

Citrus storage moulds (197)

Common Name

Citrus blue and green moulds

Scientific Name

Penicillium italicum (blue mould) and *Penicillium digitatum* (green mould).

Distribution

Asia, Africa, North, South and Central America, the Caribbean, Europe, Oceania. *Penicillium italicum* is recorded on citrus from Australia, Cook Islands, Fiji, New Caledonia, Samoa, and Solomon Islands, and *Penicillium digitatum* from Australia, Cook Islands, Fiji, and Niue.

Hosts

Citrus species primarily.

Symptoms & Life Cycle

At first, small water-soaked areas - greyish, lacking a clear margin - on the fruits, enlarging rapidly to form white rots several centimetres in diameter. Spore masses develop giving the moulds their characteristic colours - green (*Penicillium digitatum*) and blue (*Penicillium italicum*) (Photos 1&2). The diseases caused by these moulds mostly occur in storage. In both cases, fruit rapidly spoils and collapses; at low humidity, the fruit may shrink and mummify.

The two *Penicillium* species are recognised by the size of their spores, the length of the stalks that hold the spores, and to a lesser extent the colour of the spores on their hosts.

Spores of these fungi are common in the atmosphere, spreading on the wind. The fungi infect through wounds in the fruit, but infection by contact can also occur (Photo 3). Handling creates the wounds required, as do fruit flies and other insects. In addition to injury and contact, infection is also helped by chilling in storage.

There is evidence that infection of fruit releases gases that increase spore germination of *Penicillium* species.

Impact

Penicillium fungi are a common cause of food spoilage, especially fruits and vegetables. *Penicillium italicum* and *Penicillium digitatum* are the most common fungi attacking citrus. Rots caused by *Penicillium italicum* are less common than those caused by *Penicillium digitatum*.

Both prefer cool temperatures, and are often found spoiling food kept in refrigerators. Of the two, *Penicillium digitatum* is considered the more important cause of postharvest decay; however, *Penicillium italicum* grows more quickly at temperatures below 10°C, and may be the more common of the two in cold storage.

Detection & inspection

Look for rots on citrus that are white at first, rapidly changing to either blue or green as spores develop. To be certain of the identification of the species, the spores and their stalks need to be examined microscopically by a fungal taxonomist.



Photo 1. Green mould of citrus, *Penicillium digitatum*.



Photo 2. Blue mould of citrus, *Penicillium digitatum*.



Photo 3. Green mould of citrus, *Penicillium digitatum*, spreading by fruit-to-fruit contact in storage.

Management

CULTURAL CONTROL

Careful handling of the fruit, and proper disposal of those that are affected, are the main ways of reducing these diseases.

Before and after harvest:

- Do not pick fruit when wet as they are more likely to be wounded.
- Handle the fruit carefully when picking, in storage and during transportation.
- Remove infected fruit as soon as they are seen, including in and around packing sheds and on the ground in orchards. Dispose of the fruit before the fungi produce spores and spread the moulds.
- If fruit is to be held in storage for any length of time, make sure that it is refrigerated quickly to avoid the development of rots, which otherwise occur very quickly.
- Wrap fruit individually in paper to prevent fruit-to-fruit spread during storage and transport.

CHEMICAL CONTROL

Fungicides are used commonly as dips or sprays to prevent *Penicillium* rots. Thiabendazole is approved in Australia for post-harvest dips of citrus against these two *Penicillium* moulds. Fruits are dipped, without rinsing, in the product at the manufacturers' recommended dosage for 30 seconds, within 24 hours of harvest.

Hot-water treatment of fruit for the control of fruit flies also reduces infection by *Penicillium* moulds.

When using a pesticide, always wear protective clothing and follow the instructions on the product label, such as dosage, timing of application, and pre-harvest interval. Recommendations will vary with the crop and system of cultivation. Expert advice on the most appropriate pesticides to use should always be sought from local agricultural authorities.

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Information from CABI (2019) *Penicillium italicum* (blue mould), and *Penicillium digitatum* (green mould). Crop Protection Compendium. (<https://www.cabi.org/cpc/datasheet/39581> and <https://www.cabi.org/cpc/datasheet/39570>); and from *Penicillium digitatum*. Wikipedia. (https://en.wikipedia.org/wiki/Penicillium_digitatum). Photos 1&3 Gerald Holmes, California Polytechnic State University at San Luis Obispo, Bugwood.org. Photo 2 Kohler F, et al (1997) *Diseases of cultivated crops in Pacific Island countries*. South Pacific Commission. Pirie Printers Pty Limited, Canberra, Australia.

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