

## U.S. Department of Agriculture, Agricultural Research Service

### Systematic Mycology and Microbiology Laboratory - Nomenclature Fact Sheets

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#### The Blue Mould of Tobacco, *Peronospora hyoscyami*, also Downy Mildew of Eggplant and Peppers

This downy mildew of Solanaceae was originally described from a *Hyoscyamus* sp. in Czechoslovakia in 1859, as *Peronospora effusa* var. *hyoscyami*. In 1863 de Bary elevated it to the rank of species, as *Peronospora hyoscyami* de Bary 1863. Due to the high degree of morphological variability among isolates, considerable nomenclatural confusion has surrounded this species.

The name *Peronospora nicotianae* was applied by Spegazzini in 1891 to an isolate from tobacco, but his description was later found to contain discordant elements, possibly a mixture of a *Peronospora* and a *Phytophthora* sp. (Skalicky 1964). In 1933 Adam proposed the name *Peronospora tabacina* for the blue mould of *Nicotiana tabacum* (tobacco) and other *Nicotiana* spp., but acknowledged that there were few morphological differences with *Peronospora hyoscyami*. Analysis of a wider sample of isolates revealed no consistent morphological differences between *Peronospora hyoscyami* and *Peronospora tabacina*, and therefore *Peronospora tabacina* should be considered a synonym of the earlier name *Peronospora hyoscyami* (Shepherd 1970). Nevertheless, the name *Peronospora tabacina* has continued to appear in the literature (e.g., Schlitz 1981, Voglmayr 2003).

In 1964 Skalicky proposed that isolates pathogenic to *Nicotiana* spp. including *Nicotiana tabacum* (tobacco), *Capsicum annuum* (peppers), *Solanum lycopersicum* (= *Lycopersicon esculentum*, tomato), *Solanum melongena* (eggplant), and *Solanum nigrum* be considered a *forma specialis* of *Peronospora hyoscyami*, under the name *Peronospora hyoscyami* f. sp. *tabacina* (=APT1), retaining *Peronospora hyoscyami* f. sp. *hyoscyami* for isolates pathogenic to hosts in the genus *Hyoscyamus*. In 1970 Shepherd further differentiated two additional *formae speciales* of *Peronospora hyoscyami*, both capable of infecting a wide range of *Nicotiana* spp. including *Nicotiana tabacum*: f. sp. *hybrida* (APT2) for isolates pathogenic to *Nicotiana* hybrids resistant to APT1, and the morphologically distinct f. sp. *velutina* (APT3). Curiously, Shepherd described these two additional f. sp. as morphologically distinct from *Peronospora hyoscyami*, but did not acknowledge them as distinct forms, varieties, or species.

While *formae speciales* have no nomenclatural standing and are not governed by the International Code of Botanical Nomenclature (de Greuter et al. 2000, Art. 4.N3), they are used for strains that are morphologically indistinguishable but physiologically distinct and characterized by adaptation to different hosts. Nevertheless, it is highly unusual to designate *formae speciales* with such extreme host overlap as occurs with f. sp. *tabacina*, f. sp. *hybrida*, and f. sp. *velutina*. Is it also highly unusual, and somewhat unwieldy, to designate a f. sp. that occurs on nearly the full host range of the species as with f. sp. *tabacina* occurring on three genera of Solanaceae, and excluding only one genus, *Hyoscyamus*. It would seem preferable to use the name *Peronospora hyoscyami* for the blue mould of tobacco and the downy mildew of Solanaceae, and accept that the species *Peronospora hyoscyami* includes isolates with different levels of pathogenicity towards various genera within the Solanaceae.

*Peronospora hyoscyami* was reported to occur on *Capsicum annuum* (pepper) and *Solanum melongena* (eggplant) by Wolf (1934) and by Simmonds (1966). According to Johnson (1989), *Capsicum annuum* is moderately resistant to f. sp. *tabacina*, f. sp. *hybrida*, and f. sp. *velutina*, while *Solanum melongena* has no reaction to f. sp. *tabacina* and is highly resistant to f. sp. *hybrida* and f. sp.

*velutina*.

*Peronospora hyoscyami* infects leaves and stems of both seedlings and mature plants in tobacco, and can also become systemic. Transmission commonly occurs via airborne spores, and there is some evidence for soil-borne transmission via oospores in plant debris (Hall 1989). While the mycelium can overwinter in plant tissues, there is no evidence of systemic transmission (Hall 1989).

## Nomenclature Report

### ***Peronospora hyoscyami* f. sp. *tabacina* (Adam) Skalicky 1964 (Oomycetes, Peronosporales)**

**Notes:** *Peronospora hyoscyami* f. sp. *tabacina* is morphologically indistinguishable from *Peronospora hyoscyami*, but displays differences in pathogenicity and host range (Hall 1989). *Formae speciales* have no nomenclatural standing (Art. 4 N3); nevertheless, this name is recorded here because it appears commonly in the literature (e.g., Hall 1989). Use of f. sp. for a taxon infecting multiple genera of host plants is generally considered to be inappropriate, and we recommend use of the name *Peronospora hyoscyami* instead.

**Distribution:** First reported in Australia, now worldwide (Hall 1989).

**Substrate:** Leaves and stems of seedlings and mature plants.

**Disease Note:** Blue mold of tobacco, a severe and economically significant pathogen of tobacco.

**Host:** Solanaceae including *Capsicum annuum*, *Nicotiana* spp., *Solanum* spp.; other Solanaceae including *Hyoscyamus* spp. may be infected via inoculation.

### **Supporting Literature:**

Hall, G. 1989. *Peronospora hyoscyami* f. sp. *tabacina*. C.M.I. Descr. Pathog. Fungi Bact. 975: 1-3.

Johnson, G.I. 1989. *Peronospora hyoscyami* de Bary: Taxonomic history, strains, and host range. Pages 1-18 in McKeen, W.E. Blue mold of tobacco. APS Press, St. Paul, Minnesota. 288 pg.

Shepherd, C.J. 1970. Nomenclature of the tobacco blue mould fungus. Trans. Brit. Mycol. Soc. 55: 253-256.

Skalicky, V. 1964. Beitrag zur infraspezifischen taxonomie der obligat parasitischen pilze. Acta Univ. Carol., Biol. Supp. 2: 25-90.

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