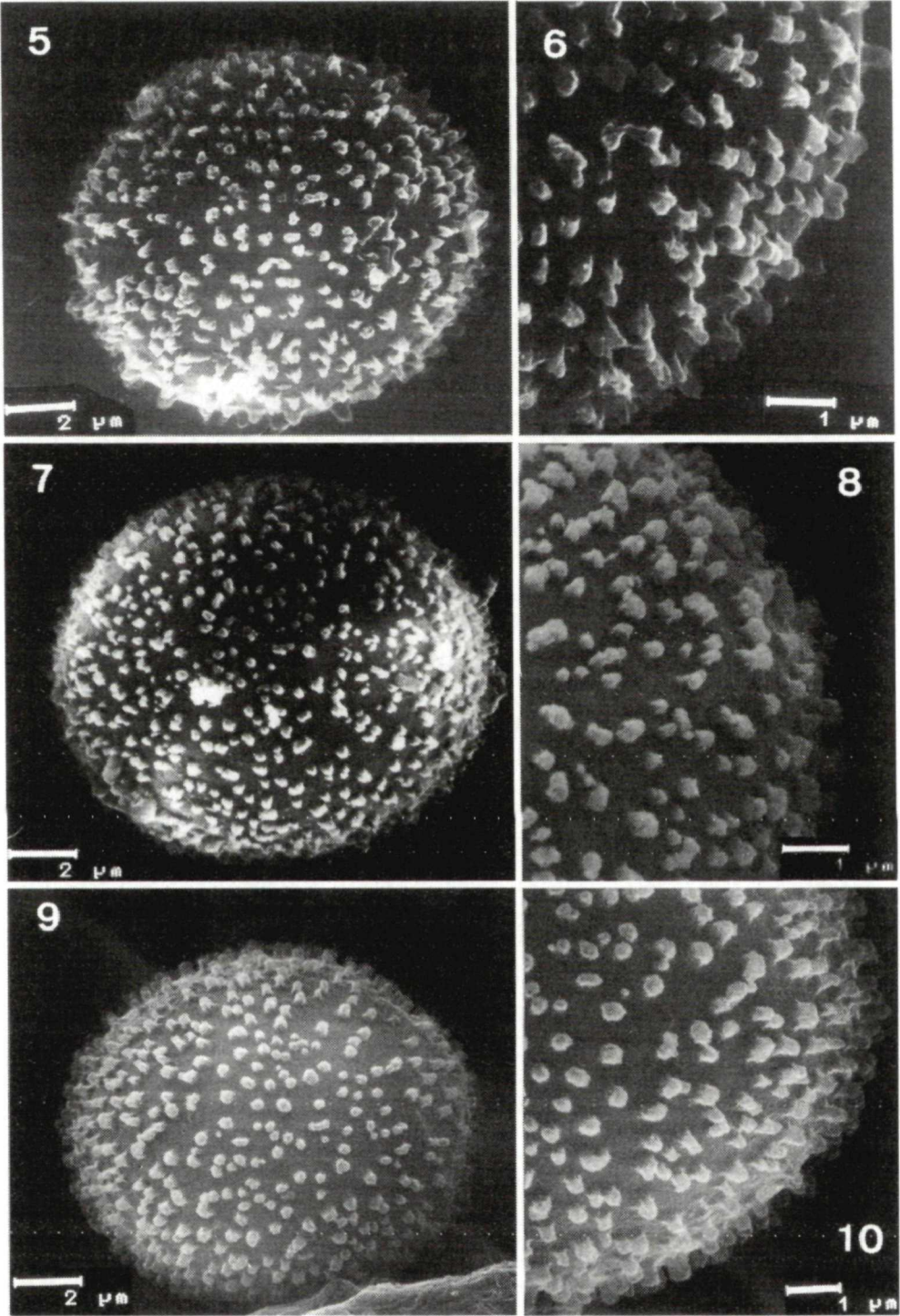
Notes:

Diderma nigrum is characterised – apart from its alpine distribution – by its sessile, dark brown to black sporocarps with a peridium composed of three layers, the outer two layers opening in a stellate manner exposing the white, non-crystalline middle layer.

The presence of a three-layered peridium can be found only in three other species of the genus: *Diderma subasteroides* M. L. FARR, *D. trevelyanii* (GREV.) FR. and *D. asteroides* (LISTER & G. LISTER) G. LISTER. *Diderma subasteroides* is distinctively stalked, *D. trevelyanii* differs in its stalked habit and its middle peridial layer containing crystalline lime.

Diderma asteroides and *D. nigrum*, however, have obviously a close relationship: Both are sessile, have a triple-layered peridium with the middle layer non-crystalline, exhibit stellate dehiscence and can be dark brown in colour. Nevertheless, KOWALSKI (1968) distinguishes *D. asteroides* from *D. nigrum*, because of its small fructifications, 0.3–0.8 mm in diam., its dark brown outer peridial wall usually marked by lines which radiate from the base of the sporangium to the apex, its well developed columella, globose and pallid in colour and its spores black in mass, minutely but regularly warted, 10–12 µm in diam. *Diderma nigrum* has more robust fructifications, 1–2 mm in diam., its outer peridial wall is dark brown to black, without radiating lines. The columella is small, often yellowish brown, sometimes absent, and its spores are purple-brown in mass, either minutely and uniformly warted or minutely and coarsely warted with the distribution of the warts highly irregular, 12–14 µm in diam. Comparing the original descriptions of both species (Table 1) we furthermore observe differences in the capillitium, being colourless to purplish in *D. asteroides* and dark brown except at the hyaline extremities in *D. nigrum*, and the possibility of *D. asteroides* to be slightly stalked.

After studying the type material of *Diderma nigrum*, we have re-examined our collection of *Diderma asteroides* from Austria (SINGER & al. 2001), gathered in a nivicolous habitat, on a trunk of *Picea* spec. under a hollow snow layer. We observed dark-brown to black sporocarps without the typical radiating lines of *D. asteroides*, 1–2 mm in diam., a brown capillitium with hyaline free ends, and spores 12–14 µm in diam. (Figs. 7–8). Without doubt this specimen fits better within the concept of *D. nigrum*, unknown by us at that time. Thus, this would be the first record of *D. nigrum* in Europe. However, after comparing this collection with other non-nivicolous specimens of *D. asteroides* collected in Spain (Figs. 3–4), we came to the conclusion that the separation of these two species, mainly based on minimal differences of the size of the sporocarps, form of the columella, colour of the capillitium and spore size can not be maintained. The occasional absence of the columella mentioned by KOWALSKI (1968) in *D. nigrum* can occur due to irregular fructifications and is not uncommon in nivicolous species. Concerning the stalked habit of *D. asteroides* we do not agree with the author of the species. *Diderma asteroides* is considered as a sessile species. Observation of the spores with SEM showed that both species have the same type of baculate spore ornamentation (Figs. 5–10). A macrosporic variety can not be maintained either, as the differences in spore size are minute. In addition, the variety *D. asteroides* var.



Figs. 5-10. *Didymia nigrum* (5-6. type; 7-8. AH 19621) and *D. asteroides* (9-10. AH 19696). Spores and details of spore ornamentation.

macrosporum, with spores 14.5-16 μm was proposed yet by ELIASSON (1975) and cited as synonym of *D. asteroides* by LADO (2001).

We propose the following taxonomic treatment:

***Diderma asteroides* (LISTER & G. LISTER) G. LISTER in LISTER, Monogr. Myceto-**
zoa, ed. 2: 113. 1911 (Colour fig. IV, Figs. 9-10).

≡ *Chondrioderma asteroides* LISTER & G. LISTER, J. Bot. **40**: 209. 1902.

= *Diderma nigrum* KOWALSKI, Mycologia **60**: 601. 1968.

	<i>Diderma asteroides</i> (LISTER, 1911)	<i>Diderma nigrum</i> (KOWALSKI, 1968)
Sporangia	Sporangia scattered, hemispherical or somewhat conical, 0.6 to 0.8 mm high, sessile, seldom either shortly stalked or forming plasmodiocarps, purplish-brown or right chocolate-brown, often mottled with darker spots or marked with numerous somewhat parallel darker lines radiating from near the apex to the base of the sporangium.	Sporangia scattered to loosely clustered, sessile, hemispherical to pulvinate, seated on a broad base, 1-2 mm in diam., dark-brown to black.
Columella	Columella hemispherical, or subglobose and depressed, white or cream-coloured.	Columella often absent, when present, reduced to a thick, yellowish brown or sometimes white mound at the base of the sporocarp, calcareous.
Capillitium	Capillitium of slender simple or anastomosing colourless or purplish threads.	Capillitium moderately abundant, consisting of long, filiform threads, sparsely branching and rarely anastomosing, threads dark brown except at the hyaline extremities, sometimes spine-like from included lime.
Spores	Spores purple-brown, minutely warted, 10 to 12 μm diam.	Spores globose, purple-brown in mass, violet-brown by transmitted light, minutely warted, the warts often arranged in a highly irregular pattern, 12-14 μm in diam.

Table 1. Comparison of *Diderma asteroides* and *D. nigrum* according to original descriptions.

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